

# Networks of Nations

THE EVOLUTION, STRUCTURE, AND  
IMPACT OF INTERNATIONAL NETWORKS,  
1816-2001



Zeev Maoz

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## Networks of Nations

In this book, Zeev Maoz offers a new theory of networked international politics. Maoz views the evolution of international relations over the last two centuries as a set of interacting, cooperative, and conflicting networks of states. International networks emerge as the result of national choice processes about forming or breaking ties with other states. States are constantly concerned with their security and survival in an anarchic world. Their security concerns stem from their external environment and their past conflicts. Because many of them cannot ensure their security by their own power, they need allies for balance against a hostile international environment. The alliance choices made by states define the structure of security cooperation networks and spill over into other cooperative networks, including trade and institutions. Maoz tests his theory by applying social network analysis (SNA) methods to international relations. He offers a novel perspective on the study of international relations as a system of interrelated networks that coevolve and interact with one another.

Zeev Maoz is a distinguished professor of political science at the University of California, Davis, and a distinguished Fellow at the Interdisciplinary Center, Herzliya, Israel. He is the author and editor of twelve books and many scholarly articles. He is past president of the Peace Science Society (international), serves on the editorial board of several journals, and is the academic editor of the book series *Innovations in the Study of World Politics*.



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# Networks of Nations

*The Evolution, Structure, and Impact of  
International Networks, 1816–2001*

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## *Preface*

When I was in graduate school, I had a debate with one of my professors on a seemingly meaningless issue. The question was whether it was more likely for two American Jewish individuals who knew one another but lived far apart to meet by chance in Israel or in New Jersey. I claimed that the probabilities of these two people meeting in Israel or New Jersey were roughly equal. Israel and New Jersey had similar populations (actually New Jersey's population was slightly larger) and a similar area. Without any additional information, there was no way of differentiating between random processes operating in New Jersey and those operating in Israel.

The professor claimed that the probability of any two American Jews meeting in Israel was much higher than a chance meeting somewhere in New Jersey. I do not recall the entire argument, but part of it was that (a) Americans who did not live in New Jersey were *a priori* unlikely to visit a place in New Jersey unless they had a specific reason for doing so; (b) New Jersey residents had all of the United States and virtually the entire world open to them, so traveling around in New Jersey was not such an attractive proposition; however, (c) many American Jews made it a point to visit Israel. Taken together, these patterns of movement suggested that it was more likely for these imaginary individuals to meet in Israel than in New Jersey.

We ended up agreeing to disagree. But over the years, I encountered more and more examples – some based on stories of friends and acquaintances, and some on personal experience – that the professor – Robert Axelrod – was probably right. This was my entry into the Small World phenomenon. Quite a few processes that may seem entirely random on first blush turn out to have interesting and counterintuitive patterns. The relationship between fairly simple principles of individual behavior and unintended social consequences is the stuff of important and innovative scholarship. Thomas Schelling – the 2005 Nobel Laureate in economics – offered numerous insights into such cases (Schelling, 1978). Robert

Axelrod himself published a number of pathbreaking studies on similar issues (Axelrod and Hamilton, 1981; Axelrod, 1984, 1986, 1997).

We often talk about complexity as a key problem in understanding international relations. This is especially true when we study long-term historical processes. There are many actors that interact with each other along multiple dimensions – military, political, economic, social, or cultural. This creates a huge number of interaction opportunities. Each of these actors is in itself a very complex structure. States are conglomerates that are composed of different institutions, individuals, social groups, or bureaucracies. Nonstate actors play an increasingly large role in international interactions. But neither policy makers nor students of international relations can give in to this complexity. Policy makers must deliberate and act on a daily basis on matters that concern the relationship between their nation or organization and other nations or organizations beyond national boundaries. Scholars develop and test ideas about how this complexity is managed.

It is not entirely clear what is happening faster – the growth of complexity of international relations or our ability to understand its nature, its aspects, and its implications. At any rate, quite a few of us are trying to figure out new ways of putting complexity into perspective. We build models that attempt to simplify this complexity by capturing some key features of international reality. We develop explanations of international processes that are logically coherent and empirically accurate. And we are constantly looking for new ways of engaging in this enterprise.

Just as in Axelrod's argument about a chance encounter between Jewish people, my encounter with social network analysis (SNA) was neither deliberate nor planned. I got into network analysis by chance. While still in graduate school, and later as a young assistant professor, I became interested in cognitive mapping as an approach to studying the belief systems of political leaders. I applied a number of graph theoretic models and developed some measures that allow systematic analyses of belief systems. I used data extracted from the coding of verbal expressions of political leaders to study such structures (Maoz and Shayer, 1987; Maoz, 1988; Maoz and Astorino, 1992). At that time, I did not think of applying models based on graphs to interactions among states on a broader scale.

Later, I became intrigued by a puzzle that emerged from multiple studies – including some of my own – on the relationships between regime types and international conflict. We had found that democracies are equally conflict prone as nondemocracies, but they almost never fight each other. We also found that there exists virtually no correlation between the proportion of democratic states in the international system and the amount of systemic conflict. It was not clear why we could not generalize the so-called democratic peace result across levels of analysis.

The more I looked into this subject, the more convinced I became that the answer to this question resides in the relationship between the political structure of states and the political structure of their external environments. This gave birth to an early – and primitive – version of the democratic networks model (Maoz, 2001), which is now expanded and extended in [Chapter 8](#). The search for ways of testing this idea brought me back to graphs and exposed me to the world of network science. It immediately became evident that this approach offers major opportunities for an analytic understanding of complexity in international relations.

I was surprised, however, to discover a huge gap between the vast and sophisticated use of network analysis in other disciplines and the near total neglect of this approach by students of international relations. The study of social networks is a cottage industry in sociology, organizational studies, social psychology, anthropology, and economics. There was a moderately growing networks literature in political science. International relations scholars, however, talked networks all the time, yet did little or no network analysis. I document this argument in [Chapter 1](#). As I delved further into SNA, I became convinced that it offers a natural approach to the study of international interactions, processes, and structures. I managed to convince a few colleagues and students of this point, and so we started a small-scale international networks project. But it was really tough convincing journal referees or grant administrators that SNA has something to offer to the field. We kept getting rejection letters saying something like “We are not sure what it is you are doing”; “We don’t know much about SNA but clearly this approach has little to offer to students of international relations”; and “OK, this is interesting, but I really don’t know enough about this approach to evaluate this work.” In each paper we had to start from scratch, explaining what SNA is, defining networks, discussing different types of networks, and explaining key concepts. We had to go over things that are considered trivial and self-evident in the disciplines that use network analysis extensively. And we had to pitch for the importance of the approach and its relevance to international relations every single time.

We were not alone, however. At about the same time, a number of other scholars in the field started using SNA methods to study different aspects of international relations. They have had the same frustrating experiences. But we persevered, and things are starting to change. More and more articles using SNA approaches, concepts, and methods appear in the leading professional political science journals. A growing number of conferences in the United States and Europe introduce network-analytic papers across the social, physical, and natural science disciplines. A political networks section was established as part of the American Political Science Association. Conferences on political networks are funded by the

National Science Foundation, and international relations scholars feature prominently in all these venues.

Despite these welcome changes, we are still confronting a widespread lack of understanding and appreciation of the relevance of network analysis for, and its insights into major aspects of, international relations. The present book attempts to fill some of the gaps between the enthusiasm and foresight of a few, and the lack of familiarity or interest of many in the field. The book is not a text of SNA, however. Nor is it focused on advocating this approach to the study of international relations. It offers a brief introduction to SNA and makes a pitch for the wider use of this approach in the study of international relations. The main focus of the book is analytical. It offers a perspective on the evolution of international relations as a set of interconnected networks. Some of these networks are conflictual – networks that are formed of the interaction among potential or actual enemies. Other networks are cooperative – they are formed out of different types of peaceful-exchange relations among, or common affiliations of, states.

The central point of the book is simple: International relations have evolved as a set of interconnected networks. These networks form out of the decisions of states to form conflictual or cooperative ties with each other. These decisions have structural consequences. The behavioral results of these decisions converge and result in consequences that are not always anticipated. They create structures that affect the behavior of states in complex ways. Each of these networks has an evolutionary logic of its own; and each affects the behavior of units in different ways. What is unique about the story this book tells, however, is that these networks appear to be interrelated. They affect each other in ways we have not previously understood. And these effects cross levels of analysis. They operate at the level of individual states; they affect dyadic relationships; they emerge in various group structures; and they operate at the global level. What these networks are, how they form and evolve, and how they relate to each other is what this book is all about.

Quite a few individuals and institutions helped bring this book to completion. First and foremost, I am indebted to my collaborators during the early stages of the networks project: Lesley G. Terris, Ranan D. Kuperman, and Ilan Talmud. We have learned from each other a great deal. Andrey Goder and Iat (Nicky) Chan were wonderful programmers who helped develop the SNA software that forms the basis of most analyses in this book. Aimee Tannehill and Carl Palmer were wonderful research assistants in this project. Kathy Barbieri, Scott Gartner, Paul Diehl, Jim Ray, Bruce Russett, Randy Siverson, Harvey Starr, John Vasquez, Mike Ward, and Doug and Lilyan White have read parts or the whole manuscript and made valuable comments on previous drafts. I have also received numerous comments from participants in various

talks, workshops, and conferences where I presented parts of this book. Two anonymous reviewers for Cambridge University Press, as well as Mark Granovetter, the academic editor of the Structural Analysis in the Social Science series gave me very useful advice that led to a fairly substantial revision of several chapters. Last but certainly not least, I would like to thank the graduate students in my political networks class in the winter and fall of 2009 for their many useful suggestions and probing questions, which forced me to clarify a fair number of arguments and analyses.

Parts of this research were supported by a grant from the University of California Institute of Global Conflict and Cooperation (IGCC). I would also like to thank Ed Parsons and Jason Przybylski of Cambridge University Press for working with me on the publication process. The network of individuals and institutions connected to this book – directly or indirectly – deserves at least part of the credit for the useful parts of the book. None of them, however, is responsible for errors of omission or commission contained in the book. Blame is to be put on the doorstep of the isolate whose name is signed below the title of the book.





## Part I

### *What Are International Networks?*



## *Social Network Analysis and the Study of World Politics*

### 1. Introduction

On October 29, 1929, “Black Tuesday,” stock markets in the United States collapsed. This event generated global ripple effects. Within weeks, worldwide production levels dropped sharply. Exports in most industrialized states plummeted by as much as 50 percent. Construction ground to a halt. Unemployment rates rose to 25 percent in the United States and to as much as 40 percent in several European states. The Western and Central European states were hit the hardest, as their economies were highly dependent on trade with the United States and with each other. England was America’s largest trading partner. It was also the largest trading partner of France, Netherlands, and Sweden. Netherlands also had substantial trade with Germany, which also happened to be the largest trading partner of Turkey, Czechoslovakia, and Poland. Economists continue to hotly debate the reasons for the Great Depression (Hall and Ferguson, 1998). However, it is clear that this event had such profound ripple effects because of a growing level of global economic interdependence, the monetary and fiscal policies of the key states in the system, and the global expansion of money supply and credit. The Great Depression also brought about political changes in several states. The rise to power of Hitler and the Nazi Party in Germany, the 1931 Japanese invasion of Manchuria, and Japan’s 1936 invasion of China can be directly or indirectly linked to the Great Depression.

On August 1, 1990, Iraqi troops invaded Kuwait. Within a few weeks, a coalition of thirty-four nations – some committing troops, others contributing funds and logistics – organized to push Iraq out of Kuwait. This coalition was led by the United States, but it also included Iraq’s Arab allies: Egypt, Syria, Saudi Arabia, and the Persian Gulf States. The United Nations Security Council authorized economic sanctions against Iraq on August 6 and later (November 29, 1990) voted to authorize

the use of force if Iraq did not withdraw from Kuwait. On the night of January 15, 1991, the coalition attacked Iraq, starting the first Gulf War.

In a 1993 article, Harvard political scientist Samuel Huntington asserted that the post-Cold War order would be restructured along civilizational divides. In the early part of the twenty-first century, these divides – which he dubbed the “clash of civilizations” – are about to form the major source of conflict. This conflict would pit the Judeo-Christian civilizations against the rest of the world’s civilizations, primarily the Islamic and Oriental ones (Huntington, 1993, 1996). Huntington’s thesis sparked a major debate among scholars. It was, however, of little interest to politicians in the United States and the West. The 1990s appeared to be an era of peace, prosperity, and stability under Pax Americana. The world seemed a far less threatening place than it had during the Cold War. The terrorist attacks on the United States of September 11, 2001, brought the clash of civilizations thesis to the fore. It became a hidden element of the Bush administration’s war on terror and an open thesis among neoconservatives in the United States and other Western states. Soon enough, the United States invaded two Islamic countries – Afghanistan and Iraq – and in the process issued threats against other Islamic countries such as Syria and Iran. Islamic terrorists became the focus of the U.S. war on terror, and they responded with attacks on Spain, the United Kingdom, Israel, and India, as well as on other Muslim states (e.g., Indonesia, Malaysia, Pakistan, Saudi Arabia, and Jordan). The concept of “terror networks” has become a central topic of discourse among security experts.<sup>1</sup>

In his 1962 book *The Gutenberg Galaxy*, Canadian scholar Marshall McLuhan coined the term “the global village,” to describe the effect of electronic communications on culture. He argued that these new media technologies create a homogeneous space and eliminate information time – the time between the source of a media message and its target. This has a profound effect on various aspects of our lives. Although his focus was on communications, other scholars and experts began using the term in a variety of economic, social, and political contexts to describe various forms of interdependence and globalization. Not surprisingly, one of the classic works in international relations – Robert Keohane and Joseph Nye’s *Power and Interdependence* – focused on networks of relations among states and how these have reshaped the key features of international relations in the modern era (Keohane and Nye, 1987).

How are these seemingly unrelated events and writings connected? The short answer is that they, along with many other examples that I discuss throughout this book, suggest a common theme: international relations

<sup>1</sup> Quite likely, Claire Sterling’s book *The Terror Network*, which covered the interrelations among terrorist organizations in Europe and the Middle East in the 1970s (Sterling, 1981), is the source of this phrase.

are about networks. Most interactions among states or between states and nonstate actors take place within different networks. People may mean different things when they talk about networks. Yet, we typically think of a network as a collection of units – in our case, states and non-state actors – that have ties with one another. These ties determine how information and influence flow in the global village. They help explain the global ripple effects of the 1929 stock market crash. Such networks are instrumental in explaining how the thirty-four-nation coalition formed to fight against the Iraqi occupation of Kuwait. If we are to understand international relations, we must study international networks.

International networks come in many shades and colors. Cooperative international networks include security alliances, general trade networks, and specific trade networks (such as arms trade), foreign direct investment, international organizations, diplomatic relations, and cultural networks, to name just a few. Conflicts are also conducted within networks – state A fighting state B may look at the prospects of having its allies help it or the risk of having B's allies join the fray (Bueno de Mesquita, 1981; Altfeld, 1984).

Like Keohane and Nye, many international relations scholars used the terminology of social networks to discuss international phenomena. Yet, for a very long time they have failed to realize that there exists a scientific approach to the study of networks. This approach is used in such diverse fields as epidemiology, evolutionary biology, physics, mathematics, and computer science (Watts, 2003; Barabási, 2003). These fields are seemingly unrelated to the study of international relations, so there was no apparent reason to see the relevance of network analysis to international politics. However, since the early 1950s, Social Network Analysis (SNA) has become increasingly influential in the study of interpersonal relations in psychology, in theories of organizations in sociology and organizational studies, and in the study of macro-social processes in structural sociology (Wasserman and Faust, 1997: 3–17), and it has become increasingly popular in economics (Jackson, 2008). SNA approaches have even been used in political science (Knoke, 1990). Yet, despite the popularity of this approach in so many disciplines, its use in international relations was minimal until quite recently. Ironically, until the early 2000s, most studies of the international system utilizing SNA approaches were conducted by sociologists, rather than by political scientists.

Recently, however, a growing number of political scientists started to apply SNA approaches to the study of international processes and phenomena. Yet, as is the case with a novel undertaking in any field, the study of international networks is treated with a great deal of suspicion and skepticism. People may use the lingo, but they are generally unfamiliar with the approach. All too often, students of international politics do not understand the relevance of SNA to the systematic study of

international structures and processes. Therefore, they find it difficult to grasp how this approach can contribute to our understanding of the substantive issues and problems of the field. Others who may understand some aspects of SNA view it in rather narrow terms, as a methodology or a set of measures of relationships.

SNA is much more than a methodology. It is a whole perspective of social processes – one that views such processes as emergent structures of a system of relationships among people, groups, institutions, and nations. It approaches social processes and structures from a vantage point in which voluntary associations (due to the choices made by units) or involuntary associations (such as geographical proximity between units or shared cultural attributes) result in structures of relationships. Many of these emergent structures are unintended. Many others are not readily visible. SNA offers a wide array of concepts, measures, and statistical and mathematical tools to systematically study these structures. In short, SNA is a science of interactions. And because international relations is all about interactions among states and between states and nonstate units, SNA is a perfect fit for the study of international relations.

One of the goals of this book is to remedy this situation. I aim to demonstrate the relevance of SNA and the substantive contributions it offers to our scientific understanding of world politics. However, the primary aim of the book is not methodological but substantive. This is the first book-length study of international relations using SNA. It develops and tests a general theory of networked international politics (NIP) that focuses on the evolution of international relations as a set of interrelated and interacting networks. This study addresses the following questions:

1. How, why, and when do different international networks form?
2. How do they change over time? What factors determine the nature, magnitude, and types of change in a given network?
3. How do different networks affect each other? Do changes in one network affect changes in the structure or characteristics of other networks? If so, how do cross-network relations work and what are their consequences?
4. How do the structure and characteristics of international networks affect various historical processes such as changing levels of international stability, the degree of economic inequality, and transformations in the structure of the system?
5. What is the relationship between *nondiscretionary* networks (e.g., geographic or cultural networks) and *discretionary* ones (e.g., alliances, trade, international organizations)?

The central argument of NIP theory is simple: International relations have evolved as a set of interrelated cooperative and conflictual networks. These networks coevolve in constant interaction with each other, and this

interaction has important implications for the behavior of nations and for the structure of the international system. To understand where we were nearly two hundred years ago, how we got from the end of the Napoleonic Wars to the hierarchical system of the present, and where we might go in the future, we must understand how these networks were formed, how they change, how they affect each other, and how they condition the behavior of state and nonstate units.

The NIP theory builds on the central paradigms of international relations: realist, liberal, and constructivist/cultural. In subsequent chapters, I introduce the theory, derive testable propositions from it on a wide array of issues, and test these propositions empirically. In this chapter, I provide a brief introduction of the key ideas of SNA. I also review the history of the approach as well as some of its key contributions to the study of international relations. Finally, I provide a brief overview of the book.

## 2. What is Social Network Analysis?<sup>2</sup>

### 2.1. Defining and Presenting Networks

A network is a set of units (nerves, species, individuals, institutions, states), and a rule that defines whether, how, and to what extent any two units are tied to each other (Wasserman and Faust, 1997: 20; Watts, 2003: 27). Such a rule can be a statement such as “live next to each other,” which defines a neighborhood network. The statement “is a friend of” defines a friendship network. In our case, a statement like “has a formal alliance with” defines an alliance network, while a statement like “trades with” defines a trade network.

Social network analysts typically distinguish between two types of networks: relational and affiliational. *Relational networks* (also called *one-mode networks*) are characterized by rules that define the presence, direction, and magnitude of a relationship between any two units. For example, neighborhood, friendship, alliance, or trade networks are relational networks. *Affiliation networks* (also called *two-mode networks*) are those in which the rule defines an affiliation of a unit with an event, organization, or group. Membership in professional associations, in social clubs, national membership in international organizations, or the distribution of states’ population across religions, all reflect affiliational networks.

A relational network can be symmetric or asymmetric. An alliance network of states is by definition symmetric. The rule “is an ally of” stipulates that if state *i* has a defense pact with state *j*, then *j* has a defense pact with *i*. This applies to all states and all alliance types. On the other hand, a

<sup>2</sup> This is a very brief and superficial introduction to SNA. More elaborate textbooks include Wasserman and Faust (1997), Scott (2000) and Jackson (2008).

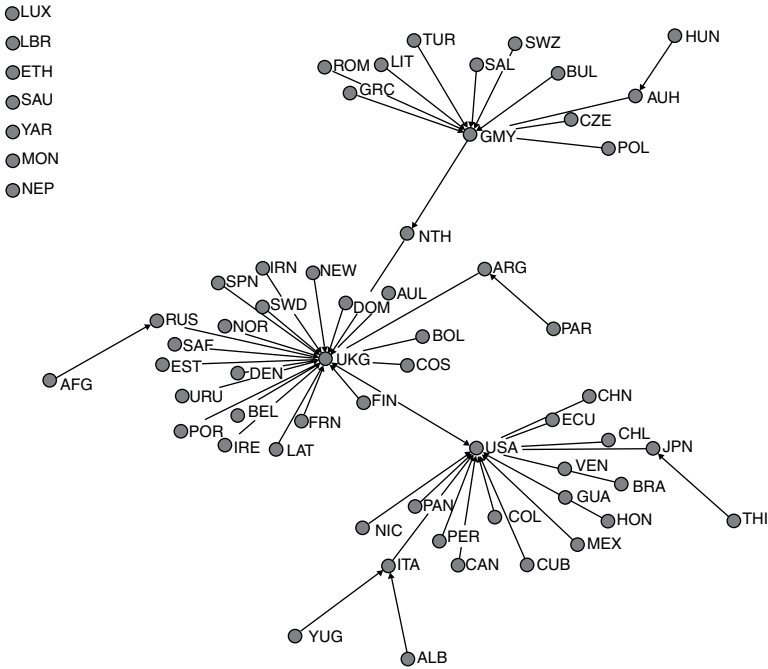


Figure 1.1. Trade network of major trading partners, 1929.

trade network defined by the rule “ $i$  exports goods worth  $x$  dollars to  $j$ ” is an asymmetric network. The fact that  $i$  exports a certain amount to  $j$  does not imply that  $j$  has any exports going to  $i$ . Or, if state  $j$  does export goods to  $i$ , there is no guarantee that  $j$ ’s exports to  $i$  are at the same level  $x$ .

Networks can be represented by graphs or by matrices. A graph is a description of a network in terms of units (nodes) and arrows (edges) connecting some of the nodes to each other. Consider, for example, [Figure 1.1](#), which describes the flow of trade in the international system in 1929. This figure is a network that is made up of states, and relations are defined by the rule “state  $j$  is state  $i$ ’s largest export partner.”<sup>3</sup> This figure displays the largest export partner of each country.

We can use this picture to illustrate some concepts in SNA. First, there are a number of states, including Luxemburg (LUX), Liberia (LBR), and Ethiopia (ETH), for which we do not have trade data. In this case, I

<sup>3</sup> States are marked by circles and labeled by three-letter identifiers. See the code list of state labels in the book’s Web site. An arrow going from state  $i$  to state  $j$  means that the cost of imports from  $i$  to  $j$  is higher than the cost of  $j$ ’s imports from any other state. So there is only one arrow going out from one state to another state. The actual trade network for this year is much more complex, as we will see in the next chapters. Sources for these data are given in [Chapter 2](#).



assumed that they have no meaningful trade ties with anybody. Units that do not have ties to any other units are called *isolates*. Second, as noted above, this is an asymmetric network. In most cases, the arrows go only one way. For example, consider the lower part of the figure. The arrows going from Yugoslavia (YUG) and from Albania (ALB) to Italy (ITA) mean that Italy was the largest trading partner of YUG and ALB. However, Italy's largest trading partner in 1929 was the United States (USA). Yet, symmetries may exist even in asymmetrical networks. For example, the arrow going from England (UKG) to the USA is bidirectional, meaning that England and the USA were each other's largest trading partners.

Third, we can see in this figure three *hubs*. A hub is a cluster of units, all connected to a relatively central one. The upper hub is clustered around Germany (GER). It includes states such as Turkey (TUR), Switzerland (SWZ), and Czechoslovakia (CZE), to name a few. The central hub clusters around UKG, and it includes states such as the Netherlands (NTH), France (FRN), Sweden (SWE), and Spain (SPN). Finally, the third, lower hub is clustered around the USA, and it includes Canada (CAN) and most of the central and southern American states. The USA and UKG are not only fairly central states but also *bridges*: They connect different clusters of states to each other. This helps to make an interesting historical point: Had it not been for the strong trade ties between the United States and England, the effects of the Wall Street collapse on the global economy may not have been as profound. Netherland is also a bridge state because it connects between the UKG hub and the GER one.

Consider the way in which an affiliation network is presented. [Figure 1.2](#) shows the international governmental organizations (IGO) network in 1910. The rule that defines this network is “state  $i$  is a full member of IGO  $k$ .”

Clearly, this is a far more complex network than was the major trading partners' network of 1929, but even this network is considered a relatively simple one. The circles in this network are still nodes, or states. The squares are events – in our case, international organizations. An arrow going from a state to an IGO means that the state is a member of a certain IGO. For example, if we look at the southmost IGO in the figure – the Organization of American States (OAS) – we can see that a cluster of states are members (e.g., Venezuela [VEN]; Salvador [SAL]; Dominican Republic [DOM]; Nicaragua [NIC]).

The complexity of the graphic form of presentation increases exponentially as networks grow in size and in the number of ties between them. Therefore, many analysts prefer using matrices to represent networks. A relational network can be represented by an  $n \times n$  sociomatrix (often labeled  $S$ ), where rows and columns represent nodes, and entries  $s_{ij}$  represent the presence/absence or magnitude of a tie between row node  $i$  and

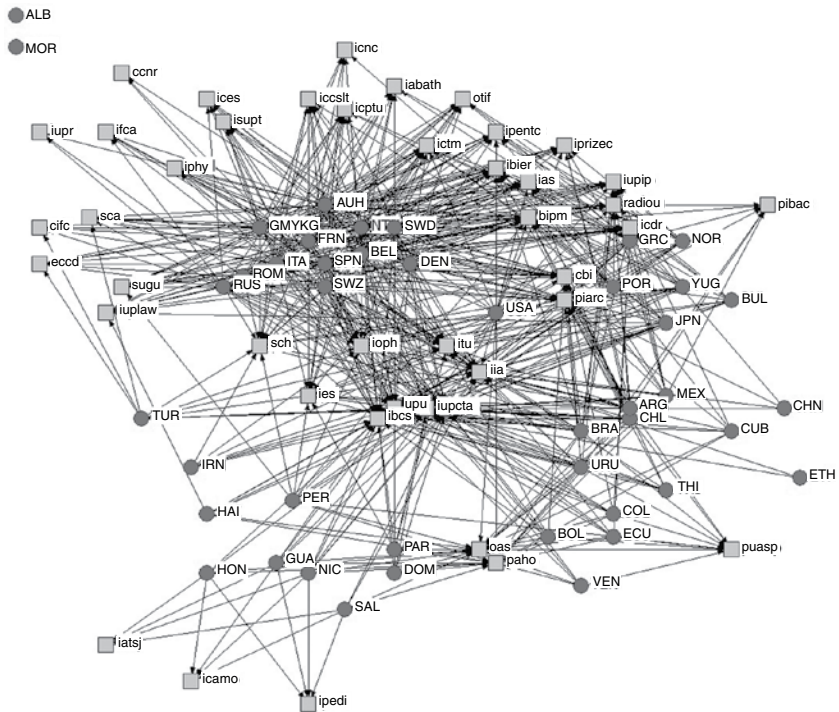


Figure 1.2. IGO network, 1910.

column node  $j$ . Likewise, an affiliational network is represented by an  $n \times k$  matrix (often labeled **A**) in which rows represent nodes and columns represent events, organizations, or other types of groups. Each entry  $a_{ik}$  reflects the presence/absence or magnitude of the affiliation of node  $i$  with group  $k$ . Matrix representations of networks allow us to perform various sorts of transformations and analyses more conveniently.

Chapter 2 provides a more detailed exposition of concepts, functions, and methods of SNA. Therefore, I restrict the discussion in this chapter to a few cardinal points. First, SNA can deal with relatively simple systems (e.g., a group of children who report friendship patterns or patterns of communication in a relatively compact organization) or with huge systems (e.g., user groups on the Internet, air traffic systems in the United States, scholarly communities in various fields of science). The more complex the system, the more useful SNA concepts and methods for tracing the structures, patterns, and processes that operate within them. If the image of the IGO network in 1910 seems complex, imagine the complexity of some of the Internet networks.

One of the better known aspects of how this tremendous complexity is reduced through a web of ties is the *small world phenomenon* (Milgram,

1967; Watts, 2003: 37–42). This set of studies that started with a simple experiment. Researchers asked people in Kansas and Nebraska to send a booklet to someone in Massachusetts whom they did not know. They had to send the booklet to someone whom they knew and ask that person to send the booklet to someone he or she knew, and so forth. Milgram showed that, for the American population, the median length (degrees of separation) between any two individuals is between two and ten, with the median being six degrees. No matter how many people are in a network, to some degree (albeit through a number of intermediaries), all are connected. This could not have happened if people had ties that were structured along geographic contiguity. The small world phenomenon is simply that even a small number of ties that are not contiguous in a specific way can generate very fast, highly connected networks.<sup>4</sup>

The second point immediately follows. The exponential increase in the complexity of social systems is not due only to the size of the system (the number of units in it) or the complexity of ties between units. Rather, complexity grows with the types of ties between units. Even relatively small units that have multiple types of ties can become highly complex. Think of the interstate system in 1816. It had “only” twenty-three states. Much of the interaction between these states was either political or economic (with ties being conflict, alliances, diplomatic relations, and some trade). But in 1816, there was only one international organization: The Central Commission for the Navigation of the Rhine. This organization had only six members: France, Belgium, Baden, Bavaria, Prussia, and Hesse Grand Ducal. In 1910, the number of states was forty-six, exactly double the number of states in 1816. Yet, there were also forty-six IGOs, and nearly all states participated in at least one of them. (Only Albania and Morocco are not listed as having at least one IGO membership.) If we want to understand international politics as a set of interconnected networks, we have to deal with complexity that arises from *multiplexity*: possible ties between states across a number of different networks. I illustrate some of this in [Chapter 3](#) and analyze aspects of this multiplexity in [Chapter 11](#). Social network analysis has developed a number of models that estimate and analyze interdependencies between different networks.

The third point is that, even in simple networks, ties reflect both visible and hidden structures. Visible structures are readily interpretable in

<sup>4</sup> Of course, there are some flaws in this model, because the people that the second person in the chain knows probably know quite a few of the people that the first person knows, and so forth. So there is a fair degree of overlap in terms of who knows whom. Nevertheless, many subsequent experiments (including reverse small world experiments; Wasserman and Faust, 1997: 53–54) confirmed Milgram’s seemingly astounding results. Watts and Strogatz (1998) published a classic article that models this process in random networks.

simple networks but become increasingly difficult to interpret as networks grow in size. More importantly, networks, even relatively simple ones, have a number of hidden structures that are not easily revealed. Some of these structures result from indirect ties between units (“the friend of my friend, the friend of the friend of my friend”); others result from the interesting clustering of units in social groups that are not easily visible. It is these hidden structures that create such phenomena as the small world or the ripple effect of the 1929 market crash. Social network analysis offers a large number of ways to reveal such hidden structures, measure some of their important features, and assess their implications. In that sense, SNA is almost unique in its ability to detect and analyze patterns of interactions that are central to international relations but are not easily understood within the traditional frameworks we have been using in the field.

The final point has to do with the “levels-of-analysis problem,” which has attracted a great deal of attention in the theoretical and empirical literature in international relations. Waltz (1958), and more clearly Singer (1961), pointed out the fact that each level of analysis has its own internal logic. Generalization of any theoretical issue across levels of analysis is fraught with problems. Empirical studies have repeatedly shown that relationships that hold at one level of analysis cannot be generalized to other levels of analysis. I discuss several problems of this sort. The principal issue here is that a higher level of analysis is not merely an aggregate of the patterns observed at lower levels of analysis. For example, the number of alliances in the system as a whole is not a simple aggregate of the number of dyadic alliance relations that exist between any two states. Therefore the impact of alliance relations on international conflict – a topic that has been the focus of many studies in the field – depends on how we conceptualize alliances at different levels of analysis (Maoz 2000).

What SNA offers in this respect has tremendous value. Specifically, the approaches incorporated into SNA allow us to move rather seamlessly across levels of analysis. This is done by incorporating measures, methods, and estimation techniques that model the transformation of relationships across levels of analysis. Such approaches allow efficient conversion of relationships across levels of analysis in ways that go beyond the linear transformation strategies often used by international relations scholars. In so doing, this approach allows us to conceive of new levels of analysis such as cohesive groups that are generated endogenously. I demonstrate this point via concepts such as network polarization and interdependence.

To summarize, SNA is – in a manner of speaking – a paradigm of social science, much like rational choice approaches and game theory. It is a way of thinking about the world as a web of relationships among

different organisms. Just as rational choice approaches make fundamental assumptions about human behavior, SNA assumes that relationships have aggregate consequences and resulting structures. These structures are emergent: They are due to the decisions of individual units but cannot be easily observed by simply aggregating these choices into collective structures. Given this assumption, SNA is engaged in uncovering the characteristics of these structures, explaining how they emerge, and understanding how they affect the units or other outcomes that are seemingly external to these networks. And, again like rational choice and game theory, SNA has developed a unique set of concepts, measures, methods, and applications for understanding complexity in different substantive fields.

### 3. SNA in International Relations Research<sup>5</sup>

Social network analysis exploded in the social sciences during the 1960s. Wasserman and Faust's (1997) bibliography lists more than 800 items that deal, directly or indirectly, with SNA methodology and empirical or theoretical applications. Jackson (2008), whose book focuses on economics, lists 657 items,<sup>6</sup> most of which concern one or more aspects of interest to social scientists. Ironically, less than 3 percent of these items have any relationship to international relations. Over the years, there have been a number of scattered applications of SNA to the study of international relations and foreign policy. In this section, I review the studies that have grown out of these applications and use them to explore the possibilities entailed in future SNA approaches to the study of international relations.

Some of the first international relations studies using graph theory were analyses of transaction flows in the international system (Brams, 1966, 1969). Brams's key objective was to derive groups based on trade, diplomatic exchanges, and joint IGO memberships. His approach was principally descriptive, aimed at endogenously generating what we today describe as blocks (see Chapter 2). His work contributed to what was then an important trend in international relations research: to delineate regions or cohesive clusters of states based on their interactions. This strategy built on the international community approach advocated by Deutsch and his colleagues (Deutsch et al., 1957; Russett, 1967, 1968;

<sup>5</sup> Hafner-Burton, Kahler, and Montgomery (2009) offer a good and slightly more detailed review of SNA in international relations, making similar arguments.

<sup>6</sup> Between 1970 and November 2009, there were 1,419 articles indexed by the Web of Science that have "social network analysis" in their title or in their abstract. Articles listing only "networks analysis" in the Social Science Citation Index over the same period number 12,396.

Russett and Lamb, 1969).<sup>7</sup> Brams did not do a lot of follow-up on applications of graph theory over the years, having moved to other fields of inquiry in political science.<sup>8</sup>

Another notable use of graph theory in the study of foreign policy was the work of Axelrod and his associates (Axelrod, 1976) on cognitive maps of political elites. We do not typically think of cognitive mapping approaches as being in the same category as SNA, but the fact is that cognitive systems – belief systems of individuals or group debates – are for all practical purposes networks. The difference between cognitive networks and social networks is that most applications of the former are based on signed graphs, whereas most applications of the latter are based on nonsigned rules. Axelrod and his associates reasoned that it is possible to model belief systems as networks made up of causal arguments in which one concept is believed (or argued) to affect one or more other concepts. Because these effects can be positive, negative, or of a special type (non-positive, nonnegative, or nonzero), the manipulation of such concepts within network structures requires a special kind of algebra, composed of Boolean rules of summation and multiplication (Axelrod, 1976: 343–44; Maoz, 1990b: 121–122).

Maoz and Shayer (1987) applied cognitive mapping approaches to the study of political argumentation in various settings. Their hypothesis was that political leaders change the cognitive structure of their public argumentation in different circumstances. Specifically, political leaders structure war argumentation in cognitively simpler ways than they structure peace argumentation. Using network measures such as density and cyclicity, as well as measures of cognitive consistency, Maoz and Shayer coded the speeches of four Israeli prime ministers in two settings: war and during peace processes. They found that war speeches exhibited significantly lower levels of density, fewer cognitive cycles, and higher levels of cognitive consistency than peace speeches.

Maoz and Astorino (1992) expanded this idea to study the effect of cognitive complexity of leadership arguments on bargaining behavior. They examined the speeches of three Israeli prime ministers (Golda Meir, Yitzhak Rabin, and Menachem Begin) and of Egyptian president Anwar Sadat between January 1970 and September 1978. They found that increased cognitive complexity was associated with more cooperative bargaining behavior in the interactions between Israel and Egypt. Here, too, as political leaders' cognitive maps increased in density and

<sup>7</sup> In contrast to Brams, who applied graph theoretic measures, most other studies that attempted to create regional or other groups based on patterns of interaction and cultural similarity used factor analytic approaches to generate these groupings.

<sup>8</sup> He continued to work occasionally on applications of directed graph models to international problems such as analysis of terrorist networks (Brams, Mutlu, and Ramirez, 2006).

cyclical, and as cognitive inconsistency declined, they tended to make increasingly cooperative bargaining decisions.

Healy and Stein (1973) applied notions of transitivity and consistency to the study of major-power diplomacy in the late twentieth century. Looking at patterns of diplomatic interactions between major powers over the 1871–1880 period, they find that the system fluctuated between balanced and imbalanced relations but converged toward balance in the late 1870s. They also find that imbalanced relations are more likely to move toward balance than are balanced relations to move toward imbalance. McDonald and Rosecrance (1985) followed a similar line of inquiry but examined the European major-power system of the 1880s. Their findings are quite different from those of Healy and Stein, revealing a high proportion of imbalanced relations that remain stable over time and quite a few balanced relations that become imbalanced. They conclude, contrary to Healy and Stein, that the European system of the 1880s moved toward increased diplomatic imbalance.

These scattered works make interesting arguments about international interactions and foreign policy processes. Yet, they were very few and far between. There has been little accumulation of knowledge and little theoretical and methodological discussion about the value of SNA approaches in the study of international relations. Many were descriptive studies, lacking a coherent theoretical and analytical goal. There was very little in the way of SNA research by international relations scholars in the 1980s and even less during the 1990s. The paucity of research utilizing SNA concepts and approaches in international relations research is extremely puzzling, particularly in light of a number of significant trends in the scientific study of international relations since the 1990s. Moreover, it is stunning to discover that sociologists had used SNA approaches to study international phenomena and structures but that these were not picked up in the international relations literature.

There have been a number of parallel revolutions in the study of international relations since the late 1980s. Some of these revolutionary trends have been theoretical in nature; others have entailed significant strides in the scientific study of international relations. The latter “revolutions” involved a smaller community of scholars, but the results were far-reaching. Theoretically, the dominant paradigm of world politics in the 1980s – structural realism – was repeatedly challenged, and ultimately badly damaged, in the 1990s. The challenges to this paradigm came from a number of directions. First, the late 1980s and much of the 1990s saw a growing influence of liberal theories that combined institutional and normative aspects of foreign policy and international interactions. Concomitantly, the 1990s saw a significant ascent of a constructivist approaches to the study of world politics. By the end of the twentieth century and the start of the twenty-first, structural realism lost



its dominant influence. Although it has not been relegated to a secondary status, the field is now characterized by a competition among equals: All three paradigms have a significant following, and all three increasingly acknowledge the challenges posed by the other paradigms.

The key ideas of all three paradigms will be discussed at length in [Chapter 5](#); therefore I do not elaborate on them here. However, one important point has emerged in this process: Challenges to realist ideas focused primarily on the growing level of cooperation in world politics. Realist scholars were increasingly hard-pressed to account for the extent and magnitude of international cooperation, particularly as the Cold War ended, and the former rivals turned to primarily cooperative interactions. In debates between liberals and realists, “networks” became one of the most common buzzwords. Yet – and this is an interesting element of the puzzle – the recognition that states networked across a number of dimensions did not convert into systematic studies of the structure of these networks.

Another challenge to the realist paradigm – especially in its structural incarnation (Waltz, 1979; Mearsheimer, 2001) – was due to the failure of a growing number of studies to find empirical support for realist propositions about various aspects of world politics (Bueno de Mesquita and Lalman, 1988; Vasquez, 1998). Concomitantly, empirical results began to compile that challenged some of the more fundamental assumptions of structural realism. The ascent of the democratic peace proposition – the finding that democracies do not fight each other – represented perhaps the single most important challenge to realist scholars. This result suggested that domestic politics and foreign policy are closely linked: different regimes behave differently in their foreign policy. The logic of international anarchy and the primacy of power and security is not as overwhelming in framing foreign policy as realists would have us believe. Here, too, notions of normative ties between regimes (Doyle, 1986; Maoz and Russett, 1993) seem to have suggested network properties. Yet, again, there was little follow-up.

Related to the resurgence of the scientific approach to the study of world politics in the 1980s and 1990s was an explosion of new and renewed datasets that made possible the statistical analysis of long-term and large-scale trends in international relations. Within the Correlates of War (COW) project, the war dataset covering all interstate wars was updated, and a new dataset on civil and internationalized civil wars was added (Small and Singer, 1982). A new dataset on militarized interstate disputes covering all low-level militarized conflicts between states since 1816 became highly popular among researchers (Gochman and Maoz, 1984; Jones, Bremer, and Singer, 1996). By the mid-1980s, the National Science Foundation provided a major grant to a consortium of universities for a project on Data Development in International Relations (DDIR).



This grant enabled the improvement and generation of a number of new data sets, such as the international crisis behavior (ICB) data set (Brecher, Wilkenfeld, and Moser, 1988; Wilkenfeld and Brecher, 1989).

The data collection effort in the 1980s focused on conflict behavior and other variables typically affiliated with realist theories of international politics (e.g., capabilities, alliances). In the 1990s, new and updated datasets emerged on trade, international organizations, culture, and various treaties. These data emphasized the cooperative elements of international politics and reflected the growing influence of liberal theories on the field. The process of data generation and data improvement is now progressing: Old datasets are being constantly updated and reformulated, and data on new forms of conflict (e.g., civil wars, terrorism), as well as additional cooperative interactions (e.g., foreign direct investment, technological assistance, communications) are being added to the inventory of datasets available to students of international interactions. Much of these data are relational in nature, and many of the datasets are arranged in forms that allow the relatively straightforward application of SNA approaches. Consequently, it is now more meaningful and feasible to look at patterns of international conflict and cooperation using SNA methods.

Finally, as in all other fields of science, the computer revolution had a strong impact on the field of international relations. It became far easier to store, manage, and analyze large amounts of data. Computations that would have required large mainframe computers, complicated programs, and many hours of operation can now be done quickly on relatively inexpensive personal computers. The belief that the size of international networks and their dynamic nature (the fact that their major elements change quite rapidly over time) required data and computational power that were beyond reach is likely one of the reasons that international scholars avoided SNA approaches in the past. This is no longer the case.

As I noted earlier, one of the interesting puzzles of SNA and international relations is that the most important questions in the field have been studied not by political scientists but by sociologists. Sociologists applied SNA approaches in testing some of the central elements of world systems theories. In particular, these studies sought to uncover the class structure of the international system – its division into groups of states differentiated by the patterns of their relations with each other. It was hypothesized that this division of labor in the world system affects widening gaps in economic growth and social and political development (Snyder and Kick, 1979; Steiber, 1979; Nemeth and Smith, 1985; Smith and White, 1992; Van Rossem, 1996; Kick and Davis, 2001). These studies made important contributions to our understanding of the empirical aspects of world systems theory. In particular, they conceived the socioeconomic character of the world system as an emergent structure. This structure emerged out of a system of dependency relations between and among states along

multiple dimensions: military, economic, institutional. They showed that the division of the world system into core, semiperiphery, and periphery emerged endogenously from this structure of ties between states across multiple networks. They used both network concepts and network methodology to rigorously test key propositions of this approach.

However, these studies also had a number of important limitations. They were static in nature; they had problems in the conceptualization and measurement of dependence; and they missed some important empirical implications of world systems theories. I discuss this literature in greater detail in [Chapter 10](#). Here, it is important simply to note that these studies went almost unnoticed by political scientists, even those who were interested in various versions of dependence and world systems approaches.

The focus on world cities as social networks offers another, related contribution by sociologists, geographers, and urban scholars to the study of international relations (Knox and Taylor 1995; Derudder et al., 2003; Taylor 2004; Witlox and Derudder 2004; Derudder and Taylor 2005; Brown et al., 2010). This work focuses on intercity relations, and it relates to the world systems theory in that it seeks to establish structural patterns by examining different types of relations – primarily trade – among cities across national boundaries. The key insight of this work is that the world system can be understood in terms of flow of information, trade, and other exchanges across urban centers. The world city network offers a good way to depict the structure of the global economic system. It also closely corresponds with commodity trade networks and other networks. This approach offers valuable understandings of world politics that go beyond the more traditional focus on interstate relations. I mention this literature here because of the important insights it offers for the study of international relations. This literature was also largely ignored by political scientists and international relations scholars.

Starting in the early 2000s, a growing number of international relations scholars started to apply SNA approaches to international relations. Maoz (2001) developed a network model to account for the process by which democracies' ties with their geographic environment explains their conflict behavior. This study is expanded in [Chapter 8](#). Ward, Hoff, and Lofdhall (2003) used latent space approaches to identify and predict the structure of international networks. They estimate the network structures utilizing international-interaction data among Central Asian states over the 1989–1999 period.

Hoff and Ward (2004) apply an exponential random graph estimation approach to model a number of network-related dependencies among states, including higher-order relationships, transitivity, clustering, and balance. They show that dyadic analysis – the single most popular unit of analysis in world politics to date – misses a great deal of higher-order

dependencies in East Asian dyads over the 1989–1999 period. Ward, Siverson, and Cao (2007) extended this approach to an analysis of the Kantian tripod – the argument that joint democracy, economic interdependence, and common membership in international organizations reduce the probability of conflict between states. When different kinds of dyadic dependencies are introduced into the analysis, the elements of the Kantian tripod lose most of their explanatory power. The importance of these studies is in the effect their structural dependencies – due to the relations between members of the dyad and other states in the system, that is, to network structures – have on dyadic relations.

This idea is central to the analysis of Maoz et al. (2006) on the effect of dyadic affinity on international conflict. They derive propositions from the realist and liberal paradigms about the effects of different types of dyadic affinity – strategic, economic, and institutional – on the probability of dyadic conflict. These affinities are measured via structural equivalence of the relations between dyad members and all other units in the system. The findings suggest that both strategic affinity and economic affinity have a dampening effect on the probability of dyadic conflict. Institutional affinity also has a dampening effect on conflict, primarily in the post-WWII era.

Another study of dyadic relations suggesting the effect of higher-order dependencies on the likelihood of conflict builds on the common conception “the enemy of my enemy is my friend,” which suggests that states with common enemies are more likely to forge alliances than states that do not share enemies. Likewise, the “enemy of my friend is my enemy” and “the friend of my enemy is my enemy” principles suggest that the allies of enemies and the enemies of one’s allies are likely to become one’s enemies as well. In general, from a realist perspective, one should expect enmity and alliance relations to form balanced triads. Maoz et al. (2007a) show that this is not necessarily the case. Enemies of enemies are likely to become allies. However, they are also much more likely to become enemies than one would expect based solely on chance. Likewise, the allies of one’s enemies and the enemies of one’s allies are likely to become one’s direct enemies (that is, the likelihood of conflict between these actors and the focal state is high). Yet, enemies of one’s allies and allies of one’s enemies also are highly likely to form alliances with the focal state. The magnitude of imbalanced friendship/enmity relations in international relations is exceptionally high. This study shows that indirect relations have paradoxical effects on direct international relations, and it offers a number of important insights into the working of politics that are not immediately visible through other approaches.

A number of studies focus on the impact of IGOs on conflict and peace between states. Hafner-Burton and Montgomery (2006) examine the effect of states’ block (or cluster) co-membership in IGO networks, as

well as prestige-related measures on their propensity to fight each other. Their results suggest that states in the same cluster in IGO networks that have high levels of prestige-related differences in their network ties are less likely to fight each other. Here, too, SNA is used to measure both individual attributes (prestige measured in terms of degree centrality), dyadic attributes derived from endogenous groups (co-membership in the same structurally equivalent clusters), and endogenous group characteristics (cluster size). The findings shed light on the effect of state clustering on states' propensity for conflict and add another layer to the myriad studies of direct dyadic IGO ties on conflict (Russett, Oneal, and Davis, 1998; Russett and Oneal, 2001; Pevehouse and Russett, 2006).

Building on these ideas, Dorussen and Ward (2008) use IGO networks, measuring indirect ties in terms of maximum flow. They examine the effects of states' degree centrality in these networks as well as the indirect links between dyad members. They find that all network variables have significant impact on the probability of dyadic conflict. Kim and Barnett (2007) examine the impact of communication variables – number of minutes of telephone calls between nations – and international air (passenger and freight) and mail traffic on the probability of dyadic conflict over the 1993–2001 period. They find that telecommunication variables actually increase the probability of dyadic conflict.

Most of these studies focused on network characteristics as the independent variable and on conflict as the dependent variable. Other studies attempted to focus on network effects on different forms of international cooperation. Ward (2006) examined the position of states on environmental sustainability using degree centrality measures of states in environmental regime networks. He found that centrality is a function of wealth (per capita GDP), population, and democracy. More importantly, regime network centrality has consistent effects on various aspects of environmental sustainability. Likewise, Von Stein (2008), relying on Ward's (2006) centrality indicators, finds that IGO degree centrality has a positive effect on the probability that states would ratify the UN Framework Convention on Climate Change (FCCC) and the Kyoto Protocol.

Social network analysis has also proved useful in the study of terrorism, in particular, terrorist networks. Enders and Su (2007) combined rational choice models and SNA to study the optimal structuring of terrorist networks and the optimal strategy for a government seeking to break up such networks. The objective of terrorists is to maintain communications while minimizing the probability of detection and network collapse. The model, then, attempts to account for the structure of terrorist networks and, based on this structure, to account for the type, complexity, and success rate of resulting terrorist attacks. On a similar subject, Brams, Mutlu, and Ramirez (2006), attempt to account for the hierarchical structure of the 9/11 terrorist network, as well as a post-9/11 terrorist network, using

an influence assumption, the idea that important persons with many network ties influence people with fewer ties. They derive from this assumption a hierarchy of the network structure and assess the complexity of the network and its block structure.<sup>9</sup>

These studies illustrate how relevant and illuminating SNA applications can be for the study of international relations. They also illustrate what is missing in this line of research. First, most of these studies use network attributes and network structure as independent variables. Yet, we have little knowledge of how such networks form and how they change. Second, most of the reviewed studies focused on one or more networks but treated the effects of each network on some external behavior as discrete. We need models that study the relationships among networks. Third, most of these studies focused on either the national or the dyadic level of analysis (Maoz, 2006b is an exception.) We do not know how networks affect behavior across levels of analysis. To better appreciate what SNA can offer to international relations research, I discuss in the next section the advantages and limitations of this approach.

#### 4. Potential Contributions of SNA to International Relations Research

SNA offers unique ways to analyze complex systems that other approaches often do not offer. International relations are about interactions. Thus, SNA offers a systematic perspective for analyzing relational structures. SNA contains several features that allow the treatment of issues and problems that have beset theory and empirical research in international relations for years. Several characteristics of SNA seem particularly germane to the field.

- *SNA offers a framework for systematic study of indirect relations and their implications.* Many important concepts in the study of conflict and cooperation concern indirect relations among units. Interdependence, a concept that is probably second only to power in terms of its impact on the field, has a built-in feature of indirect relations. If a state's security is affected by another state's security, and if these two states live on a desolate island without contact with the outside world, interdependence is limited. However, as long as states are connected and each state's security depends on the security of other states, then interdependence requires understanding indirect relations. The same applies to economic interdependence. If state A sells oil to state B and state

<sup>9</sup> A more descriptive study of terrorist network is Kerbs (2002).

B uses this oil to produce tractors, which it sells to state C that uses these tractors to grow wheat which it sells to state A, then in a way we have a cycle: Each state is dependent on other states to keep its economy going. If we fail to understand the structure of these indirect relations, we fail to capture an important element in the process of international interactions. The concepts of “a friend of my friend is a friend,” “the enemy of my enemy is my friend,” have played an important role in both the jargon and the practice of international security policies.

Many of the conventional measures of SNA allow exploration of indirect relations. So do the measures I have developed in the course of my work. Exponential random graph approaches can be applied to the estimation of indirect interdependencies on direct relations (Ward, Siverson, and Cao, 2007). Empirical studies have shown the importance of indirect relations on direct relations, revealing significant imbalances in such issues as alliance politics (Maoz et al., 2007a) and political and economic affinities (Maoz et al., 2006). Yet very few studies offered empirical evidence about when and how indirect relations play a role in various aspects of world politics. The elements of SNA offer therefore a unique opportunity to study these issues systematically.

- *A bridge across levels of analysis.* The level-of-analysis problem (Singer, 1961; Ray, 2001) has been a key puzzle in international relations research for many years. However, the nature of this problem is subject to at least two interpretations. One interpretation concerns the defining unit of analysis of international relations: Is the behavior of units dictated by the structure of the international system, or is the international system nothing but an emergent entity arising out of the choices and behaviors of units (Maoz, 1990b: 547–564).<sup>10</sup> Another interpretation of the level-of-analysis problem is methodological: A large number of empirical studies – primarily about the causes and consequences of international conflict – revealed a disconnect between empirical regularities observed at one level of analysis and the regularities (or nonregularities) obtained at other levels of analysis.<sup>11</sup>

<sup>10</sup> Another version of this is the so-called agent-structure debate. The version presented here concerns the question of the source of the causal arrow in international relations: Does the system cause actors to behave the way they do, or do the actors’ choices induce systemic effects? The constructivist approach to this problem concerns the coconstitution of agents and structure: Does the structure define the identity of actors or do actors’ actions – as determined by their self-conceptions and identities – transform into some kind of collective structure? See Wendt (1999: 12–13, 26–27), Goddard and Nexon (2005), and O’Neill, Balsiger, and VanDeveer (2004).

<sup>11</sup> There are quite a few empirical examples of this disconnect across levels of analysis (cf. Ray, 2001). One of the most glaring concerns the democratic peace proposition: It was shown repeatedly that democracies are equally war and conflict prone, as are

*How can SNA help deal with this problem?* Consider the question of the origin of the causal arrow in theories of international relations. If the source of units' behavior lies in the structure of the system, then the characteristics of this structure can be measured in terms of the attributes of international networks (e.g., polarization, density, centralization, transitivity). These attributes can then be used to account for the behavior or attributes of units. Some of these behaviors may be exogenous to the networks that we use to gauge structure. However, other aspects of these attributes can be endogenous to the networks. For example, who becomes a central actor in a highly polarized alliance system? Are central actors more likely to have transitive ties, given the overall levels of transitivity in a system? What are the characteristics of trade blocks in highly dense systems, and how do the characteristics of these blocks change when trade densities go down?

If we believe that the causal arrow goes from units' attributes and choices to the structure of the system – as I suggest in the overviews of [Chapters 3, 4, and 5](#) that follow – then we can conceptualize system structure as an emergent property. We can use the attributes of the units and the logic that defines their networking choices to derive processes that result in certain systemic structures. We can then examine the extent to which these rules actually explain the aggregate characteristics of networks. In such cases, network measures are dependent variables, the result of a system of interaction between and among units that have certain attributes and that apply certain rules to form network ties. Either way, SNA offers both concepts and methodologies that enable us to cross from one level of analysis to the next in a relatively transparent and seamless manner.

SNA offers a set of strategies to address the cross-level-of-analysis paradox by substituting the process of linear aggregation (the ecological inference problem) with a set of systematic processes of transformation from one level to another. The basic building block in SNA is the dyad. Yet, what distinguishes SNA from other approaches is that, given a set of variables mapped in terms of dyadic relations, we can deduce structures, attributes, and

nondemocracies; yet there is little conflict between democratic states and (almost) no war between them. However, there is no statistical association between the proportion of democratic states in the system and the amount of conflict in it. I discuss this at length in [Chapter 8](#). Incidentally, this is – in a manner of speaking – the flip side of the *ecological fallacy* (King, 2004) that refers to inferences about individual preferences from aggregate statistics about the distribution of a population. Very often, the level-of-analysis paradox reflects a failure to aggregate traits of units to a systemic pattern in a linear manner. It is possible that the level-of-analysis paradox is an empirical manifestation of the causal arrow or the agent-structure problem.

processes at different levels of analysis. This process of deduction is nonlinear. Moreover, a given set of dyadic relationships may induce multiple measures that describe the attributes of individual units (e.g., multiple measures of centrality, prestige, influence, brokerage). It can also induce a number of different groupings of units (e.g., cliques, N-cliques, blocks, and other types of endogenous groups not discussed herein). Finally, it induces a number of systemic characteristics (e.g., density, transitivity, polarization, interdependence). Each such characteristic has its own internal logic and fits different theoretical and methodological goals. The flexibility of these measures is that they are quite different from another and therefore reflect different attributes of units, subgroups, or the network as a whole. Again, I demonstrate how this helps induce consistent interpretations across levels of analysis of concepts such as interdependence. This allows the testing of theoretical issues in a logically consistent manner at multiple levels.

It is important to note that the capacity of SNA to provide a logically coherent bridge across levels of analysis is unique; no other theoretical or methodological approach has this feature. As such, the contribution of SNA to understanding and resolving level-of-analysis paradoxes is as profound as it is underutilized.

- *SNA allows systematic derivation of new levels of analysis.* The capacity of SNA to induce endogenous groups of various types allows examining international relations beyond the traditional monadic, dyadic, regional, or systemic levels of analysis. This has particular importance when we have a reason to believe that interactions induce certain clusters of states that have theoretical or empirical significance. If our theoretical reasoning leads us to believe that the world is composed of social classes, then SNA affords a systematic way of deriving those classes. Rather than determining who belongs where in terms of exogenous criteria, SNA derives these classes (blocks) in terms of the structure of relations among states along a number of different relations. SNA is not unique in this respect (e.g., factor analysis, small space analysis, or other hierarchical clustering methods can do similar things). Yet, what is special about SNA is that it offers different ways of grouping units into subsets. Each of these ways corresponds to different logical, theoretical, or methodological considerations. This flexibility is useful when researchers' goals or considerations change.
- *An approach that combines attributes, relations, and structure within one package.* As will become apparent in the next chapters, many if not most empirical studies of international relations deal either with attributes of units (power, regime type, cultural



characteristics of nations); relations (alliances, trade, conflict, cooperation in dyads); or structure (polarization, centralization of the international system). Yet, when examining theories of international relations, few studies combine attributes, relations, and structure in a comprehensive fashion. In most cases, one set of approaches or methodologies is used to conceptualize and measure attributes, another is used to conceptualize and measure relations, and still another is used to conceptualize and measure structure. There is nothing wrong with this research strategy. It is useful and it produced a rich array of empirical results. Yet, for some theoretical or empirical purposes, it is useful to have an integrative framework that allows the combination of attributes and relations, and produces measures of structure that are based on both. SNA does just that. The measures that I develop using this combined strategy include the concepts of network polarization and network interdependence (Maoz, 2009a). Other, more conventional examples entail the relationships between various measures of centrality and measures of group centralization in SNA (Wasserman and Faust, 1997: 178–198).

- *A laboratory for theory testing as well as an aid for theory development.* Most SNA applications entailed the use of the concepts and methods of this approach to test theories in social and cognitive psychology, sociology, organizational behavior, political science, and international relations. Theories that dealt with the form, structure, and consequences of social interactions were particularly amenable to SNA studies. The brief literature review of the evolution of SNA research in international relations illustrates this point. However, in some cases, the interaction between theory and empirics led to important innovations in SNA. One such prominent example is Ronald Burt's work on structural holes (Burt 1992). Burt attempted to characterize structures of competition among individuals in organizations in terms of brokerage opportunities. A structural hole is a form of discontinuity in the flow of information – in his case, within an organization. People who hold brokerage positions in the sense that they capture strategic places that connect otherwise disconnected groups, enjoy a competitive advantage over others who are less well placed. In order to conceptualize these ideas, Burt developed a number of important network measures of brokerage and generalized them to the structural characteristics of networks as a whole. This was not only the advent of a new theory of social exchange and competition; it was also an important source for conceptualizing another trendy idea in the social sciences: social capital (Burt, 1997, 1999, 2007).

Social network analysis offers an important set of tools and ideas for the systematic study of social and international interactions. But it is not the be all and end all in international relations research. Thinking in terms of networks does not exclude the use of other approaches. Nor does the reliance on SNA suggest that it is superior to other ways of theorizing or empirically testing ideas. Moreover, SNA has a number of important limitations and weaknesses. It is important to point out the limitations of SNA approaches for international relations research.

- *Dynamic network modeling.* Most social scientific applications as well as most aspects of SNA modeling entail the analysis of single networks. The typical application is one wherein a researcher collects data on a given network that entails some snapshot of relations or affiliations at a given point in time. This network is then analyzed within a certain theoretical context. The results reflect the structure, characteristics, and behavioral consequences of the networks or the units making up the network at a given point in time. However, most of the interesting questions in international relations entail tracing the change in and evolution of international networks over time. Some of the methods that were developed by social scientists to deal with dynamic networks – that is, networks in which relations may change over time – typically assume that the size of the network (in terms of the number of units) is unchanging over distinct observations. Even more restrictive assumptions have to do with the notion that the identity of units within the network remains relatively fixed over time (Huisman and Snijders, 2003; Snijders, 2005).<sup>12</sup> Alternative approaches to structural comparison of networks that differ in size and identity (e.g., Faust and Skvoretz, 2002) rely on assumptions that may not be appropriate in international relations research. The current study uses a fairly simple approach in which each year is assumed as a networked observation. Dependencies that exist over time are treated via standard statistical methods for the analysis of longitudinal data.
- *Incomplete inventory of concepts and measures for international relations research.* SNA has dozens of measures of units, dyads, triads, groups, and entire networks that have potential implications for international relations research. Many of these measures will be utilized in this study. There is no need to reinvent the

<sup>12</sup> For example, SIENA, the only networks software package that deals with the evolution of networks (Huisman and Van Duijn, 2003) treats changes in the size of a network over time by creating a supernet of all units that were ever in the network and using dummy variables for units that enter and/or exit the network after its inception or prior to the last observation.

wheel. Yet, SNA concepts were not developed within a political science or international relations context. Therefore, some of the key characteristics of political systems that are of interest to international relations scholars have yet to be developed. I have tried to fill this gap by developing measures of network polarization and network interdependence. But other central concepts in international relations research that entail relational features of units or systems still need to be developed. This is not a problem for SNA, but it may be an issue for those who wish to use available measures rather than engage in the often thankless task of devising and validating new measures of international structure and international interaction.

- *Complexity.* When looking at the myriad of studies employing SNA, one is often struck to see that most networks social scientists study are relatively small in size. However, international networks are fairly sizable. When the units are nations, networks may range from a very few number of units to a relatively large number of units (about 191 states in 2001). Affiliational networks, such as IGOs, can be significantly larger, maxing at 435 at a time. Yet, even small networks can be partitioned into huge numbers of subgroups. For example, the international trade network that I study in this book breaks up (under certain assumptions of minimum levels of dyadic trade) into an extremely large number of cliques, over 81,000 at its peak. It takes significant computer resources and a great deal of time to process certain projects. The algorithms for clique derivation and clique manipulation are relatively inefficient and require significant modifications to allow more timely and efficient management of data. This imposes severe restrictions on the types of networks that can be analyzed, but it is a hurdle that can be overcome with more research and resources. It has certainly proved to be a deterrent to political scientists in the past, however.

These problems notwithstanding, the balance sheet seems to be largely positive for SNA applications in international relations research. In the next section, I show how this book attempts to use SNA approaches to study the central issues in international relations.

## 5. A Brief Overview of This Book

The book is divided into three parts. The first part introduces the basic concepts and lays out the foundations of the theory of international network formation. The second part presents the theory of network formation and tests some of its key elements. The third part presents the

implications of the theory and tests some of the central ideas of the NIP theory. What follows is a chapter-by-chapter overview.

## Chapter 2: Fundamental Issues in Social Network Analysis: Concepts, Measures, Methods

This chapter discusses the key functions of SNA and the principal concepts and methods used to measure and analyze international networks in this book. I introduce traditional SNA measures, as well as a number of measures that I developed. I also introduce the major SNA methods used to estimate and analyze social networks. This is a rather technical chapter. Readers who are interested primarily in the substantive topics covered by this book may skip it without much loss. Readers familiar with SNA can skip most of the chapter, as it covers familiar grounds. However, Sections 7 and 8 introduce new concepts and methods and are worth studying. Readers who are not familiar with SNA and how it can be used in international relations research are advised to read it closely.

## Chapter 3: The Network Structure of the International System, 1816–2001

This chapter offers a description of the evolution of international relations as a system of networks. It discusses the density, polarization, interdependence, and transitivity of alliance, trade, and IGO networks. Finally, it discusses some important empirical puzzles that emerge from this systematic description. For example, it contrasts observed patterns of polarization with traditional notions of polarization that are based on the number of major powers. It contrasts notions of interdependence in the qualitative literature on globalization and interdependence with the actual levels of economic and institutional interdependence emerging from the network analytic measures. These puzzles set the stage for the theory of network formation.

## Chapter 4: Security Egonets: Strategic Reference Groups and the Microfoundations of National Security Policy

This chapter lays the foundations for the theory of networked international politics. It defines and validates the basic concept that underlies this theory: Strategic Reference Groups (SRGs). The SRG of a given state refers to the set of actors that have an immediate, direct, and profound impact on its security. It is – in SNA jargon – the security-related *egonet* of a state. The structure and characteristics of the SRG of any given state determines the key elements of its security policy. Specifically, the size of

the strategic reference group and the capabilities of its members have a profound impact on the magnitude and nature of security challenges the state faces. This, in turn, affects the choice of policy instruments designed to deal with these security challenges. The chapter first identifies the different conceptions of security environments that have been offered in the literature and contrasts them with the operational definition of SRGs. It then validates the definition of the SRG by examining empirically the effects of SRG characteristics on the conflict and alignment behavior of states.

### Chapter 5: Networked International Politics: A Theory of Network Formation and Evolution

This chapter focuses on network formation. It presents the key ideas of the NIP theory. It reviews how the three central paradigms of international relations – realism, liberalism, and culturalism/constructivism – explain the causes of international cooperation on security, economic, and institutional matters. It then presents the principal ideas of NIP. This theory offers an integrated perspective on the processes by which security networks form. It also explains how security, economic, and institutional networks interact and coevolve, and examines the structural implications of the processes of network formation and cross-network interactions.

The key idea of the NIP theory is that states' behavior is governed by two contrasting realities. One is the anarchic structure of the international system, which makes states both suspicious of others and constantly worried about their security and survival. The other is the social nature of states, which drives them to forge various ties across national boundaries and induces interdependence. These factors determine the calculations of national policy makers, and consequently, the ties that states forge with other actors in the international system. Security challenges determine the extent to which states require allies to insure their security and survival. The social nature of states defines the affinity they share with other states. Such affinity is a function of states' cultural makeup, political systems, and history of past cooperative relations with other states. The theory allows us to deduce propositions regarding clique structures of various international networks, as well as regarding the determinants and effects of various network structures and cross-network spillover effects.

### Chapter 6: Testing the Theory of Networked International Politics

This chapter tests empirically the key propositions derived from the NIP theory. It examines the patterns of national alliances, determinants

of dyadic alliance and strategic trade relations, and the interrelations between alliance cliques/blocks on the one hand, and trade or institutional cliques/blocks, on the other. These empirical tests reveal also how nondiscretionary (e.g., cultural) networks and mixed (SRG) networks affect the structure and characteristics of discretionary networks. The tests also allow inferences regarding cross-network spillover effects, and the extent to which historical turning points (e.g., the two world wars and the end of the Cold War) affected network structures and cross-network spillover effects.

### Chapter 7: Nations in Networks: Prestige, Status Inconsistency, Influence, and Conflict

States – just as individuals – worry about their status and prestige. International status and prestige serve an important function of building one's reputation. Reputation can then be converted into practical currencies such as deterrence, credibility, and peaceful influence. One of the implications of the NIP theory is that the consequences of networking choices reflect a nation's prestige. In turn, status and prestige may affect the cooperative and conflictual behavior of states.

This chapter examines the factors that determine the prestige of states – defined by different measures of centrality – in discretionary international networks. It then tests the extent to which network centrality affects the ability of states to exert peaceful influence through patterns of UN voting. One of the implications of network centrality concerns the discrepancies between the attributes of states by virtue of their internal characteristics – principally their power – and their prestige. This reflects the degree of status inconsistency states might experience. The argument is that status inconsistency lies at the heart of states' conflictual and cooperative interactions. Given that this is the case, does the level of stability in the international system depend on the level of status inconsistency that central members (e.g., major powers) experience? This chapter explores the implications of NIP theory for state behavior and for systemic stability.

### Chapter 8: Democratic Networks: Resolving the Democratic Peace Paradox

In this chapter, I examine one of the central implications of the NIP theory for the analysis of international conflict. The central idea relies on the concept of democratic networks. The theory argues that the spread of democracies is meaningful only if it affects the SRG structures of states. As the SRGs of democratic states becomes increasingly democratic, they

tend to engage in fewer disputes and wars. SRG cliques that are dominated by democratic states experience far less conflict than SRG cliques that are composed of a majority of nondemocratic states. Finally, as the number of democratically dominated SRG cliques increases, the level of systemic conflict declines significantly. I explore the implications of these important results for policies for expanding the level of democracy in the international system.

### Chapter 9: Interdependence and International Conflict: The Consequences of Strategic and Economic Networks

Networks are about interdependence. Yet the theoretical and empirical implications of network interdependence have not been sufficiently explored. More important, the potential power of SNA for the study of international interdependence offers new insights into the debate on the effects of interdependence on conflict. This chapter applies a SNA conception of dependence and interdependence that contains several innovations. First, it integrates “sensitivity interdependence” – the effects of changes in one state on other states – with “vulnerability interdependence” – the opportunity costs of breaking a relationship. Second, it measures interdependence at different levels of analysis and across multiple relationships. Third, these measures integrate multiple dimensions of interdependence into a single index. I derive hypotheses from the realist and liberal paradigms regarding the effects of strategic and economic interdependence on monadic, dyadic, and systemic conflict. I test these hypotheses using alliance and trade network data. The findings provide support for the propositions derived from the liberal paradigm, but not for those derived from the realist paradigm.

### Chapter 10: Evolution and Change in the World System: A Structural Analysis of Dependence, Growth, and Conflict in a Class Society

As noted in the literature review, sociologists have extensively studied ideas deduced from world systems and dependency theories about the effects of international factors on economic growth and on the economic stratification of the international system. These theories claim that the location of states in the international division of labor – the center, semiperiphery, or periphery – has a powerful effect on their ability to achieve and sustain high levels of economic growth and development. I review these studies, focusing on some basic problems in their theoretical arguments, research design, and empirical results. I offer an alternative

conception of the strategy by which we may test world systems theories. Using both traditional concepts of structural and role equivalence and the new measures of dependence developed in [Chapter 9](#), the analyses conducted in this chapter replicate previous studies and offer new tests of world system theories.

### [Chapter 11](#): An International System of Networks: How Networks Interact

This chapter focuses on the systemic coevolution of networks. It discusses the major NIP-theory ideas about the factors that affect network structure and cross-network spillover. It then examines the systemic effects of international networks. Focusing on systemic measures of networks – components, polarization, density, transitivity, and group centralization – it examines empirically the ideas derived from the NIP theory at the systemic level of analysis. The results suggest consistent cross-network effects: The structural characteristics of one cooperative network affect the structural characteristics of other networks. Moreover, the analyses reveal consistent effects of cooperative network relationships between network characteristics and the extent of conflict in the international system. The theoretical and practical implications of these results are extremely important. They suggest that designing and structuring of discretionary international networks have important effects on the level of peace and stability in the world.

### [Chapter 12](#): The Network Analysis of International Politics: Insights and Evidence

This concluding chapter first reviews and evaluates the results emerging out of the previous chapters. It then discusses their implications for the theory of international politics and for national and international policy. Based on the theory and empirical evidence, this chapter evaluates the actual and potential contribution of social network analytic applications in the study of international relations. It concludes with some ideas about further research on international networks.



## *Fundamental Issues in Social Network Analysis: Concepts, Measures, Methods*

### 1. Introduction

This chapter provides a brief introduction to SNA methods. It is not meant to replace general textbooks on this topic (e.g., Scott, 2000; Wassermann and Faust, 1997; Jackson, 2008). SNA is an incredibly rich approach; a brief chapter can capture but a small aspect of this perspective. My aim here is to introduce the key concepts and methods that I use throughout this book, discussing their logic and how they are developed. This may help illuminate some of the major functions of SNA and demonstrate the relevance of SNA for the study of international relations.

Those familiar with SNA concepts and methods can skip most of the chapter, except [Sections 7 and 8](#), which contain new measures of cliques and of network characteristics. Nevertheless, I encourage readers to at least read the next section, “The Functions of Social Network Analysis.” It covers the array of topics that SNA addresses and illuminates the levels of analysis it encompasses. Those unfamiliar with SNA can find some basic information about major measures of networks across levels of analysis. Brief definitions of SNA concepts can be found in the glossary at the end of the book. I begin by discussing the functions of SNA and its main branches. Then I review the basic methods and concepts of SNA at several levels of analysis. These levels include the individual-unit level, the dyadic level, the triadic level, the group (clique and block) level, the network (or system) level, and the Internetwork (multiplex) level. I conclude by discussing some interrelationships between levels of analysis as they are conceived by SNA approaches.

### 2. The Functions of Social Network Analysis

I use two examples of international networks throughout the chapter to illustrate the various concepts and methods I cover. The first is the

network of formal alliances; the second is an International Governmental Organization (IGO) network. I chose the year 1913 to illustrate these networks because the international system then was neither too large nor too small in terms of both the number of states and the density of their relations. [Figure 2.1](#) displays these two networks.

As in [Chapter 1](#), circles represent states, with three-letter state abbreviations next to the nodes.<sup>1</sup> Arrows represent ties or affiliations. The width of the lines reflects the relative strengths of ties. In the alliance network ([Figure 2.1.1](#)), all arrows are bidirectional, reflecting the symmetry of alliance ties. In the IGO network, the squares represent IGOs; arrows going from states to IGOs reflect the fact that a given state was a member of a specific IGO. Clearly, most states were members of more than one IGO. I do not elaborate on the complexity or structure of these networks at this point. Rather, I use these two networks as the basis of the discussion in the following sections.

### 2.1. The Functional Elements of Social Network Analysis

Social network analysis evolved out of graph theory in mathematics. Generally speaking, graph theory studies the structural aspects of relations. Epidemiologists who wanted to study the spread of contagious diseases through contact picked up some of these ideas. Biologists and neurologists who studied neural networks and physicists who wanted to study relationships among particles in matter also found them relevant in their fields. Gradually, sociologists and social psychologists who were interested in interpersonal and intergroup relations became increasingly fascinated by what network approaches had to offer.<sup>2</sup>

Network analysis provides an analytic framework – sort of a toolbox – for the systematic description, analysis, and estimation of the structure of relations among different units (neurons, people, organizations, or nations). These relations may take place within a single network or across multiple networks. The toolbox contains several compartments: One holds a collection of descriptive measures that enable us to summarize complex relationships in a systematic way. Another contains tools for analyzing the implications of these structures and for estimating unobserved relationships, or relationships that are not easily visible (such as indirect, i.e., second-, third-, fourth-order relations, etc.). Another compartment contains various strategies for splitting networks into subnetworks and for analyzing their properties. Finally, one of the most complex

<sup>1</sup> State abbreviations and Correlates of War state numbers are given in this book's replication Web site: <http://psfaculty.ucdavis.edu/zmaoz/networksofnations.htm>.

<sup>2</sup> On the history of the approach in general and in the social sciences in particular, see Scott (2000: 7–37), Wasserman and Faust (1997: 10–17), and Freeman (2004). For a more informal presentation of the history of the approach across sciences, see Watts (2003).



compartments deals with relations among multiple networks. I discuss each of the compartments very briefly.

## 2.2. Description

As noted, descriptive measures of networks are one of the basic elements of SNA. These measures summarize the structural aspects of relationships at multiple levels of analysis, starting with the single unit (node), progressing through dyads, triads, and various groups, up to measures of the network as a whole. There are also measures that describe relationships between and among different networks with the same nodes. Consider some examples: [Figure 2.1](#) demonstrates why we need some ways to systematically measure a complex web of relations. For example, if we want to compare the IGO network in 1913 to the same network in 1950 and 2001, which are exponentially more complex, we need measures that allow such a comparison. These measures help tap important substantive characteristics of nodes, dyads, triads, different groups, and entire networks. Many of these measures are also “mobile” in that they can be meaningfully transformed across levels of analysis.

One may think that developing measures of network attributes is a simple task. This is hardly the case. The derivation of network measures is extremely complex – both theoretically (in terms of the mathematics involved) and computationally (especially in large networks like those we cover in the book). In the course of this book, we will use a wide variety of network characteristics. The software package I developed covers all of these measures, and so do most other SNA software packages.<sup>3</sup>

## 2.3. Analytic Methods

There are several mathematical and statistical methods unique to SNA. These methods build on other approaches, but their implementation is fitted to the kind of issues that are of interest to students of complex systems. Since my focus is not on methodology, I will not spend much time on these approaches, other than to briefly describe what they do. One important family of analytic methods deals with *exponential random graphs*. These methods estimate the probability of observing a given structure in a “real data” network from a family of hypothetical networks with similar properties. They also estimate actual relations as a consequence of

<sup>3</sup> The SNA software package I developed differs from most other packages in two important respects. First, it accommodates the kind of data structures we use in international relations. Specifically, it can input and output dynamic and multiple network data in various forms (matrices, dyadic datasets, attribute datasets, etc.). Second, it implements a number of new network characteristics and network analysis methods I have developed (such as network polarization, interdependence, multiple networks clique analyses, simulations, cognitive algebra methods). The MaozNet package is available at: <http://psfaculty.ucdavis.edu/zmaoz/networks/netsoftware.htm>.

hidden structures that result from some random processes. I do not discuss these here. There are some good technical introductions to this family of approaches (e.g., Anderson, Wasserman, and Crouch, 1999; Wasserman and Robins, 2005; Jackson, 2008). One of the interesting applications of this method (Faust and Skvoretz, 2002) allows the comparison of networks that differ from one another in size or type of units. They also enable comparison of networks at different points in time.

Related to this is a family of methods that focuses on longitudinal networks dynamics (Huisman and Snijders, 2003; Snijders, 2005). Dynamic network methods focus on ways in which one can account for changes in the structure of ties within a network over time. Factors that can affect change in the structure of ties can be endogenous – due to the nature of ties in the previous period – or exogenous, that is, external to the particular rule that defines the ties between nodes.

A group of methods typically not associated with SNA *per se* concerns studies of cognitive maps (Axelrod, 1976; Maoz, 1990b: 116–135). These approaches attempt to systematically characterize and explain cognitive structures – for example, the belief systems of individuals or debates within decision-making groups. These can be formalized as cognitive maps. A cognitive map a logical network consisting of causal links between concepts. This approach to reasoning, decision making, and argumentation focuses on signed graphs. Logical relations between beliefs can be positive (e.g., concept A has a positive effect on concept B – an increase in the defense spending of a given state increases the threat perception of its immediate neighbors) or a negative effect (a rise in oil prices reduces the expendable income of commuters). Relations between concepts can be more complex (increasing class size does not improve the attitude of students toward professors). The consequences of these types of relationships are logically complex, and special mathematical operations are needed to manipulate and measure network structure (Maoz, 1990b). Such structures are logical rather than quantitative. These methods apply a set of special algebraic operations – called *cognitive algebra* – to the analysis of cognitive maps.

Social network applications also rely on more conventional statistical approaches to study both the structures of various networks and the impact of networks on units or on other structures that are not part of the networks under observation. There are other interesting linkages between SNA and approaches used in the social sciences, such as game theory and decision theory (Jackson, 2008).

## 2.4. Endogenous Groups

Social networks entail a lot of observed features that can be traced using various summary measures. Yet, networks possess a number of “hidden” structures that are not easily detectable. When we look at international

trade patterns, we typically ask about the major importers or exporters of a given state. In a more general sense, however, we wish to examine the extent to which an international economy is dependent on international trade. We can thus examine the total amount of trade in the system divided by the system's GDP. When trade/GDP in the system increases, a greater share of what states produce is traded among them. When we examine security cooperation, we typically look for the number, type, or identity of a state's allies. When a lot of states have alliances, we can surmise that the system is highly interdependent in terms of international security.

These measures are quite simplistic, however. The volume of trade in the system is indeed a component of international economic interdependence, but it does not capture the entire structure of trade relations. For example, states may trade within distinct groups, such that there is a high degree of trade within a given group but little trade between groups. This pattern is quite distinct from a trade network in which everybody trades with everybody else. Likewise, a system in which security alliances are clustered to form distinct alliance blocks is very different from a system in which alliances are relatively diffuse and no clear groupings are detected.

Another way of thinking about international relations relies heavily on geography. We study regional politics assuming that the politics of one region are somehow "different" from the politics of other regions. The regional perspective typically starts with an attempt to define regions (Russett, 1967; Cantori and Spiegel, 1970; Gleditsch, 2002a; Lemke, 2002). In some cases, the boundaries of a region are defined by historical convention. More sophisticated definitional strategies look at the volume of interactions among actors based on the assumption that cohesive regional structures are not merely geographic in nature. Rather, they reflect a grouping of states based on cultural, political, and economic ties, which are then reflected in the extent to which states interact with each other (Russett, 1968). Here, too, we assume hidden structures, which can be detected through a systematic analysis of relations.

Social networks are typically formed of subsets of nodes that are organized through their ties with each other. Consider the alliance network in [Figure 2.1.1](#). Some groups emerge immediately: First, the triple alliance between Greece, Serbia (Yugoslavia), and Bulgaria, was formed to fight the Ottoman Empire in the first Balkan War.<sup>4</sup> The four-member alliance of Honduras, El Salvador, Guatemala, and Nicaragua forms another group. These are closed and exclusive subsets of the alliance networks. The states in each of these two groups have direct alliance ties with all other states in the group and no ties to any states outside the group. There is a third

<sup>4</sup> Ironically, this alliance, which defeated the Ottoman Empire, taking away most of its European territories, split during 1913 with the former two attacking the third in what came to be known as the second Balkan War. See Maoz (1990a: Chapter 7, 1989b).

group that is also “natural” in a special sense – the group of isolates, or nonaligned states, on the left side of the picture. These states all have something in common – they do not have alliances. The subnetwork at the center of the figure offers a glimpse into the complexities involved in dividing the networks into groups. The alliance group consisting of Germany, Austria-Hungary, Romania, and Italy forms a cohesive group. However, it is not a completely closed subset of the network: Italy has alliance ties to Russia and France, thereby connecting the upper alliance to the lower ones. France has ties to England, Spain, and Russia, and England and Russia have alliance ties with Japan. This means that there is some degree of overlap among different alliances, which is not typically captured in examining formal alliances as institutions.

When one considers this alliance network as a precursor of World War I, a lot of interesting issues emerge. For one thing, there is no formal alliance between Serbia and Russia. Second, Italy, a member of the Triple Alliance, bridges Germany and Austria-Hungary and the Triple Entente (Russia-France-England), making the pre-WWI alliance system less polarized than it appears in historical accounts.

The IGO network presented in [Figure 2.1.2](#) is already divided into groups. Each group is a single IGO, and the arrows going from the circles (states) to the squares (IGOs) represent national affiliations with these IGOs. These groups may not, however, be the most interesting from a networks perspective. Because of the complexity of this picture, it is difficult to see other groups that might exist there. Yet, when we apply these methods to partitioning the network into groups, some hidden structures emerge. For example, some of the states in the system share multiple IGO memberships, while others share only a few or none at all. Those who share multiple memberships typically form natural groups. Likewise, those who share relatively few IGO memberships are typically parts of separate groups. They are invisible in this picture and would be even if this picture were less messy.

Social network analysis allows extraction of a number of “natural” and “derived” endogenous groupings. There are quite a few methods for extracting groups. I rely on two approaches to group extraction. Both approaches carry methodological and theoretical implications for a wide array of substantive issues. Membership in these groups, their structure, and the relations between distinct groups are not only important as a way of partitioning networks into interesting subsets; they are also elements in strategies for measuring the entire structure of networks.

## **2.5. Multiplexes: Relations Among Multiple Networks**

Recall that networks are characterized by a rule that defines the existence, magnitude, and/or direction of ties between nodes. It follows that in

many cases, the same nodes may simultaneously be involved in multiple networks, each defined by a different rule. Children in school may be part of friendship networks, neighborhood networks, extracurricular activity affiliations (sports, debate, art teams, etc.). Individuals in society may simultaneously be members of professional associations, part of an ethnic group; they may have friends; they are tied to other individuals by virtue of their residence, and so forth. States interact with each other in a number of different dimensions: They form security alliances with some states; they trade with other states; they share membership with other states in international organizations; and they may have administrative or political relations with other states by virtue of geographical contiguity. Each system of interactions forms a distinct network.

We can learn a great deal by analyzing the pattern of ties within a specific network. Yet in many situations, we have reason to believe that two or more networks are related to each other. More importantly, in many cases what we mean by complexity is that we cannot account for the behavior of individuals, groups, or nations with a single rule that defines their relationships. Rather, this behavior and its collective consequences are determined by a number of factors. If each variable is derived from a different type of relationship that a state has with others, then saying that behavior has multiple causes implies that international reality is shaped by multiple networks.

A set of networks involving the same set of nodes is called a *hypernetwork* or a *multiplex*. It is represented by a *hypergraph* or by a *hypermatrix*. There are several methodologies for analyzing multiplexes and a number of social science applications (e.g., McPherson, 1982, 2001). Since individual networks may entail huge complexities, multiplexes can very quickly get out of hand. One way of dealing with this compound complexity entails methods for reducing it. This family of methods is clustered around a special kind of mathematical approach called *relational algebra* (Wasserman and Faust, 1997, 425–460), which focuses on the structures of relations across networks as elements in the analysis of nodes, dyads, triads, and networks as a whole. Concepts such as density, transitivity, centrality, as well as new measures of hypernetworks, can be extended to describe relations across multiple networks.

Another set of methods examines relations between and among networks. This is the principal approach I take in this book. This approach focuses on the extent to which the characteristics of a given network, that is, the traits of nodes, dyads, groups, and the network as a whole relate to the characteristics of another network. The idea underlying this approach is different from the relational algebra strategy. In relational algebra we attempt to find ways to reduce complexity by summarizing the structures of relations across multiple networks. There is no assumption of causality. Rather, causality is inferred from the relationship between



these summary measures that are derived from a multiplex and external variables that are not part of the network structure. The cross-network relations approach assumes that the structure and characteristics of one network have a causal impact on the structure and characteristics of other networks.

For example, one of the arguments I advance in the coming chapters has to do with spillover effects. This means that a given *set* of relationships (e.g., security alliances) affects through some sort of causal process another *set* of relationships (e.g., arms trade). This does not necessarily imply that states that have an alliance will also trade arms with each other. Rather, the argument is more complex. States that establish a certain pattern of alliance-making may also be more likely to form a similar arms-trade patterns. The groups that result from the pattern of states' alliance choices have an effect on the kind of groups that form from the pattern of these states' arms-trade partners. In order to examine these relationships, we need to compare the structures of alliance and of arms trade networks.

These methods allow the development of nested network structures and causal relations between networks that are made up of different nodes. This may lead to innovative ideas and methods to address an important set of issues in the study of international relations: the inter-relations between domestic political structures and international relations. In domestic networks, the actors may be individuals, groups, or institutions. The patterns of relations among these actors may determine patterns of relations among states (e.g., the structure of alliance, trade, IGO, or conflict networks). These methods are as yet underdeveloped, but several studies suggest that they have a tremendous potential (Thurner and Pappi, 2008; Thurner and Binder, 2009).

### 3. Preliminary Issues: Matrix Representation and Affiliation to Sociomatrix Conversion

Before I begin to describe various network characteristics, it is necessary to cover some presentational issues.

As noted, networks can be presented via graphs or matrices. Matrices are more suitable for analytic purposes. [Tables 2.1](#) and [2.2](#) are the matrix representation of the alliance and IGO networks, respectively.<sup>5</sup> Note that the alliance network represents a valued network. Entries reflect the strength of the alliance commitment between two states. Alliance commitments are coded as follows: First, I employ the Alliance Treaty

<sup>5</sup> I select only a few states and IGOs to demonstrate the sociomatrices of the alliance and IGO networks. This is done due to space considerations and presentation clarity.

Table 2.1. *A matrix representation of the alliance network, 1913 (first ten states only)*

|     | USA | CUB | HAI | DOM | MEX | GUA  | HON  | SAL  | NIC  | COL |
|-----|-----|-----|-----|-----|-----|------|------|------|------|-----|
| USA | 1   | 0   | 0   | 0   | 0   | 0    | 0    | 0    | 0    | 0   |
| CUB | 0   | 1   | 0   | 0   | 0   | 0    | 0    | 0    | 0    | 0   |
| HAI | 0   | 0   | 1   | 0   | 0   | 0    | 0    | 0    | 0    | 0   |
| DOM | 0   | 0   | 0   | 1   | 0   | 0    | 0    | 0    | 0    | 0   |
| MEX | 0   | 0   | 0   | 0   | 1   | 0    | 0    | 0    | 0    | 0   |
| GUA | 0   | 0   | 0   | 0   | 0   | 1    | 0.15 | 0.15 | 0.15 | 0   |
| HON | 0   | 0   | 0   | 0   | 0   | 0.35 | 1    | 0.35 | 0.35 | 0   |
| SAL | 0   | 0   | 0   | 0   | 0   | 0.15 | 0.15 | 1    | 0.15 | 0   |
| NIC | 0   | 0   | 0   | 0   | 0   | 0.15 | 0.15 | 0.15 | 1    | 0   |
| COL | 0   | 0   | 0   | 0   | 0   | 0    | 0    | 0    | 0    | 1   |

Obligations and Provisions data set (Leeds 2005). This data set lists all alliance treaties between states and includes several types of alliances. I assign a value to the type of alliance between two states such that:

$$cs_{ij} = \begin{cases} 0 & \text{if allytype} = \text{none} \\ 0.2 & \text{if allytype} = \text{consultation pact} \\ 0.45 & \text{if allytype} = \text{nonaggression treaty} \\ 0.55 & \text{if allytype} = \text{neutrality pact} \\ 0.65 & \text{if allytype} = \text{offense pact} \\ 0.75 & \text{if allytype} = \text{defense pact} \end{cases}$$

This coding reflects the credibility of an alliance, defined as the probability that a state will actually aid its ally if the latter becomes embroiled in conflict (Leeds 2003). Now, two states can have several different pacts simultaneously. So the alliance commitment is measured as

$$ALYCOMMIT_{ij} = \frac{\sum_{k=1}^5 cs_{ijk}}{\sum_{k=1}^5 cs_k} \quad [2.1]$$

Where  $cs_{ijk}$  is a commitment between states  $i$  and  $j$  of type  $k$  (consultation pact., ..., defense pact), and  $\sum cs_k = 2.6$  is the sum of all possible commitments that can exist between two states of a given type. It follows that all states have a maximal commitment to themselves. This is conveyed by the diagonal of the matrix being set to 1 for all states. The value of commitments between states therefore reflects the extent of their security commitment to each other. This commitment increases as (a) in the level of commitment of a given alliance, and (b) in the number and

Table 2.2. *Matrix representation of the IGO affiliation network, 1913 (selected IGOs and states)*

|     | O1 | O5 | O10 | O17 | O18 | O19 | O24 | O25 | O31 | O32 | O33 | O37 | O38 | O39 | O40 | O41 | O42 | O43 | SUM | IGOS |
|-----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| USA | 0  | 0  | 0   | 0   | 0   | 0   | 1   | 1   | 1   | 1   | 1   | 0   | 0   | 0   | 1   | 1   | 1   | 1   | 21  |      |
| CUB | 0  | 0  | 0   | 0   | 0   | 0   | 0   | 0   | 1   | 0   | 0   | 1   | 0   | 1   | 1   | 0   | 0   | 1   | 8   |      |
| HAI | 0  | 0  | 0   | 0   | 1   | 0   | 0   | 0   | 1   | 0   | 0   | 0   | 0   | 1   | 0   | 1   | 1   | 1   | 7   |      |
| DOM | 0  | 0  | 0   | 0   | 0   | 0   | 0   | 0   | 1   | 0   | 0   | 0   | 0   | 1   | 0   | 1   | 1   | 1   | 6   |      |
| MEX | 0  | 0  | 1   | 0   | 0   | 0   | 1   | 1   | 1   | 1   | 1   | 1   | 0   | 1   | 1   | 0   | 1   | 1   | 14  |      |
| GUA | 0  | 1  | 0   | 0   | 0   | 0   | 0   | 0   | 1   | 0   | 0   | 0   | 0   | 1   | 0   | 1   | 1   | 1   | 9   |      |
| HON | 0  | 1  | 0   | 0   | 0   | 0   | 0   | 0   | 1   | 0   | 0   | 0   | 0   | 1   | 0   | 0   | 1   | 0   | 7   |      |
| PER | 0  | 0  | 0   | 1   | 0   | 0   | 0   | 0   | 1   | 0   | 1   | 0   | 0   | 1   | 0   | 0   | 1   | 1   | 11  |      |
| BRA | 0  | 0  | 0   | 1   | 0   | 0   | 1   | 1   | 1   | 0   | 0   | 0   | 1   | 0   | 1   | 1   | 1   | 1   | 16  |      |
| BOL | 0  | 0  | 0   | 1   | 0   | 0   | 0   | 0   | 1   | 0   | 0   | 0   | 1   | 1   | 0   | 0   | 1   | 1   | 8   |      |
| PAR | 0  | 0  | 0   | 1   | 0   | 0   | 0   | 0   | 1   | 0   | 0   | 0   | 1   | 1   | 0   | 1   | 1   | 0   | 8   |      |
| CHL | 0  | 0  | 0   | 1   | 0   | 0   | 1   | 0   | 1   | 1   | 1   | 1   | 0   | 1   | 1   | 1   | 1   | 1   | 15  |      |
| ARG | 0  | 0  | 1   | 1   | 0   | 0   | 1   | 0   | 1   | 0   | 1   | 1   | 1   | 0   | 1   | 0   | 1   | 1   | 16  |      |
| URU | 0  | 0  | 1   | 1   | 0   | 0   | 1   | 0   | 1   | 0   | 0   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 14  |      |
| UKG | 1  | 0  | 0   | 0   | 1   | 0   | 0   | 0   | 0   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 29  |      |
| NTH | 1  | 0  | 0   | 0   | 0   | 1   | 1   | 1   | 0   | 1   | 0   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 28  |      |
| BEL | 0  | 0  | 0   | 0   | 1   | 0   | 1   | 1   | 0   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 26  |      |
| FRN | 0  | 0  | 1   | 0   | 1   | 1   | 0   | 1   | 0   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 32  |      |
| SWZ | 0  | 0  | 0   | 0   | 1   | 1   | 0   | 1   | 0   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 23  |      |
| SPN | 0  | 0  | 0   | 0   | 1   | 0   | 0   | 1   | 0   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 24  |      |
| POR | 0  | 0  | 1   | 0   | 0   | 0   | 0   | 0   | 0   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 19  |      |
| GMY | 1  | 0  | 0   | 0   | 1   | 1   | 1   | 0   | 0   | 1   | 1   | 0   | 1   | 1   | 1   | 1   | 1   | 1   | 27  |      |

(continued)

|     | O1 | O5 | O10 | O17 | O18 | O19 | O24 | O25 | O31 | O32 | O33 | O37 | O38 | O39 | O40 | O41 | O42 | O43 | SUM |
|-----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| AUH | 0  | 0  | 1   | 0   | 0   | 1   | 1   | 1   | 0   | 1   | 1   | 0   | 1   | 0   | 1   | 1   | 1   | 1   | 30  |
| ITA | 0  | 0  | 0   | 0   | 1   | 1   | 0   | 1   | 0   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 30  |
| ALB | 0  | 0  | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| YUG | 0  | 0  | 0   | 0   | 0   | 1   | 0   | 0   | 0   | 1   | 1   | 1   | 1   | 0   | 1   | 1   | 0   | 1   | 13  |
| GRC | 0  | 0  | 1   | 0   | 0   | 1   | 0   | 0   | 0   | 1   | 0   | 1   | 1   | 0   | 1   | 1   | 1   | 1   | 15  |
| BUL | 0  | 0  | 0   | 0   | 0   | 0   | 1   | 1   | 0   | 1   | 1   | 0   | 1   | 0   | 1   | 0   | 1   | 1   | 12  |
| ROM | 0  | 0  | 0   | 0   | 0   | 1   | 1   | 1   | 0   | 1   | 1   | 1   | 1   | 0   | 1   | 1   | 1   | 1   | 20  |
| RUS | 0  | 0  | 0   | 0   | 0   | 1   | 1   | 1   | 0   | 1   | 1   | 0   | 1   | 1   | 1   | 1   | 1   | 1   | 24  |
| SWD | 0  | 0  | 0   | 0   | 1   | 1   | 1   | 1   | 0   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 0   | 1   | 24  |
| NOR | 0  | 0  | 0   | 0   | 0   | 0   | 1   | 0   | 0   | 0   | 0   | 1   | 1   | 1   | 1   | 0   | 1   | 1   | 15  |
| DEN | 0  | 0  | 0   | 0   | 1   | 1   | 0   | 0   | 0   | 0   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 21  |
| TUR | 0  | 0  | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1   | 0   | 1   | 1   | 1   | 1   | 10  |
| CHN | 0  | 0  | 0   | 0   | 0   | 0   | 0   | 1   | 0   | 0   | 0   | 1   | 0   | 0   | 1   | 0   | 1   | 1   | 5   |
| JPN | 0  | 0  | 0   | 0   | 1   | 0   | 0   | 0   | 0   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 15  |
| THI | 0  | 0  | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1   | 1   | 1   | 0   | 1   | 1   | 1   | 7   |
| SUM | 3  | 4  | 7   | 10  | 11  | 12  | 15  | 16  | 19  | 20  | 21  | 22  | 27  | 29  | 33  | 33  | 37  | 40  |     |

Table 2.3. A converted sociomatrix from the IGO affiliation network (first ten states only)

|     | USA | CUB | HAI | DOM | MEX | GUA | HON | SAL | NIC |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| USA | 21  | 6   | 5   | 5   | 11  | 5   | 3   | 4   | 6   |
| CUB | 6   | 8   | 4   | 4   | 7   | 4   | 3   | 4   | 5   |
| HAI | 5   | 4   | 7   | 6   | 5   | 6   | 4   | 3   | 6   |
| DOM | 5   | 4   | 6   | 6   | 5   | 6   | 4   | 3   | 6   |
| MEX | 11  | 7   | 5   | 5   | 14  | 5   | 4   | 4   | 6   |
| GUA | 5   | 4   | 6   | 6   | 5   | 9   | 7   | 6   | 9   |
| HON | 3   | 3   | 4   | 4   | 4   | 7   | 7   | 5   | 7   |
| SAL | 4   | 4   | 3   | 3   | 4   | 6   | 5   | 7   | 7   |
| NIC | 6   | 5   | 6   | 6   | 6   | 9   | 7   | 7   | 10  |

types of alliances they share. The alliance matrix is symmetrical because alliances are symmetrical.

In contrast, the  $IGO_A$  network is an affiliation (or two-mode) network. It is represented by an  $n \times k$  matrix where rows represent states and columns represent IGOs. A cell entry of  $igo_{ik}$  gets a value of 1 if state  $i$  is a member of IGO  $k$  and zero otherwise.<sup>6</sup> The row marginal (right-most column) reflects the number of IGO memberships of each state, and the column marginal's (lowest row) reflects the number of members in each IGO.

It is desirable for analytical purposes to convert affiliational networks, such as the  $IGO_A$  network, into sociomatrices. This can be done in a number of different ways: The most common is the *sociomatrix transformation approach*. Conversion is accomplished multiplying the affiliation matrix by its transpose, so that  $IGO_S = IGO_A \times IGO_A'$ . The resulting sociomatrix has a special structure. First, it is symmetric ( $igo_{sij} = igo_{sji} \forall i, j \in N$ ). Second, its diagonal entries reflect the number of IGO memberships of each state and are equal to the row marginals in Table 2.2. The nondiagonal entries  $igo_{sij}$  reflect the number of IGO memberships that any two states have in common. Table 2.3 shows the  $IGO_S$  matrix. (Here, too, only selected states and IGOs are presented.)

There is, however, some bias in the presentation of this matrix as a valued social network of dyadic IGO relations. To see this, consider the joint IGO membership between the United States and Cuba (first row-second column and second row-first column of matrix  $IGO_S$  in Table 2.3). Compare

<sup>6</sup> IGO data are based on the Correlates of War (COW) IGO dataset (Pevehouse, Nordstrom, and Wranke, 2004a). Data are collected for all states every five years over the period of 1815–1965 and each year afterwards. I interpolated IGO memberships for missing years over the 1815–1965 period.

that to the joint IGO membership between Haiti and the Dominican Republic (third row-fourth column and fourth row-third column of the same table). Both dyads share memberships in six IGOs. One may imply that both sets of network ties are of identical value. If one were to make this inference, one would be wrong on two counts: first, on the symmetry of IGO co-membership within any given dyad, and second, on the equivalence between dyads. As we can see from the diagonals, the United States is a member of twenty-one IGOs; Cuba is a member of only eight IGOs. This means that the extent to which Cuba overlaps with the U.S. is not symmetrical. Cuba accounts for only 6/21 co-memberships of the U.S. IGO memberships, whereas the US accounts for 6/8 co-memberships of Cuba's IGO memberships. Second, Haiti and the Dominican Republic are very highly connected. The Dominican Republic accounts for 6/7 co-memberships of Haiti's IGO memberships, whereas Haiti accounts for all of the Dominican Republic's six IGO memberships.

To remove these potential biases and get a better sense of the extent of ties between nodes in a converted affiliation network, we can diagonally standardize the sociomatrix given in Table 2.3. Specifically, a diagonally standardized matrix  $\overline{IGO}$ s is defined by entries  $\overline{igo}_{ij} = \frac{igo_{ij}}{igo_{ii}}$  where  $igo_{ii}$  is the diagonal entry of the corresponding row. This redefines the extent of IGO-related ties of any two states as a proportion of the number of IGO memberships of the row state. The standardized IGO matrix is now asymmetric. Dyads in which one or both members have no IGO memberships have a standardized joint IGO membership of zero. Table 2.4 presents the standardized IGO matrix.

The standardized IGO matrix now can be interpreted as a relational social network in which the values of the ties reflect the strength of institutional relations between states. These are operationalized as the ratio of actual ties (co-membership) to the level of affiliation of any member of the dyad.

There is another type of conversion that can be performed on affiliation networks. Recall that such networks are called two-mode networks. The nodes, or units, of an affiliation matrix serve as the focus of the conversion of an affiliation matrix into a sociomatrix. The dimension of the sociomatrix is defined by  $N$ , the number of nodes (the number of states in our case). The second type of conversion uses the "event" (in our case, this is the IGO) as the focus of the conversion. The operation here examines relationships, not between nodes – states – but between events, that is, IGOs. If we multiply the transpose of the  $IGO_A$  matrix by  $IGO_A$  we get an IGO co-membership matrix ( $IGO_M$ ). This matrix is of dimension  $k$  (the number of IGOs) and it is symmetrical. The diagonal entries of this matrix  $igo_{mii}$  reflect the number of members in IGO  $i$ . Off-diagonal entries  $igo_{mij} = igo_{mji}$  reflect the number of members that are common to

Table 2.4. A diagonally standardized IGO sociomatrix

|     | USA | CUB | HAI | DOM | MEX | GUA | HON | SAL | NIC |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| USA | 1   | 0.3 | 0.2 | 0.2 | 0.5 | 0.2 | 0.1 | 0.2 | 0.3 |
| CUB | 0.8 | 1   | 0.5 | 0.5 | 0.9 | 0.5 | 0.4 | 0.5 | 0.6 |
| HAI | 0.7 | 0.6 | 1   | 0.9 | 0.7 | 0.9 | 0.6 | 0.4 | 0.9 |
| DOM | 0.8 | 0.7 | 1   | 1   | 0.8 | 1   | 0.7 | 0.5 | 1   |
| MEX | 0.8 | 0.5 | 0.4 | 0.4 | 1   | 0.4 | 0.3 | 0.3 | 0.4 |
| GUA | 0.6 | 0.4 | 0.7 | 0.7 | 0.6 | 1   | 0.8 | 0.7 | 1   |
| HON | 0.4 | 0.4 | 0.6 | 0.6 | 0.6 | 1   | 1   | 0.7 | 1   |
| SAL | 0.6 | 0.6 | 0.4 | 0.4 | 0.6 | 0.9 | 0.7 | 1   | 1   |
| NIC | 0.6 | 0.5 | 0.6 | 0.6 | 0.6 | 0.9 | 0.7 | 0.7 | 1   |

IGOs  $i$  and  $j$ . This matrix can also be diagonally standardized to reflect the proportion of common members of two IGOs of the number of members of each. Table 2.5 shows the standardized IGO-by-IGO membership overlap matrix.

Note that all of the members of IGO number O43 (International Union of Pruth, Table 2.2) are also members of IGO O1 (Permanent Court of Arbitration). However, only 8 percent of O1 are also members of O43. Likewise, O1 and O6 (International Telecom Union) share six members in common. However, these six members constitute two-thirds of O1 and only a third of O6. Again, the standardization of the IGO-by-IGO overlap matrix offers a new perspective of the extent to which two IGOs share members. We will come back to these kinds of matrices when we talk about endogenous groups.

#### 4. Ego Networks<sup>7</sup>

Networks reflect relationships between nodes. As such, dyads are the basic building block of relational networks. I start with nodal characteristics for an important reason: In discretionary networks, it is the individual unit that makes decisions about forming relations. A person chooses to form friendship ties with another person; a manager chooses to consult with a coworker; a state chooses to form an alliance with another state, and so forth.

Social network analysis contains a number of ways to characterize nodes in networks. One such strategy, *ego networks* focuses on a subset of a network that consists of a focal node (ego) and the nodes to which

<sup>7</sup> The discussion of ego networks covers the material discussed in Chapters 4–6. Elements of ego networks are also referenced in Chapters 7, 8, and 10.

Table 2.5. *Standardized IGO-by-IGO overlap (first ten IGOs only)*

|     | O1   | O2   | O3 | O4 | O5 | O6   | O7   | O8   | O9   | O10  |
|-----|------|------|----|----|----|------|------|------|------|------|
| O1  | 1    | 0    | 0  | 0  | 0  | 0.67 | 0.67 | 0.67 | 1    | 0    |
| O2  | 0    | 1    | 0  | 0  | 0  | 0    | 0.67 | 0.67 | 0.33 | 0.33 |
| O3  | 0    | 0    | 1  | 1  | 1  | 0    | 0    | 0    | 0    | 0    |
| O4  | 0    | 0    | 1  | 1  | 1  | 0    | 0    | 0    | 0    | 0    |
| O5  | 0    | 0    | 1  | 1  | 1  | 0    | 0    | 0    | 0    | 0    |
| O6  | 0.33 | 0    | 0  | 0  | 0  | 1    | 0.5  | 0.5  | 0.5  | 0.33 |
| O7  | 0.33 | 0.33 | 0  | 0  | 0  | 0.5  | 1    | 1    | 0.5  | 0.33 |
| O8  | 0.29 | 0.29 | 0  | 0  | 0  | 0.43 | 0.86 | 1    | 0.43 | 0.29 |
| O9  | 0.43 | 0.14 | 0  | 0  | 0  | 0.43 | 0.43 | 0.43 | 1    | 0    |
| O10 | 0    | 0.14 | 0  | 0  | 0  | 0.29 | 0.29 | 0.29 | 0    | 1    |

it is directly connected (alters). An ego network also specifies the ties that exist between the alters. This is called a first-order egonet. A second-order egonet reflects the relations between alters and other nodes in the network. This allows us to track both the direct and indirect relationship between ego and alters. To make this notion more concrete, consider [Figure 2.2](#), which examines the alliance egonet of Italy in 1913. The left part of the figure displays the first-order egonet, and the right part presents the second-order egonet. Note that the first-order egonet contains all the direct alliance ties that Italy has with other states in the system. Some of these alliance commitments are both direct and indirect. For example, Italy has a weak direct alliance with Romania. Yet, it also has a set of indirect alliances with Romania (via its alliances with Austria-Hungary and Germany). The second-order egonet shows a much more complex web of alliances, as well as a number of second- and third-order alliance commitments (e.g., Japan is Italy's ally of an ally of an ally).

Thinking of each of the nodes in a network as a possible ego and examining its relations with all the alters opens up a set of strategies for comparing nodes in a network. There are a number of ways to systematically measure ego networks. We can measure their size (how large each state's network is); their characteristics (e.g., nodal homophily – the extent to which the ego networks are composed of similar nodes); the strength of ties of each node; their diameter (the longest distance between ego and any of its alters); and so forth. In this study, I focus on three concepts that build on ego networks: size, attributes, and centrality. The first two concepts are directly linked to ego networks; the third builds on the size of the egonet but expands it in different ways.

Perhaps the simplest way to compare the nodes in the network is by examining the size of their egonets. This is the *nodal degree*. The degree of



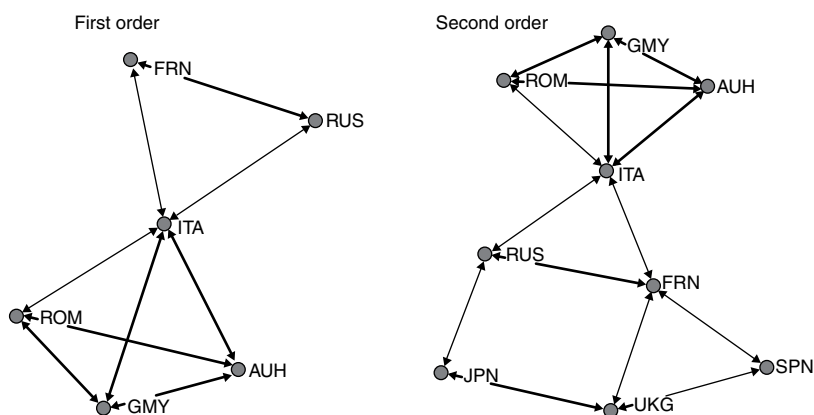


Figure 2.2. Italy's alliance egonet: first and second order.

the nodes in the alliance network of 1913 reflects the extent to which any of the states are connected. In plain English, the sizes of the egonets of this alliance network indicate simply how many allies each state has. This is admittedly a very simple index of how well connected states are in terms of allies, but it also serves as a foundation of more interesting and sophisticated indices. To examine the relationship between a state and its egonet, we can use an attribute dataset that contains certain theoretically relevant characteristics of the nodes in the network, for example, their capabilities, regime types, political stability, and so forth. Such attributes may also be useful in comparing egonet structures across different networks.

Let us demonstrate some of the aspects of this process by looking at another network of states in 1913, the strategic reference network (SRN). I do not discuss this network in detail here because it is the subject of [Chapter 4](#). Briefly, the rule that describes relationships in this network is “strategic relevance.” This means that state  $i$  considers state  $j$  as strategically relevant, to the extent that it perceives  $j$  to pose a potential challenge to its security. Viewed from the perspective of a given state, the strategic reference egonet of the state consists of the states it considers to pose meaningful challenges to its national security. I label this the SRG (strategic reference group) of a state. The SRN of 1913 is displayed in [Figure 2.3](#).

I use a number of attributes to describe these egonets, or SRGs. These include the aggregate national capabilities of the states comprising each egonet, and the proportion of democratic states in such egonets. Breaking up the data of [Figures 2.1.1](#) and [2.3](#) into egonets and merging the attribute data provides a comparison of alliance and strategic reference egonets. This is given in [Table 2.6](#). (Here, too, I use several selected states for presentation brevity.)

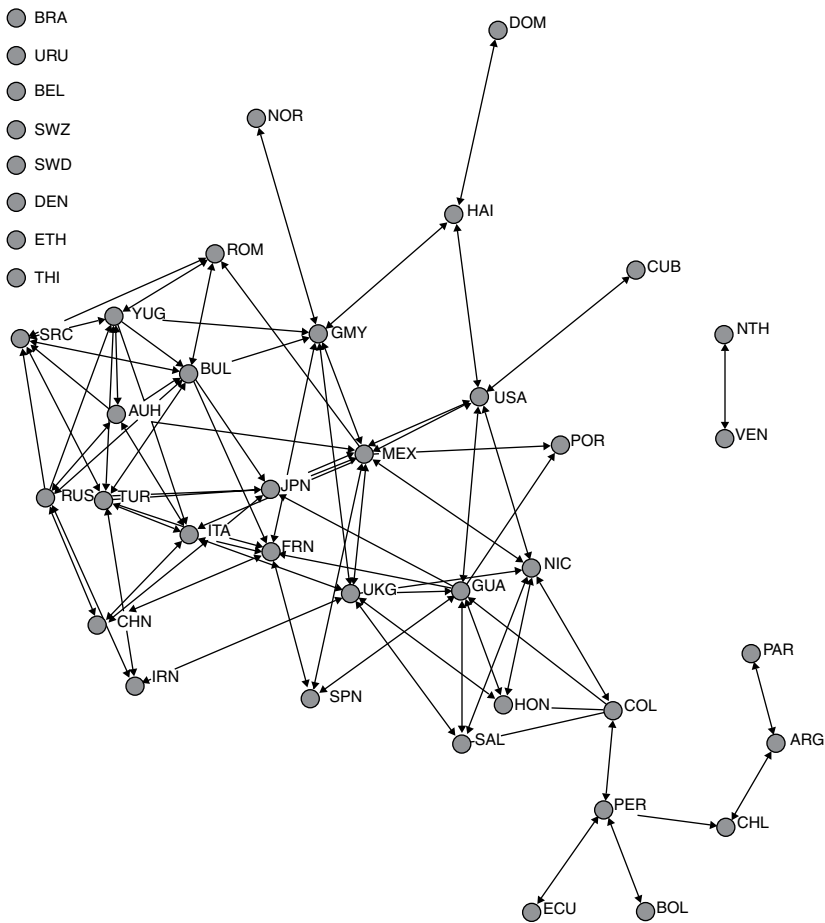


Figure 2.3. Strategic relevance network, 1913.

This table shows a number of interesting features about the structure of strategic egonets. Rather than cover the entire table, let us focus on the two rightmost columns of the table (columns 13 and 14). Column 13 reports the difference between the capabilities of the members of a state's strategic reference egonet and the capabilities of the state's allies, as well as those of the focal state. This measure captures the level of security (or insecurity) of a given state. When this measure yields a negative number, it means that the state and its allies (assuming that they fulfill their obligations) can effectively meet the challenges posed by its SRG. This is indeed the case for most states. However, states such as Mexico, the United Kingdom, France, and Spain face a positive capability balance, implying that their capability pool is not sufficient to

Table 2.6. *A comparison of strategically reference and alliance egonets, 1913 (selected states only)*

| Ego attributes |                 |              | Strategic reference group (SRG) |            |                 |            | Alliance egonet |            |                |                | 13. SRG – and        | 14. SRG |                  |
|----------------|-----------------|--------------|---------------------------------|------------|-----------------|------------|-----------------|------------|----------------|----------------|----------------------|---------|------------------|
| 1. State       | 2. Capabilities | 3. Democracy | 4. Size                         | 5. Density | 6. SRG capabil. | 7. SRG dem | 8. Size         | 9. Density | 10. Allies cap | 11. Allies dem | 12. Allies + Ego cap | cap     | alliance overlap |
| USA            | 0.220           | Yes          | 6                               | 13.33      | 0.04            | 0.00       | 0               | 0.00       | 0.00           | 0.00           | 0.22                 | -0.18   | 0.00             |
| DOM            | 0.000           | No           | 1                               |            | 0.00            | 0.00       | 0               | 0.00       | 0.00           | 0.00           | 0.00                 | 0.00    | 0.00             |
| MEX            | 0.005           | No           | 10                              | 12.22      | 0.61            | 0.30       | 0               | 0.00       | 0.00           | 0.00           | 0.01                 | 0.60    | 0.00             |
| COL            | 0.001           | No           | 5                               | 40.00      | 0.00            | 0.20       | 0               | 0.00       | 0.00           | 0.00           | 0.00                 | 0.00    | 0.00             |
| BRA            | 0.011           | No           | 0                               | 0.00       | 0.00            | 0.00       | 0               | 0.00       | 0.00           | 0.00           | 0.01                 | -0.01   | 0.00             |
| BOL            | 0.001           | No           | 0                               | 0.00       | 0.00            | 0.00       | 0               | 0.00       | 0.00           | 0.00           | 0.00                 | 0.00    | 0.00             |
| ARG            | 0.006           | No           | 2                               | 0.00       | 0.00            | 0.00       | 0               | 0.00       | 0.00           | 0.00           | 0.01                 | 0.00    | 0.00             |
| UKG            | 0.113           | Yes          | 8                               | 23.21      | 0.19            | 0.13       | 4               | 16.67      | 0.03           | 0.50           | 0.14                 | 0.04    | 0.00             |
| FRN            | 0.068           | Yes          | 7                               | 16.67      | 0.32            | 0.14       | 4               | 33.33      | 0.05           | 0.25           | 0.12                 | 0.20    | 0.67             |
| SWZ            | 0.000           | Yes          | 0                               | 0.00       | 0.00            | 0.00       | 0               | 0.00       | 0.00           | 0.00           | 0.00                 | 0.00    | 0.00             |
| SPN            | 0.015           | No           | 3                               | 16.67      | 0.07            | 0.33       | 2               | 100.00     | 0.02           | 1.00           | 0.03                 | 0.04    | 0.50             |
| GMY            | 0.143           | No           | 7                               | 7.14       | 0.21            | 0.71       | 3               | 100.00     | 0.05           | 0.00           | 0.19                 | 0.02    | 0.00             |
| AUH            | 0.045           | No           | 6                               | 33.33      | 0.18            | 0.50       | 3               | 100.00     | 0.09           | 0.00           | 0.13                 | 0.05    | 0.20             |

*(continued)*

Table 2.6 (*continued*)

| 1. State | Ego attributes  |              | Strategic reference group (SRG) |            |                    |               | Alliance egonet |            |                   | 13. SRG – and<br>(A + E) cap |                         | 14. SRG<br>alliance<br>overlap |
|----------|-----------------|--------------|---------------------------------|------------|--------------------|---------------|-----------------|------------|-------------------|------------------------------|-------------------------|--------------------------------|
|          | 2. Capabilities | 3. Democracy | 4. Size                         | 5. Density | 6. SRG<br>capabil. | 7. SRG<br>dem | 8. Size         | 9. Density | 10. Allies<br>cap | 11. Allies<br>dem            | 12. Allies +<br>Ego cap |                                |
| ITA      | 0.034           | No           | 7                               | 19.05      | 0.35               | 0.43          | 5               | 40.00      | 0.14              | 0.20                         | 0.17                    | 0.50                           |
| YUG      | 0.002           | Yes          | 8                               | 41.07      | 0.38               | 0.25          | 2               | 100.00     | 0.02              | 1.00                         | 0.02                    | 0.38                           |
| GRC      | 0.007           | Yes          | 6                               | 66.67      | 0.20               | 0.33          | 2               | 100.00     | 0.01              | 1.00                         | 0.01                    | 0.75                           |
| BUL      | 0.016           | No           | 9                               | 34.72      | 0.44               | 0.33          | 2               | 100.00     | 0.00              | 1.00                         | 0.02                    | 0.00                           |
| ROM      | 0.005           | No           | 4                               | 33.33      | 0.03               | 0.75          | 3               | 100.00     | 0.06              | 0.00                         | 0.07                    | 0.00                           |
| RUS      | 0.116           | No           | 8                               | 37.50      | 0.22               | 0.38          | 3               | 33.33      | 0.03              | 0.33                         | 0.14                    | 0.13                           |
| NOR      | 0.002           | Yes          | 0                               | 0.00       | 0.00               | 0.00          | 0               | 0.00       | 0.00              | 0.00                         | 0.00                    | 0.00                           |
| TUR      | 0.018           | No           | 8                               | 30.36      | 0.28               | 0.50          | 0               | 0.00       | 0.00              | 0.00                         | 0.02                    | 0.00                           |
| CHN      | 0.096           | No           | 4                               | 33.33      | 0.25               | 0.25          | 0               | 0.00       | 0.00              | 0.00                         | 0.10                    | 0.00                           |
| JPN      | 0.034           | No           | 7                               | 28.57      | 0.47               | 0.29          | 2               | 0.00       | 0.09              | 0.50                         | 0.12                    | 0.33                           |

Notes: Density (Column 5). *The proportion of the egonet (size/(N – 1))*.

SRG (Alliance) Capabilities (Columns #6, 10): The total military capabilities of the members making up the SRG (Alliance) egonet.

SRG (Alliance) Egonet DEM (Columns #7, 11): the proportion of members of the SRN (Alliance) egonet that are democracies.

Allies + Ego Cap (Column #12): The total capabilities of ego's allies + ego's capabilities.

SRG – (A + E) CAP (Column #13): The difference between the capabilities of the SRG and that of the Allies + Ego (see [Chapters 4–5](#)).

SRG-Alliance Overlap (Column #14): The proportion of the SRG that is composed of allies.

balance that of their potential enemies. At this point, we do not make much of it, but we will return to it later. By analyzing the egonet that affects a state's national security, we can get a sense of both the challenges the state faces from its external environment and the manner in which it may address them.

Column 14 shows an interesting and, from some perspectives, counterintuitive and puzzling feature of international relations: potential enemies that are also friends. A significant proportion of the SRGs (the list of potential enemies) of states such as Guatemala, Honduras, El Salvador, Austria-Hungary, Greece, Yugoslavia, Russia and Japan is composed of allies. This suggests that some of a state's enemies are also its friends and that some of its friends may be or have been its enemies (cf. Maoz *et al.* 2007a).

## 5. Centrality<sup>8</sup>

The concept of *centrality* is one of the most important instruments for comparing individual nodes within and across networks. It is also used by social network analysts as an indicator of prestige within a social system. The complication is that there is not a single measure of centrality; in fact, there are quite a few ways to gauge the centrality of nodes in networks, and each of them tells a different story about the concept.

To illustrate the different conceptions of centrality in SNA, consider again the 1913 alliance network (Figure 2.1.1). Just by looking at the graph we can eyeball the basic concept of *degree centrality*. According to this concept, the centrality of a given a state is a function of the proportion of ties it has with all other nodes in the network. Italy has alliance ties to five other states; these constitute 11 percent of the possible alliance ties it can have in a system of forty-six states. Seen in these terms, it is the most central state in the network. Given that the commitment matrix reflects both the number of allies and the level of commitment to them, however, Germany turns out to be the most central state in the system. We measure degree centrality twice: The indegree centrality is the centrality of a node based on incoming ties. The outdegree centrality is the degree centrality based on outgoing ties. Indegree centrality in a network of  $n$  nodes is measured as:

$$C_{Di}^i = \frac{\sum_{j=1}^n s_{ij} - s_{ii}}{\max(s_{ij})(n-1)} \quad [2.2]$$

<sup>8</sup> Most of the material discussed in this section is relevant for the discussion and analyses in Chapter 7.

Where  $C_D^i$  is the degree centrality of node  $i$ . This applies to outdegree centrality. When measuring outgoing degree centrality, we get:

$$C_{Do}^i = \frac{\sum_{j=1}^n s_{ji} - s_{ii}}{\max(s_{ij})(n-1)} \quad [2.3]$$

In symmetrical networks, indegree and outdegree centrality produce identical results.

Degree centrality is a simple and intuitively appealing index. However, in many other contexts, it is a partial or even deceptive indicator of social position. SNA theorists focus on a number of alternative conceptions. These conceptions often help uncover communications bottlenecks or gaps in organizational structures that disrupt communication and adversely affect decision making and organizational effectiveness (Burt 1992). Individual positions within such organizations are conceptualized principally in terms of the ability of a person to control information or influence other people within a network.

Many of these ideas were developed in the context of information flow in organizations. The concept of *closeness centrality* is a measure of the extent to which a node can approach other nodes or is approachable from other nodes in the network, taking into account the distance it has to cover (or the distance other nodes have to cover) up to the point of direct contact. Closeness centrality is thus defined as

$$C_{co}^i = \frac{(n-1)\max(s_{ij})}{\sum_{j \neq i}^n d_{ij}}$$

for outgoing ties and

$$C_{ci}^i = \frac{(n-1)\max(s_{ij})}{\sum_{i \neq j}^n d_{ji}} \text{ for incoming ties} \quad [2.4]$$

Where  $\max(s_{ij})$  is the maximum value that any relationship in the network can assume, and  $d_{ij}$  is the distance between nodes  $i$  and  $j$  (direct ties receive a score of the relationship  $s_{ij}$ , second-order ties are set to  $s_{ik} \times s_{kj}$ , and so forth). In contrast to degree centrality, which has meaningful values for any number or type of ties, closeness centrality is undefined for isolates. (In such cases, the denominators of the ratios in equation [2.4] are zero.)

*Betweenness centrality* envisions centrality as a brokerage position. We start again with organizational networks. A person who bridges two other persons is in a position to manipulate the information he or she

receives and to determine the type, accuracy, and quantity of information that goes through. In the context of the alliance network, a state is conceived as central to the extent that its alliance ties place it in a strategic bridging position. If Austria-Hungary gets into a war with Serbia, then it can rely (with some nonzero probability) on its direct allies, Germany, Romania, and Italy. The latter, though, is especially important. If Italy decides to join the war, it has the potential to get as many as five other states to help (Russia, UK, France, Spain, and Japan). This makes Italy rather central. Thus, betweenness centrality measures the brokerage role of a given node. This is given by

$$C_B^i = \frac{2 \sum_{j < k} g_{jk}(s_i) / g_{jk}}{(n-1)(n-2)} \quad [2.5]$$

Where  $g_{jk}(s_i)$  is any path between  $j$  and  $k$  going through  $i$ . This measures the proportion of the ties between  $j$  and  $k$  that is mediated by a  $j \rightarrow \dots i \rightarrow \dots k$  tie. The maximum number of such mediated ties is the number of possible triads of which  $j$  is a member in a network of size  $n$  [that is given by  $(n-1)(n-2)/2$ ].

As I pointed out in [Chapter 1](#), one of the key advantages of a network perspective of social interaction is the ability to track indirect relations. This is transparent in the contrast between the closeness and betweenness conceptions of centrality, on the one hand, and the simple conception of degree centrality, on the other. This distinction between the position of a person in the network based on the direct ties as well as one's indirect ties is probably best captured by the concept of *eigenvector centrality*.<sup>9</sup> The idea of this concept is that a person's status within a network is based not only on the number of ties that person has but also on the centrality of the people he or she is tied to. Eigenvector centrality implies that the centrality of a person increases the more central are the people to which one is tied. Thus, eigenvector centrality weighs the degree centrality of a given node by the degree centrality of the nodes it is connected with. The measure of eigenvector centrality is given by

$$C_E^i = \frac{\alpha \sum_{j \neq i} s_{ij} C_D^j}{(n-1)^2 \max(s_{ij})} \quad [2.6]$$

Where  $\alpha$  is a parameter (the reciprocal of the principal eigenvalue of the matrix) that is designed to give the measure a nontrivial solution, and  $C_D^j$  is the degree centrality score of the  $j$ th node. Eigenvector centrality is

<sup>9</sup> There are two contrasting conception of eigenvector centrality (Bonacich, 1987; Bonacich and Lloyd, 2001). The measure of influence centrality is based on an opposite notion to the one presented here. I do not discuss this here because it is less relevant for the kind of networks analyzed in this book. I mention the ideas of this measure briefly in the appendix.

based both on the number of ties of a given node and on the degree centrality of those nodes. A node that is tied to more central nodes receives a higher eigenvector centrality score than another node with the same number of ties, but to less central nodes.

Table 2.7 illustrates the similarities and differences between these measures via the centrality scores of the alliance network in Figure 2.1.1. To simplify matters, I exclude the isolates.

I focus on the rank columns because they help illustrate the following points. As can be seen from Table 2.7, Italy is the most central state in terms of degree centrality and betweenness centrality. It is connected to more states than any other state in the system and is also the most “strategically” positioned state. However, it is not the most central state in terms of closeness centrality, nor is it the most central state in terms of eigenvector centrality. When we take into account the nature of commitments and the extent of directedness, as well as the centrality of each state’s allies, Germany and Austria-Hungary are more central than Italy. Each concept tells a slightly different story about the notion of prestige.

## 6. Dyadic Characteristics

In international relations research, dyadic characteristics are often defined in terms of some direct relationship between dyad member (e.g., geographic contiguity, the presence or absence of an alliance, the magnitude of trade, etc.). Dyadic characteristics are also often defined in terms of whether or not members of a dyad share a common attribute (whether both are democratic, whether both are developed states, and so forth). SNA approaches have a different take on dyadic characteristics. I start with two conceptions of dyadic characteristics that are derived from “traditional” SNA approaches and continue with two characteristics that I develop here. All four sets of dyadic characteristics are used extensively throughout the book.

### 6.1. Structural Equivalence<sup>10</sup>

Two nodes are structurally equivalent to the extent that they have exactly the same profile of relations with all other nodes in the network. Here, the identity of nodes with which a given node has ties is meaningful. In practice, it is unlikely that any two nodes will have the same relational profiles. So we wish to measure the degree of similarity between the profiles of any two

<sup>10</sup> The material in the next two sections is relevant to analysis conducted in Chapter 10.



Table 2.7. *Centrality scores of (connected) states in the 1913 alliance network*

| State | Degree centrality | Rank degree centrality <sup>a</sup> | Closeness centrality | Rank closeness centrality | Betweenness centrality | Rank betweenness centrality | Eigenvector centrality | Rank eigenvector centrality |
|-------|-------------------|-------------------------------------|----------------------|---------------------------|------------------------|-----------------------------|------------------------|-----------------------------|
| GUA   | 0.016             | 12                                  | 91                   | 4                         | 0                      | 24.5                        | 0                      | 28.5                        |
| HON   | 0.011             | 15.5                                | 91                   | 4                         | 0                      | 24.5                        | 0                      | 28.5                        |
| SAL   | 0.016             | 12                                  | 91                   | 4                         | 0                      | 24.5                        | 0                      | 28.5                        |
| NIC   | 0.016             | 12                                  | 91                   | 4                         | 0                      | 24.5                        | 0                      | 28.5                        |
| ECU   | 0.008             | 17.5                                | 121.30               | 1                         | 0                      | 24.5                        | 0                      | 28.5                        |
| BOL   | 0.008             | 17.5                                | 121.30               | 1                         | 0                      | 24.5                        | 0                      | 28.5                        |
| UKG   | 0.019             | 10                                  | 4.70                 | 12.5                      | 1.10                   | 3                           | 1.62                   | 10                          |
| FRN   | 0.02              | 9                                   | 6.79                 | 9.5                       | 1.63                   | 2                           | 11.16                  | 8                           |
| SPN   | 0.005             | 19                                  | 4.04                 | 13.5                      | 0                      | 24.5                        | 1.00                   | 12                          |
| POR   | 0.011             | 15.5                                | 2.57                 | 18.5                      | 0                      | 24.5                        | 0.17                   | 13                          |
| GMY   | 0.038             | 3.5                                 | 3.28                 | 17                        | 0                      | 24.5                        | 79.83                  | 1                           |
| AUH   | 0.038             | 3.5                                 | 3.28                 | 17                        | 0                      | 24.5                        | 71.78                  | 2                           |
| ITA   | 0.044             | 1                                   | 6.29                 | 10.5                      | 2.09                   | 1                           | 66.81                  | 3                           |
| YUG   | 0.04              | 2                                   | 24.82                | 8.5                       | 0                      | 24.5                        | 25.68                  | 5                           |
| GRC   | 0.032             | 5.5                                 | 31.65                | 7                         | 0                      | 24.5                        | 22.17                  | 6.5                         |
| BUL   | 0.032             | 5.5                                 | 31.65                | 7                         | 0                      | 24.5                        | 22.17                  | 6.5                         |
| ROM   | 0.022             | 8                                   | 3.51                 | 15.5                      | 0                      | 24.5                        | 46.58                  | 4                           |
| RUS   | 0.015             | 14                                  | 5.29                 | 11.5                      | 0.52                   | 4                           | 8.34                   | 9                           |
| JPN   | 0.023             | 7                                   | 3.88                 | 14.5                      | 0.12                   | 5                           | 1.09                   | 11                          |

<sup>a</sup>Lower numbers indicate higher ranks

nodes in a network. The more similar these profiles, the more structurally equivalent these nodes. (One can argue that the level of affinity between nodes that have a high level of structural equivalence is also very high; see Maoz et al., 2006.) Measures of structural equivalence apply to relational profiles for one, two, or several networks, as long as the nodes are the same across these networks. There are a number of ways to measure structural equivalence (Wasserman and Faust, 1997: 367–375). For a single network we can use a standardized Euclidean distance measure such that

$$Ese_{ij} = Ese_{ji} = 1 - \frac{\sqrt{\sum_{k=1}^n (s_{ik} - s_{jk})^2 + \sum_{k=1}^n (s_{ki} - s_{kj})^2}}{n^2 \max(s_{ik} - s_{jk})} \quad [2.7]$$

where  $Ese_{ij}$  denotes the Euclidean distance structural equivalence scores of nodes  $i$  and  $j$ ,  $s_{ik}$  and  $s_{jk}$  are the ties going from nodes  $i$  and  $j$  to node  $k$ , respectively,  $s_{ki}$  and  $s_{kj}$  are the ties going from node  $k$  to nodes  $i$  and  $j$ , respectively, and  $\max(s_{ik} - s_{jk})$  is the maximum possible distance between any two nodes in the matrix. Conceived in these terms, structural equivalence is the complement of the ratio of the actual Euclidean distance between the relational profiles of two nodes and the maximal possible Euclidean distance of a network with  $n$  nodes and a maximum inter-nodal difference of  $\max(s_{ik} - s_{jk})$ . This measure varies between zero (no structural equivalence) and 1 (perfect structural equivalence). Clearly, the more similar the relational profiles of two nodes, the higher their level of structural equivalence.

Another measure of structural equivalence for a single network is based on the bivariate correlation coefficient of the relational profiles of any two nodes. This is given by

$$Cse_{ij} = Cse_{ji} = \frac{\sum_{k=1}^n (s_{ik} - \bar{s}_{\bullet i})(s_{jk} - \bar{s}_{\bullet j}) + \sum_{k=1}^n (s_{ki} - \bar{s}_{i \bullet})(s_{kj} - \bar{s}_{j \bullet})}{\sqrt{\sum_{k=1}^n (s_{ik} - \bar{s}_{\bullet i})^2 + \sum_{k=1}^n (s_{ki} - \bar{s}_{i \bullet})^2} \sqrt{\sum_{k=1}^n (s_{jk} - \bar{s}_{\bullet j})^2 + \sum_{k=1}^n (s_{kj} - \bar{s}_{j \bullet})^2}} \quad [2.8]$$

where  $\bar{s}_{\bullet i}$  and  $\bar{s}_{i \bullet}$  are, respectively, the means of rows  $i$  and  $j$ , and  $\bar{s}_{j \bullet}$  and  $\bar{s}_{\bullet j}$  are the means of columns  $i$  and  $j$ . The correlation-based structural equivalence scores ( $Cse$ ) vary between  $-1$  and  $+1$  with negative values indicating that the relational profiles of nodes tend to be drastically different from each other (i.e., node  $i$  tends to have ties with nodes that are not tied to  $j$  and vice versa).

As noted, we can extend these measures to assess structural equivalence across multiple networks. Consider a set of  $R$  [ $r_1, r_2, \dots, r_m$ ] networks with the same nodes. The standardized Euclidean distance structural equivalence of nodes  $i$  and  $j$  across these networks is given by

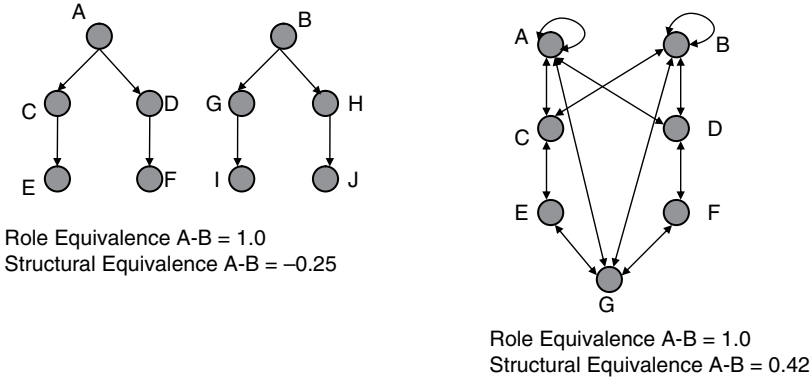


Figure 2.4. Structural and role equivalence.

$$Ese_{ij}^R = Ese_{ji}^R = 1 - \frac{\sqrt{\sum_{r=1}^m \sum_{k=1}^n (s_{ikr} - s_{jkr})^2 + (s_{kir} - s_{kjr})^2}}{mn^2 \sum_{r=1}^m \max_r (s_{ikr} - s_{jkr})} \quad [2.9]$$

And the correlation-based multinetwork structural equivalence algorithm is given by

$$Cse_{ij}^R = Cse_{ji}^R \frac{\sum_{r=1}^{2m} \sum_{k=1}^n (s_{ikr} - \bar{s}_{ir\bullet})(s_{jkr} - \bar{s}_{jr\bullet})}{\sqrt{\sum_{r=1}^{2m} \sum_{k=1}^n (s_{ikr} - \bar{s}_{ir\bullet})^2} \sqrt{\sum_{r=1}^{2m} \sum_{k=1}^n (s_{jkr} - \bar{s}_{jr\bullet})^2}} \quad [2.10]$$

where  $m \in \mathbb{R}$  indexes networks,  $s_{ikr}$ ,  $s_{jkr}$  are network relations ( $-\infty \leq s_{ikr}$ ,  $s_{jkr} \leq +\infty$ ) between nodes  $i$  and  $k$  and  $j$  and  $k$ , respectively, in network  $r$ , and  $\bar{s}_{ir\bullet}$ ,  $\bar{s}_{jr\bullet}$  are, respectively, the mean level of ties of nodes  $i$  and  $j$  with all other nodes in network  $r$ .<sup>11</sup>

## 6.2. Role Equivalence

Structural equivalence measures capture internodal equivalence based on the *identity* of the nodes that have ties to the focal dyad. Two nodes that have ties to the same other nodes are perfectly structurally equivalent. However, nodes can have structurally similar *patterns of ties*, but a low level of structural equivalence. Consider Figure 2.4.

Briefly, role equivalence captures the position of nodes in a network based on the structure of their triadic relationships with other nodes.

<sup>11</sup> Note that the correlations use the transposed network matrices to incorporate both outgoing and incoming ties so that they are calculated over both incoming and outgoing ties.

Role equivalence allows systematic detection of organizational structures (Burt, 1990). A given triadic relationship in a binary network can take one of thirty-six possible forms (e.g., a null profile is denoted by  $i \not\leftrightarrow j$ ,  $i \not\leftrightarrow k$ ,  $j \not\leftrightarrow k$ ; a full symmetrical profile is  $i \leftrightarrow j$ ,  $i \leftrightarrow k$ ,  $j \leftrightarrow k$ , and so forth). Two nodes that have identical triadic profiles in terms of their relations with other nodes – regardless of the identity of these other nodes – are fully equivalent in terms of their roles.

For example, in Figure 2.4, nodes A and B on the left part of the figure are considered perfectly role equivalent despite the fact that they have neither ties to each other nor common ties to other nodes in the network. We can think of them as two division managers working in different plants of the same corporation. Both have structurally the same kind of relationship to subordinates, but the people they supervise have no ties to each other. Thus the structural equivalence of these two nodes is negative. On the right hand side of the figure, again, nodes A and B capture identical roles in the system, but now their pattern of ties to specific nodes is much more similar than in the left part. Thus the structural equivalence score for these nodes is positive and moderate.

Role equivalence methods compare the patterns of triadic ties each node has with all other nodes in the network. Two nodes are said to be role equivalent to the extent that they have exactly the same triadic census profiles. In practice, the extent of role equivalence is measured via correspondence matching between the triadic profiles of one node and the triadic profiles of another node. For example, Burt (1990) and Van Rossem (1996) use Euclidean distance measures of role equivalence. This is illustrated by equation [2.11].

$$RE_{ij} = \sqrt{\sum_{q=1}^{36} (t_{iq} - t_{jq})^2} \quad [2.11]$$

where  $q$  indexes the triangle census number, and  $[0 \leq t_{iq}, t_{jq} \leq 36]$  index the number of cases where each of the nodes  $i$  and  $j$  have a triangular tie of the particular type. In order to create a standardized measure of role equivalence that parallels that of the structural equivalence indices discussed above, I standardize the index in [2.11] as:

$$RE_{sij} = 1 - \frac{2\sqrt{\sum_{q=1}^{36} (t_{iq} - t_{jq})^2}}{(n-1)(n-2)} \quad [2.12]$$

This standardization is due to the fact that each node in a network of  $n$  nodes can be part of  $(n-1)(n-2)/2$  triads. Thus the standardized role equivalence measure is the complement of the maximum possible distance between two sets of triad censuses.

The measures of structural and role equivalence play an important role in comparing dyads. However, they also serve as a foundation for

more complex operations designed to partition the network into endogenous subgroups. We can now compare the advantages and limitations of structural and role equivalence measures.

Role equivalence requires binary data; thus, valued matrices must be binarized. Moreover, with signed graphs (where values can take on positive or negative values), role equivalence measures cannot be applied. Such data need to be binarized in a manner that hides all information about the nature of relationships that is converted to binary values. This might cause considerable bias.<sup>12</sup> Structural equivalence measures, however, can handle all types of data equally well and do not cause loss of information.

The triadic census process that underlies the calculation of role equivalence scores ignores self-ties. However, self-ties may be meaningful. For example, in alliance networks, relationships indicate the strength of states' commitments to each other relative to some maximum. Self-ties indicate maximum commitment. Structural equivalence scores deal equally well with self-ties as with data in which self-ties are not meaningful.

As we have seen, structural equivalence matrices can reflect a single relationship (one network) or multiple relationships (multiple networks). Some measures of structural equivalence (e.g., Euclidean distance measures) can even allow for weights of the relative effect of various networks on the overall magnitude of structural equivalence. The notion of role equivalence was developed for single networks. It is not practical, nor is it meaningful, to conduct triadic censuses over multiple networks. One can, however, conceive of some weighting scheme where role equivalence measures are computed for each network separately and are integrated through some weighted (or unweighted) summation of the role equivalence scores across individual networks. Thus, given a set of  $R = [1, 2, \dots, \rho]$  networks with the same nodes, an integrated role equivalence score could be formulated as:

$$RE_{sij|R} = \sum_{k=1}^{\rho} RE_{sijk} w_k \quad \text{where } 0 \leq w_k \leq 1, \sum w_k = 1 \quad [2.13]$$

The previous characteristics suggest that role equivalence has serious limitations when it comes to the kind of input data it requires and when it deals with self-ties. The main advantage of role equivalence measures is the focus on the structure of ties regardless of the identity of nodes with which a given pair of nodes is connected. This is particularly important for dynamics of networks. Suppose a state **A** decides to terminate its alliance with state **B** and instead form an alliance with state **C**. If the

<sup>12</sup> For example, if we decide to binarize values such that all positive numbers receive a score of one, and all other values receive a score of zero, then we have no way of distinguishing between relationships that are negative and nonrelationships.

relationships between **B** and all other states in the system are identical to those of **C** and all other states, then **A**'s triadic census pattern will not change due to its shift in alliance memberships. Consequently, the role equivalence scores of **A** with other states will not change in any meaningful way. Structural equivalence scores are likely to change because the identity of the states with whom **A** is allied is now different from what it used to be, and therefore its structural equivalence scores with other states may change at least marginally. When we are interested in "blind" structural features of relationships, particularly, in cases where we are looking for the functional attributes of dyads, role equivalence indices are probably more meaningful than structural equivalence scores.

## 7. Endogenous Groups

One of the most interesting properties of SNA is that it can partition networks into endogenously formed groups. This partitioning can be done for a single network or for multiple networks with the same nodes. I focus in this book on two types of endogenous groups: cliques and blocks. SNA has other types of grouping strategies (Wasserman and Faust, 1997: 249–290), but these are beyond the scope of the present study.

### 7.1. Cliques

A clique is a fully connected (or closed) subset of a network. This means that a clique is composed of a set of nodes, all of which have direct ties to each other at a predefined level or above (a cutoff point used to binarize a network).<sup>13</sup> A given network can be partitioned into a set of cliques based on this definition. Cliques are not mutually exclusive groups. Any two cliques can have one or more members in common. The only restriction is that no clique can be a proper subset of another clique. This implies that any two cliques must differ with respect to at least two members: at least one member in clique *k* is not a member of clique *l* and at least one member of clique *l* is not a member of clique *k*. For example, if we have a system of five states **A**, **B**, ..., **E** and if states **A**, **B**, and **C** have an alliance and members **A**, **D**, **E** have an alliance, the system has two cliques, **ABC** and **ADE**. State **A** is a member of both alliances and the two alliances share one common member.

As noted, with valued networks we must establish a threshold for defining a relationship because clique derivation algorithms require binary

<sup>13</sup> The concept of *n-cliques* refers to cliques composed of nodes that have a direct or indirect tie of order 1, 2, ... *n*. So a 3-clique, for example, consists of nodes that have either direct (my ally), second-order (the ally of my ally), or third-order (the ally of the ally of my ally) ties with each other.

networks. Likewise, if the sociomatrix is asymmetrical, it needs to be symmetrized. Here, too, different symmetrization strategies may be used. Most SNA software packages apply a computerized algorithm to derive cliques. The cliques are represented by a clique affiliation (CA) matrix of order  $n$  (nodes)  $\times$   $k$  (cliques). Like any other two-mode (affiliation) network, the clique affiliation matrix can be converted into two matrices, each based on one of the modes of the CA matrix. The clique membership overlap (CMO) matrix is obtained by multiplying the CA matrix by its transpose ( $\text{CMO} = \text{CA} \times \text{CA}'$ ). The CMO matrix is an  $n \times n$  matrix that has the following structure: (1) diagonal entries  $\text{cmo}_{ii}$  reflect the number of clique membership of each unit  $i$ ; (2) the matrix is symmetrical ( $\text{cmo}_{ij} = \text{cmo}_{ji} \forall i, j \in N$ ); and (3) off-diagonal entries  $\text{cmo}_{ij}$  reflect the number of cliques which units  $i$  and  $j$  share.

For some analytical purposes, we need to provide a more credible picture of the extent of shared clique membership that differentiates between nodes with high numbers of clique affiliations and those with few clique affiliation. I normalize the CMO matrix by dividing each entry by its respective row diagonal  $\widetilde{\text{cmo}}_{ij} = \text{cmo}_{ij} / \text{cmo}_{ii}$ . The resulting normalized clique membership overlap matrix is defined by the following elements: (1)  $\widetilde{\text{cmo}}_{ii} = 1 \forall i \in N$ , (2)  $\widetilde{\text{cmo}}_{ij} \neq \widetilde{\text{cmo}}_{ji}$ , and (3)  $0 \leq \widetilde{\text{cmo}}_{ij} \leq 1 \forall i, j \in N$ .

Consider the following example of a ten-member hypothetical network. The network shown in Figure 2.5.1 is asymmetrical (e.g., there is only a one-way arrow going from 3 to 10 or from 10 to 2). This network is symmetrized such that the link  $s_{ij}$  gets a score of 1 if and only if  $s_{ij} = s_{ji} = 1$ , and zero otherwise. Here, we lose some of the information given in the graph because unidirectional ties are ignored. Figure 2.5.2 shows the clique affiliation graph. Nodes are marked by circles and cliques are marked by squares. Arrows going from node  $i$  to clique  $k$  indicate that the node is a member of this clique. This particular network is divided into three cliques. Any given node can belong to several cliques, and any two cliques can share several nodes in common. Table 2.8 shows the sociomatrix and the CA matrix of this network. The row marginals of the clique affiliation matrix reflect the number of clique memberships of each node and the column marginals reflect the number of nodes affiliated with a given clique.

The CA matrix can be treated, for all practical purposes, as an affiliation network. Thus, we can convert the CA matrix into a CMO matrix, and we can diagonally standardize the CMO matrix to obtain the relative overlap of nodes across cliques. Table 2.9 shows the result of converting the CA matrix in Table 2.8 into a CMO and  $\widetilde{\text{CMO}}$  matrices. The nodes serve as the baseline for conversion. We can also use the cliques as a baseline for converting the CA matrix into a clique-by-clique ( $\widetilde{\text{CO}}$ ) matrix and normalize this as diagonally standardized matrix.

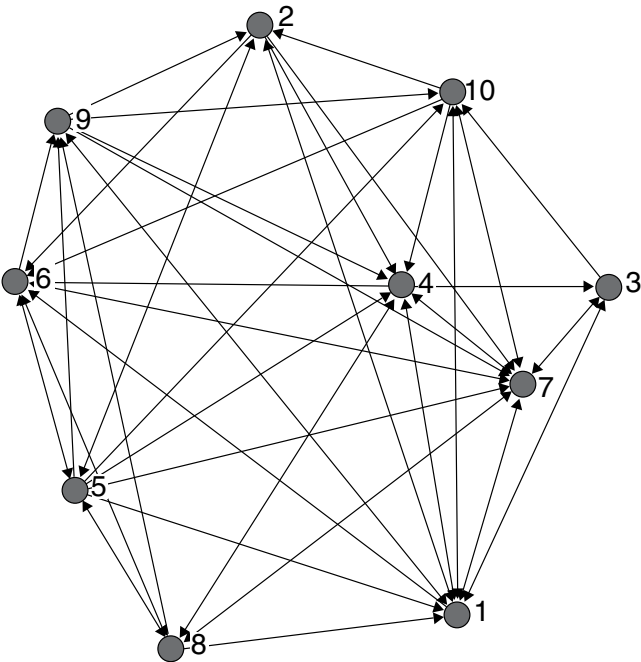


Figure 2.5.1. A ten-member network.

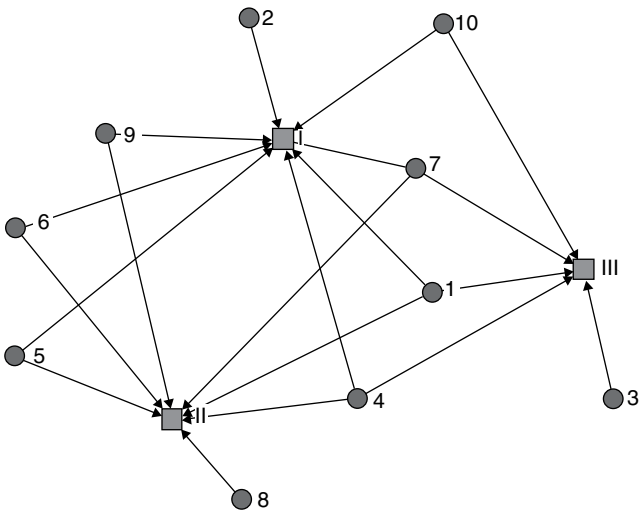


Figure 2.5.2. A clique affiliation representation of the network.  
Figure 2.5. A hypothetical ten-member network and its clique structure.



Table 2.8. *A matrix representation of sociomatrix and clique affiliation matrix*

| 2.8.1. Sociomatrix ( $S^1$ ) |   |   |   |   |   |   |   |   |   |    |
|------------------------------|---|---|---|---|---|---|---|---|---|----|
|                              | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1                            | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1  |
| 2                            | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0  |
| 3                            | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1  |
| 4                            | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0  |
| 5                            | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1  |
| 6                            | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0  |
| 7                            | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1  |
| 8                            | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0  |
| 9                            | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1  |
| 10                           | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0  |

| 2.8.2. Clique affiliation matrix ( $CA$ ) |   |    |     |         |
|-------------------------------------------|---|----|-----|---------|
|                                           | I | II | III | $TCA_i$ |
| 1                                         | 1 | 1  | 1   | 3       |
| 2                                         | 1 | 0  | 0   | 1       |
| 3                                         | 0 | 0  | 1   | 1       |
| 4                                         | 1 | 1  | 1   | 3       |
| 5                                         | 1 | 1  | 0   | 2       |
| 6                                         | 1 | 1  | 0   | 2       |
| 7                                         | 1 | 1  | 1   | 3       |
| 8                                         | 0 | 1  | 0   | 1       |
| 9                                         | 1 | 1  | 0   | 2       |
| 10                                        | 1 | 0  | 1   | 2       |
| $CM_i$                                    | 8 | 7  | 5   | 20      |

| 2.8.3. Second-order relations ( $S^2$ ) |   |   |   |   |   |   |   |   |   |    |
|-----------------------------------------|---|---|---|---|---|---|---|---|---|----|
|                                         | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1                                       | 5 | 2 | 2 | 4 | 2 | 3 | 6 | 3 | 1 | 3  |
| 2                                       | 3 | 2 | 3 | 3 | 1 | 3 | 4 | 3 | 3 | 3  |
| 3                                       | 2 | 1 | 1 | 2 | 0 | 1 | 1 | 1 | 0 | 1  |
| 4                                       | 2 | 1 | 2 | 3 | 2 | 2 | 4 | 2 | 3 | 3  |
| 5                                       | 5 | 3 | 3 | 5 | 2 | 4 | 6 | 3 | 2 | 3  |
| 6                                       | 4 | 2 | 1 | 4 | 1 | 2 | 3 | 1 | 2 | 3  |
| 7                                       | 3 | 2 | 2 | 3 | 1 | 4 | 5 | 1 | 2 | 2  |
| 8                                       | 4 | 3 | 3 | 4 | 1 | 3 | 5 | 3 | 3 | 4  |
| 9                                       | 4 | 2 | 3 | 4 | 1 | 4 | 4 | 2 | 1 | 2  |
| 10                                      | 3 | 1 | 3 | 3 | 2 | 3 | 4 | 3 | 2 | 2  |

Table 2.9. *Clique membership overlap (CMO), standardized clique membership overlap ( $\widetilde{\text{CMO}}$ ), clique-by-clique overlap (CO) and standardized clique-by-clique overlap ( $\widetilde{\text{CO}}$ ) matrices derived from the CA matrix of Table 2.8*

| 2.9.1. CMO |   |   |   |   |   |   |   |   |   |    |
|------------|---|---|---|---|---|---|---|---|---|----|
|            | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1          | 3 | 1 | 1 | 3 | 2 | 2 | 3 | 1 | 2 | 2  |
| 2          | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1  |
| 3          | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1  |
| 4          | 3 | 1 | 1 | 3 | 2 | 2 | 3 | 1 | 2 | 2  |
| 5          | 2 | 1 | 0 | 2 | 2 | 2 | 2 | 1 | 2 | 1  |
| 6          | 2 | 1 | 0 | 2 | 2 | 2 | 2 | 1 | 2 | 1  |
| 7          | 3 | 1 | 1 | 3 | 2 | 2 | 3 | 1 | 2 | 2  |
| 8          | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0  |
| 9          | 2 | 1 | 0 | 2 | 2 | 2 | 2 | 1 | 2 | 1  |
| 10         | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 0 | 1 | 2  |

| 2.9.2. $\widetilde{\text{CMO}}$ |   |      |      |   |      |      |   |      |      |      |
|---------------------------------|---|------|------|---|------|------|---|------|------|------|
|                                 | 1 | 2    | 3    | 4 | 5    | 6    | 7 | 8    | 9    | 10   |
| 1                               | 1 | 0.33 | 0.33 | 1 | 0.67 | 0.67 | 1 | 0.33 | 0.67 | 0.67 |
| 2                               | 1 | 1    | 0    | 1 | 1    | 1    | 1 | 0    | 1    | 1    |
| 3                               | 1 | 0    | 1    | 1 | 0    | 0    | 1 | 0    | 0    | 1    |
| 4                               | 1 | 0.33 | 0.33 | 1 | 0.67 | 0.67 | 1 | 0.33 | 0.67 | 0.67 |
| 5                               | 1 | 0.5  | 0    | 1 | 1    | 1    | 1 | 0.5  | 1    | 0.5  |
| 6                               | 1 | 0.5  | 0    | 1 | 1    | 1    | 1 | 0.5  | 1    | 0.5  |
| 7                               | 1 | 0.33 | 0.33 | 1 | 0.67 | 0.67 | 1 | 0.33 | 0.67 | 0.67 |
| 8                               | 1 | 0    | 0    | 1 | 1    | 1    | 1 | 1    | 1    | 0    |
| 9                               | 1 | 0.5  | 0    | 1 | 1    | 1    | 1 | 0.5  | 1    | 0.5  |
| 10                              | 1 | 0.5  | 0.5  | 1 | 0.5  | 0.5  | 1 | 0    | 0.5  | 1    |

| 2.9.3. CO |   |    |     |
|-----------|---|----|-----|
|           | I | II | III |
| I         | 8 | 6  | 4   |
| II        | 6 | 7  | 3   |
| III       | 4 | 3  | 5   |

| 2.9.4. $\widetilde{\text{CO}}$ |       |       |       |
|--------------------------------|-------|-------|-------|
|                                | I     | II    | III   |
| I                              | 1.000 | 0.750 | 0.500 |
| II                             | 0.857 | 1.000 | 0.429 |
| III                            | 0.800 | 0.600 | 1.000 |

The unstandardized **CMO** and **CO** matrices have the same general properties:

1. Their dimensions reflect the number of nodes ( $n$  for **CMO**) or the number of cliques ( $k$  for **CO**), respectively.
2. They are symmetrical.
3. Diagonal entries ( $cmo_{ii}$ ) reflect the number of cliques in which each node is a member (for **CMO**, these are row marginals in **CA**), or ( $co_{kk}$ ) the number of nodes in each clique (for **CO**, the column marginals in **CA**).
4. Off-diagonal entries ( $cmo_{ij}$ ) reflect the number of cliques in which any two nodes overlap, or the number of common nodes ( $co_{kl}$ ) across any two cliques.

The standardized matrices ( $\widetilde{CMO}$ ,  $\widetilde{CO}$ ) have the following properties:

1. They are asymmetrical ( $\widetilde{cmo}_{ij} \neq \widetilde{cmo}_{ji}$ ,  $\widetilde{co}_{ki} \neq \widetilde{co}_{lk}$ )
2. Diagonal entries are 1.
3. Off-diagonal entries ( $\widetilde{cmo}_{ij}$ ) reflect the number of cliques over which nodes  $i$  and  $j$  overlap as a proportion of the number of cliques in which  $i$  is a member, or ( $\widetilde{co}_{ij}$ ) the number of members that cliques  $k$  and  $l$  share as a proportion of the number of members in clique  $k$ .

As we will see, the normalized clique membership and clique-by-clique overlap matrices serve a number of useful purposes when measuring general network attributes. Yet, the  $\widetilde{CMO}$  matrix provides a useful basis for dyadic comparisons. The entries in this matrix measure a new form of affinity between nodes: their shared clique membership. The shared clique membership score tells a significantly different story from the structural and role equivalence measures of dyadic affinity. It measures the extent to which two states are grouped together across the different cohesive groups formed by their network ties. More important, because the normalized clique membership scores are asymmetric, they provide richer information about affinity than the other scores. In practice, the correlation between the standardized CMO scores and the role and structural equivalence scores are extremely low.<sup>14</sup>

I have extended the clique derivation algorithm to allow the derivation of cliques across multiple networks with the same nodes. This is a straightforward (yet computationally tedious) algorithm that works in the following manner: Given a set of  $R = [1, 2, \dots, \rho]$  networks with the same  $n$  nodes, the algorithm has the following general structure:

1. Derive the clique affiliation matrix for each of the  $\rho$  networks [**CA**<sub>1</sub>, **CA**<sub>2</sub>, ..., **CA** <sub>$\rho$</sub> ].

<sup>14</sup> A simulation with a large number of random networks (with sizes ranging between  $15 \leq n \leq 200$ ) and each iterated between 100 and 1,000 times yields a correlation of  $r_{cmo-cse} = 0.011$ .

2. Generate a joint clique affiliation (**JCA**) matrix of size  $n \times ?$  (with the column dimension defined by the outcome of the pairwise clique comparison as outlined below) that represents the affiliation of the  $n$  nodes with all of the nonredundant cliques across the  $p$  networks.
3. Generate a counting vector **R** of dimension  $?$  that defines the magnitude of redundancy of a given clique across networks (the entries of **R** ( $r_j$ ) range between 1 and  $p$ ).
4. Perform a pairwise comparison of all cliques from each network [ $c_{11} \Leftrightarrow c_{21}, \dots, c_{11} \Leftrightarrow c_{qm}, \dots, c_{(p-1)1} \Leftrightarrow c_{pm}$ ].
5. For each pairwise comparison  $c_{qi} \Leftrightarrow c_{sm}$ : (a) if a given clique  $c_{qi}$  is either equivalent to or a proper subset of another clique  $c_{sm}$ , ( $c_{qi} \subseteq c_{sm}$ ) delete  $c_{qi}$  and add 1 to  $r_m$ ; (b) If clique  $c_{qi}$  “survives” the comparison across all  $p$  networks, enter  $c_{qi}$  as a column of the **JCA** matrix.
6. When the pairwise comparison of all cliques is completed, **JCA** reflects all nonredundant cliques across all networks. The **R** vector reflects the extent of redundancy of each of the cliques. Each entry in **R**,  $r_j$ , reflects the number of cliques that were either equal to or a subset of clique  $j$  in **JCA**.
7. Clique operations (node-based **CMO** or clique-based **CO** matrices) can be performed on either the unweighted **JCA** matrix or can be weighted by the **R** vector. For example:
  - a. A weighted **CMO** (**WCMO**) matrix can be computed such that  $\mathbf{WCMO} = (\mathbf{JCA} \times \mathbf{JCA}') \circ \mathbf{R}'$  (where  $\circ$  represents element-wise multiplication).
  - b. A weighted **CO** (**WCO**) matrix can be generated such that  $\mathbf{WCO} = (\mathbf{JCA}' \times \mathbf{JCA}) \circ \mathbf{R}'$ .

The **WCMO** matrix reflects the extent of cross-network overlap of clique membership of any two nodes. The **WCO** matrix reflects the extent of joint overlap of clique members for any two cliques across all networks. The normalized  $\widehat{\mathbf{CMO}}$  and  $\widehat{\mathbf{CO}}$  matrices are calculated in the same way as for single-network overlap matrices.<sup>15</sup>

## 7.2. Blocks

The process of deriving cliques from networks requires making some modifications in the structure of some networks, and thus has a number of drawbacks. First, valued or signed networks need to be binarized. Second, directional networks need to be symmetrized. Consequently, the derivation of cliques from such networks misrepresents their structure to

<sup>15</sup> The MaozNet program has a special module for clique derivation and clique operations with multiple networks.

some extent. Another issue that proves problematic for some operations stems from the fact that cliques form nondiscrete groups. This is a problem if we need to divide the network into discrete groups that are based on some relational properties. Blockmodeling methods address many of these issues.

A block is a subset of a network formed of nodes with similar – or equivalent – relational patterns. There are different ways to assign nodes to *positions*, that is, to discrete blocks (Wasserman and Faust, 1997: 375–385). In the present study, I use a method called convergence of iterated correlations (CONCOR). This method uses as its principal input a matrix of structural equivalence (SE) or role equivalence (RE) scores, such that each entry in the input matrix ( $se_{ij}$  or  $re_{ij}$ ) reflects the structural (role) equivalence scores between nodes  $i$  and  $j$  across one or more relationships in  $R$ .

CONCOR operates by running iterated correlations on the matrix of structural equivalence (or role equivalence) scores. This process polarizes the correlations between nodes in the network such that positive correlations (no matter how low they are in the first iteration) gradually increase to the point of perfect correlation and negative correlations gradually decrease to the point of perfectly inverse correlations. After a number of iterations, the iterated SE/RE matrix becomes a matrix composed of +1s and –1s. The CONCOR procedure then partitions this matrix into two separate matrices such that all nodes in one of the matrices (say SE1) are perfectly correlated with each other and have perfect negative correlations with all nodes that are in the other matrix (say SE2). These two matrices are again assigned the original correlation scores between each pair of nodes in them and the iteration process repeats itself, now separately on each of the two matrices. Once these two matrices converge to matrices consisting strictly of +1s and –1s, they are again partitioned in the same manner. This procedure continues until all nodes have been assigned to a block. The depth of this procedure (that is the number of splits that are required before all nodes are assigned) can be determined exogenously. This defines the number of resulting blocks; the more splits are defined, *ceteris paribus*, the more blocks will emerge.

The end result of this method is a block affiliation (BA) (or position) matrix that assigns each unit to one and only one block. An affiliation-to-sociomatrix conversion of BA to a block membership overlap (BMO) matrix is done in the usual form ( $BMO = BA \times BA'$ ). The block membership overlap is a binary symmetrical matrix in which entries  $bmo_{ij}$  stipulate whether or not units  $i$  and  $j$  belong to the same block.

Table 2.10 illustrates the block partitioning process using the sociomatrix of Table 2.8 as the basic example. Table 2.10.1 is the basic input for partitioning – the CSE matrix of Correlated Structural Equivalences. Table 2.10.2 shows the resulting BA matrix that the CONCOR method

Table 2.10. *Block partition (CONCOR) of the network in Table 2.8*

2.10.1. *Structural equivalence matrix (SE)*

|    | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      | 10     |
|----|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 1  | 1.000  | -0.066 | 0.127  | 0.137  | 0.238  | 0.000  | -0.212 | -0.069 | -0.066 | 0.000  |
| 2  | -0.066 | 1.000  | -0.047 | 0.358  | -0.154 | 0.124  | -0.024 | 0.170  | 0.184  | 0.505  |
| 3  | 0.127  | -0.047 | 1.000  | -0.024 | -0.076 | 0.095  | -0.197 | 0.221  | 0.188  | 0.116  |
| 4  | 0.137  | 0.358  | -0.024 | 1.000  | -0.137 | 0.170  | 0.051  | -0.242 | -0.063 | 0.209  |
| 5  | 0.238  | -0.154 | -0.076 | -0.137 | 1.000  | -0.134 | -0.053 | 0.207  | 0.507  | 0.000  |
| 6  | 0.000  | 0.124  | 0.095  | 0.170  | -0.134 | 1.000  | -0.099 | -0.043 | -0.082 | -0.408 |
| 7  | -0.212 | -0.024 | -0.197 | 0.051  | -0.053 | -0.099 | 1.000  | -0.435 | 0.220  | -0.243 |
| 8  | -0.069 | 0.170  | 0.221  | -0.242 | 0.207  | -0.043 | -0.435 | 1.000  | -0.043 | 0.105  |
| 9  | -0.066 | 0.184  | 0.188  | -0.063 | 0.507  | -0.082 | 0.220  | -0.043 | 1.000  | 0.303  |
| 10 | 0.000  | 0.505  | 0.116  | 0.209  | 0.000  | -0.408 | -0.243 | 0.105  | 0.303  | 1.000  |

2.10.2 *Block affiliation matrix (BA)*

|    | I | II | III | IV |
|----|---|----|-----|----|
| 1  | 1 | 0  | 0   | 0  |
| 2  | 0 | 1  | 0   | 0  |
| 3  | 0 | 0  | 1   | 0  |
| 4  | 0 | 1  | 0   | 0  |
| 5  | 1 | 0  | 0   | 0  |
| 6  | 0 | 0  | 0   | 1  |
| 7  | 0 | 0  | 0   | 1  |
| 8  | 1 | 0  | 0   | 0  |
| 9  | 0 | 0  | 1   | 0  |
| 10 | 0 | 1  | 0   | 0  |

2.10.3. *Block membership overlap matrix (BMO)*

|    | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|----|---|---|---|---|---|---|---|---|---|----|
| 1  | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0  |
| 2  | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1  |
| 3  | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0  |
| 4  | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1  |
| 5  | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0  |
| 6  | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0  |
| 7  | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0  |
| 8  | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0  |
| 9  | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0  |
| 10 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1  |

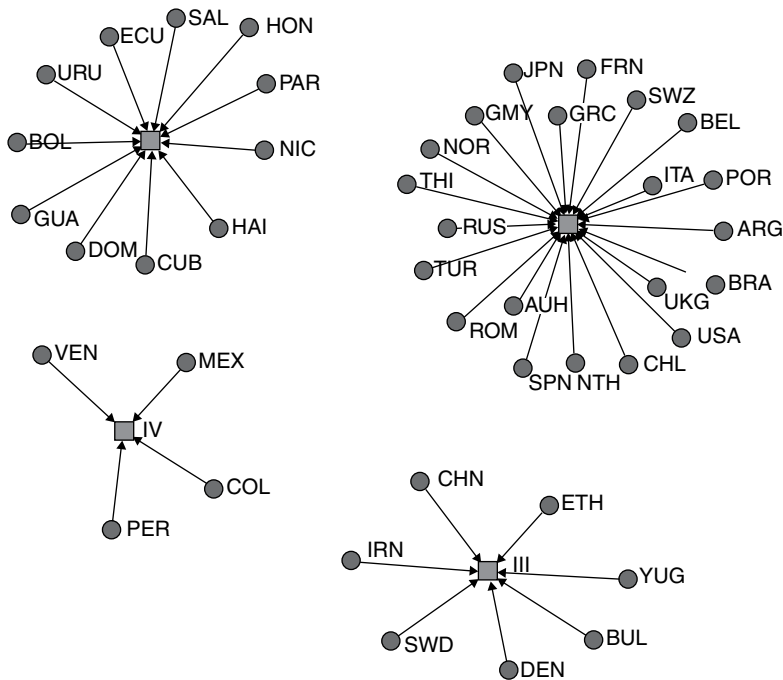


Figure 2.6. The block structure of alliance, trade, and IGO networks in 1913.

produces, and Table 2.10.3 shows the resulting Block Membership Overlap ( $BMO = BA \times BA'$ ) matrix. The resulting block structure yields a binary dyadic dataset such that each entry is defined as 1 if two states were in the same block at a given year and zero otherwise.

Since blockmodels start out with equivalence matrices, we can derive endogenous groups from a single network or from several networks. So, consider, for example, the three major networks that form the focus of this study. The grouping of states in 1913 in terms of structurally equivalent blocks is given in Figure 2.6. This figure displays the partition of the system into four blocks. B1 consists of primarily industrialized states and/or European ones. B2 consists of South American and Caribbean States, B3 consists of Central American states, and B4 appears to be a residual category of states that were typically nonaligned, had relatively little trade with other states, and participated in relatively few IGOs. Whether or not this partitioning of the system into endogenously derived blocks makes intuitive sense depends on the perspective of the observer.

This example highlights the relative strengths and weaknesses of blocks as endogenously derived groups. First, blocks are based on the real

values of the network data: valued networks do not require binarization; directional networks do not require symmetrization. Second, blocks can reflect equivalent relationships within a single network or across several networks with the same nodes. Third, when we are interested in splitting one or more network into discrete subgroups, blocks offer a natural way of doing this endogenously. These are important advantages of blockmodels.

However, as we will see below, this strategy of dividing the network into discrete blocks has weaknesses. First, such methods contain a number of moving parts. These include different strategies for measuring equivalence (role vs. structural, Euclidean distance vs. correlation), and different scaling methods for partitioning networks into blocks (CONCOR, hierarchical clustering, various matrix decomposition methods). The variation in these moving parts results in significant differences in the results of each operation. Second, as the next section indicates, blocks may not be cohesive in terms of direct ties between nodes belonging to each. In fact, interblock cohesion levels may be often higher than within-block cohesion levels. Third, the results of block assignments of nodes are often not intuitive. In some cases, they may seem quite odd. Even in [Figure 2.6](#) we may wonder why some states are in one block rather than another.

The general point about different types of endogenous groups and different methods of extracting such groups is that each type has both specific advantages and specific liabilities. The preference of one type of approach to extracting endogenous groups over another is first and foremost a function of the theoretical purpose of the researcher.

### 7.3. Clique and Block Characteristics

Just as we have done with individual nodes when examining egonets, we can provide some important description of the attributes of the endogenous groups. In this study, I treat these endogenous groups as units of analysis, that is, meaningful observations that enable us to understand structures in international politics. Given that conception, we can summarize the structure and characteristics of these groups and examine behavioral patterns of states within these groups.

[Table 2.11](#) provides a summary description of the cliques and blocks that are derived from the 1913 alliance network.

A number of points are worth noting here. First, twenty-four out of the forty-three states (55.8%) in the system are isolates. If we follow the general SNA rule that considers a clique to have a minimum of three members, then only five (or 15.2%) of the possible cliques in the system meet this minimum. Second, there is considerable variation in terms of clique attributes. The rate of clique democratization – measured as the



Table 2.11. *Alliance clique and block characteristics, 1913*

| Clique no.            | Clique characteristics, 1913 |                      |                       |                     |               | Block no. | No. of states | Block characteristics, 1913 |                  |                       |                     |               |                    |
|-----------------------|------------------------------|----------------------|-----------------------|---------------------|---------------|-----------|---------------|-----------------------------|------------------|-----------------------|---------------------|---------------|--------------------|
|                       | No. of states                | Pct. democracies (%) | Avg. pol. persistence | Clique capabilities | No. MID dyads |           |               | Pct. MID dyads (%)          | Pct. democracies | Avg. Pol. persistence | Clique capabilities | No. MID dyads | Pct. MID dyads (%) |
| 1                     | 4                            | 0.00                 | 37.00                 | 0.227               | 0             | 0.00      | 1             | 26                          | 0.115            | 31.81                 | 0.42                | 6             | 0.018              |
| 2                     | 4                            | 25.00                | 24.50                 | 0.001               | 0             | 0.00      | 2             | 7                           | 0.429            | 22.43                 | 0.03                | 4             | 0.190              |
| 3                     | 3                            | 66.67                | 19.67                 | 0.025               | 4             | 133.33    | 3             | 6                           | 0.500            | 26.17                 | 0.35                | 0             | 0.000              |
| 4                     | 3                            | 33.33                | 18.67                 | 0.218               | 0             | 0.00      | 4             | 4                           | 0.000            | 37.00                 | 0.23                | 0             | 0.000              |
| 5                     | 3                            | 66.67                | 34.33                 | 0.196               | 0             | 0.00      |               |                             |                  |                       |                     |               |                    |
| 6                     | 2                            | 0.00                 | 26.00                 | 0.150               | 0             | 0.00      |               |                             |                  |                       |                     |               |                    |
| 7                     | 2                            | 50.00                | 39.00                 | 0.146               | 0             | 0.00      |               |                             |                  |                       |                     |               |                    |
| 8                     | 2                            | 100.00               | 17.50                 | 0.116               | 0             | 0.00      |               |                             |                  |                       |                     |               |                    |
| 9                     | 2                            | 0.00                 | 58.00                 | 0.001               | 0             | 0.00      |               |                             |                  |                       |                     |               |                    |
| Single-member cliques | 24                           | 12.50                | 29.63                 | 0.017               | 0             | 0.00      |               |                             |                  |                       |                     |               |                    |

Table 2.12. *Image matrix of alliance blocks, 1913*

| Block | Block Density/Network Density |       |       |       |
|-------|-------------------------------|-------|-------|-------|
|       | 1                             | 2     | 3     | 4     |
| 1     | 0.615                         | 0.623 | 0.602 | 0.602 |
| 2     | 0.623                         | 2.032 | 2.032 | 2.032 |
| 3     | 0.602                         | 2.032 | 2.323 | 2.323 |
| 4     | 0.602                         | 2.032 | 2.323 | 3.252 |

proportion of clique members that are democratic states<sup>16</sup> – varies considerably. Some of the cliques have no democratic members, other are composed of a majority of democracies. The variation of regime persistence – a measure of political stability – is also considerable across cliques. Note that the total capabilities of an alliance clique are not correlated with its size. Clique #2, composed of four states, is much weaker than all of the multimember cliques except clique #9. It is also weaker than the average single-member clique. Finally, all the alliance cliques are peaceful. There is, however, a glaring exception: Clique #3 with three members (and 3 dyads) had four militarized interstate disputes in 1913.<sup>17</sup> This clique serves to suggest that cohesive strategic groups may be prone to internal discord just as much as discrete groups.

Moving to the block structure, the patterns here are quite similar to those of the clique structures. The most salient features of these blocks are the discrepancies between the size of blocks and their capabilities (e.g., block #1 has twenty-six states, but its capabilities are only marginally higher than block #3 with six states). In addition, two blocks that are composed of relatively structurally equivalent states experience a fair amount of intrablock conflict.

Table 2.12 shows an “image” matrix of the four blocks (Wasserman and Faust, 1997: 401–406). It uses the block as the unit of analysis and compares the various blocks to each other in terms of a special quantity: the ratio of block density to network density. I discuss the concept of density in the next section. Basically, it refers to a proportion of the actual ties within a network or within a block to the number of possible ties in the network/block. The main diagonal of this matrix provides the within-block density ratio; off-diagonal entries show between-block densities. This comparison suggests that the density of block #1 is only 60 percent of the density of the entire network. This means that states making up this block had less contact with each other than the average dyad in the

<sup>16</sup> I define regime type and regime scores in Chapter 4.

<sup>17</sup> This is the Serbia-Bulgaria-Greece alliance that was at the center of the Second Balkan War. See Maoz (1989b, 1990a: Ch. 8).

network as a whole. At the same time, this block had also relatively weak ties to other blocks. Blocks #2 to #4 had relatively high within-block densities and also between-block densities. This suggests that states belonging to one of these blocks had a substantial number of ties with members of other blocks.

These patterns offer a rich potential for analyzing network structures. They constitute important building blocs in structural measures and methods that attempt to describe networks in their entirety.

Before we move to a discussion of network characteristics, it is important to briefly comment on an ongoing debate among network theorists about the use of cliques and blocks. How much can we rely on the information we obtain from clique structures as opposed to block structures? To what extent is the manipulation of clique structures, on the one hand, and block-modeling (the use of image matrices), on the other hand, meaningful in terms of actual structures of networks? Can we use cliques and blocks as “units of analysis”? Is using such structures equivalent to reifying them?

These are important issues for the current study because I often use these endogenous groups as units of analysis, and the information obtained from them as actual variables that are said to carry theoretical and empirical import. My position on these matters is simple: There is value in endogenous grouping of states into groups based on the structure of relations observed in networks. In particular, there is tremendous value in endogenous grouping that is not discrete (i.e., cliques).

This makes a great deal of sense in political science. For example, if we analyze political coalitions in multiparty parliamentary systems, we may wish to determine the array of possible coalitions and predict which coalitions actually form given some theoretical specifications. Most of the studies of coalition formation and coalition politics focus on the attributes of parties (e.g., size). However, an important aspect of coalition politics has to do with the ideological similarity or relations between political parties. The ability to endogenously form possible coalitions (wherein a given party can be in multiple coalition structures) is a tremendous contribution of SNA to the study of politics.<sup>18</sup>

In sociology or organizational behavior, when one wishes to examine the different group structures in a society or in an organization, clique overlap provides a nice measure of this issue. The complexity of organizational or social relations rest not only on the density of dyadic ties but also on the endogenous groupings these ties form.

Likewise, one of the key issues in this book concerns the question of which alliance and trade structures form given the decision rules states employ to form alliances or form trade ties. The contribution of this study is that it looks beyond the likelihood of two states forming an

<sup>18</sup> See, e.g., Maoz and Somer-Topcu (2010).

alliance or the structure of specific alliances. Rather, it examines the structural consequences of alliance choices; in particular, the – possibly unintended – endogenous structures that emerge as a result of conscious alliance formation choices or arms transfer choices. This requires us to look at cliques and blocks.

As noted above, block extraction may yield sometimes quite different results based on the method used to extract blocks. Intuitively, the results may also seem odd. However, blockmodels are very useful for some purposes that carry significant meaning in international relations research (e.g., an endogenous process of dividing the international system into “social classes”). I discuss this issue in [Chapter 10](#). For such purposes, blockmodeling methods are essential. Capturing the theoretical constructs of class structures in the world system requires endogenously assigning states into discrete groups as a function of the structure or profile of ties they have on a number of different networks.

The CMO index that I use does not control for the sizes of the cliques over which states overlap because this is not of interest here. In principle, this could be done by weighting the clique overlap of any two states by the sizes of these cliques, but the theory behind this is not clear, and such weighting operations could go all kinds of ways. For example, is the fact that two states are bound together in a triadic alliance clique more meaningful than if they are bound together in an alliance clique that has ten members? The answer to this question depends on our research focus. If we wish to assess the strength of commitment that states have toward each other, then the smaller the clique size, the stronger (more exclusive) the commitment. However, suppose we wish to examine whether clique overlap increases the chances that one or both states engage in war, and we expect that the larger the clique overlap the higher the chances of war. In such a case, we should weight overlap in larger cliques more than overlap in smaller ones. This issue, in and of itself, deserves a technical paper; however, this is not a key matter in the present study.<sup>19</sup>

The clique affiliation of states represents different group commitments; some of these commitments overlap with other commitments, others do not. Clique membership overlap takes into account not only the extent to which some states overlap with each other in their clique memberships, but the extent to which each state has differential levels of clique memberships. For example, the measure of IGO overlap as the raw number of IGO memberships that are common to two states is widely used in the quantitative literature on conflict.<sup>20</sup> As we have noted elsewhere (Maoz, et al., 2007a), this measure biases in favor of states that have an overall

<sup>19</sup> This problem is somewhat similar to Bonacich's (1987) two conceptions of eigenvector centrality. One of these conceptions focuses on centrality as control (e.g., of information) and views a node's centrality to be a function of the centrality of the nodes with which it is connected. The other views centrality as power, and therefore centrality is an inverse function of the centrality of the nodes with which one is connected.

high rate of IGO participation. The normalized CMO offers a new perspective of the degree of cooperative (or conflictual) network ties that states have with one another. It relies on direct ties between states (or common affiliations of states), but it also reveals hidden structures that do not typically come up in conventional dyadic studies in international relations (e.g., alliances of A-B, A-C, B-C will be treated in such studies as three dyadic alliances. In fact, they form a single ABC clique that exists despite the lack of a formal triadic alliance treaty).

Two final comments on this issue: First, blockmodeling does involve data reduction because it uses scaling techniques to induce discrete blocks in less than fully equivalent dyadic profiles. However, clique extraction in fact involves data expansion because it reveals hidden structures simply by looking beyond the building bloc of dyadic relations. Clique extraction algorithms do not make assumptions about how units are grouped beyond measuring the strength of the tie between any two nodes. Finally, it is true that traditional SNA does not consider isolates or dyads to form cliques. I depart from this tradition because, in the kind of analyses I conduct, isolates and dyadic relations have important meanings. Just as I want to examine what causes states to have multiple allies, I need to examine why some choose to have no allies at all. Likewise, two states can have overlapping membership in multiple alliance or trade cliques, but states that do not have overlapping clique memberships may reflect polarized relationships (the allies of one state are completely different from the allies of another state). Alternatively, one or both states choose not to have any (additional) allies. Ignoring these fairly prevalent structures may cause significant biases.

## 8. Network Characteristics

We saw in [Chapter 1](#) that networks can be quite complex. The complexity of the networks we cover in this study is a small fraction of the complexity of other types of networks – the internet, transportation networks, power grids, and so forth. This necessitates the use of measures that characterize networks in their entirety. In this section, I discuss several such measures. Some of these measures – components, density, transitivity, and group centralization – are commonly used in SNA. The remaining two measures – polarization and interdependence – are ones that I developed, and they have particular significance in the study of international relations in general, and international networks, in particular.

<sup>20</sup> See, e.g., Russett and Oneal (2001), Pevehouse and Russett (2006).

### 8.1. Density and Transitivity

In a network of  $n$  nodes in which every node is linked with every other node, there can be  $n(n-1)$  possible ties. In reality this is seldom the case. *Density*, denoted by the symbol  $\Delta$  measures the proportion of actual ties to the number of possible ties. This is given by:

$$\Delta = \frac{\sum_{i=1}^n \sum_{j=1}^n s_{ij}}{\max(s_{ij})n(n-1)} \quad [2.14]$$

where  $s_{ij}$  is any element of the sociomatrix  $S$ , and  $\max(s_{ij})$  is the maximal value that a relationship can assume. When the network is binary,  $\max(s_{ij}) = 1$ , and the denominator is reduced to  $n(n-1)$ . If self-ties are meaningful, then the denominator of [2.14] is  $\max(s_{ij})n^2$ .

Density is the simplest and most intuitive description of network structure; it allows us to measure the level of connectivity, controlling for network size and the range of relationships that exist within it.<sup>21</sup> The key problem with this measure is that it tells us only about the volume of relationships, not about the structure of relationships within a network.

Accordingly, the measure of transitivity is helpful in this respect. *Transitivity* (or *clustering coefficient*, Watts and Strogatz, 1998) is based on triadic ties. It breaks up the network into all possible set of ties. For a given binary network of size  $n$ , there exist  $n(n-1)(n-2)/6$  triads. We define a triad  $ikj$  as transitive if  $s_{ij} = s_{ik} = s_{jk} = 1$ . In a directed network, a transitive triad must not only be closed, but the direction of the ties must be the same. Thus if we have  $i \rightarrow j$  and  $j \rightarrow k$  then we must have  $i \rightarrow k$ ; any other tie (e.g.,  $i \leftrightarrow k$  or  $i \leftarrow k$ ) does not count. In valued networks, the final (derived) tie must be at least as strong as any of the other two ties (if  $iRj \geq jRk$  then  $iRk \geq iRj$ ).<sup>22</sup> The measure of transitivity is the proportion of transitive closed triads to the number of possible triads, that is:

$$t = \frac{3\sum s_t}{(n-1)(n-2)} \quad [2.15]$$

where  $s_t$  indicates a closed transitive triad. Transitivity reflects the extent to which the network is composed of consistent relational structures.

### 8.2. Components and Component-Based Characteristics

Density measures only first-order connectivity. The *number of components* in a network is another measure of connectivity that network scientists

<sup>21</sup> Signed networks require special modifications. Some examples are given in Maoz (1990b: 124–127).

<sup>22</sup> In signed graphs a transitive triad must have zero or two minus signs.

often use. To explore this concept, we need to define the concept of *reachability*. Reachability measures whether nodes are reachable through either direct or indirect ties. It is easiest to demonstrate reachability via a binary network. This measure can be extended to valued networks and to signed graphs, although the math involved in the latter type of networks is more complicated (Maoz, 1990b: 119–127).

Consider again Table 2.8.1, which shows a simple binary ten-member network. I label this matrix as  $S^1$  because it reflects first-order relations. Assume that the rule that defines ties in this matrix is “my ally.” Second-order relations in this matrix will represent “the ally of my ally.” To obtain such relations we raise  $S^1$  to the second power such that  $S^2 = S^1 \times S^1$ . The results of this operation are shown in Table 2.8.3.

Matrix  $S^2$  reveals several interesting things. First, all of the diagonal entries of this matrix are nonzero even though the diagonal of  $S^1$  is empty. In fact, all symmetrical networks have nonzero entries in the higher-order relations where the order is even ( $S^2$ ,  $S^4$ , ...). This is so because if nodes  $i$  and  $j$  have a symmetrical ties (e.g., are allies) then  $i$  will be the ally of its ally, the ally of the ally of the ally of its ally, and so forth. For example, the diagonal entry  $s_{11}^2$  is 5. This is so because node 1 has five allies. Second,  $S^2$  is valued, even though  $S^1$  is binary. This means that there are several ways of reaching one node from to another. Consider for example the tie between node 1 and node 8 in  $S^1$  and  $S^2$ . In the first-order matrix, these nodes do not have a direct relationship. However, in the second-order matrix  $s_{18}^2 = s_{18}^2 = 3$ . This means that there are three ways to define these nodes as the ally of my ally. The reason for that is that both node 1 and node 8 have three common allies (nodes 4, 6, and 7).

Third, matrix  $S^2$  is almost fully connected. The only dyads that are empty are  $s_{35}^2$  ( $s_{53}^2$ ) and  $s_{39}^2$  ( $s_{93}^2$ ). Third-order relationships are obtained by raising  $S^1$  to the third power such that  $S^3 = S^2 \times S^1$ . In this manner, we can raise the original sociomatrix to successive powers (2,...,  $n-1$ ) each of which reflects an indirectness and so forth. The reachability matrix is defined as

$$R = \sum_{i=1}^{n-1} S^i \quad [2.16]$$

A *component* (CM) is a closed subset of reachable nodes. Specifically, it consists of a subset of nodes all of which are reachable from all of the other nodes in the component and none of which is reachable from nodes that are not in the component. A network can have up to  $n$  components (in a completely disconnected network). The reason network scientists favor the number of components over density as a measure of connectivity is that it reflects both direct and indirect relations. Questions of information flow, in particular, are better suited to

measure in terms of component-based conceptions than in terms of network density.<sup>23</sup>

*Normalized number of components.* The normalized number of components is simply a ratio of the number of components to the size of the network.  $CM^* = CM/N$ . This measure varies from  $1/N$  when the network is fully connected (and there exists only one component) to  $1$  when the network is empty.

*G/N index.* An important component-based index of network structure is the G/N index. The concept G refers to *giant component*, namely a component that consists of a majority of the nodes. Clearly in any given network there can be only one giant component. However, we can modify this concept to measure the proportion of the nodes in the largest component in the network. G/N can vary from  $0$  (when no component has more than half the nodes) to  $1$  in a fully connected network.

### 8.3. Centrality-Based Network Characteristics

A number of the characteristics of networks are based on some form of aggregation or transformation of various centrality indices. Here, I present two such characteristics.

*Average nodal degree.* This is one of the most commonly used measures of network structure. It is simply the average level of nodal degree centrality, and is defined as:

$$ND = \frac{1}{n} \sum_{i=1}^n D_i \quad [2.17]$$

where  $D_i$  is the degrees (number of ties) of node  $i$  and  $n$  is the number of nodes in the network. The average nodal degree of a network is the same as its density.

*Group centralization indices.* Group centralization indices can be derived from any of the centrality indices discussed in the previous section. The general structure of centralization indices is given by,

$$GC = \frac{\sum_{i=1}^n (\max_{Cx} - C_{xi})}{n(\max_{cx} - \min_x)} \quad [2.18]$$

This index measures the sum of differences between the most central node and all other nodes in the network (the numerator of [2.18]), as a proportion of the maximally possible difference (the denominator). The denominator of [2.18] changes depending on the kind of centrality scores used to measure group centralization. Thus, if we base the group

<sup>23</sup> Components are *n-1-cliques*, that is, cliques obtained from the reachability matrix. By definition, these cliques must be discrete, such that  $c_l \cap c_m = \emptyset$ ,  $l, m \in C$ .



centralization index on degree centrality, the denominator is  $(n-1)(n-2)$ . If we use closeness group centralization, the denominator is  $(n-1)(n-2)/(2n-3)$ . Group betweenness centralization converts the denominator of [2.18] to  $(n-1)^2(n-2)$ .<sup>24</sup>

This index converges to unity when one node is maximally central and other nodes' centrality scores are minimal (typically a star network), and to zero if the network is fully connected. Clearly, there is an inverse correlation between average nodal degree and group degree centralization. High average nodal degrees are associated with low group degree centralization and vice versa.

#### 8.4. Network Polarization<sup>25</sup>

The concept of polarization is central to systemic studies of international relations. It also plays an important role in such disciplines as sociology, economics, and other subfields of political science. Maoz (2009b) reports that a social science and humanities index search of yielded over 1,900 scientific articles where the term polarization appeared in the title or abstract of the article. This suggests a widespread use of the concept across the social sciences. There are also multiple measures of polarization, but surprisingly, SNA does not have such a measure. Maoz (2009b) provides a formal explanation and derivation of the measure of network polarization. The current discussion focuses only on the essential features of this measure.

The Network Polarization Index (NPI) is a product of two separate measures. Both are based on the clique structure of the network. The first, Clique Polarization (CPOL), measures the extent of polarization between the members of a given clique and all other nodes in the network. The second, the Clique Overlap Index (COI), measures the extent to which cliques share members. Both of these measures reflect ratios of actual levels of clique polarization or clique overlap to maximally possible degrees of clique polarization/overlap. The most important feature of the NPI is that it can incorporate both the structure of the network and the attributes of the nodes, if those are available.

I discuss the logic of each of the two components of NPI briefly and then explain how they merge to produce the measure of network polarization. I begin the discussion of CPOL assuming that we have only information about relationships between  $n$  nodes (whether binary or valued) that allow us to define a network. These relationships induce a set of

<sup>24</sup> The denominator for the Eigenvector group centralization measure is more complex and does not reduce to a simple function of  $n$ .

<sup>25</sup> The first version of this index, based on minimum information about attributes and cohesion, was published in Maoz (2006b); a more advanced version – identical to the one presented here – is given in Maoz (2009b).

$Q = [q_1, q_2, \dots, q_k]$  cliques with clique membership specified by a **CA** matrix of order  $n \times k$ . Let  $S = [s_1, s_2, \dots, s_k]$  be the set of nodes included in cliques  $q_1, q_2, \dots, q_k$ , respectively, and let  $P = [p_1 = s_1/n, \dots, p_k = s_k/n]$  be the clique members proportions. The polarization between the members of clique  $j$  and all other network members is defined by  $d_j = \sum_{i=1}^{n-1} \sum_{m=i+1}^n (ca_{ij} - ca_{mj})^2$ .

It is easy to show that maximum polarization for each column (clique) of matrix **CA** is when half of the nodes in the network are members of a given clique and half are not. Stated in terms of proportions, for any clique denote the maximum polarization of clique vs. non clique members as  $d_{jmax} = \max[p_j(1-p_j)] = 0.5(1-0.5) = 0.25$ . For a clique affiliation matrix of size  $k$ ,  $D_{max} = 0.25k$ .

The CPOL is defined as follows:

$$CPOL = \frac{\text{actual clique polarization} | Network_T}{\text{maximum clique polarization} | Network_T} = \frac{\sum_{j=1}^k p_j(1-p_j)}{D_{max|k}} \quad [2.19]$$

Given that  $p_j = s_j/n$ , and  $CPOL_{max|k} = 0.25k$ , we substitute these terms in [2.19], with the result being

$$CPOL = \frac{\sum_{j=1}^k \frac{s_j}{n} (n - \frac{s_j}{n})}{0.25k} = \frac{4 \sum_{j=1}^k s_j (n - s_j)}{kn^2} \quad [2.20]$$

This index has several interesting properties. First, it varies from zero when **CA** is an  $n \times 1$  matrix with all states in one clique ( $q_1 = n$ ) to one when **CA** is an  $n \times 2$  matrix with exactly half (in the case of an even matrix), or  $(n-1)/2$  nodes are in one clique and the remaining nodes are in the other clique (when  $n$  is odd). Second, in an empty network, there are  $k = n$ -cliques of size 1. Thus, the clique polarization index for such networks is

$$CPOL_0 = \frac{4(n-1)}{n^2} \quad [2.21]$$

This means that the larger number of nodes without any ties to other nodes, the lower the clique polarization index. Third, as the number of cliques exceeds 2, CPOL decreases, just as we suggested earlier. In other words, maximum clique polarization is obtained when the network is characterized by strict bipolarity.

However, this definition of CPOL ignores two important features of clique polarization. The first has to do with the actual cohesion of cliques and the loss of information when we take valued and/or directed networks and convert them into cliques. Recall that clique extraction requires binarization of valued networks (by setting a cutoff point that reflects

the minimum level of a relationship that qualifies it to be a “cohesive” one such that it meets the minimum clique threshold). This process also requires symmetrization of directional networks, resulting in significant loss of information. It also ignores important differences between cliques. A given clique  $q_j$  can be dramatically different from another clique  $q_m$  in that the membership of the former is based on high values of relationships between all of its members, whereas the value of relationships of the members of the second clique are just above the cutoff point used to binarize the original sociomatrix. This suggests that the former clique is far more “cohesive” than the latter. For example, the cliques formed by the four Latin American states of Guatemala, Honduras, El Salvador, and Nicaragua, and that of the three Balkan states – Bulgaria, Serbia, and Greece – entail substantially higher levels of commitments than the alliance between Russia and Japan, or between the United Kingdom and Japan (see [Figure 2.1](#)). We can safely assume, therefore, that the level of cohesion in the former two alliances is higher than in the latter.

Another issue that may bias the measurement of polarization is that the “size” of a clique is not measured in terms of the number of nodes in it, as we have assumed in equation [2.20] above. Rather, it may be measured in terms of some attribute of the nodes that is related to the theoretical purpose of the measurement process. The “size” of an alliance clique is not measured in terms of the number of states comprising it, but in terms of their capabilities. For example, the four-member Latin American alliance clique in [Figure 2.1](#) accounts for only 1.1 percent of the system’s capabilities. On the other hand, the three-member alliance clique of France, Russia, and Italy accounts for nearly 21.8 percent of the system’s capabilities (see [Table 2.11](#)). Likewise, in a multiparty democracy, we may conceive of cliques as reflecting possible coalitions among political parties. In such a case, the size of a coalition is a function of the number of seats that its members control. A two-member coalition made up of two large political parties may be “larger” than a four- or five-member coalition made up of very small parties.

The “cohesion” of a clique can be measured in terms of some exogenous measure of proximity between its members. However, in the absence of such information, a good endogenous measure of cohesion is the average structural equivalence score across all dyads comprising it, measured by a standardized Euclidean distance. This is given by

$$c_j = \frac{2 \sum_{k=1}^{s_j-1} \sum_{r=k+1}^{s_j} E s e_{kr}}{s_j(s_j - 1)} \quad [2.22]$$

Likewise, given an attribute vector of a quantity that represents the sizes of cliques (e.g., members’ income, capabilities), we multiply **CA** elementwise by the attribute and get a modified clique affiliation matrix

where entries are zero for nonmembers of a given clique and  $p_{ij}$  reflecting the “size” of member  $i$  of clique  $j$ . Consequently,  $p_j = \sigma_j p_{ij}$  and the modified CPOL index can now be redefined as:

$$CPOL_{cs} = \frac{4 \sum_{j=1}^k p_j (1 - p_j) c_j}{k} \quad [2.23]$$

Thus, the modified  $CPOL_{cs}$  index measures the actual level of clique polarization as a proportion of the maximally possible level of clique polarization in a network that consists of  $k$  cliques. This measure recaptures the information that was lost in the process of clique extraction. The cohesion index is based on the original sociomatrix. If this sociomatrix is valued and/or directional, this is reflected in the cohesion index. The minimum and maximum levels of clique polarization in a network of size  $n$ , given the modified CPOL index do not change. Minimum polarization is still possible *iff* (if and only if) this network collapses into a single clique. This can happen *iff* the network is fully connected above the cutoff point for clique definition. Likewise, maximum polarization can happen *iff* the network collapses into two discrete cliques, each controlling exactly half of the size-related attribute.

In reality, however, most networks collapse into nondiscrete cliques. Thus even if a network is converted into a bipolar structure with half of the resources in one clique and the other half in the other clique, polarization may not be maximal. This happens if there is overlap between cliques in terms of membership. Moreover, when a network collapses into more than two cliques, there may be some membership overlap between the cliques.

Consider Table 2.8. When we convert the sociomatrix in Table 2.8.1 into the CA matrix in 2.8.2, we can see that there is some level of membership overlap among most of the cliques. This is nicely reflected in Table 2.9 that examines the extent of membership overlap between any set of cliques. Thus, in Table 2.9.2, which shows the normalized (diagonally standardized) extent of clique overlap, we see that 75 percent of the members of clique #1 overlap with clique #2 (top row, second column of Table 2.9.2). Likewise (second row, first column of Table 2.9.2), 87.5 percent of the members of clique #2 overlap with clique #1, and so forth. Thus, when measuring the extent of polarization in a network, we must include not only the polarization of cliques with respect to nonclique members, but also the extent to which cliques overlap in terms of membership. Accordingly, the clique overlap index is defined as

$$COI = \frac{\sum_{i=1}^k \sum_{j=1}^k \widehat{co}_{ij} - k}{k(k-1)} \quad [2.24]$$

In this case, too, COI measures the actual level of membership overlap across cliques as a proportion of the maximal level of clique overlap. COI

is zero when none of the cliques have any membership overlap with other cliques, and approaches unity when there is substantial clique overlap.<sup>26</sup>

Now, if we combine the clique polarization index with the clique overlap index, we get the measure of network polarization. In general, NPI is defined as  $NPI = CPOI \times (1 - COI)$ . This implies that, in its simplest form, when we have no information about cohesion and size-related attributes, NPI is

$$NPI = \frac{4 \sum_{i=1}^k s_i (n - s_i)}{kn^2} \times \left( 1 - \frac{\sum_{i=1}^k \sum_{j=1}^k \widehat{co}_{ij} - k}{k(k-1)} \right) \quad [2.25]$$

$$= \frac{\left[ 4 \sum_{i=1}^k s_i (n - s_i) \right] \left[ k(k-1) - \left( \sum_{i=1}^k \sum_{j=1}^k \widehat{co}_{ij} - k \right) \right]}{n^2 k^2 (k-1)}$$

If we have data about size and cohesion of cliques, NPI is defined as

$$NPI = \frac{4 \sum_{j=1}^k p_j (1 - p_j) c_j}{k} \times \left( 1 - \frac{\sum_{i=1}^k \sum_{j=1}^k \widehat{co}_{ij} - k}{k(k-1)} \right) \quad [2.26]$$

$$= \frac{4 \sum_{j=1}^k p_j (1 - p_j) c_j \left( k(k-1) - \sum_{i=1}^k \sum_{j=1}^k \widehat{co}_{ij} - k \right)}{k^2 (k-1)}$$

### 8.5. Network Dependence and Interdependence

Interdependence is a central concept in international relations. It is also a cornerstone of SNA. Relations create dependence, whether or not they are discretionary. Mutual relationships cause interdependence. However, we do not have good measures of these concepts in both international relations and in SNA. In [Chapter 9](#), I discuss the international relations literature on interdependence, noting that the concept of interdependence has two meanings in international relations theory. *Sensitivity interdependence* reflects the extent to which change in one actor affects change in other actors. *Vulnerability interdependence* reflects the opportunity costs of breaking up a relationship.

The present section develops a SNA conception of interdependence that addresses the problems I have identified in the international relations literature. This conception covers multiple levels of analysis. Conceptually,

<sup>26</sup> Here COI can never be one because, by definition, there cannot be full overlap between two cliques. However, with large highly connected networks, COI asymptotically approaches unity. When the network collapses into a single clique, the CO matrix becomes a scalar, and COI has no meaning. Under these circumstances it can be arbitrarily defined as 1 without loss of generality.

an actor  $i$  is dependent on another actor  $j$  when a change in  $j$  causes a meaningful change in  $i$ , and if  $i$  incurs some cost once the tie with  $j$  is broken. Accordingly, *interdependence* implies reciprocal dependence – a change in  $j$  affects changes in  $i$  and a change in  $i$  affects changes in  $j$ , and both actors bear some cost for disrupting this relationships. These are fundamentally dyadic definitions, but they can – and as SNA concepts, should – be extended to other levels of analysis.

*Dyadic dependence* has two dimensions: scope and extent. The extent of dependence reflects the magnitude of change in an actor caused by a unit change in another actor, *and the opportunity cost of disrupting this relationship*. Scope reflects the *number of dimensions* of dependence relations between actors. If two states trade with each other, are allied, and are members of the UN security council, then military, political, or economic changes in one state affect the security, status, and well being of the other. Given a single *direct* relationship  $\rho$ , the dependence of state  $i$  on state  $j$  is defined as:

$$d_{ij|\rho}^1 = oc_{i|\rho} \beta_{j|\rho} s_{ji|\rho} \quad [2.27]$$

where  $s_{ji}$  is an indicator of the relationship sent by  $j$  to  $i$  (amount of trade, type of alliance, etc.),  $\beta_{j|\rho}$  is a measure of sensitivity interdependence – the extent to which a unit change in  $j$ 's supply of factor  $\rho$  affects change in actor  $i$  – and  $oc_{i|\rho}$  measures the *opportunity cost* to  $i$  of a disruption of the relationship  $\rho$  with  $j$ . It is desirable, for reasons discussed later, to standardize dependence scores within the  $[0, 1]$  range, with dependence monotonically increasing in this range.<sup>27</sup>

Dependence can be measured across a number of relationships (e.g., commodities, alliances, IGO memberships). Define the set of relationships as  $R = [\rho, \rho_2, \dots, \rho_m]$ . The single relationship measure of dependence can now be generalized as

$$D_{ij}^1 = \sum_{\rho=1}^m w_{\rho} d_{ij|\rho}^1 \quad [2.28]$$

where  $0 \leq w_{\rho} \leq 1$  ( $\sum_{\rho=1}^m w_{\rho} = 1$ ), is the weight assigned to relationship  $\rho$ .

Extending this conception to a system of  $n$  units, define a square matrix  $S_{\rho}$  of order  $n$  as a network in which  $s_{ij}$  denotes the presence or magnitude of relationship ( $\rho$ ) between units  $i$  and  $j$ . Matrix  $B_{\rho}$  and vector  $OC_{\rho}$  reflect, respectively, the sensitivity and opportunity cost parameters. We obtain matrix  $D_{\rho}^1$  as an elementwise ( $\circ$ ) product of the three matrices such that,

$$D_{\rho}^1 = S_{\rho} \circ \beta_{\rho} \circ oc_{\rho} = s_{ij|\rho} \beta_{j|\rho} oc_{i|\rho} \quad \forall i, j \in n \quad [2.29]$$

<sup>27</sup> This is done by setting  $0 \leq oc_{ik}, \beta_{kj}, \rho_k \leq 1$ . The superscript on  $d^1$  denotes the fact that these measures are based only on *direct* relations. Extensions for indirect relations are provided below.

Thus,  $d_{ij|\rho}^1$  denotes the dependence of  $i$  on  $j$  in terms of relationship  $\rho$  ( $d_{ij|\rho}^1 \neq d_{ji|\rho}^1$ ). Across a set of relationships  $\mathbf{R}$ , the matrix operation of integrated dependence is given by

$$\mathbf{D}_{\mathcal{R}}^1 = \sum_{\rho=1}^m w_{\rho} \mathbf{D}_{\rho}^1, \quad [2.30]$$

where  $w_1, w_2, \dots, w_m$  are weight scalars, and each entry  $d_{ji\mathcal{R}}^1$  denotes the dependence of  $i$  on  $j$  across all  $m$  relationships.<sup>28</sup> We measure dyadic interdependence as

$$id_{ij}^1 = id_{ji}^1 = \frac{1}{2}(d_{ij}^1 + d_{ji}^1) \quad [2.31]$$

We can now measure the dyadic dependence balance as

$$db_{ij}^1 = \frac{d_{ji}^1 - d_{ij}^1}{d_{ij}^1 + d_{ji}^1 + d_{ii}^1}; \quad [2.32]$$

The dyadic dependence balance reflects the difference between the dependence of  $j$  on  $i$  as a proportion of the total dyadic dependence and the degree of the focal actor's self-reliance. This particular measure differentiates between dyads that are highly dependent on each other relative to their self-reliance and those that have ties with each other but whose level of reliance on each other is low given their level of self-reliance. Note that this measure does not, however, differentiate between low balances due to relative independence (i.e., low but equal values of  $d_{ij}$  and  $d_{ji}$ ) and low balances that are due to high interdependence but equal dependence (i.e. high but equal values of  $d_{ij}$  and  $d_{ji}$ ). This reflects a common problem of balance-related measures (and applies to trade balances as well).

*Indirect interdependence.* Even though states may not have a direct relationship, thus being seemingly *independent* of each other, they can be indirectly tied. This implies that states' dependence on each other is due both to their direct ties and to their indirect ties. To illustrate this distinction between direct and indirect interdependence, consider a trade network  $\mathbf{T}$  and an alliance network  $\mathbf{A}$  in [Figure 2.7](#).

Note that the trade network is directional. Now, consider the difference between direct and indirect dependence. State B's direct trade dependence on A is 0.4 and A's trade dependence on B is 0.1. B's alliance dependence on A is 0.3 and A's alliance dependence on B is 0.2. Although A does not have a direct trade relationship with C, C exerts an indirect influence on

<sup>28</sup> The diagonal entries of  $\mathbf{D}^1$  reflect the degree of self-reliance. For example, in the context of trade we insert the proportion of GDP that is not due to imports (i.e.,  $SD = (C + I + G + X - M) / (C + I + G + X)$ , where  $C$ =consumption,  $I$ =Investment,  $G$ =Government purchases,  $X$ =exports, and  $M$ =Imports). In the case of strategic interdependence, we insert on the diagonal the state's capabilities as a share of the system's capabilities. See below.

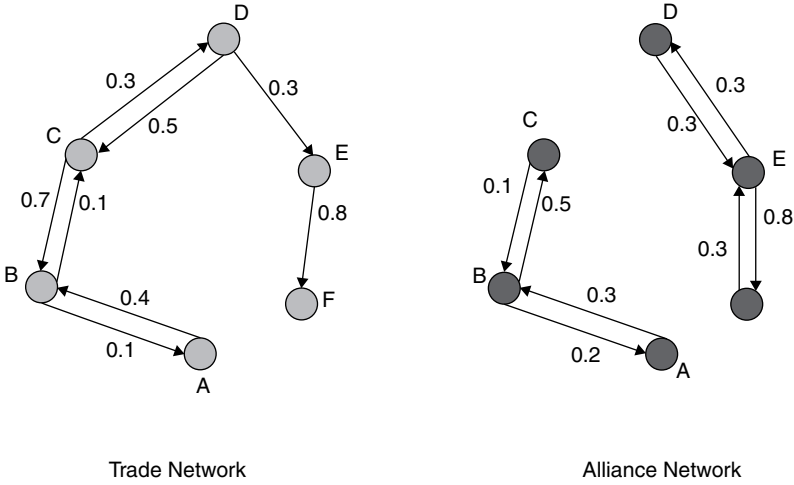


Figure 2.7. Direct and indirect dependence in two hypothetical networks.

A because it exports to B who, in turn, exports to A. This is second-order dependence between A and C. Likewise, in the alliance network, A and C are indirectly interdependent even though they do not have a direct alliance, because they have a common ally, B. Indirect interdependencies are discounted by the extent of “indirectness.” The trade dependence of A on C is the product of the dependence of B on C and of A on B, that is,  $d_{ACIT}^2 = d_{BCIT}^1 \times d_{ABIT}^1 = 0.7 \times 0.1 = 0.07$ . Likewise, A’s alliance dependence on C is  $d_{ACIA}^2 = d_{BCIT}^1 \times d_{ABIA}^1 = 0.1 \times 0.2 = 0.02$ .

Define an  $r$ th order dependence matrix as  $D^r = \prod_r D^1$ . Thus,  $D^2 = D^1 \times D^1$  reflects the second-order dependence of actors in the system ( $d_{ij}^2$  reflects the dependence of  $i$  on  $j$  due to the dependence of  $i$  on  $k$  and  $k$ ’s dependence on  $j$ ),  $D^3 = D^1 \times D^1 \times D^1$ , and so forth.<sup>29</sup> Direct and indirect dependence are measured via the reachability matrix  $R$ , which we label  $D$  (for dependence):

$$R = \overline{D} = \sum_{i=1}^m D^i; \quad 2 \leq m \leq n-1 \quad [2.33]$$

The entries in this matrix  $\overline{d}_{ij}$  reflect the total dependence of unit  $i$  on unit  $j$  due to both direct and indirect relations. This matrix serves as the foundation for calculating dependence and interdependence at the monadic, dyadic, and systemic level of analysis. At the dyadic level, we use the same dyadic measures of dependence and interdependence

<sup>29</sup> These operations require a decision about ignoring indirect self-ties (or cycles) by setting diagonal values of  $D^1$  to zero. SNA theorists tend to disagree on this issue (Taylor, 1969; Hubbell, 1965). Such a decision is based on theoretical considerations regarding specific relations.



discussed above (Equations [2.27]-[2.33], dropping the superscript). We now proceed to the monadic level of analysis.

*Monadic dependence.* There are two measures of monadic dependence: *ondependence* and *outdependence*. Ondependence reflects the extent and scope of a state's dependence on other actors in the system. Outdependence reflects the extent to which other actors in the system depend on a given state. As is customary in SNA, measures are standardized as a ratio of the actual value to a maximum possible value. Define the maximum level of dyadic dependence between any two units as  $k$ . If a single unit were dependent on all other units in the system, the maximum level of direct dependence for a system of  $n$  units would be  $k(n-1)$ . Given the definition of the reachability matrix ( $\overline{\overline{D}}$ ), the maximum level of dependence assuming a certain order of *indirectness*,  $m$  ( $m = 2, \dots, n-1$ ) is given by the geometric series:

$$\begin{aligned} d_{i(\max)} &= k(n-1) + [k(n-1)]^2 + \dots + [k(n-1)]^m = \sum_{i=1}^m [k(n-1)]^i \\ &= \frac{k(n-1)\{1 - [k(n-1)]^m\}}{1 - k(n-1)} \end{aligned} \quad [2.34]$$

Accordingly, ondependence and outdependence are defined as the actual level of (direct and indirect) dependence divided by this maximum. This is given by

$$\begin{aligned} OUTD_i &= \frac{out\overline{\overline{d}}_i}{\overline{\overline{d}}_{i(\max)}} = \frac{\sum_{j=1}^n \overline{\overline{d}}_{ij} - \overline{\overline{d}}_{ii}}{\frac{k(n-1)\{1 - [k(n-1)]^m\}}{1 - k(n-1)}} = \frac{(\sum_{j=1}^n \overline{\overline{d}}_{ij} - \overline{\overline{d}}_{ii})[1 - k(n-1)]}{k(n-1)\{1 - [k(n-1)]^m\}} \\ OND_j &= \frac{on\overline{\overline{d}}_j}{\overline{\overline{d}}_{j(\max)}} = \frac{(\sum_{i=1}^n \overline{\overline{d}}_{ji} - \overline{\overline{d}}_{jj})[1 - k(n-1)]}{k(n-1)\{1 - [k(n-1)]^m\}} \end{aligned} \quad [2.35]$$

where  $\overline{\overline{d}}_{ij}$  is an element of matrix  $\overline{\overline{D}}$  and  $\overline{\overline{d}}_{ii}, \overline{\overline{d}}_{jj}$  are the  $i$ th row and  $j$ th column diagonal elements, respectively.  $OUTD_i$  and  $OND_i$  are, respectively, the sum of the  $i$ th row and  $j$ th column of  $\overline{\overline{D}}$ , minus the  $i$ th and  $j$ th diagonal, divided by the maximum possible out and on dependence.

The *monadic dependence balance*, similar to dyadic dependence balance, thus reflects the difference between the dependence of other actors on the focal actor and the dependence of the focal actor on others. It is defined as  $db_i = (outd_i - ond_i) / (outd_i + ond_i + d_{ii})$ . This index has similar properties to the dyadic dependence balance.

*Monadic interdependence.* A typical example of this concept in the trade literature is *trade openness* – trade divided by GDP (Heston, Summers, and Aten, 2008; Gartzke and Li, 2003a). Barbieri (2002: 58–59), Crescenzi (2005: 121–122), and Oneal and Russett (2005) use trade openness as a proxy of trade interdependence. I employ a variation of this measure

to tap a more general measure of monadic interdependence beyond the trade context. Monadic interdependence is the share of a state's resources that is due to its relations with others. Specifically,

$$intd_i = \frac{oud_i + ond_i}{oud_i + ond_i + d_{ii}} \quad [2.36]$$

Where  $d_{ii}$  is  $i$ 's level of self-reliance.

This index is preferable to the dependence balance as a measure of monadic interdependence. States are fully autonomous only when the assets on the variable in question depend solely on internal resources. The maximal value of  $intd_i$  approaches one when a state's resources are a small fraction of its out and on dependence.

*Systemic interdependence.* Systemic interdependence is the ripple effect that a change in any node engenders in the network as a whole. Operationally, it is expressed as a ratio of actual systemic interdependence to the maximally possible interdependence in the system.

Maximum interdependence in a network with  $n$  nodes – given a maximum rate of dependence  $k$  between any pair of nodes – is obtained when all nodes have a direct tie of level  $k$ . Thus, maximum direct interdependence in a system with  $n$  nodes is  $n^2k$ . To reflect both direct and  $m$ -order indirect relations between units in such a system, we calculate the  $m$ -order dependence/reachability matrix as:

$$\begin{aligned} R_{\max} &= \overline{D}_{\max} = n^2k + n^3k^2 + \dots + n^{m+1}k^m = \sum_{i=1}^m n^{i+1}k^i \\ &= \frac{(kn)^2[1 - (kn)^m]}{k(1 - kn)} = \frac{kn^2[1 - (kn)^m]}{1 - kn} \end{aligned} \quad [2.37]$$

Accordingly, actual Systemic Interdependence (SYSIN) is measured as a proportion of this maximum:

$$SYSIN = \frac{\overline{D}}{\overline{D}_{\max}} = \frac{\sum_{i=1}^n \sum_{j=1}^n d_{ij}}{\frac{k[1 - (kn)^m]}{1 - kn}} = \frac{(1 - kn) \sum_{i=1}^n \sum_{j=1}^n d_{ij}}{k[1 - (kn)^m]} \quad [2.38]$$

SYSIN reflects an interesting and potentially important feature: cyclical interdependence, that is, indirect interdependence of a unit on itself, due to its ties to others.<sup>30</sup>

<sup>30</sup> If we are not interested in cyclical interdependence ( $i \rightarrow j \rightarrow k \rightarrow i$ ), we can omit self-ties from each  $r^{th}$  order matrix. In such a case, maximal interdependence

$$\begin{aligned} R_{\max} &= \frac{k(n-1)[1 - [k(n-1)]^m]}{1 - k(n-1)} \quad \text{and} \quad \text{systemic interdependence is} \\ SYSIN &= \frac{[1 - k(n-1)](\sum_{i=1}^n \sum_{j=1}^n d_{ij} - \sum_{i=1}^n d_{ii})}{k(n-1)[1 - [k(n-1)]^m]} \end{aligned}$$

A more elaborate discussion of the properties – advantages and limitations – of these measures is given in Maoz (2009a). That study also provides an empirical demonstration of the measurement process of interdependence across levels of analysis, using a hypothetical alliance network.

*Comparing interdependence measures to SNA influence measures.* There exist several influence measures that bear some resemblance to the method proposed herein. In order to compare them to our approach, we start with a first-order dependency matrix, the entries of which already reflect sensitivity and vulnerability dependence. In our example, matrix  $D_A^1$  in Table 1.6 of Maoz (2009a) provides the baseline for comparison. It is important to note at the outset that the influence measures in SNA are predicated on notions of centrality and prestige. However, these other algorithms bear some resemblance to the current measures of interdependence.

How does the current approach to the conceptualization and measurement of interdependence match up against the more conventional network analytic measures of influence (e.g., Katz, 1953; Hubbell, 1965; Taylor, 1969)? Hubbell's (1965) measure of influence is based on a similar logic to the eigenvector centrality concept in which a given unit's centrality is a function of the centrality of the units that choose it. Its operational derivation is defined as  $HI = I + \sum_{i=1}^m (\beta D)^i$  where  $I$  is the identity matrix, and  $\beta$  is an attenuation factor whose value is defined exogenously but cannot be larger than the value of the reciprocal of the largest eigenvalue of the first-order dependency matrix. The idea here is also that influence declines with indirectness, and this is reflected in the discounting of successive high-order dependencies by the attenuation factor  $\beta$ . What is different here is the fact that influence is not defined in terms of a ratio of actual influence to some possible maximum. In our case, compare the dependence balance and monadic interdependence scores we get from our method to the figures obtained from the Hubbell measure. This is done in Table 2.13.<sup>31</sup>

Note that this is just one example and does not suggest a general pattern. Yet, while the dependence balances derived from both sets of measures appear to be quite highly correlated ( $r = 0.923$ ), the monadic interdependence measures derived from both algorithms are not ( $r = 0.378$ ). The key difference lies in the standardization procedure. All measures of eigenvector centrality use an arbitrarily selected attenuation factor to discount for higher order relations. In contrast, the dependence algorithm standardizes by a systematic factor that takes into account the size of the network, the maximum strength of a given relationship, and the level of indirectness desired by the user.

<sup>31</sup> I use here only the Hubbell influence index for comparison because it most closely resembles the interdependence algorithms provided herein. The Katz (1953) index is defined as  $KI = (I - \beta D^1)^{-1}$ , and the Taylor influence index is based on a normalized Katz dependence matrix. The latter indices show low relationship to the dependency indices I have developed in this chapter. A more elaborate comparison of the mathematical properties of these indices is beyond the scope of this study.

Table 2.13. *A comparison of dependence scores and Hubbell influence scores*

| State | Maoz dependence scores |      |                         |      | Hubbell (1965) influence scores |      |                         |      |
|-------|------------------------|------|-------------------------|------|---------------------------------|------|-------------------------|------|
|       | Dependence balance     | Rank | Monadic interdependence | Rank | Dependence balance              | Rank | Monadic interdependence | Rank |
| a     | 0.120                  | 5    | 0.155                   | 6    | 0.064                           | 6    | 0.085                   | 2.5  |
| b     | -0.115                 | 3    | 0.359                   | 2    | -0.032                          | 2    | 0.138                   | 1    |
| c     | -0.272                 | 2    | 0.272                   | 3    | -0.012                          | 3    | 0.012                   | 6    |
| d     | 0.167                  | 6    | 0.167                   | 5    | 0.050                           | 5    | 0.050                   | 5    |
| e     | 0.005                  | 4    | 0.189                   | 4    | 0.003                           | 4    | 0.056                   | 4    |
| f     | -0.475                 | 1    | 0.495                   | 1    | -0.080                          | 1    | 0.085                   | 2.5  |

Source: Maoz (2009a).

Beyond these differences, it is important to note that these other measures were designed primarily for the monadic scoring of influence. The dyadic influence measures allow some comparison to the current index. However, the current index is more flexible in that it allows generalization for both monadic and systemic measures of dependence. As we will see in the Chapter 10, it is possible to use dyadic dependence measures in order to derive endogenous groups (blocks) that carry theoretical significance.

## 9. Conclusion

This chapter was is an introduction of the concepts and methods used throughout this book. The general point of the chapter is simple, however. Social network analysis offers a host of measures and methods that capture important aspects of the interaction among units. As such, it is eminently suitable for systematic analysis of systems of interactions in international relations. It can tell us new things about individual states – such as how they relate to their environment (egonets), or their position with respect to relational networks (centrality). It can tell us interesting and not intuitively observable things about dyadic relations – such as affinity (measured in terms of structural equivalence), positional similarity (role equivalence), or involvement in subgroups of states (clique overlap). It can help us envision new units of analysis that are derived endogenously from the structure of relations among states (cliques, components, and blocks). Such units – though not directly observable – may have important implications for international relations. Finally, it allows for different ways to measure structural aspects of the international system. This opens new windows into the testing of systemic theories of international politics.

## *The Network Structure of the International System, 1816–2001*

### 1. Introduction

States make decisions about their interactions with other states or with other nonstate actors in the international system. Very often, these decisions have limited and local implications, or so political leaders think most of the time. When two states sign a trade agreement, both sides may think about the benefits that this agreement affords. More often than not, however, these seemingly isolated acts of cooperation have far-reaching consequences involving other nations that were not part of these agreements.

It is instructive to see how this works for international alliances. Consider the situation in Europe in the mid- and late 1930s. France and Britain viewed Germany and Italy as potential rivals. Germany and Italy thought of France and Britain as rivals. The Soviet Union, although it was not friendly with any of these states, was considered by them to be neither ally nor rival. None of these four states knew how the Soviet Union would behave in the event of a conflict between France and a coalition of Germany and Italy. On August 22, 1938, Germany and the Soviet Union signed the Ribbentrop-Molotov Agreement. The agreement stipulated that in the event of a war between the France-UK coalition and the Germany-Italy coalition, the Western allies could not rely on the Soviet Union's help, nor could they assume that Germany would be attacked by (or would be interested in attacking) the Soviet Union.<sup>1</sup> The Soviet Union also had a potential enemy in the East: Japan, which also had a neutrality pact with Germany and Italy. When Germany attacked

<sup>1</sup> This is so assuming that signatories to nonaggression pacts are more likely than not to comply with their treaty obligations, which in itself is an important question in the study of alliance politics (Starr, 1972; Leeds, 2003). In this particular case, this nonaggression pact was blatantly violated by the German attack on Russia on June 22, 1941. See Weinberg (2005).

the Soviet Union in 1941, Stalin's key concern was that Japan would attack the Soviet Union from the east. Until they had received reliable information about the Japanese decision not to attack, Soviet decision makers had been forced to concentrate considerable numbers of troops in the east in preparation for such an attack. This affects the uncertainty that all states in the system – not only the two signatories of the nonaggression pact – have about the behavior of various allies (e.g., Bueno de Mesquita 1981).

Consider another scenario drawn out of the depths of World War II. In 1940, both Hungary and Romania signed defense pacts with Germany. Britain, facing an expanded alliance between Germany and several Balkan states, now had to consider Hungary and Romania as potential enemies when the Germans invaded Yugoslavia and Greece in preparation for its attack on the Soviet Union. These examples suggest that seemingly limited decisions may have far reaching implications. Sometimes, forming alliance or trade ties may well entail risks (and opportunities), not unlike having unprotected sex: By having sex with a person one may well be having sex with that person's former partners and the partners of that person's partners, and so forth (cf. Maoz et al., 2007a).

Students of international conflict have often noted that a conflict between two states may have broader implications, depending on who these states are and how they relate to other states in the system. Generally speaking, however, it is commonly recognized that even seemingly isolated conflicts can have ripple effects. It is also well established that international conflicts may spread either across space or over time (Most and Starr, 1980; Siverson and Starr, 1991; Maoz, 1996).

It is useful, therefore, to start the analysis of international networks by taking a bird's-eye view of these networks, rather than discussing in minute detail the characteristics of the units that form them. What follows is a descriptive survey of the three international networks analyzed in this study.

We often envision the political world in terms of maps. Political maps draw the boundaries of political units (states, colonies) across space and tell us how territories are divided among these units. Examining two political maps drawn at different points in history allows comparison of the world's political structure over time. Clearly, this information is important for anyone who wants to know something about international relations. Historical maps provide informative snapshots of the geopolitical structure of the world as it changes over time. What they do not tell us is how and why such changes occurred, how various states are politically or economically connected to each other, or how these connections change over time.

Similarly, SNA can provide a useful description of the structure of relations among states that give us a sense of what is happening in a specific

type of international relation at a given point in time. We can also draw network maps of international relations and compare the structure of the world looking at different types of relations. Let us consider a few examples.

I chose the years 1878 (the year the Congress of Berlin ended the Russo-Turkish War) and 1962 (the height of the Cold War). [Figure 3.1](#) displays three networks: two cooperative networks (alliances and trade) and a conflict network.<sup>2</sup>

Each of the three networks is characterized by a different rule that defines relations between states. The ties in [Figure 3.1.1](#) reflect the presence of an alliance treaty between the states. The width of the line is a function of the degree of commitment reflected in that treaty: Thicker lines represent stronger commitments. Note that the arrows connecting any two states are bidirectional. This means that the commitment of state A to state B is identical to the commitment of state B to state A. This is a *symmetric*, or *nondirectional*, network.

Note that most of the states in the system are isolates. There are three dyadic alliances: Peru (PER) and Bolivia (BOL); Argentina (ARG) and Brazil (BRA); and the Ottoman Empire (TUR) and the United Kingdom (UKG). All three are defense pacts. Next, there is a trilateral alliance involving Prussia (GER), Austria-Hungary (AUH), and Russia (RUS). While all three states have some commitment to each other, the level of commitment is not the same in this triad: Prussia and Austria-Hungary have a consultation pact; Prussia and Russia have a defense pact; and Austria-Hungary and Russia have a neutrality pact. This triad forms a fully connected subset of the alliance network, and thus represents a *component*. Each isolate and each of the dyadic alliances also count as components. The density of this network is rather low; only a few of the possible alliance ties are realized. This network also does not appear to be very polarized.

[Figure 3.1.2](#) shows the alliance network of 1962. The density of this network is much (in fact, it is three times) higher than the density of the 1878 network. This network shows significant complexity. It is organized around five alliance clusters. The top cluster is the Arab League; the central cluster is NATO and its affiliates; the bottom right cluster is the Organization of American States (OAS), the bottom left cluster is the Warsaw Pact and its affiliates, and the leftmost cluster is the Organization of African Unity (OAU). These clusters are interconnected. None constitutes a component such as those in [Figure 3.1.1](#). Some states, (e.g., the United States, the Soviet Union, France) occupy important bridging positions, connecting one cluster of alliances to others.

<sup>2</sup> Sources of data for these networks and other methodological subjects are discussed in the appendix to [Chapter 4](#).





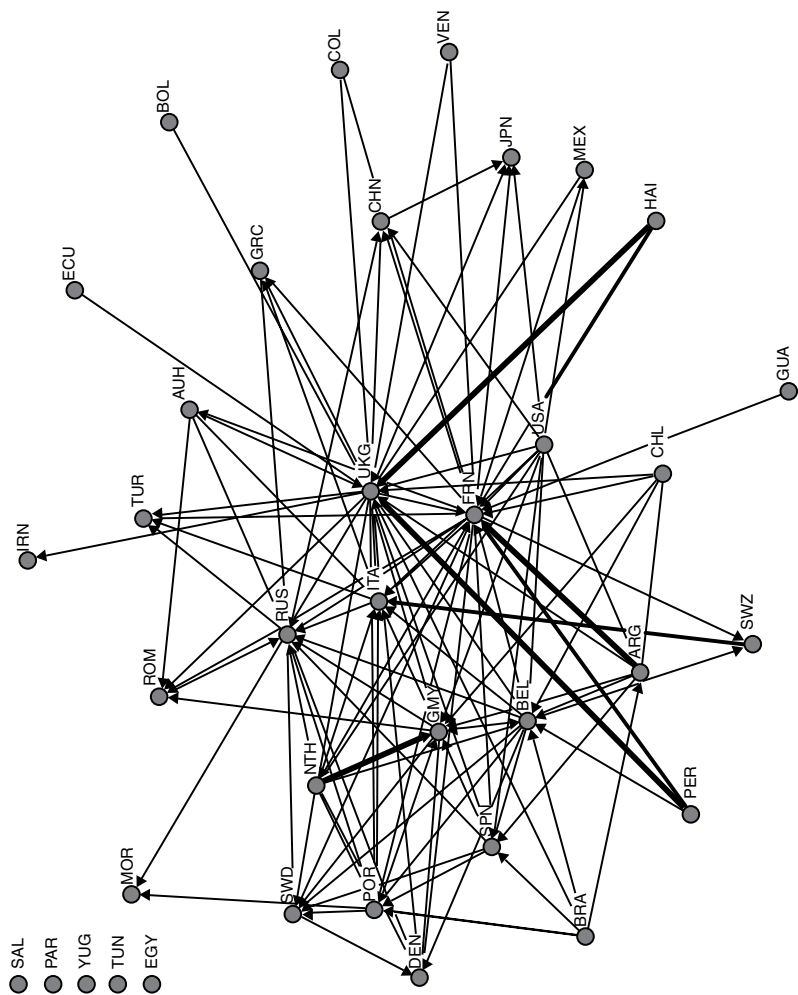


Figure 3.1.3. Trade network, 1878



Figure 3.1.4. Trade network, 1962.



Figure 3.1.3 and 3.1.4 reflect the structure of trade networks at the same points in time.<sup>3</sup> The 1878 trade network is relatively sparse, with a few isolates. The United Kingdom, France, Italy, and Russia appear to be fairly central trading players. The trade network in 1962 is so complex that no real patterns can be discerned visually. Clearly, it is a far denser network than its 1878 predecessor, with fewer isolates and more general trade ties.

The third network is a conflict network (Figures 3.1.5 and 3.1.6). Ties reflect the occurrence of a militarized interstate dispute (MID) between states.<sup>4</sup> In 1878, the system can be characterized as relatively peaceful, with only a few states having MIDs, and these MIDs tend to be quite isolated. Clearly, the 1878 Russo-Turkish war, with Britain supporting Turkey and Greece challenging Turkey, is the only instance of a semi-complicated conflict. The other conflicts are relatively minor. In 1962, we see a more complex network of conflicts, with the United States, Iraq, Egypt, Russia, and China being fairly central conflict players.

As useful as these pictures may be, they tell us a limited story about international relations. We can say that the two cooperative – alliance and trade – networks and the conflict network display significantly greater complexity in 1962 than in 1878. At the same time, they do not provide us with a precise assessment of the increased complexity of these networks over time. Nor do these pictures offer a way of systematically comparing different networks. We need to use more precise measures of network structure to impose a more systematic meaning of these pictures.

Moreover, a comparison of the same networks at several historical time points does not provide us a dynamic image of how the international system has changed over time. Nor does it allow us to find out when particular changes took place. We may look at years that are considered watershed years for certain networks (e.g., the end of World War I, the end of the Cold War, in terms of alliance networks, or the establishment of the General Agreement on Tariffs and Trade – GATT) and do a before-after comparison. But such comparisons would be both tedious and unsystematic.

<sup>3</sup> A trade tie is defined as nonzero if state *i* exports to state *j* at a level of 0.1 percent of the former's GDP. In subsequent chapters, I examine valued and directed trade networks. In these chapters, I use data on exports as percentage of row state's GDP as the strength of the outgoing tie from the row state to the column state. The trade dataset contains a fair amount of missing data. Here, I treat missing data as zero. In the chapters in which trade networks are analyzed in more detail, I discuss alternative methods for dealing with missing data. The other networks discussed herein are fairly complete and contain almost no missing data.

<sup>4</sup> A MID is a set of interactions involving the threat, display, or use of force between or among states (Gochman and Maoz, 1984: 535). A more detailed discussion of the MID dataset is provided in the appendix to Chapter 4.

We can use the structural measures of networks we discussed in [Chapter 2](#) to gain a systematic understanding of the evolution of international networks over time. These measures also allow us to compare different networks. I consider each year as a source for the formation of a distinct set of networks. The reasoning is straightforward. Each year things happen which may change the structure of the world. States make decisions about forming or ending alliances; they sign trade agreements or switch trading partners. New international organizations form and states join/leave existing ones. Clearly, most states maintain the patterns of ties they had the previous year, but – as I demonstrate throughout the book – it is the nature of changes that defines the structure of networks, not necessarily the volume of such changes. If we accept the idea that each year offers a potentially new set of networks, we can trace evolution and change in these networks over time in a fairly consistent manner.

Note that this and the subsequent chapters analyze long-term changes in several international networks that vary substantially in terms of both their size (the number of states) and structure. In this sense, the descriptive discussion of international networks that follows is quite unique and novel. This discussion also makes an important descriptive contribution. Very few studies trace the structural evolution of international interactions over time, so the picture that emerges here is unique.

I use several indicators to trace the evolution of various international networks over time. However, a word of caution is needed: There is no single best indicator of network structure. Different indicators measure different aspects of this structure. This is not necessarily a limitation. Just as we cannot evaluate the performance of a given economy via a single indicator, it is impossible to assess the structure of a network by a single measure. Each of the measures of network structure is discussed in some detail in [Chapter 2](#). For the benefit of readers who chose to skip the technical discussion of these indicators, I explain briefly what each of them mean.

I start with a fairly simple measure of network structure – network density. Density is a ratio of the number of actual ties divided by the number of possible ties in a network of a given size. [Figure 3.2](#) shows the density of the three networks that we discussed earlier.

Several patterns are visible in the evolution of these international networks. First, the overall densities of both the alliance and trade networks are quite low (ranging from 0.02 to 0.24 and an average of 0.053 for alliances, and 0.105 for trade). Note that trade density actually declines over time, in contrast to the huge increase in the overall volume of trade. This suggests that density as a characteristic of trade networks tells a very different story about the patterns of economic interactions than the volume of trade among nations. In contrast, the variation in IGO density ranges from a low of 0.03 to a high of 0.388 (with an average density

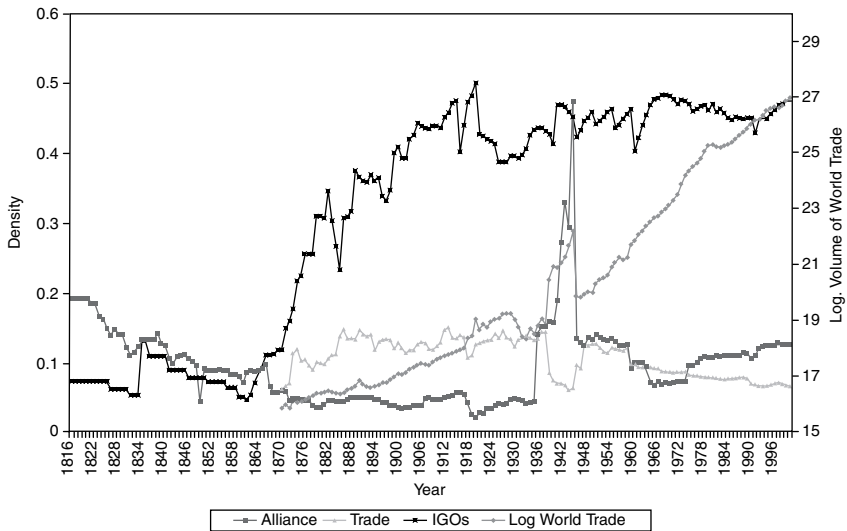


Figure 3.2. Density of International Networks, 1816–2001.

of 0.202) with a significant secular trend of increasing density over time. Alliance density shows a declining trend during the nineteenth century and the early part of the twentieth century, a significant spike during WWII, and a moderate increase in the postwar era, a trend that continues after the end of the Cold War.

Another way to understand trends in network structure is to examine the transitivity of international networks. Transitivity measures the number of closed triads divided by the number of possible triads in a network of a given size.<sup>5</sup> High transitivity – in the networks under analysis here – implies that cooperative relations are consistent. For example, high levels of transitivity in alliance structures imply that the allies of one’s allies tend to be allies with each other, one’s trading partners tend to trade with each other, and so forth.

By and large, IGO transitivity scores are consistently high, and – for the most part – nearly or fully perfect. This should not be surprising given the minimal definition of paired ties. Since the establishment of the League of Nations in 1922 and the UN in 1947, almost all states in the system have been tied to each other. This implies perfect or near-perfect transitivity. However, the level of transitivity declines after WWII, as more states share regional organization memberships. Trade transitivity rates show some fluctuations but stabilize in the post-WWII era

<sup>5</sup> A triad is said to be transitive (or closed) if whenever A is tied to both B and C, B and C also have a tie between them. See [Chapter 2](#) for a formal definition.

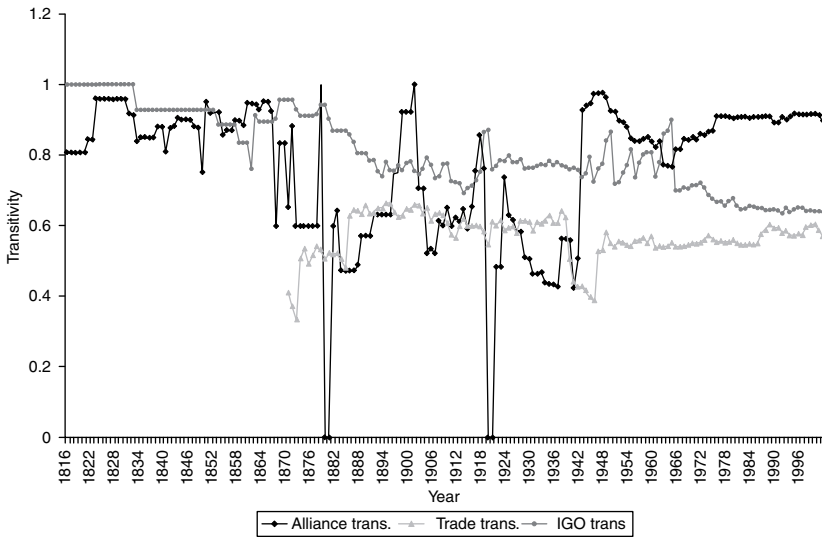


Figure 3.3. Transitivity of international networks, 1816–2001.

at levels that are somewhat lower than during the prewar era. Alliance transitivity levels fluctuated quite significantly but have also stabilized in the post-WWII era, particularly since the late 1970s. Trade networks display – with some exceptions – moderately high levels of transitivity, particularly in the post-WWII era.

A third structural attribute of international networks is polarization. International relations scholars consider polarization to be an important element of the geopolitical structure of the international system. It is also considered to be an important predictor of war and peace in international politics.<sup>6</sup> A network is said to be maximally polarized under strict bipolarity, that is, when the states in that network are split into two discrete alliance clusters such that each of the groups has the same number of members, and there is no overlap between these groups (that is, no state is a member of both alliance groups). Conversely, a network is completely non-polarized if all members are in the same alliance (Maoz, 2009b). Figure 3.4 shows changes in the level of polarization of these three networks.

These data suggest significant differences between patterns of polarization in different networks: Trade and IGO networks exhibit a moderate downward trend in polarization over time. Alliance polarization displays

<sup>6</sup> See Waltz (1979) for the effect of polarity on international stability, and Wayman and Morgan (1991) for discussion of various measures of polarization. See also Bueno de Mesquita and Lalman (1988); Moul (1993); Maoz (2006b), and Hegre (2008) for examples of studies on the effect of polarization – measured and defined in different ways – on international conflict.

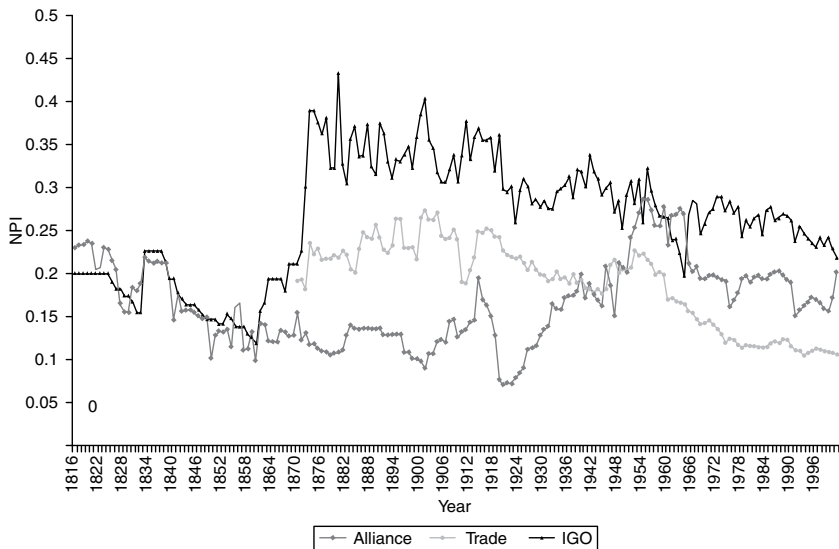


Figure 3.4. Network polarization, 1816–2001.

seasonal trends: It declines over the 1816–1913 period, spikes in WWI, and experiences a sharp decline in the post-WWI era. It spikes again at the end of WWII and reaches its peak at the height of the Cold War. It starts declining in the 1970s and 1980s and shows a tendency to increase in the last few years of our sample. It is interesting to note – and I return to this point in [Chapter 11](#) – that the trend of alliance polarization does not always correspond to the conceptions of traditional international relations scholars. The conventional wisdom holds that alliance polarization has been on the increase, particularly during the second half of the twentieth century. In the post-Cold War period many scholars envisioned declining polarization. Again, the data presented here do not suggest such a pattern.

One way to estimate the way in which states cluster together in different networks (apart from the transitivity index based on first-order ties) is by focusing on the number of components in a network. A component is defined as a subset of the network composed of reachable nodes. All nodes in a given component can be reached directly or indirectly from all other nodes in that component. No node in a component can reach or can be reached to a node outside the component. The number of components in a network of  $n$  states varies from one when the network is fully connected (even though not all nodes have direct ties with each other, for example, in a chain network) to  $n$  when the network is empty when all nodes are isolates). Because the number of components may vary with the number of states, I used a normalized measure in which the number of components in a given network and at a given point in time is divided



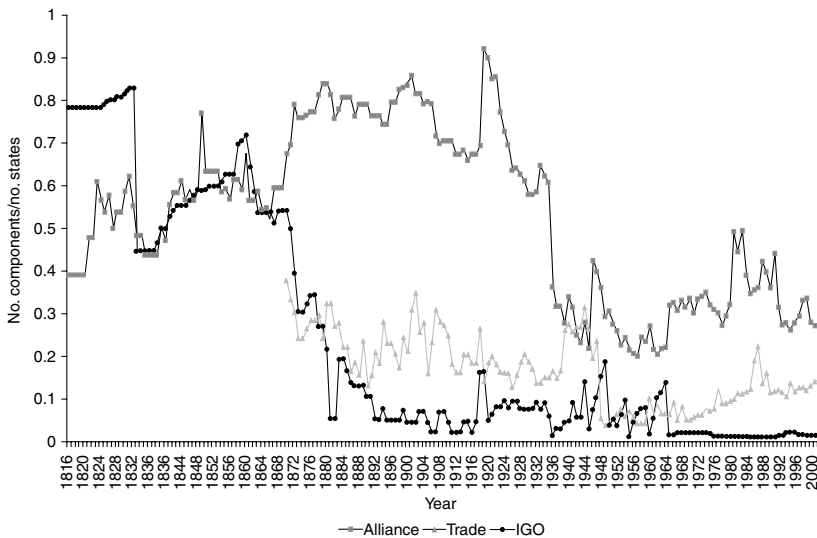


Figure 3.5. Proportion of components, 1816–2001.

by the number of states at the same point in time. Figure 3.5 provides the trends in the normalized number of components in the three networks.

There is a clear secular trend in the number of IGO components; it declines substantially over time, and stabilizes at a level of about  $1/n$  in the mid-1960s. Trade networks show a similar pattern up to the end of WWII, but then increases gradually. Still, it remains at very low levels, which suggests a general centralization of trade patterns. The normalized number of alliance components fluctuates quite a bit over time but shows a substantial decline since the mid-1920s, with more minor fluctuations in the post-WWII era.

Taken together, these figures suggest marked shifts in network characteristics over time and significant differences in network structure across different networks. How different are these network structures from each other? How different are the various indicators of network structure for a given network? To answer these questions, I conducted a number of time-series estimates. First, I examined the key characteristics of each network separately. This is given in Table 3.1.

We should not make too many causal inferences from the results displayed in this table. These data only show the extent to which various indicators of network structure are related to one another.<sup>7</sup> Two things

<sup>7</sup> Simple pairwise correlations are not very meaningful here due to very high autocorrelations for all three networks. This requires interpretation of relationships among indicators, correcting for autocorrelation. The interpretation of the table is also based on bivariate correlations among the various indicators of network structure.

Table 3.1. *Relations among network structure indicators for alliance, trade, and IGO Networks – time-series regression*

| Independent variable         | Systemic interdependence |                     |                     |
|------------------------------|--------------------------|---------------------|---------------------|
|                              | Alliance                 | Trade               | IGO                 |
| Density                      | 0.744**<br>(0.001)       | 0.186**<br>(0.008)  | 1.925**<br>(0.031)  |
| Normalized no. of components | 0.001<br>(0.001)         | 0.003+<br>(0.002)   | 0.275**<br>(0.013)  |
| Network polarization         | -0.009*<br>(0.004)       | -0.012<br>(0.007)   | -0.161**<br>(0.019) |
| Group degree centralization  | -2.367**<br>(0.151)      | -0.009**<br>(0.003) | -0.036**<br>(0.016) |
| Rho                          | 0.897                    | 0.852               | 0.867               |
| constant                     | -0.009*<br>(0.001)       | -0.005<br>(0.004)   | -0.271**<br>(0.014) |
| D-W statistic                | 1.707                    | 1.996               | 1.914               |
| N                            | 186                      | 132                 | 186                 |
| Adjusted R <sup>2</sup>      | 0.979                    | 0.864               | 0.965               |
| F                            | 2,165.08**               | 209.03**            | 1,260.01**          |

Notes: Numbers in parentheses are standard errors.

+  $p < 0.10$ ; \*  $p < 0.05$ ; \*\*  $p < 0.01$ .

are clearly visible: First, most indicators of alliance, trade, and IGO networks are strongly interrelated. Systemic interdependence in all three networks is closely related to their densities. This is not surprising because interdependence is defined based on the number of ties in the network. Second, group degree centralization and network polarization are negatively related to interdependence. This is also not surprising because as networks become increasingly interdependent, they are less likely to lean toward bipolarity, and their degree distribution tends toward increased uniformity. However, the interrelations among indicators of network structure are something to keep in mind. We return to these issues in [Chapter 11](#).

Next I turn to an analysis of the effects of the various networks on each other, focusing on the extent to which the structure of one network – such as its polarization – is affected by the structure of other networks measured by the same indicator. [Table 3.2](#) presents this analysis. I add to the analysis of this table another network that will become important in the ensuing chapters. This is the SRN (strategic reference network). In contrast to the other – cooperative – networks, the SRN is a conflictual network. As I briefly discussed in [Chapter 2](#), strategic reference networks are defined by the fact that a tie between two states means that they consider each other as potential enemies. Increased polarization of such networks indicates that the world becomes increasingly bipolar

Table 3.2. *Cross-network effects: network polarization, 1870–2001*

|                         | Network polarization |                    |                    |
|-------------------------|----------------------|--------------------|--------------------|
|                         | Alliance             | Trade              | IGO                |
| Alliance NPI            | –                    | 0.447**<br>(0.159) | 0.082<br>(0.259)   |
| Trade NPI               | 0.138**<br>(0.046)   | –                  | 0.467**<br>(0.131) |
| IGO NPI                 | 0.003<br>(0.019)     | 0.017<br>(0.035)   | –                  |
| SRN NPI                 | 0.079*<br>(0.033)    | 0.043<br>(0.062)   | 0.229+<br>(0.133)  |
| Constant                | 0.063**<br>(0.012)   | 0.128**<br>(0.022) | 0.167**<br>(0.019) |
| Rho                     | 0.901                | 0.912              | 0.473              |
| D-W statistic           | 1.57                 | 1.822              | 1.879              |
| N                       | 132                  | 132                | 132                |
| F                       | 21.14**              | 12.02**            | 15.74**            |
| Adjusted R <sup>2</sup> | 0.316                | 0.202              | 0.252              |

Notes: Numbers in parentheses are standard errors.

\*  $p < 0.10$ ; \*  $p < 0.05$ ; \*\*  $p < 0.01$

along the “enemy of my enemy” logic. This means that states converge into two components, each of which is characterized by suspicion, mistrust, and fear among members. States in one component do not regard states in the other components as enemies.

The results of Table 3.2 show that trade polarization and alliance polarization positively affect each other. SRN polarization also affects alliance polarization and, marginally, IGO polarization. Trade polarization affects IGO polarization. Taken together, we see some cross-network effects – what I refer to as “spillover effects” throughout this book. Methodologically, the test in Table 3.2 is incomplete in terms of interpreting the presence or nature of spillover effects. We will get to a more theoretically driven and methodologically complex analysis of these issues in subsequent chapters.

Let us briefly summarize the key patterns revealed by the statistical description of the evolution of international networks over time.

1. International networks went through dramatic changes over time. These changes are not consistent across the various indicators of network structure, nor are they uniform across networks. In some cases, we observed significant increase in network complexity (e.g., increased density, increased interdependence, reduced polarization). In other cases, we have seen a fair amount of consistency

over time (e.g., levels of network transitivity). These fluctuations suggest the complex and multifaceted structure of some of the central cooperative networks in world politics. They imply a need to understand these trends more fully in terms of causal theories of network formation and network evolution.

2. Different network characteristics tend to provide a different image of the evolution of a network. However, significant correlations exist across various network characteristics for these networks.
3. There exist some interesting relationships between seemingly distinct international networks. This suggests that we need a more coherent conception of the evolution of international relations in terms of possible coevolution of different dimensions of interactions among nations.
4. Taken together, these results raise interesting questions about how international networks form, how they evolve, and how they relate to each other. These questions are the focus of the next part of the book.

### Data Appendix to Chapter 3

The datasets used in this chapter include the following:

1. *Alliance data*, the Alliance Treaties Obligations Project (ATOP) (Leeds 2005).
2. *Trade data*. Oneal and Russett (2005) and on Gleditsch (2002b).
3. *International organization data*. Pevehouse, Nordstrom, and Wranke (2004a).
4. *Strategic reference groups*. Dataset discussed in the next chapter.

## *Security Egonets: Strategic Reference Groups and the Microfoundations of National Security Policy*

### 1. Introduction

A key assumption of this book is that international structures emerge out of the complex interaction among agents. For the purposes of this study, I consider the principal agents to be nation states.<sup>1</sup> To understand how international networks emerge and how they evolve and change, we must have a theory that deals with the following questions:

- What factors drive the calculations and choices of individual states?
- How do these factors operate in the process of national policy making?
- What kind of national choices result from such processes?
- What is the *system of interactions* (Schelling, 1978: 14; Maoz, 1990b: 33–36) that defines how these national choices aggregate into international processes?

This chapter attempts to answer the first three questions. [Chapter 5](#) focuses on the remaining one.

Most international networks emerge out of decisions by international actors to form some sort of *cooperative or conflictual* ties with other actors. Hence, discretionary networks reflect the revealed choices of nation-states. The structure of an alliance network is defined by the choice of some actors to form security alliances with each other, or to not form such alliances. The choices of alliance partners by individual states

<sup>1</sup> Some of the theories I rely upon focus on sub- and superstate actors. Yet all theories consider nation-states to play a crucial role in shaping international structures. For that reason, I start by discussing the microfoundations of international networks as emerging from the calculations of individual states and from the interaction among states. In subsequent chapters I examine the role of international organizations – as one example of nonstate actors – in shaping international networks.

define the general features of alliance networks: their density, polarization, interdependence, and so forth. Some states choose to trade with each other, others choose not to. These choices define the structure of trade networks. Just as this idea applies to cooperative networks, it also applies to conflict networks. States choose opponents; they choose whom, when, and how to fight. These choices have structural implications. Unless we understand what drives states to make these choices, we cannot gain a meaningful understanding of the emergent structures of relations.

Now, if we want to explain how cooperative international networks emerge, we need to start out with a model that tells us what happens *in the absence of such cooperative ties*. This is the baseline of network formation. It is analogous to a global “state of nature”: a system that lacks any cooperative structure or any mechanism for enforcing rules, order, or constraints on the behavior of individuals. This metaphor can help us develop ideas about network formation.

The questions enumerated at the beginning of the chapter are at the core of the central theories of international relations. However, we know rather little about these matters. There are quite a few theories of foreign policy behavior. Some of them are complementary, but quite a few put forth rival propositions about the factors that move states to react to external stimuli. A wealth of studies explore the instruments states use to respond to international challenges. Most empirical investigations of these approaches have not yielded robust and clear-cut generalizations. In light of this plethora of explanations, we need an integrative approach that simplifies existing models and combines their insights.

The approach I develop builds on existing theories in a novel way. Many studies of foreign and security policies treat key theoretical paradigms of world politics as competing explanations. I view these paradigms as complementary. My approach rests on several key ideas. First, any explanation of foreign policy behavior must start from a realist baseline, that is, it must rely on the assumptions of structural realism (Waltz, 1979; Mearsheimer, 2001). Second, the liberal or cultural/constructivist paradigms build on and modify this baseline but do not directly contradict it. Third, the integration of these paradigms is neither additive nor linear; a more coherent theoretical structure is required. Most important, I argue that any theory of international cooperative networks – such as alliances, trade, international organizations, and international diplomacy – must start from an image of a world characterized by the potential or actual prevalence of international conflict. In other words, *cooperation emerges from (actual or anticipated) conflict; cooperative networks stem from (actual or anticipated) conflict networks*.

I present the theory of international network formation in two stages. The first stage lays out the microfoundations of the theory. These reside in the motivations and calculations that lead states to form cooperative

ties with other states in the system. The focus of this chapter is on these preliminaries. Chapter 5 uses the ideas developed here to lay out the NIP theory. Accordingly, the present chapter addresses several questions:

1. How do states assess the foreign and security challenges they face?
2. What is the nature of the external environment that shapes states' foreign policy?
3. How does the assessment of external challenges affect states' policy choices? Specifically, what is the relationship between the nature and magnitude of external challenges and the nature and magnitude of states' responses?
4. How do different paradigms of world politics respond to the previous questions?
5. How do the predictions of these paradigms relate to each other? To what extent do the predictions of one paradigm converge, supplant, or contradict those of other paradigms?
6. How can these paradigms be integrated in a manner that allows a more complete understanding of the processes by which states respond to their external environment?

This chapter explores the empirical implications of Strategic Reference Groups (SRGs), a key concept that forms the foundation of the Networked International Politics (NIP) theory. Briefly, it refers to an international environment that affects the perception of national security challenges by foreign policy elites of individual states. This environment consists of a group of state (and possibly nonstate) actors that are considered to have an immediate, direct, and profound impact on national security of the focal state.

To lead a discussion of this concept, I begin with a brief overview of various theoretical approaches that have been used to study foreign policy behavior. Section 3 explains why it is important to study the context for states' national security choices in terms of SRGs. Section 4 discusses the manner in which the realist paradigm utilizes this concept to develop propositions about the non-cooperative behavior of states. These propositions are used to examine the empirical validity of this concept. Section 5 presents the empirical tests of the realist propositions about the effects of SRGs on different dimensions of policy. The last section discusses the implications of SRGs for cooperative network formation.

## 2. Foreign Policy Behavior: General Approaches

Foreign policy behavior is one of the major topics of inquiry in international relations research. It is not my purpose to provide a detailed review of the voluminous literature in this field; thorough reviews exist elsewhere

(e.g., Maoz, 1990a; Levy, 1994; Holsti, 2004; Vertzberger, 1993; Walker et al., 2010). Rather, I offer a general classification of the field in terms of key theoretical approaches and discuss very briefly the empirical evidence that has emerged from research based on these approaches.

The study of foreign policy analysis can be classified along two dimensions: issues and theoretical paradigms. The most common issues analyzed in this literature consist of (a) input-output studies; (b) process-oriented studies; and (c) actor-based studies. There are a few studies that encompass all three types of issues (e.g., Brecher et al., 1969; Brecher, 1975; Maoz, 1990b), but most foreign policy analyses focus on a single issue. *Input-output* studies focus on the factors that affect foreign policy choices and typically seek to establish a relationship between a set of inputs – the independent variables – and a set of behaviors – the dependent variables. This kind of analysis generally minimizes the effect on policy outcomes of policy-making processes and actors participating in them.

*Process-oriented* approaches focus on foreign and security policy decision making. They examine the ways in which individual policy makers, groups, and organizations engage in problem solving. The focus of these studies is on the perception of problems and processes of decision-making bodies. The independent variables in these studies include the personality traits of decision makers, their belief systems, the structure and dynamics of groups, and organizational and bureaucratic politics. These are seen as important filters through which decision makers process internal and external stimuli. The dependent variables typically refer to various degrees of the rationality or irrationality of policy decisions.

*Actor-oriented* studies examine the role of specific actors – principally various types of domestic actors – in the shaping of states' foreign policies. A key focus of this literature is on the impact of public opinion on policy in democracies (Holsti, 2004; Aldrich et al., 2006). Other studies focus on bureaucratic organizations (e.g., intelligence, military-industrial complexes, interest groups; Allison and Zelikow, 1999), or on legislatures and/or judiciaries. The typical study of this genre evaluates the impact that one or more of these actors have on foreign policy decisions, on shift in policies, or on the processes by which policy is made.

The three theoretical paradigms that dominated the study of international relations in the last thirty years or so are realism, liberalism, and constructivism. I discuss them at length in the next section. Here, I discuss how they relate to the foreign policy literature. The *realist paradigm* emphasizes the impact of external factors on the shaping of foreign policy, largely at the expense of domestic political factors. It tends to focus on capability-based variables and on alliance dynamics as key inputs to foreign policy. It views the foreign policy-making process as essentially rational and guided by a universal conception of a national



interest. States are said to focus on security concerns. They focus primarily on the accumulation or preservation of power as a key instrument of policy. The realist paradigm portrays the decision-making process of states as a product of rational calculations made by unitary actors (Bueno de Mesquita, 1981; Allison and Zelikow, 1999). The empirical implication of this vision is an almost exclusive focus on the decision-making process of the executive branch of government.

The *liberal paradigm* emphasizes both external factors and internal stimuli to foreign policy. External inputs include those identified by the realist paradigm, as well as from other external factors, such as economic and institutional interdependencies. This paradigm also emphasizes the impact of domestic structures and processes in the shaping of foreign policy. Finally, this paradigm suggests that foreign policy processes reflect a complex interplay among multiple – formal and informal – actors and issues (Keohane and Nye, 1987; Mansbach and Vasquez, 1981). Liberal scholars generally reject the notion that foreign policy is made by a unitary actor with a consistent and well-defined conception of the national interest.

The *constructivist* paradigm maintains that foreign policy actions are shaped by the intersubjective understanding of reality. In other words, people use ideas and conventions to make sense of reality. These ideas are shaped by their experiences, which are shaped, in turn, by their interactions with other people. The ideas people have about the world are also shaped by their conceptions of who they are – their identity. This identity is culturally bound. Thus, one is apt to observe fundamental differences in the way states respond to the same environmental stimuli. This is due to the fact that leaders' reactions are shaped by self- or socially constructed perceptions of identity, friends, and foes. This paradigm focuses both on inputs – factors that shape national identities – and on process – how ideas are formed, how some rise to the status of collectively accepted “truths,” how these ideas change, and how they define behavior.

Most foreign policy studies – whether or not they consider states to be unitary actors – typically agree that states' decisions are affected by factors and processes that take place in their external environment. However, the precise definition of the scope, content, and nature of that external environment is less evident in these studies. Who are the actors that shape states' perceptions of the challenges they face? What is the geographic or political scope of that environment? For example, Goldstein and Freeman (1991) criticized studies of U.S.-Soviet strategic interaction during the Cold War by arguing that they did not pay close attention to the relations between each of the superpowers and China. By incorporating China into the web of relations between the two superpowers, a strategic triangle is formed which helps explain conflict and cooperation between the two superpowers far better than a strictly dyadic analysis of U.S.-Soviet

relations. After the end of the Cold War – and especially after September 11, 2001, the relevant environment that affects U.S. foreign policy has become increasingly blurred. Unfortunately, the general implications of the argument – the need to derive an operational definition of the security environment of states – have not been systematically explored in the foreign policy literature.

### 3. Strategic Reference Groups

I offer an ideal-type process that purports to capture how national elites plan and organize their foreign policy. This sequence may not exactly replicate reality, yet it is a useful benchmark for analyzing real world behavior. A rational and well-organized policy process consists of the following stages:

1. Identifying and specifying the state's objectives
2. Identifying and specifying challenges (threats and opportunities) in the external environment that affect the state's ability to accomplish these objectives
3. Identifying the resources that are required for accomplishing the state's objectives – given the external challenges
4. Exploring options for confronting these challenges and evaluating them in terms of the state's objectives and in terms of the probability of success or failure
5. Choosing the preferred bundle of policies and implementing them
6. Evaluating the performance of these policies and repeating the previous stages (Whittaker, Smith, and McKune, 2007: 15–20; Palmer and Morgan, 2006).

Goertz (1994: 4–5, 16–20) argues that studies of the effect of the characteristics of the international system on international conflict define both the dependent variable (amount of conflict) and the independent variables (various characteristics of system structure such as polarity) in aggregate terms. Yet, such studies have not presented compelling models of the process by which the structure of the international system accounts for the behavior of individual states. I define the key question in a slightly different manner: How does the international context in which a state finds itself at a given point in time affect its behavior? The *context* is defined and operationalized in terms of SRGs.

States have multiple objectives – both domestic and international. The specific objectives differ from one state to another and from one point in time to another. Yet, promoting and safeguarding national security is an overriding concern of policy makers across states and over time.

International relations scholars are aware of the tradeoffs between the pursuit of national security and the ability to accomplish other national objectives (e.g., welfare, political stability, cultural and educational progress). We cannot overestimate the significance of the process by which foreign policy elites trade off these different goals. In this chapter, however, I focus on the process by which political leaders attempt to deal with national security issues. The trade-off between national security and other national goals is embedded in some of the ideas that follow.

The concern about security requires states to identify actual or potential challenges to their nation, which include both threats to national values or assets and opportunities to acquire additional ones (Maoz, 1990b: 86–101; Palmer and Morgan, 2006). Accordingly, policy makers issue guidelines to intelligence agencies about the kind of information that they need for policy planning. In theory, any information about the state's external environment could be relevant for policy making. Yet, most states have a limited span of interests – not all events or actors in the world immediately impact their security. Moreover, most states have limited resources for identifying security challenges and must spend the intelligence resources they have in an efficient manner. These constraints impose strict limits on the number of targets for intelligence gathering, requiring agencies to focus on some targets and to exclude others.

What criteria do “typical” intelligence agencies employ to determine who will be included in the scanning of the international environment? The problem-definition process of intelligence agencies (Clark, 2005: 14–15) serves as a useful starting point for answering this question. Intelligence gathering is centered on a state's SRG: *Those actors in the international system whose structure, behavior, and attributes are perceived to have a direct, immediate, and profound effect on the focal state's security and well-being, or on its ability to accomplish its foreign policy objectives* (Maoz, 1996: 138). In other words, intelligence agencies focus on the kind of information that is directly relevant to policy making. This implies that such agencies target information gathering operations on a select number of external (state and nonstate) actors. These actors are considered “relevant” in that they have an actual or potential effect on the focal state's security.

How do intelligence analysts decide who is relevant and who is not? The simple answer is that the intelligence agencies of each state have a different conception of their SRG. In addition, a given state's SRG may change significantly over time. For example, the focus of the United States during the Cold War was primarily on the Soviet Union and on China. These major powers were permanent members of the SRG of the United States over the period of 1945–1990. However, at different points in time, other states entered and left the SRG of the United States. In the 1950s, the United States cared about North Korea, but it did not pay a

great deal of attention to events in Southeast Asia. American national security calculations in the 1960s and early 1970s were centered on Vietnam, Cambodia, Laos, and Thailand, but the importance of these states diminished in the 1980s and 1990s. For over a century, Prussia (and later Germany) was a key member of France's SRG. France's strategic planning depended a great deal on its expectations of Prussia's/Germany's policies. This changed drastically after World War II. So, one may argue that there is no general or objective answer to the question of who makes up a state's SRG.

Such an answer is unacceptable, however, if we are to develop a more general theory of foreign and security policy. We may not be able to develop a precise and "clean" definition of states' SRGs that is fully valid and reliable across time and space. Yet, it may well be possible to think in terms of a reasonable approximation, that is, a general rule that defines the strategic reference group of the "typical" state. One strategy for developing such an operational definition is to focus on a geographic conception of SRGs. In a previous study (Maoz, 1996: 139–141) I used the concept of politically relevant international environment (PRIE). The PRIE of a given state consists of the following:

1. All states that are directly or indirectly (through colonial possessions) contiguous to the focal state
2. All regional powers in the state's region, that is, all states in one's region that have the capacity to project military power across the region
3. All global powers that have the capacity to project military power globally.<sup>2</sup>

The underlying assumption of this definition is that, for most states, the span of strategic concerns is defined in terms of their strategic reach capacity. Small states' reach capacity – their ability to project power – is typically limited to their immediate surroundings. Regional powers have a regional reach capacity and a regional span of interests. And global powers' reach capacity and span of interests is – by definition – global.

The concept of PRIE as an indication of the focal state's SRG proved quite useful in a number of studies of national conflict behavior (Lemke and Reed, 2001; Maoz, 2001; Russett and Oneal, 2001; Bennett and Stam, 2004). Yet, the concept of PRIE has two important drawbacks. First, it induces an excessively large group of states, many of which are only marginally relevant to one's security. For example, the United States, by virtue of its global status, has all states in the international system as part of

<sup>2</sup> Gleditsch (2002a) develops a similar approach along regional lines. Lemke and Reed (2001) and Bennett (2006) examine the properties of politically relevant dyads in terms of the extent to which they tap international conflict, but not to validate this concept theoretically or empirically.

its PRIE. Thus, for global powers, the PRIE concept does not produce any filtering of security-relevant actors. Nor does it follow that *all* states consider *all* global powers as having an a priori effect on their security. To what extent was Costa Rica concerned about the Soviet Union or the United Kingdom during the Cold War? To what extent was the United Kingdom concerned about Costa Rica's power during the same period?

Second, the definition of the PRIE is strictly geographic. In reality, political leaders and intelligence analysts use functional indicators to identify their strategic reference groups. For example, the United States is not likely to expend significant intelligence resources to monitor Canada or Mexico. Nor does France consider Belgium or Switzerland as posing security challenges. On the other hand, Iran and Israel are not directly contiguous, yet each of them considers the other as posing major threats to its national security.

An alternative concept that rests on perceptual foundations is Thompson's (2001: 562) notion of "strategic rivalry." A strategic rivalry is composed of: "[t]hreatening enemies who are also adjudged to be competitors in some sense, as opposed to irritants or simply problems." This concept may be helpful in determining SRGs because it draws attention to a perceived notion of a fairly permanent enmity that is typically a concern to policy planners. Yet, strategic rivals are only a subset of states' SRGs. A state may well (and usually does) consider states that are not strategic rivals as potentially threatening at specific junctures. There is good reason to believe that the allies of strategic rivals (not included in Thompson's list) also constitute potential threats. When planning national security policy, states consider the possibility that a conflict with one of their strategic rivals would draw in all or some of the rival's allies (Bueno de Mesquita, 1981; Altfeld, 1984).<sup>3</sup>

Perhaps the best way to address this issue is to base the definition of SRGs on claims, or contentious issues. States consider each other strategically relevant if they have specific claims toward each other. If we were somehow able to identify a broad range of claims – territorial, political, economic, or ideological – that states invoke, we could use this as the backbone of an operational definition of SRGs. A dataset on territorial, river, and maritime claims is now being collected by the Issue Correlates of War (ICOW) project (Hensel, 2001; Hensel, Mitchell, and Sowers, 2006; Hensel et al., 2008). At this time, however, this dataset is still incomplete. Moreover, it lacks claims that are economic, political, ideological, or strategic in character (e.g., the claim of the United States regarding North Korea's and Iran's nuclear programs).

<sup>3</sup> Thompson's conception is one of several conceptions of "enduring rivalries" (Diehl and Goertz, 2000; Bennett, 1997, 1998; Maoz and Mor, 2002; Klein, Goertz, and Diehl 2006). While most other conceptions of enduring rivalries rest on a long history of actual conflict between states, Thompson's perspective is primarily perceptual and thus seems more germane to our notion of SRGs than the other definitions of enduring rivalries.

Thus, we need a more realistic filter for tapping the strategic reference groups of states. Such a filter should provide a reasonably good approximation to a claims-based conception of SRG. Accordingly, an operational definition of SRGs must satisfy two conditions: (a) It should provide a more selective filter than the concept of PRIE; and (b) it should incorporate both geographic and functional features of states' international environment. Thus, the SRG of a given state consists of all states<sup>4</sup> that meet one of the three following conditions:

1. Over the initial five-year period of a state's independence, all states that are in its PRIE.
2. After the initial five-year period of a state's independence:
  - a. A state that had a MID with the focal state in the last five-year period or a war during the last ten-year period.
  - b. A state that does not qualify under conditions 1 or 2a but is a strategic rival of the focal state according to Thompson's (2001) definition.
  - c. An ally of a state in (1 or 2 a-b) ("friend of my enemy"; Maoz et al., 2007a).

Since this definition incorporates functional factors (i.e., past conflict, perception of rivalry), it only partially overlaps with the concept of PRIE. If Nicaragua considers Honduras (with whom it shares a land border) to be a member of its SRG, and Honduras forms a military alliance with Guatemala, then Guatemala would become a member of Nicaragua's SRG, even though it is not part of the latter state's PRIE. Moreover, two states may be in each other's SRG even if they had no prior conflict, simply because they consider each other strategic rivals. The United States and Japan did not have an MID until they were well into their strategic rivalry. Thompson considers these two states to be strategic rivals as of 1900, yet the first MID between these states takes place in 1932.

This definition of SRGs has several advantages over the concept of PRIE. First, it employs both geographical and functional criteria. Second, it allows expanding the universe of strategically relevant dyads to those states that are not strictly members of one's region but which may have a history of or interest in regional involvement. Third, this definition incorporates actors' past conflict experience or anticipated future conflict.

At the same time, this definition suffers from a number of problems. First, it implies that states "miss" placing their first-time protagonists in their SRG.<sup>5</sup> Second, past conflict is an important predictor of future conflict. Thus, using past conflict as a criterion for SRG placement and using this variable to estimate future conflict may raise endogeneity issues.

<sup>4</sup> This definition of SRGs can be extended to include nonstate actors as well.

<sup>5</sup> To the extent that these first-time protagonists were not member of the state's PRIE.

These reservations can be overstated, however. Once a state has accumulated a significant amount of historical experience as a member of the interstate system, it has no *a priori* reason to suspect its neighbors of having hostile intentions unless these intentions have been converted into threats, displays, or uses of force, or some other indicator of an actual conflict of interest (such as claims). Concomitantly, the fact that past disputes predict future disputes is not a statistical artifact; it is a result of precisely the reasoning discussed here – the use of history to create strategic expectations. Most students of national security view this strategic anticipation to be a prime factor in shaping states' security policies. This notion underlies the literature on enduring rivalries – especially the dynamic and evolutionary perspectives of this concept (Maoz and Mor, 2002; Hensel, 1999).

The most serious concern about this definition is that strategic anticipation of future security challenges posed by state *j* to state *i* does not necessarily depend on prior conflicts. Nor does such strategic anticipation diminish because they had not been engaged in a MID for a long time. States may regard each other as potentially threatening even if they have no immediate history of conflict or have not had conflict for a very long time. The case of Israel and Iran comes to mind. Up to 1979, Israel and Iran held significant cooperative ties. Israel helped Iran develop its missile program, and both cooperated in helping the Kurds in Iraq in their struggle against the Iraqi government (Maoz, 2006a: 367–372). The Iranian revolution of 1979 brought to power an Islamic regime that embarked on a vehement anti-Israeli rhetoric. After the establishment of Hizballah in Lebanon in 1982, Iran consistently offered political, financial, and military assistance to this organization's struggle against Israel. While there was no direct conflict between these two states, both started regarding each other as dangerous enemies. Since the mid-1990s, both states have exchanged numerous threats, and both have developed capabilities to fight each other over a great distance. Yet, by August 2010, neither has crossed the use-of-force threshold.

A reality of conflict reflects the presence of some claim. The claim may have preceded the conflict, but a history of conflict is the best approximation to the existence of claims that we have. A partial remedy of the anticipation of future conflict when we do not have evidence of prior militarized disputes is provided by Thompson's perceptual definition of strategic rivalry. This conception offers a reasonably close approximation to the actual definition of SRGs by policy makers.

The inclusion of the allies of former enemies and strategic rivals in one's SRG also requires some discussion. The literature on security alliances is too vast to consider here at length. When one's enemies form security alliances with other states, threat perceptions rise. This idea is common in the literature on international alliances, and it is often incorporated into models of international conflict. For example, Bueno de Mesquita's (1981)

rational model of conflict initiation incorporates the notion that states must take into account how third parties would react to a conflict between themselves and their direct enemy. Such a reaction by third parties depends on whether they are allied with one or another (Altfeld, 1984).

There is no guarantee that (a) an ally would come to the aid of a state in trouble, or that (b) a state that is not allied with one of the disputants would stay out of the conflict. Yet, the empirical evidence clearly suggests that states worry about the allies of their enemies. First, the likelihood of allies fulfilling their treaty obligations is quite high. About 75 percent of all allied states come to the aid of their allies when the latter get involved in wars (Starr, 1972; Leeds, Long, and Mitchell, 2000; Leeds, 2003). A more recent study (Maoz et al., 2007a) showed that a friend (ally) of one's enemy is seventeen times more likely to engage in an MID and twenty-two times more likely to engage in a war with a focal state than would be a state that is not an ally of one's enemy. This provides an empirical foundation for including the allies of one's enemies into one's SRG.

The literature on security planning repeatedly mentions the concern that states have about the alliance politics of their enemies. Alliances emerge out of states' desire to expand their capability pool beyond their domestic resources to balance the capabilities of their enemies. Another motivation for alliance formation is to prevent third parties from forming alliances with one's enemies, thus increasing the capability pool of their enemies (Walt, 1988; Morrow, 1994; Maoz, 2000). The latter motivation provides theoretical justification for the inclusion of the allies of one's enemies into one's SRG.

Third, the historical literature is replete with examples of decision makers' reactions to changes in the alliance portfolios of their enemies. The Ribbentrop-Molotov alliance between Nazi Germany and the Soviet Union was seen by the United Kingdom as a "fundamental change in the basic situation: Germany would be more dangerous, not less so, as a result of finding a new friend" (Weinberg, 2005: 41). Similarly, when Egypt and Jordan signed a defense pact, and Jordan placed its troops under Egyptian command on June 1, 1967, the Israeli government concluded that the last opportunity to resolve the crisis with Egypt through diplomatic means had vanished. Consequently, Israel decided to launch a preemptive strike against its Arab neighbors (Oren, 2002: 132–139).

The concept of SRG and its empirical content can now be placed within a broader theoretical framework of security-related international interactions. Several scholars frame explanations of international conflict in terms of opportunity and willingness (e.g., Most and Starr, 1989; Siverson and Starr, 1991). This framework asserts that states are likely to fight each other to the extent that they have both high motivation to



fight (willingness), and the chance to do so (opportunity). Opportunity, in this context, was typically operationalized in geographic contiguity terms (Starr and Thomas, 2005). Willingness, however, was more difficult to define. Some have offered to define this concept in terms of the presence of actual or potential claims (e.g., Furlong et al. 2006; Hensel, Mitchell, and Sowers, 2006: 388). Others (e.g., Boehmer and Sobek, 2005) define willingness in terms of economic development (arguing that low economic development increases the willingness to fight). Still others (e.g., Kinsella and Russett, 2002) broaden this net to include other “suppressors” of willingness such as democracy, economic openness, and participation in international organizations. So, although there is consensus on the operational definition of the opportunity concept, there is no agreement on what constitutes a willingness to fight.

The concept of SRG builds on the opportunity-willingness framework but applies a different spin on this framework. Specifically, the SRG of a state represents the group of actors that have both the opportunity and the willingness to pose challenges to its security. This group’s opportunity of challenging the focal state’s security is defined by geographic proximity. The willingness to do so is evidenced by past enmity/rivalry or by strategic ties with past enemies of the state (allies of one’s enemies). The PRIE of a state reflects only the states that have an opportunity to pose a security challenge. The SRG concept narrows this set by incorporating states that have a demonstrated willingness to pose security challenges. Thus, all actors that make up a state’s PRIE have the opportunity to challenge its security, but not all have the willingness to do so. On the other hand, actors that are outside a state’s PRIE but had fought with it in the past, or actors who have forged alliances with one of that state’s enemies are considered to have an actual or potential “willingness” to challenge its security.

The SRG concept corresponds to the notion of security egonets.<sup>6</sup> The *egonet* of a given node (unit) in a network is the set of nodes that have direct ties with it. The juxtaposition of security egonets across the international system allows us to identify Strategic Reference Networks (SRNs) that are defined by the rule “*i* is strategically relevant to *j*.”

Figure 4.1.1 illustrates these concepts. It describes the entire international system in 1895 in terms of policy relevant ties. Again, policy relevance is defined by geographic contiguity or strategic reach capacity. Figure 4.1.2 shows the strategic reference network at the same time. Figure 4.1.3 and Figure 4.1.4 show the politically relevant and strategic reference networks a century later (in 1995). The complexity of these networks grew exponentially over time. However, the strategic reference

<sup>6</sup> This concept was defined and illustrated in Chapter 2. I repeat this definition for the benefit of those who had skipped this chapter.

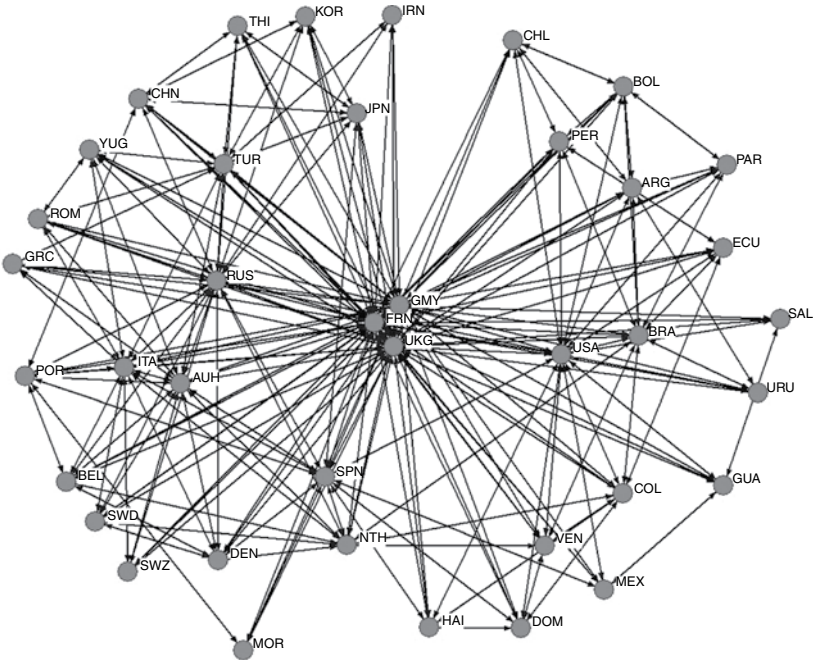


Figure 4.1.1. Policy relevant network, 1895.

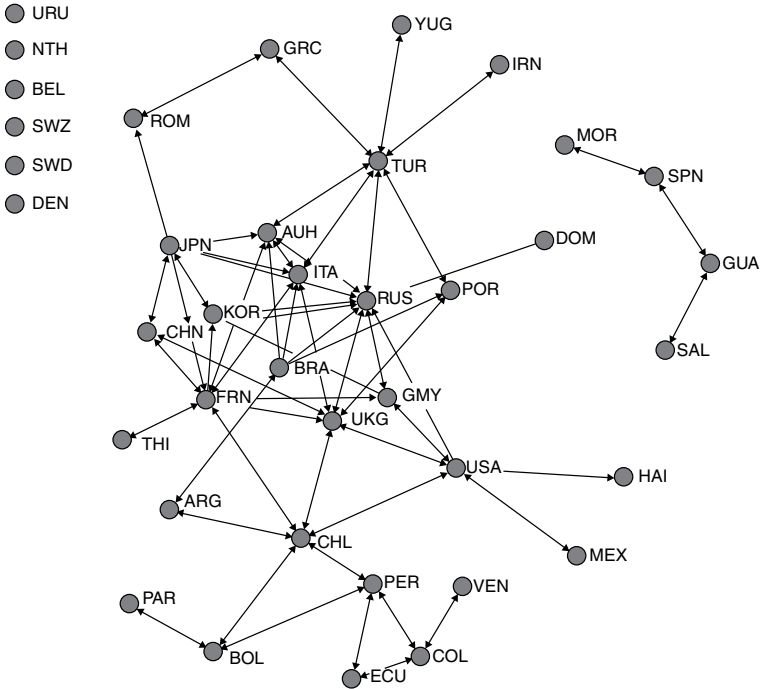


Figure 4.1.2. Strategic reference network, 1895.

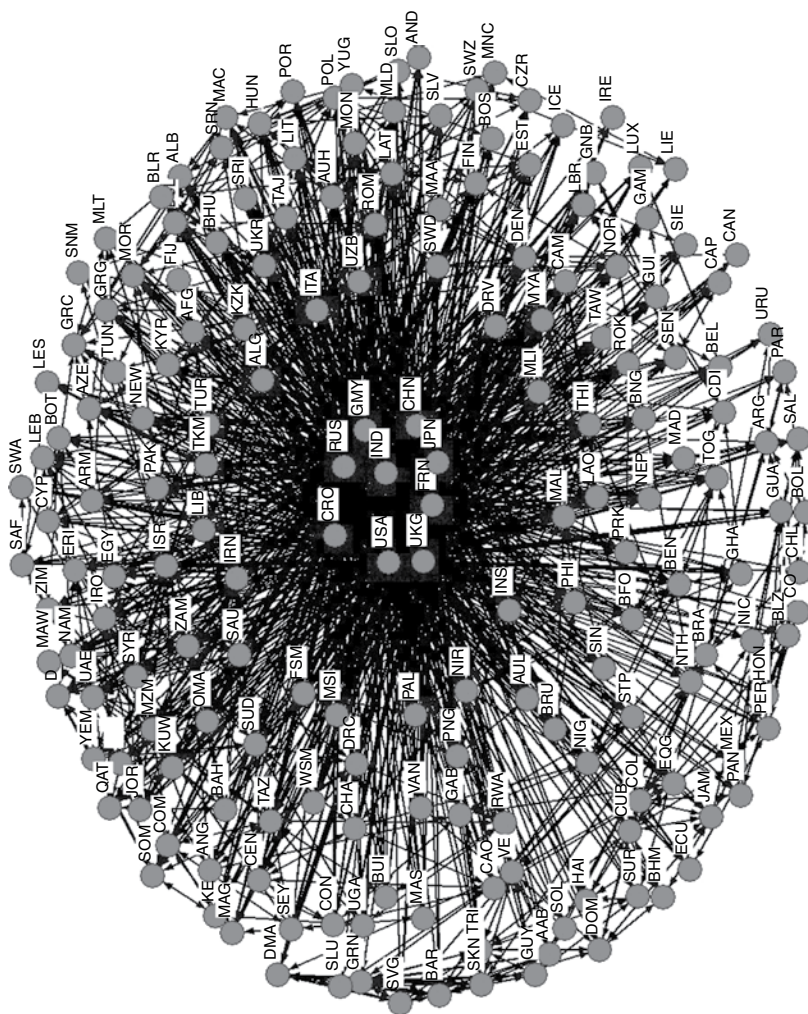


Figure 4.1.4. Strategic reference network, 1995.

Figure 4.1. Policy relevant networks and strategic reference networks.

network is again far less complex than the politically relevant network for the same year.

Figure 4.2 provides a security-related map of the world from the vantage point of the United States. In 1895, the PRIE of the United States encompassed twenty out of the thirty-eight states in the system. Its SRG for that year included only six states. In 1995, the PRIE of the United States (by then a global power) consisted of all 186 states in the system. Its SRG, in contrast, consisted of “only” forty-one states, roughly 22 percent of all system members. This is still a complex set of actors to monitor and to be concerned about. Yet, the SRG of the United States – or any other state for that matter – provides a more workable environment for policy planning than the concept of PRIE.

This demonstration provides some insights into the difference between what some scholars have considered in the past to constitute the security environment of states (i.e., the PRIE) and what I suggest is a more valid conception of this environment (i.e., the SRG). A more systematic validation of this concept is provided in the following sections.

#### 4. The Realist Foundations of Foreign Policy

Realist assumptions serve as a useful baseline model of foreign policy behavior for several reasons. First, realism offers perhaps the most parsimonious perspective of national security of all the major paradigms of world politics (Walt, 1991). Second, other paradigms do not challenge most of these assumptions, but rather build upon them. Third, the realist paradigm is preoccupied with security matters in general, and focuses on processes of war and conflict in particular (Walt, 1991). Since I envision the reality of conflict as the basic building block of the theory of network formation, this paradigm becomes a natural starting point. The realist assumptions about the sources of foreign policy behavior are as follows:

- RA1. *Anarchy as the ordering principle of world politics.* The key characteristic of world politics is anarchy – the absence of a central authority capable of enforcing order on states.
- RA2. *National insecurity.* International anarchy makes states inherently insecure. Thus, states are constantly preoccupied by the need to identify challenges to their security and by the necessity of devising ways to cope with these challenges.
- RA3. *SRGs as source of national threat/opportunity assessments.* States assess the nature and magnitude of

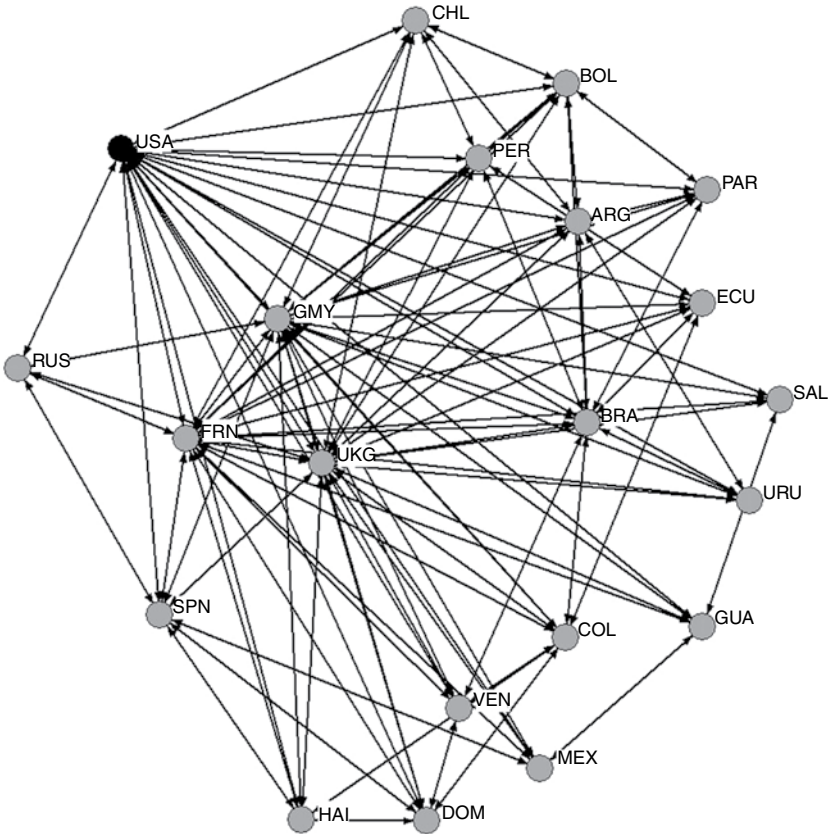


Figure 4.2.1. United States' PRIE, 1895.

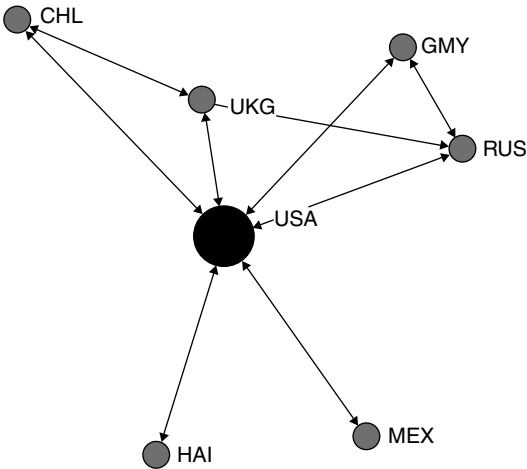
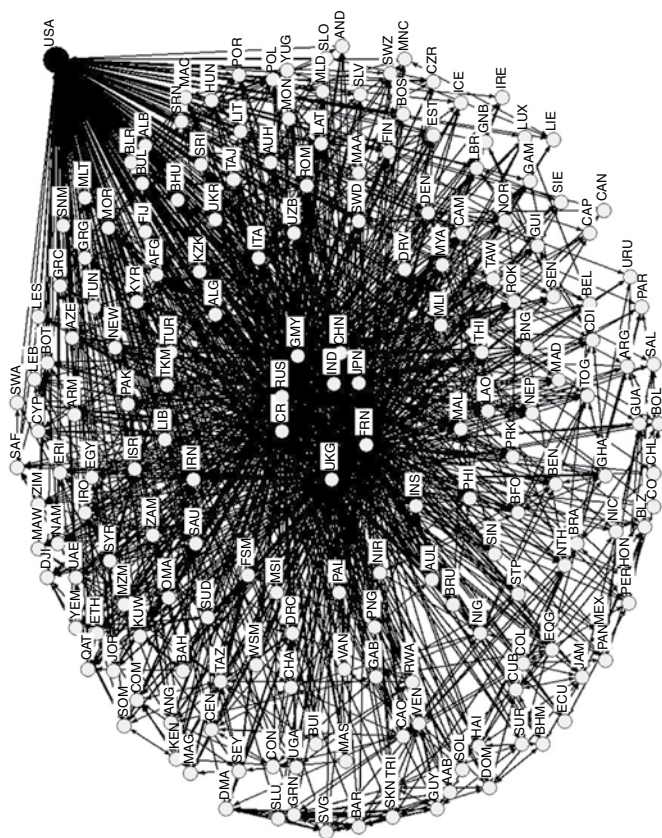


Figure 4.2.2. United States' SRG, 1895.





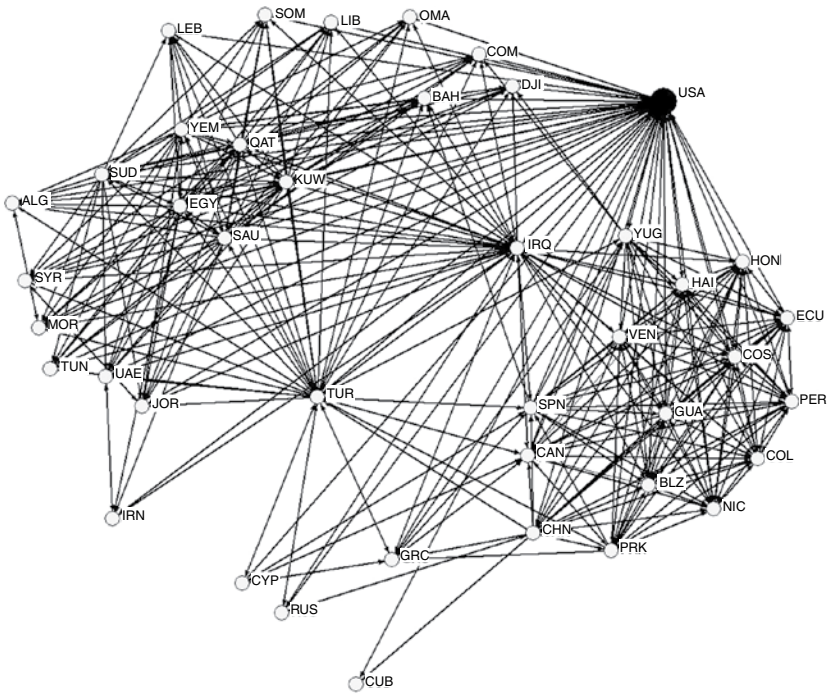


Figure 4.2.4. United States' SRG, 1995.

Figure 4.2. Policy relevance and strategic reference group of the United States.

challenges (threats or opportunities) to their security by evaluating the characteristics, structure, and behavior of members of their SRG.

- RA4. *Power is the key indicator of security and insecurity.* Because power is the currency of international politics, the key concern of national leaders is with the level of power in their international environment. The level of power in their SRG reflects the magnitude of challenges they confront, and thus the nature and extent of policies they need to implement in order to safeguard or advance their national security.

It is useful to discuss these assumptions in some detail. The first assumption is the quasi-axiomatic claim of both classical realism (Morgenthau, 2005: 4–15) and its more modern incarnation – structural realism (Waltz, 1979). It is equivalent to the assumption about an open market in



capitalist-centered economic theories. This assumption asserts that states – viewed by realists as the central actors in international politics – have no higher authority to report to. In domestic political systems, political institutions have a monopoly over the use of force and thus can enforce laws on their constituents. International politics lacks this attribute.

The second assumption immediately follows. International anarchy requires states to be the sole and ultimate guardians of their own security, in what realists call a “self-help” system. As Mearsheimer (1994/5: 9) puts it: “The international system is portrayed as a brutal arena where states look for opportunities to take advantage of each other, and therefore have little reason to trust each other.” Political philosophers noticed this fundamental vulnerability in states long ago. Rousseau pointed out that even “the most frail man has more force for his own preservation than the most robust State has for its” (Rousseau, 2005 [1754]: 68). Under this ominous structure, national security concerns often override all other concerns. National leaders cannot improve or sustain the level of welfare in their states if their independence and territorial integrity is lost.

The third assumption sets the stage for the process by which states make foreign policy. Basically, it asserts that states identify their SRG and monitor its structure and attributes. The result of this situational assessment is a perception of the extent of threats and opportunities stemming from the state’s international environment. This is the central input for the planning and execution of the state’s foreign and security policy.

Political realism is obsessed with power, and for good reason. Political power – most often defined in terms of national military capabilities – is the key scale by which states measure their national security. Realists usually agree on the particular aspects of the SRG that define the magnitude of security challenges – for example, shifts in power, changes in alliance structures – yet they often disagree on how these challenges affect states’ responses. They also disagree on the precise links between specific challenges and specific responses.

The conception of SRGs suggests a rather simple story about foreign policy processes. Political leaders consider two principal indicators of security challenges: The number of states in their SRG and their capabilities. These indicators define both the magnitude of threats the focal state might have to confront and the magnitude of resistance it would face if it wanted to impose its will on its environment. The policy process that follows from this story is somewhat complicated and entails a number of different actions.

States typically consider several foreign policy instruments when confronting international challenges. These include the investment of internal resources for national security tasks (i.e., changes in military spending, or in military personnel), the use of diplomacy (alliance formation, negotiations), the application of economic incentives and

disincentives (foreign aid, economic sanctions), and the threat or use of force (Palmer and Morgan, 2006: 3–6). States may apply any one of these instruments or a sequence or combination thereof. There is no clear statement in the realist literature about the kind of challenges that invoke specific choices from the policy menu.<sup>7</sup> However, as these challenges mount, states select both more and higher doses of these foreign policy instruments.

In this chapter, I focus on those hypotheses that deal with the effect of SRGs on the employment of non-cooperative instruments by states. These instruments include military allocations – changes in military spending and military personnel – and conflict behavior – the initiation of, and participation in militarized interstate disputes. In Chapter 5, I explore cooperative responses of states to the challenges emanating from their SRGs. Several propositions (realist hypotheses [RHs]) emerge from the realist story about the link between the structure of and processes taking place in the SRG of states and their employment of various foreign policy instruments:

- RH1. A state is significantly more likely to engage in conflicts with members of its SRG than with states that are not part of its SRG.
- RH2. The higher the difference between the capabilities of a state's SRG and its capabilities, the more resources would the focal state invest in its own military capabilities.
- RH3. The larger the SRG of a given state, the more likely it is to employ conflictual instruments of foreign policy (engage in MIDs and wars).
- RH4. The higher the imbalance between a state's capabilities and the capabilities of its SRG, the more likely is the state to be involved in international conflict.
- RH5. Controlling for the capabilities of the SRG and of the focal state, the higher the capabilities of the focal state's allies,
  - RH5.1. The less likely it is to increase its military capabilities.
  - RH5.2. The less likely it is to initiate or get involved in international conflicts.

<sup>7</sup> Palmer and Morgan (2006) call these instruments “foreign policy portfolios.” Their work builds on an important body of literature on foreign policy “substitutability” (Most and Starr, 1989; Morgan and Palmer, 2000; Palmer and Bhandari, 2000; Clark and Reed, 2005). This literature asserts that foreign policy makers have at their disposal a wide array of tools to deal with external challenges and with domestic demands. They often select the mix of tools on the basis of both domestic and international considerations. Just what mix of inputs induces a given mix of responses is what this literature tries to figure out. In this sense, the following discussion builds on the substitutability literature.

Hypothesis RH1 is fundamental. The anticipation of hostility induces states to take seriously any action by SRG members that has security-related implications, such as increased military spending, formation of new alliances, or threatening political and military moves. Consequently, states react in discernible ways when one or more of their SRG members takes actions that have security implications. This implies that states are quicker to react to changes in their SRG than to changes in other environments that have no immediate bearing on their security. Consequently, we should see more “critical” interaction between states and members of their SRGs. Conflict behavior is one aspect of such critical interactions. In fact, the theory of network formation rests squarely on RH1; without empirical support for this proposition, the theory collapses altogether.

The subsequent hypotheses posit that the structure of a state’s SRG affects its use of non-cooperative policy instruments. Propositions RH2–RH4 focus on self-help strategies that states adopt in response to the security challenges of their SRGs. RH2 suggests that the “rational” response of a state to threats emanating from its environment is to engage in arms buildups (Glaser 2000). The difference between the focal state’s military capabilities and the aggregate capabilities of its SRG serves as the key indicator of how much the state needs to defend itself.<sup>8</sup> A state’s sense of security challenge may increase when its SRG grows in size or when existing SRG members increase their capabilities. This increases the pool of resources that can be directed at the focal state. If the decision makers of the focal state believe that they can mobilize extra financial and human resources to fend off such threats, they will do so. The next chapter explores what happens when national leaders think that they lack internal resources to balance the capabilities of their enemies, or if they do not believe that they can engage such threats through unilateral resort to force.

RH3 and RH4 spell out a preventive conflict response of states to these two indicators of SRG-related security challenges. Proposition RH3 is straightforward: The more states are considered as would-be enemies, the more “opportunities” exist for fighting. Such opportunities may stem either from defensive or aggressive motivations. Larger SRGs imply higher threats. Higher threats create strong incentives for preventive engagements. But larger SRGs may also imply that there are more actors out there that are likely to resist the focal state’s expansionist or hegemonic aims.

<sup>8</sup> Glaser distinguishes between “rational” and “irrational” (or extrarational) responses of states to the capabilities of their SRG. Rational responses imply that a state would invest only as much effort in increasing its capabilities as is necessitated by the capabilities of its SRG. If a state’s resources – controlling for its domestic needs – are sufficient to balance the capabilities of its SRG, then it should invest just as much as it needs to do so. However, some states might be “greedy ... not threatened” (p. 254), overspending on arms buildups, thus causing unwanted consequences.

Proposition RH4 aims to reconcile the offensive and defensive versions of the realist paradigm. Offensive realism views states as opportunistic animals that are hardwired to exploit others. Thus, if a state's capabilities outweigh those of its SRG, it is expected to exploit this advantage in order to increase its power. One way to do that is to initiate conflict (Mearsheimer, 2001).

Defensive realism suggests that states seek balance. When they are weaker than members of their SRGs, they opt for preventive or preemptive conflicts. These conflicts are aimed at fixing this imbalance before it widens or before others attempt to exploit it to their advantage. However, states that are more powerful than their SRGs would not be tempted to initiate conflict because their survival is guaranteed without it. They are averse to spending resources on risky adventures. Thus, to reconcile both versions of the realist paradigm, I posit that the probability of conflict initiation or conflict involvement by the focal state goes up as the imbalance between the capabilities of the focal state and the capabilities of its SRG increases. Taken together, propositions RH2-RH4 establish the manner in which a state adjusts its security policy to the structure and characteristics of its SRG.

Proposition RH5 is a prelude to what is to come in [Chapters 5–8](#). States can and often do have inconsistent relations with other states (Maoz et al., 2007a). States that have traditionally regarded each other as potential rivals may still have temporary common interests that induce them to cooperate. Likewise, long-term friends might enter into some short-term quibbles. RH5 addresses these inconsistencies. It suggests that the extent of security challenge that states face from their SRG may be modified by political arrangements. Thus, if some of the members of one's SRG have security alliances with the focal state, the latter feels less threatened than it would if it had no such alliances with anybody in its SRG. Consequently, under such circumstances the state would not be inclined to increase its capabilities or to initiate conflict against other states.

These propositions tell a simple story about the non-cooperative aspects of foreign policy behavior. States determine an SRG on the basis of both geographic (opportunity-related) factors and functional (willingness-related) factors. The states that make up one's SRG become the target of close surveillance and monitoring by the state's intelligence. The capabilities of the members of a state's SRG are a key indicator of the magnitude and nature of the security challenges that the focal state confronts. Thus, states react quickly and decisively to changes in the composition and strategic attributes of their SRGs. Specifically, states have most of their fights with members of their SRGs. In addition, states attempt to adjust their capabilities to changes in the capabilities of their SRG members. Finally, states tend to match the level and frequency of their hostile actions to changes in the size and capabilities of their SRGs.

The realist paradigm provides a fairly parsimonious conception of the origins of non-cooperative foreign policy behavior. Because it offers a baseline model for other paradigms of international behavior, it is important to test the propositions of the model before we develop alternative explanations of national behavior. The remainder of this chapter focuses on such tests. In the next chapter, I build on these results to develop the theory of networked international politics.

## 5. Testing the Validity of the SRG Construct

The conceptual definition of SRGs is not controversial. The operational definition I have offered, however, may well be. The concept of PRIE was subject to some criticism, and although it withstood empirical challenges (e.g., Lemke and Reed, 2001; Bennett, 2006), it is not without problems. The concept of SRG is novel, and its elements – the history of conflict and the indirect enmity concept – may well invoke criticism. Confronting this criticism requires assessment of the validity of the SRG concept – the extent to which the empirical measure captures the theoretical construct of a security-relevant egonet.

I offer three tests of validity. The first – a construct validity test – uses the notion of claims as a construct that captures an important substantive aspect of security egonets. As I noted in the previous section, a state may feel challenged by another state to the extent that either one of them has some claim on the other's territory, policy, or regime. When claims are resolved or abated, this sense of challenge diminishes or disappears. For years, Israel and Egypt have directed significant claims at each other. In the 1950s and the first half of the 1960s, these claims involved political as well as territorial issues: Egypt did not recognize Israel's right to exist, and Israel challenged Egyptian restrictions on freedom of navigation in the Red Sea and the Suez Canal. After the Six Day War of 1967, Egypt's principal claims were territorial – the return of the Sinai. Both Israel and Egypt followed these claims with frequent conflicts and several wars. During the entire period, Israel and Egypt regarded each other as the major threats to their security. When these states finally resolved their territorial conflict with the 1979 peace treaty, the sense of threat diminished substantially. Egypt has still some political claims that involve Israeli-Palestinian relations, but it has become a mediator in the Israeli-Palestinian conflict rather than a threat. Israel still considers Egypt to be an important source of challenge to its security, but it certainly is not the most important, nor is it the most persistent and urgent challenge (Maoz and Mor, 2002; Maoz, 2006a).

Territorial claims are a subset of all claims, but they are important ones (Huth and Alee, 2003; Senese and Vasquez, 2008). Thus, if SRG is a valid concept, then states that have territorial claims toward each other are

Table 4.1. *Claims, SRG membership, and PRIE membership, 1816–2001*

| Claim        | SRG                                                                             |        |           | PRIE                                                                          |         |           |
|--------------|---------------------------------------------------------------------------------|--------|-----------|-------------------------------------------------------------------------------|---------|-----------|
|              | No                                                                              | Yes    | Row total | No                                                                            | Yes     | Row total |
| No           | 358,510                                                                         | 24,307 | 382,817   | 278,484                                                                       | 104,333 | 382,817   |
|              | 93.7%                                                                           | 6.4%   | 97.9%     | 72.8%                                                                         | 27.2%   | 97.9%     |
| Yes          | 4,432                                                                           | 3,628  | 8,064     | 492                                                                           | 7,572   | 8,064     |
|              | 55.0%                                                                           | 45.0%  | 2.1%      | 6.1%                                                                          | 93.9%   | 2.1%      |
| Column total | 362,946                                                                         | 27,935 | 390,881   | 278,976                                                                       | 111,905 | 390,881   |
|              | 92.9%                                                                           | 7.1%   |           | 71.4%                                                                         | 28.6    |           |
|              | $\chi^2 = 1.8\text{e}+04$ ; Yule's Q = 0.847;<br>Tau-b = 0.213; $m_b = 0.903^9$ |        |           | $\chi^2 = 1.7\text{e}+04$ ; Yule's Q = 0.953;<br>Tau-b = 0.210; $m_b = 0.706$ |         |           |

Notes: Directed dyad-years only.

Second row in each cell represents row percentage.

Highlighted cell represents the basis for the calculation of the  $m_b$  statistic.

likely to be in each other's SRG. Likewise, states that are not in each other's SRG are not expected to have territorial claims toward each other. The correlation between the SRG concept on the one hand, and territorial, maritime, and river claims on the other, allows us to assess the construct validity of the SRG.<sup>10</sup> I also compare the SRG-claims analysis to the PRIE-claims contingency table (Table 4.1). This gives us a comparison between SRGs and PRIEs in terms of their correlations with territorial claims.

The results of Table 4.1 may seem disappointing. Only 45 percent of the dyad-years involving territorial claims were due to SRG dyads. This is in stark contrast to the 94 percent of the claims made by politically relevant dyads. Also, 87 percent of the states that were in each other's SRG did not have any territorial claims vis-à-vis each other. This contrasts with over 93 percent of PRIE members that had no territorial claims. However, the statistical association between these variables is quite strong if we focus on the critical cell in this table – the Yes-Yes cell. The SRG dyads with no territorial claims may well involve claims of a political, ideological, or regime-related nature. These types of claims are not coded in the Issue Correlates of War (ICOW) dataset. The dyad-years that entailed non-SRG territorial claims may have been fairly dormant territorial disputes of a lower nature. In fact, the number of observed SRG dyad-years that involved territorial claims were over seven times the number of such that would have been expected by chance alone. This contrasts with only a 2:1 ratio of observed to expected frequencies for the PRIE-claim dyad-years. Using Hensel et al.'s

<sup>9</sup> See Appendix for a discussion of this coefficient.

<sup>10</sup> I discuss this dataset and the adaptation of the Hensel, Mitchell and Sowers (2006) data to this study in the appendix to this chapter.

Table 4.2. *SRG and international conflict*

| SRG dyad?  | Militarized interstate disputes                        |                |                  | War                                                     |              |                  |
|------------|--------------------------------------------------------|----------------|------------------|---------------------------------------------------------|--------------|------------------|
|            | No                                                     | Yes            | Row total        | No                                                      | Yes          | Row total        |
| No         | 651,336<br>94.8%                                       | 467<br>10.8%   | 653,803<br>94.2% | 653,729<br>94.3%                                        | 74<br>9.9%   | 653,803<br>94.2% |
| Yes        | 35,040<br>5.2%                                         | 3,849<br>89.2% | 38,889<br>5.8%   | 38,216<br>3.4%                                          | 673<br>90.1% | 38,889<br>5.8%   |
| Col. total | 670,376                                                | 4,316          | 674,692          | 673,945                                                 | 747          | 674,692          |
| Statistics | $\chi^2 = 5.6+04$ ; Yule's Q = 0.987;<br>$m_b = 0.930$ |                |                  | $\chi^2 = 1.6e+04$ ; Yule's Q = 0.987;<br>$m_b = 0.961$ |              |                  |

(2006) measure of the severity of the claim as a predictor of whether two states would be in each other's SRG reveals that most discrepant cases (SRG members without claim or claims between non-SRG members) entailed lower-level claims. Higher-level claims (a combination of significant territorial, river, and maritime claims) were extremely likely to be between SRG members. Thus, overall, the convergence between the claims construct – as partial as it may be – and the SRG construct is quite strong.

A related – and possibly more meaningful – way to analyze the extent to which SRG membership and territorial claims converge entails correlating these two variables across dyads rather than across dyad-years. If two states had issued territorial claims to one another at a given point in their history, were they also likely to be in each other's SRG? I correlate the proportion of the years of common history of a given dyad where at least one state issued a territorial claim vis-à-vis the other with the proportion of the years of common history where members of the dyad were in each other's SRG. This correlation is  $r = 0.494$  ( $N = 8,188$  dyads,  $p < .0000$ ). Here, too, we observe a reasonable correspondence between the territorial-claim indicator and the SRG indicator.

The third test (see Table 4.2) examines the validity of this concept through the analysis of the hypothesized consequences of the definition. Recall that states regard their SRG members as security challenges. Thus we expect these states to fight each other far more frequently than states that are not in each other's SRG. Again, the correlation between SRG membership and conflict tells us whether our conception of SRG relations leads to the expected interactive outcome.<sup>11</sup>

<sup>11</sup> This may sound as an odd – or even an improper – validity check. Given that our hypotheses specify a relationship between SRG and conflict, the test of construct validity is also a test of our research hypotheses. However, this particular test is different from the way in which I test the hypotheses. Specifically, the validity test is conducted on a dyadic level. The unit of analysis is a dyad-year. In the tests of the hypotheses derived from the various paradigms, the unit of analysis is a state-year. In other words, we check here whether states that consider each other as security challenges are more

The results suggest that over 89 percent of all dyadic militarized interstate disputes and over 90 percent of all war dyads occurred between states that have been in each other's SRG. The observed-to-expected ratio of these cases is 15:1 for MIDs and nearly 16:1 for wars.<sup>12</sup> Taken together, these tests suggest that the current definition of strategic reference groups provides a fairly valid measure of the security environment of states. Although probably not ideal, it is a reasonably good approximation of what policy makers view as their security environment. Any systematic measure that attempts to capture a subjective interpretation of a security environment is bound to entail some odd results. In our context, there are cases entailing territorial, river, or maritime claims involving non-SRG dyads. These cases may suggest that both the target and initiator of such claims consider each other as part of their SRG. Yet, the absence of overt conflict makes such dyads less "dangerous" (Bremer, 1992). There are also quite a few SRG dyads that are due to some incidental low-level dispute in the recent past. In reality, such states do not actually worry about each other in a security sense. Nevertheless, these analyses suggest that – over a long period of time and a large number of dyads – this definition yields reasonable results in terms of its construct validity. It also appears to have a fair amount of face validity, but this is, of course, arguable.

This last analysis also provides support for RH1: States that are in each other's SRG are ten times more likely to fight than states that are not in each other's SRG. Clearly, the probability of conflict between SRG members is also a function of who these states are and of other aspects of their relationships. Some of these issues are captured in the test of the remaining propositions in the next section.

## 6. Testing the Realist Hypotheses: Empirical Results

I start the discussion with the test of propositions RH2 and RH5.1 which focus on the effect of the structure of one's SRG on the propensity to invest in military capabilities.

The results shown in Table 4.3 generally support these hypotheses. As the difference between the capabilities of the focal state and the aggregate capabilities of its SRG increases, the extent of the absolute and rate-of-change in the state's capabilities declines. States that feel weak compared to their SRGs tend to increase their military capabilities more

likely to fight each other than what we should expect by chance alone. The substantive hypotheses focus on how *the structure* of one's SRG affects its conflict behavior.

<sup>12</sup> This compares favorably to an association between PRIE membership and conflict. In this case, only 85.1% of the PRIE dyad-years ended in MIDs (with a 6.1:1 observed-to-expected ratio) and 77.4% (6:1 observed-to-expected ratio) for wars. The contingency table analysis of PRIE and MIDs yields an  $m_b = 0.883$ , and the correlation between PRIE membership and war is  $m_b = 0.883$ .



Table 4.3. *The effects of the structure and characteristics of SRGs on military capabilities – time-series cross-sectional analysis of nations, 1816–2001*

| Independent variable           | Absolute capability change                         | Relative capability change                         |
|--------------------------------|----------------------------------------------------|----------------------------------------------------|
| No. states in SRG              | -3.28e-04**<br>(1.04e-04)                          | -5.18e-04<br>(3.40e-04)                            |
| Non-SRG allies' capabilities   | -0.003<br>(0.012)                                  | -0.177**<br>(0.046)                                |
| SRG allies' capabilities       | -0.046**<br>(0.09)                                 | -0.141**<br>(0.049)                                |
| Capability Imbalance State/SRG | -0.046**<br>(0.008)                                | -0.168**<br>(0.024)                                |
| Model statistics               | N = 12,187<br>States = 184<br>Chi-square = 31.80** | N = 12,187<br>States = 184<br>Chi-square = 86.50** |

Note: Number in Parantheses are robust standard errors.

\*  $p < 0.05$ ; \*\*  $p < 0.01$

than states that feel “secure” in that particular sense. This result supports the “rational” conception of military buildups (Glaser, 2000). Likewise, as the state benefits from pooling capabilities with other states, it tends to invest fewer resources in military capabilities. Surprisingly, however, the size of one’s SRG tends to have a negative impact on its military buildup strategy, contrary to what we may expect. This may suggest that states may look for coping strategies other than investment in military buildups when they confront large-sized SRGs.

Table 4.4 examines RH3-RH4 and RH5.2. This analysis estimates the extent to which the size and structure of the SRG of a focal state affect the likelihood that it would initiate or get involved in MIDs and/or wars. Table 4.5 shows the percentage change in the probability of conflict as a result of changes in independent variables.

The results in Tables 4.4 and 4.5 suggest that the realist propositions are supported, but the predictive power of the model is not high. First, SRG size increases the probability of conflict initiation or conflict involvement by sixteen to nineteen percent. Second, both very weak states and very strong states compared to their SRGs are less likely (by 9–15 percent) to get involved in conflict than states that have a fairly balanced state-to-SRG capability ratio. Third, as the proportion of SRG members allied with the focal state rises, the probability of conflict involvement by the focal state declines between ten and 22 percent.<sup>13</sup>

<sup>13</sup> The relatively high proportion of predicted outcomes is not due primarily to the strong effect of the independent variables on the dependent variable. Rather, it is due to the number of peace years and the cubic spline variables that are introduced to take care of autocorrelation.

Table 4.4. *The effect of the size and structure of SRGs on the conflict behavior of nations, 1816–2001 – time-series cross-sectional regression*

| Independent variable                  | MID initiation                                                | MID involvement                                               | War involvement <sup>3</sup>                                  |
|---------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------|
| No. states in SRG                     | 0.027**<br>(0.002)                                            | 0.029**<br>(0.002)                                            | 0.019**<br>(0.003)                                            |
| Capability imbalance<br>state/SRG     | -1.415**<br>(0.208)                                           | -1.198**<br>(0.184)                                           | -1.530**<br>(0.288)                                           |
| Proportion of SRG allies              | -0.377**<br>(0.082)                                           | -0.348**<br>(0.070)                                           | -0.570**<br>(0.161)                                           |
| Number of peace years                 | -1.153**<br>(0.057)                                           | -0.460**<br>(0.025)                                           | -0.809**<br>(0.041)                                           |
| Constant                              | 0.282**<br>(0.051)                                            | -0.186**<br>(0.047)                                           | 0.042<br>(0.086)                                              |
| Proportion correctly<br>predicted     | 0.826                                                         | 0.755                                                         | 0.951                                                         |
| Improvement in Fit (PIF) <sup>2</sup> | 0.254                                                         | 0.080                                                         | 0.172                                                         |
| <b>Model statistics</b>               | N=12,806<br>$\chi^2=2,651.64$<br>Pseudo R <sup>2</sup> =0.254 | N=12,806<br>$\chi^2=1,728.02$<br>Pseudo R <sup>2</sup> =0.145 | N=12,806<br>$\chi^2=1,306.77$<br>Pseudo R <sup>2</sup> =0.346 |

<sup>1</sup> Cubic splines not shown in table to conserve space.

<sup>2</sup> Improvement in fit is the percentage correctly predicted given the model relative to a modal-case based prediction. Specifically,  $PIF = [P(FIT|Model) - P(ModalCat.)]/[(1 - P(ModalCat.))]$ . Where  $P(FIT|Model)$  is the proportion of correctly predicted cases given the model and  $P(ModalCAT)$  is the proportion of the modal category of the dependent variable.

<sup>3</sup> For war I use rare-event logit correction (King and Zeng 2001).

\*  $p < .05$ ; \*\*  $p < .01$

Table 4.5. *Changes in probability of initiation of SRG-related variables in Table 4.4*

| Independent variable                           | Change in probability of |                 |                 |
|------------------------------------------------|--------------------------|-----------------|-----------------|
|                                                | MID initiation           | MID involvement | War involvement |
| No. states in SRG                              | 19.48%                   | 19.70%          | 16.40%          |
| Capability imbalance state/SRG                 | -11.75%                  | -9.13%          | -14.98%         |
| Proportion of SRG allies                       | -12.57%                  | -10.64%         | -21.92%         |
| Baseline probability of<br>dependent variable* | 16.40%                   | 22.80%          | 2.06%           |

\*This is the probability of the dependent variable assuming a value of 1 (a state initiates, or is involved in a MID/War at a given year) when all independent variables are at their mean. The probability changes are percent changes in the probability of conflict when the independent variable shifts from its 20th percentile value to its 80th percentile value and all other variables are held constant at their respective means.

In more general terms, the model deduced from the realist paradigm is between eight and 25 percent more accurate than a null model that relies on the modal category of the dependent variable. This implies that there is a great deal of unexplained behavior that is not accounted for by the realist model. This low level of fit suggests two points. First, states might consider non-unilateral strategies to deal with their SRGs. Some of these strategies may be cooperative. Second, the results seem to support the arguments of other international relations paradigms: The realist paradigm explains some of the patterns of national behavior, but the world is more complex than the realist paradigm would have us believe. The key message, however, is that the structure and characteristics of strategic reference groups seem to affect the way in which states structure certain aspects of their security and foreign policy. This is an important starting point for our exploration of cooperative international networks.

## 7. Conclusion

This chapter addressed a number of issues.

1. *What is the security environment of states?* The security environment of a given state is a group of actors in that state's external setting that pose challenges to its security. Operationally, the strategic reference group of each state is composed of other states that have been enemies or rivals in the near past, and the allies of such past enemies.
2. *How does the security environment of a given state affect its behavior?* Different paradigms offer different answers to this question. This chapter focused on the answers we can glean from the realist perspective. The realist paradigm suggests that the size of the SRG and the ratio of the state-to-SRG capabilities have a powerful effect on states' behavior. States can try to convert some of these past enemies into friends or allies. And when they do, their tendency to invest in military might or to engage in conflict declines.
3. *Is the concept of SRGs a valid depiction of security environments?* Most scholars and practitioners would probably agree with the conceptual definition of strategic reference groups. As I mentioned, such a concept is not only theoretically meaningful; it is practically necessary. However, it is not evident that this conceptual definition can be converted into an operational definition of SRGs that is not subjective in nature. Nor is it evident that everybody would agree with the definition I offered

here. The validity tests of this definition suggest that the SRG variable compares well and even favorably to its older cousin – the concept of PRIE. It captures relatively well another approach to identifying possible security challenges – the notion of claims. Finally, the operational definition of SRGs tends to predict rather well actual conflict between states.

4. *How do the size and characteristics of a state's SRG affect its non-cooperative foreign policy behavior?* The results of a number of empirical analyses reveal several points about two aspects of national behavior: investment in military capabilities and conflict behavior. States tend to increase their investment in military capabilities to the extent that they are increasingly weak compared to members of their SRG. This tendency to invest additional resources on military capabilities may be modified by the pooling of resources with other states. This is an important point that serves as one of the core elements of the networked international politics theory.

Second, the size of a state's SRG is a relatively robust predictor of its tendency to initiate conflict and to get involved in militarized interstate disputes and in wars. Also, as some SRG members are converted from foes to friends via security alliances, states reduce their tendency to resolve conflicts of interest via the use of force. Interestingly, as the gap between the capabilities of the focal state and the capabilities of its SRG widens – whether the focal state is excessively weak or excessively powerful – its tendency to get involved in conflict increases. This suggests that both the offensive and the defensive version of realism seem to be supported by these analyses.

5. *What do these results tell us about security networks?* Strategic reference groups make for an interesting case in terms of our classification of network types. Politically relevant international environments form clearly nondiscretionary networks. On the other hand, SRGs are hybrid networks. They are discretionary to the extent that a state chooses to confront some other states through the threat or use of force. Once this happens, the targets of such conflict become – at least for a few years – members of its SRG. However, when the state becomes embroiled in actual or potential conflict – thus converting the partners of such conflicts into members of its SRG – this part of its egonet becomes nondiscretionary. While conflict is an important area of inquiry in international relations, it is only one – and quite infrequent – form of international interactions. The analysis here suggests that other strategies of dealing with a hostile security network may be at work. SRGs may also serve as the foundation for

cooperative network formation processes. This is the focus of [Chapter 5](#).

## Appendix to Chapter 4

### Data

I add a number of datasets to those discussed in previous chapters.

- i. *Contiguity*. To generate PRIEs I use the COW contiguity dataset.<sup>14</sup>
- ii. *Conflict*. The data for dependent variables, and also for the generation of the SRG data are derived from Maoz's (2005) dyadic MID dataset.
- iii. *Strategic rivalry*. I use the Thompson (2001) strategic rivalry data for the definition of SRGs.
- iv. *Capability*. I use the COW National Capability dataset (COW, 2003b, Singer, 1990).
- v. *Claims*. I use the Issue Correlates of War (ICOW) dataset (Hensel, Mitchell, and Sowers, 2006). Data cover territorial, river, and maritime claims, excluding a limited number of regions and organized in a dyadic dataset with a dyad-year as a unit of observation.

### Unit of Analysis

The unit of analysis is the nation-year. The generation of SRG data, the validity tests, and the test of RH1 use a dyad-year unit of analysis. This encompasses all possible dyads. The time frame covers the 1816–2001 period.

### Measurement of Variables

The dependent variables are three measures of international conflict:

- a. *Absolute capability change*. The absolute change in a given state's military capabilities, defined in terms of military personnel and military expenditures. The algorithm used to calculate this variable is:

$$abscapch_{i(t-1 \rightarrow t)} = \frac{(prmilper_t - prmilper_{t-1}) + (prmilex_t - prmilex_{t-1})}{2} \quad [4.1]$$

<sup>14</sup> All COW datasets mentioned here are available from the Correlates of War (COW) project Web site at: <http://www.correlatesofwar.org>

*Relative capability change.* This is the percentage change in the military aspect of national capabilities from one year to the next. It is measured as:

$$relcapch_{i(t-1 \rightarrow t)} = \frac{\left( prmilper_{it} - prmilper_{i(t-1)} \right) / prmilper_{i(t-1)} + \left( prmilex_{it} - prmilex_{i(t-1)} \right) / prmilex_{i(t-1)}}{2} \quad [4.2]$$

- b. *MID initiation.* Coded as 1 for a year in which the focal state has initiated at least one MID and zero otherwise.
- c. *MID involvement.* Coded as 1 if the focal state was involved in at least one dyadic MID during the year and zero otherwise.
- d. *War involvement.* Coded as 1 if the focal state was involved in at least one dyadic war and zero otherwise.

*Independent variables.* All of the independent variables are based on the operational definition of the SRG. The calculation of SRGs follows a three-step process.

1. Measurement of the state's PRIE. The point of origin for the measurement of PRIEs is a dataset of dyad-years that includes all dyads in the international system over the 1816–2001 period. Following the categories developed by Maoz (1996), a dyad is politically relevant if it meets the criteria discussed earlier (p. 116).
2. Derivation of the SRG. Each dyad is assigned a dyad-year score starting with the first year the dyad was in existence (the date of independence of the youngest member of the dyad), and accumulating each year afterward. For the first five years of existence, a politically relevant dyad is automatically defined as being in each member's SRG. After the fifth dyad-year a dyad – whether it is politically relevant or not – is coded as 1 for each year if the dyad had at least one MID in the past five-year period or at least one war in the last ten-year period and zero otherwise. This designates direct enemies. To this set, I add dyad-years that are designated by Thompson (2001) as strategic rivalry years. Third, the allies of one's direct enemies/strategic rivals are designated members of one's SRG (whether or not they are in the focal state's PRIE), as derived by Maoz et al., (2007). Thus each dyad-year is assigned a score of 1 if it meets the conditions stated earlier (p. 118), and zero otherwise.
3. *SRG aggregation of independent variables.* Using the dyad-year dataset, data are collapsed for each state and each year such that

each independent variable is defined for each state's SRG and for each year. The definitions of the independent variables are given in the material that follows.

*Number of states in the SRG.* For any given state and any given year, this is the sum of all states assigned a SRG score of 1 in the dyad-year dataset.

*Difference state/SRG capabilities (state/SRG capability imbalance).* Using the Composite Index of National Capabilities (CINC) (COW 2003b), I subtract a state's military capabilities from the sum of the military capabilities of its SRG members. For states with no SRG members this variable is computed as  $CINC_i$  (where  $CINC_i$  is the capability score of the focal state). This is done not to omit from the analyses states that have no SRGs.

*Non-SRG allies' capabilities.* This index aggregates CINC scores over all states with whom the focal state had an alliance and which were not part of the state's SRG.

*Capabilities of SRG allies.* This index aggregates CINC scores over all states with whom the focal states had an alliance and which *were* part of the state's SRG.

### Model Specification for Empirical Tests

*Estimation.* The tests of RH1 is done via contingency table analyses that link SRG structures to conflict. The  $m_b$  measure of association serves as an important evaluation tool for the effects of SRGs on dyadic conflict propensities. Therefore it is useful to explain its logic.

The  $m_b$  measure of association (Maoz, 1996: 130–132) is a Proportionate Reduction in Error (PRE) coefficient that varies between -1 and +1 and measures the proportion of the Chi-Square statistic that is due to variation consistent (positive  $m_b$ ) or inconsistent (negative  $m_b$ ) with a given hypothesis. Briefly,  $m_b$  is calculated as:

$$m_b = \frac{\sum_{m=1}^k \frac{(o_{cm} - e_{cm})^2}{e_{cm}} - \sum_{j=1}^l \frac{(o_{ij} - e_{ij})^2}{e_{ij}}}{\chi^2}$$

Where  $o_{cm}$  and  $e_{cm}$  are, respectively, the observed and expected frequencies in “consistent” cells and  $o_{ij}$  and  $e_{ij}$  are, respectively, the observed and expected frequencies in “inconsistent” cells, and  $\chi^2$  is the Chi-Square score. Here we examine only the effect of the cases in the bottom right cell in the table, to which the various hypotheses about balance refer. The  $m_b$  score is the proportion of the Chi-Square score

accounted for by the consistent/inconsistent frequency of this particular cell. In this particular example the  $m_b$  score is calculated only by examining the bottom-right (Yes-Yes) cell.

Multivariate analyses of RH2 and RH5.1 are based on a Generalized Least-Squares model estimating the level of military buildup in states. Versions with generalized autoregressive error structure or panel-specific error structures yielded essentially similar results. The tests of RH3-RH4 and RH5.2 are based on time-series cross-sectional logit models with nonconflict years and cubic splines (Beck, Katz, and Tucker, 1998).



## Part II

### *The Formation of International Networks: Theory and Evidence*



## *Networked International Politics: A Theory of Network Formation and Evolution*

### 1. Introduction

The concept of *emergence* in complexity theory refers to “the arising of novel and coherent structures, patterns and properties during the process of self-organization in complex systems” (Goldstein, 1999). The characteristics of emergent systems include (a) *radical novelty* (features not previously observed in the system); (b) *coherence or correlation* (meaning integrated wholes that maintain themselves over some period of time); (c) *a global or macro level* (i.e., there is some property of “wholeness”); (d) *evolution* – it is the product of a dynamical process; and (e) it is *ostensive* – it can be perceived (Corning, 2002: 25).

Many phenomena and structures in international relations are emergent systems. These include global wars or global warming, the rise and decline of imperialism, the rise and decline of norms and institutions, bipolarity and multipolarity. However, it is often unclear how these phenomena emerge, function, and evolve. Corning (2002: 18) suggests that “reductionism, or detailed analysis of the parts, and their interactions is essential for answering the ‘how’ question in evolution – how does a complex living system work? But holism is equally necessary for answering the ‘why’ question – why did a particular arrangement of parts evolve? In order to answer the ‘why’ question, a broader, multi-leveled paradigm is required.”

This chapter presents a theory of how international networks emerge. Networked International Politics (NIP) theory builds on the key ideas of the central paradigms of the field. It outlines the microfoundations of international networks by specifying how states choose to form different types of cooperative relations. The cooperative choices of states open a window into the emergence of international networks as a consequence of the *system of interactions* among multiple nations. National decisions about international cooperation have profound structural effects. These

effects determine how networks form, how they evolve, how they change, and how they affect each other.

The NIP theory focuses on the microfoundations of cooperative networks. This is so because alliance, trade, and IGO networks are all discretionary – that is, they evolve as a result of national choices. Thus, a meaningful explanation of network formation must start from states' choices to cooperate with each other. If we are to understand networks as emergent structures, we must explore how cooperative choices of individual states – operating within an anarchic international system – give rise to different network structures. The NIP theory addresses the following questions:

1. Why do states choose to cooperate with other states?
2. How do states decide with whom to cooperate, when to forge cooperative ties, and what kind of ties to forge?
3. Is there a relationship between international cooperation in one domain (e.g., security) and cooperation in other domains (e.g., economics, institutions)?
4. What are the structural consequences of states' cooperative choices? What kind of systemic structures emerge given the cooperative choices of individual states?

As noted previously, we need not start this endeavour from scratch; the central paradigms of international relations have addressed most of these questions. The microfoundational logic may be implicit and indirect in these paradigms; they may use neither the terminology nor the methodology of network analysis. Nevertheless, the assumptions of these paradigms and the stories they tell about international relations allow deduction of logical explanations regarding the ways in which different networks form and change. The NIP theory builds on and integrates ideas that are drawn from the realist, liberal, and constructivist/cultural paradigms. I start by reviewing the key tenets of these paradigms with respect to network formation. I then outline the key ideas of the NIP theory. These ideas are specified at the national or monadic level, the dyadic level, the clique level, and the systemic level of analysis.

## 2. The Realist Story of International Network Formation

As noted in Chapter 4, the realist perspective of network formation processes serves as the baseline for the stories developed by the other paradigms. The realist perspective can be captured by the simple statement: *“Independence is what states aim for; interdependence is what they*

*must accept and manage.*” This notion is captured by the story of this paradigm about the origins and structure of cooperative networks.

## 2.1 Realism and Security Cooperation

Realist perspectives of world politics are predicated to a large extent on a Hobbesian image of the state of nature. In the international state of nature, states are strong enough to harm other states, but their resources are not sufficient to insure survival. This creates a strong incentive to forge cooperative security ties with other states. Such ties are designed to augment members’ power, thus balancing against security threats emanating from their SRGs.

The realist story of the origins and nature of international cooperation requires us to supplement the assumptions outlined in [Chapter 4](#) by two additional assumptions.<sup>1</sup>

RA5. *Suspicion of others.* The anarchical structure of the international system and the principal motivations of states (power maximization, pursuit of relative gains, and fear of cheating) render states inherently suspicious about each other’s intentions (Mearsheimer, 1994/5: 8–9).

RA6. *Common interests as criterion for cooperation.* To the extent that cooperation is deemed necessary, states tend to cooperate on the basis of common interests. Cooperation persists only as long as such interests outweigh conflicting goals and prevalent suspicion of cheating.

These assumptions yield a seeming contradiction: states cannot unilaterally insure their own security, yet they are wary of cooperation with others due to the fear of cheating. This contradiction is more apparent than real, however. What these assumptions imply is a trade-off between two conflicting forces: the security imperative and the suspicion of others. The last assumption suggests how this trade-off can be resolved.

As we saw in [Chapter 4](#), realists believe that the size and the cumulative capabilities of members of one’s SRG define the magnitude of the national security challenges of states. Because conflict is costly and its outcome uncertain, states are first and foremost inclined to balance the capabilities of their SRGs by increasing their human and material investment in military capabilities. Since states are rational actors, the allocation of their

<sup>1</sup> As a reminder, the basic realist assumptions introduced in [Chapter 4](#) are: (1) international anarchy is the key condition of international relations; (2) anarchy causes states to be concerned first and foremost about their survival and security; (3) the characteristics of one’s SRGs determine the scope of security challenges a state faces; and (4) the power of one’s SRG determines the extent of security challenges a state faces.

resources for military purposes is supposed to be “optimal.” This means that political leaders optimize the allocation of resources between security and welfare. This allocation provides the best response to domestic needs and to external challenges. Consequently, the difference between the state’s own capabilities to the cumulative capabilities of its SRG – the state/SRG capability difference – reflects the maximum that it can reasonably allocate to confront external challenges without risking domestic upheaval (Cusack and Stoll, 1990). This ratio then determines the need for security cooperation.

When a state’s internal resources are sufficient to balance the capabilities of its SRG, the state can resort to unilateralist strategies to deal with security challenges. It can increase its military capability to the point that it would balance the capabilities of its SRG, thereby deterring members of its SRG from attacking it. Or, it can initiate conflict against members of its SRG to remove security challenges. With a positive state/SRG capability difference, its leaders can be fairly confident that it would prevail. Thus, favorable state/SRG capability balances remove the trade-off between the imperatives of security and the suspicion of others: one does not need to rely on others to confront security challenges.

On the other hand, under an unfavorable state/SRG capability balance, internal resources are insufficient for facing international challenges. The risk of defeat in war is high. The complications of international commitments seem less costly than having to face powerful enemies all alone. This resolves the debate among realist scholars about alliance formation: whether states form alliances to balance against threats or to balance against power (Walt, 1988). The composition of one’s SRG determines who is a potential security challenge; the state/SRG capability balance determines the magnitude of the challenge.

Now that we know when states feel a need to address security challenges via alliance formation, we need to address the question of which other states are seen as acceptable alliance partners. The answer to this question follows directly from the model’s assumptions: The prime candidates for security alliances are the enemies of a state’s enemies. Mearsheimer (1994/95: 13) argues, “balance-of-power logic causes states to form alliances and cooperate against common enemies.” In a realist world, the only common interest that matters is a common threat (Walt, 1988).<sup>2</sup>

There is more to the choice of alliance partners than having common enemies, however. Realist scholars regard alliances as creatures of necessity; their chief purpose is to balance security challenges. The

<sup>2</sup> For example many realist (and nonrealist) scholars dismiss the democratic peace proposition – the finding that democracies do not fight each other – by arguing that the absence of war between democracies is an artifact of the Cold War, when most democracies aligned with each other to face the common Soviet threat (Mearsheimer, 1990; Cohen, 1994; Farber and Gowa, 1995, 1997).

scope of the search for allies depends on decision makers' beliefs about which or how many allies it would take to achieve balance. The enemies of one's enemies may not be sufficiently powerful to form a countervailing coalition against the SRG, so additional allies are required. Alternatively, the members of one's SRG may themselves have a large number of enemies. In such a case, the "enemy of my enemy" principle induces an extremely large pool of candidates for alliance, well beyond what is needed to form a balancing coalition. In the latter case, states need to impose some filters in order to narrow down the list of plausible candidates for alliance.

The instinctive reluctance to rely on others for one's security suggests that a state will opt to have just the right number of allies needed to accomplish the desired balance. To paraphrase Riker's (1962) concept, states opt for "minimally balancing coalitions." Excessively large alliances create more problems than they solve. If the capabilities of its allies from the list of the states with whom it shares enemies suffice to balance the state/SRG power ratio, then it need not go further. Alliances made up of states with common enemies may not, however, pool sufficient capabilities to reach a state/SRG balance. In such cases, states need to expand the list of possible alliance candidates. The expanded alliance will consist of states that are nonaligned with members of one's SRG.

To summarize, the realist paradigm suggests several propositions regarding the national origins of alliance networks:

- RP1. States that can balance or outweigh their strategic reference group's capabilities with their own resources tend to avoid alliance commitments. States with an adverse state/SRG power ratio opt to balance this ratio through alliance formation.
- RP2. The candidates for alliance are enemies of the states making up the focal state's SRG
- RP3. If the enemies of one's enemies do not suffice for balancing the SRG's capabilities, then states search for additional allies from among those states that are not allied with members of its SRG.

Two examples might illustrate this logic. The first one concerns the security policy of the embattled state of Israel (Maoz, 2006a). Israel's SRG in 2001 consisted of Syria, Egypt, Lebanon, Iraq, and Iran. It is the capabilities of this group of states that concern Israel's security planners.<sup>3</sup> Israel's Composite Index of National Capabilities (CINC) in 2001 was 0.0042. The CINC of its SRG for that year was 0.037. To balance

<sup>3</sup> Clearly the Palestinian Authority (PA) and other Palestinian groups such as Hamas and Islamic Jihad should be part of Israel's SRG. However, this study focuses on inter-state interactions, so we omit these groups as members of Israel's SRG.

that, Israel sought a memorandum of strategic cooperation with the United States, which – in the parlance of formal alliances – is equivalent to a consultation pact. According to a measurement system I discuss in the next chapter, this suggests that the United States commits 25 percent of its capabilities to defend Israel if attacked. This does not mean necessarily that the United States would send roughly 350,000 troops to wage battle in the Middle East, but it may be willing to supply Israel with weapons, economic aid, or even direct military involvement at a low level.

The second example concerns the United States during the same year. The SRG of the United States in 2001 consisted of a total of thirty-six states. This group accounted for roughly 31 percent of the system's capabilities. The United States accounted for roughly 15 percent of the system's capabilities. The state/SRG capability ratio for the United States in 2001 was a little below 0.5. To reach a balance, the United States sought allies. Clearly, the total pool of capabilities accounted for by U.S. allies (including NATO, OAS, and other scattered allies – even if we count only defense pacts but not lesser alliances) was much higher than the SRG's capabilities.<sup>4</sup> This suggests significant excess, but it does prove the point of states seeking allies to balance against possible threats emanating from their SRGs.

These processes by which realists expect alliance networks to form suggest several systemwide implications. Before discussing these implications, however, we have to make two important points about alliance formation processes. First, both SRGs and alliances are symmetric. This symmetry might be misleading, however. Common enmities make for symmetry, yet the needs for alliance formation of states are not symmetric. State A and C may share the same enemy – state B – but this does not automatically imply that both are interested in forming an alliance with each other against the common enemy. One of the states may be sufficiently powerful to fend off state B by itself.

This means that it takes at least two to tango. The interests of at least two states must converge to form an alliance: they must have a common drive to augment their capabilities; they must have common enemies to share a perception of common interest; and they must feel that they need each other – more than they need third parties – to clinch the deal. These points suggest several structural implications.

RP4. Alliance cliques tend to converge to bipolar structures.

RP5. Alliance cliques tend to be balanced. Their capability pools tend to be roughly equal, irrespective of the number of states in each.

<sup>4</sup> The combined capabilities pool of the allies of the United States, plus U.S. capabilities in 2001 was roughly 50% of the system's resources. I discuss the reasons for this excess in the next section.



Table 5.1. *Relationships among states in a five-member hypothetical system*

| State | Capabilities | A | B | C | D | E |
|-------|--------------|---|---|---|---|---|
| A     | 0.25         | 0 | 1 | 0 | 0 | 1 |
| B     | 0.20         | 1 | 0 | 0 | 1 | 0 |
| C     | 0.15         | 0 | 0 | 0 | 0 | 0 |
| D     | 0.25         | 0 | 1 | 0 | 0 | 1 |
| E     | 0.15         | 1 | 0 | 0 | 1 | 0 |

RP6. Alliance networks tend to be transitive:

- a. states that share common enemies tend to be allies and are unlikely to fight each other;
- b. enemies are unlikely to be part of the same alliance; allies of one's enemies tend to be one's enemies, and so do enemies of one's allies.<sup>5</sup>

RP7. Most conflicts in the system take place between and among states from opposing alliance cliques or blocks rather than within such cliques/blocks.

The first structural proposition of the realist paradigm is that international systems made up of states that follow these principles tend to become bipolar (Lee, Muncaster, and Zinnes, 1994; Saperstein, 2004). A hypothetical example illustrates this point. Assume a system of five states, A through E. Table 5.1 summarizes the attributes of and the relationship between these states.

Entries in the capabilities column of the table reflect the share of the system's resources accounted for by a given row state. The entries in the remainder of the table are defined as 1 if the column state was a member of the row state's SRG, and zero otherwise. In this system, state A with 25 percent of the system's capabilities, must balance against B and E, who together account for 35 percent of the system's capabilities. B must balance against A and D, who account for 50 percent of the system's capabilities. D needs to balance against B and E, who account for 35 percent of the system's capabilities, and E needs to balance against A and D who account for 50 percent of the system's capabilities. Now, if states follow the "enemy of my enemy is my friend" rule, the potential alliances in the system are given in Table 5.2.

In the first stage, the "enemy of my enemy" principle suggests two possible alliances, each with three members. One member – state C – qualifies

<sup>5</sup> Maoz et al. (2007a) provide a more elaborate discussion of this proposition.

Table 5.2. *An initial alliance configuration in a hypothetical five-state system*

| State              | Stage I    |             | Stage II   |             |
|--------------------|------------|-------------|------------|-------------|
|                    | Alliance I | Alliance II | Alliance I | Alliance II |
| A                  | 1          | 0           | 1          | 0           |
| B                  | 0          | 1           | 0          | 1           |
| C                  | 1          | 1           | 0          | 1           |
| D                  | 1          | 0           | 1          | 0           |
| E                  | 0          | 1           | 0          | 1           |
| Total capabilities | 0.65       | 0.5         | 0.5        | 0.5         |

as a member of both alliances. If C joins the “natural” alliance between A and D – formed through the “enemy of my enemy” logic – this alliance would possess 65 percent of the system’s resources. If, however, C joins the second alliance, it would contain exactly 50 percent of the system’s resources. The problem of balancing becomes immediately apparent when we examine the capability pools formed by these alliances. The second alliance, BE, is considerably weaker than the AD alliance. It turns out that, in this example, the “enemy of my enemy” principle is not sufficient to create a balance. This requires the members of the BE alliance to entice C into their alliance. If balancing happens, as realists expect it should, then C has an incentive to join this alliance, thus creating a perfectly balanced bipolar world.

The second structural implication of the balancing logic follows immediately. Specifically, the capability pool of the two alliances is no smaller and no larger than that which is required to balance opponents. The number of states in each alliance is thus the minimum number of states required to create such a balance. Given the balancing principle, A and D do not have an incentive to entice into joining them, and C does not have an incentive to join the AD alliance. However, B and E have a strong incentive to increase the size of their alliance so as to balance against the capability pool of the AD alliance.

The third implication is that conflicts tend to occur between blocks, rather than within blocks. Conflicts within blocks disrupt the balance of power because each state tends to treat members of its block as enemies, and thus seeks to balance against them with members of the other block. This induces a great deal of uncertainty regarding the identity of friends and foes and it moves the system away from bipolarity. In the view of realist scholars (e.g., Waltz, 1979; Mearsheimer, 1990; 2001) bipolarity is the only structure that affords any kind of stability in the international

system. Conflicts between blocks seem natural in a bipolar system. Yet structural realists argue that such interblock conflicts tend to decline, in both frequency and intensity, the more balanced (i.e., bipolarized) the system.

The realist story implies that as long as the structure of relations between states remains constant and the capability distribution in the system does not change dramatically, the balanced alliance structure is in equilibrium. Moreover, because alliances are balanced, this equilibrium induces relative peace, one that rests on mutual deterrence. There may be ideological conflicts, economic competition, and even lower-level militarized disputes between members of the opposing alliances. Yet, the likelihood of interblock war is very low. Under perfect bipolarity, states in both alliances are reluctant to escalate low level conflicts into an all-out confrontation that entails uncertain benefits and prohibitively high costs.

## 2.2 Realism and Economic Cooperation

Realist scholars do not assign a high value to institutionalized ties that are not based on strategic interests (Mearsheimer, 1994–5). International organizations are convenient devices for management of a wide variety of issues, but they do not meaningfully impact the structure of the system, state behavior, or cardinal matters such as war and peace. Nor do realists assign any significance to cultural networks, that is, to international networks defined by cultural – ethnic, religious, linguistic, or racial – affinities. There is, however, one exception to this rule: Realist scholars care about security trade and the networks formed of commodities with direct security implications. State power is based on its wealth (Mearsheimer, 2001: 55–82) and trade is a major determinant of a state's wealth. Moreover, some aspects of international trade are directly affected by, and impinge on, strategic relations and on military power. Hence, realists care about those trade networks that affect national security.

The problem of interdependence is more profound in trade networks than in the case of alliances; virtually no state is self-sufficient. States worry about absolute as well as relative gains; a state cannot be concerned about doing better than others unless it can first feed its people. To maximize economic power, states must maximize production in ways that allow them to derive the most benefits (Gill and Law, 1988: 25–32; Gilpin, 1987: 32). This drives economies toward specialization in commodities over which they have relative advantage and to importing other commodities. Hence, in international trade, utility maximization principles are far more prominent than relative gains. This also distinguishes trade relations from alliance politics, and realists generally concur on this point.

However, for some – strategically significant – commodities, security-related calculations override economic considerations. Realists regard raw materials that are essential for military production, energy resources, some food products (grain, meat, dairy products, etc.), and some technologies as strategic goods. Other goods such as textiles, luxury goods and raw materials (e.g., gold, diamonds) may be very valuable as far as their market price is concerned, but they do not have direct impact on a state's military power. Ideally, states would like to be self-sufficient, at least in terms of strategically significant goods. They want to control the raw materials, technology, and food supplies that maximize their military capabilities and sustain them during times of conflict (Krasner, 1978).

Just as states cannot insure their security through reliance on their own military capability, they cannot secure self-sufficiency on all goods that are required for sustaining and improving their military power. Even the most militarily powerful and technologically sophisticated state must import essential raw materials. In the past, states could rely on their human resources and some basic raw materials (metals for producing fairly simple arms such as swords, shields, and even cannons) to develop their military power. This is no longer the case. Military power is increasingly technologically driven and less human intensive. All this necessitates a diversified economy. The ability of states to achieve strategic or resource sufficiency has declined dramatically with the advent of the industrial revolution in the nineteenth century, and the technological revolution in the twentieth century (Gat, 2006).

Thus, when it comes to strategically important goods, states base at least some of their trading decisions on security considerations. Specifically, they tend to export strategically important commodities to those whom they regard as actual or potential friends; they also seek to import strategically important goods and technologies from states that they can trust. This is so even if these constraints increase the costs and reduce the economic benefits of such trading patterns. Consequently, one would expect a rough convergence between alliance groupings (cliques or blocks) and trade groups involving strategically relevant goods.

States that depend on others for raw materials, technology, and basic resources such as food wish to insure that their trading partners have an interest in sustaining trade even if they can get better deals elsewhere. In other words, if the United States depends on strategically important oil imports from Saudi Arabia, it wants to make sure that the Saudis would not cut off their trading ties just because it is economically expedient to do so. Thus, the United States can affect Saudi Arabia's trading reliability by creating dependence between trade relations and security relations. Several propositions follow from this discussion.

- RP8. Alliance groupings (cliques) and strategic commodity cliques tend to overlap.
- RP9. Strategic commodity trade interdependence is high within security cooperation cliques and low across security cooperation cliques.
- RP10. Both alliance and strategic trade ties tend to reduce the likelihood of conflict between and among states. This does not apply to the effects of nonstrategic trade on dyadic conflict.

These propositions require a brief explanation. First, the basic idea of the realist paradigm about strategic trade is reflected in the “trade follows the flag” notion (Keshk, Pollins, and Reuveny, 2004). The realist story of alliance formation also defines the political constraints states impose on their choice of trading partners when it comes to strategic commodities and services. States first form their security networks, and then forge strategic trade networks that serve their security concerns. General trade networks are structured in accordance with the principles of supply and demand. However, the structure of strategic commodity networks resembles that of alliance networks.

Second, there is an age old question of whether trade inhibits conflict.<sup>6</sup> From a realist perspective, the answer to this question depends on the kind of trade in question. In the case of strategic commodities, realists expect trade to dampen intrablock conflict, but not interblock conflict. This does not apply to the effect of general trade interdependence. There, realists expect to find no relationship between trade and conflict (Barbieri, 2002). Realists consider the relationship between strategic trade interdependence and conflict to be spurious. Instead, the same strategic interests that cause states to form alliances or engage in strategic trade may cause states that share strategic trade to avoid fights with each other.

### 2.3 Realism and Institutional/Cultural Networks

Realism is concerned primarily with security affairs, national power, and anything that may impact both (Walt, 1991). It generally dismisses the importance of “low” international politics, that is, relations among states that do not immediately involve matters of security (Vasquez, 1998). Consequently, realism does not have much to say about the origins of IGO, diplomatic, or cultural networks. Nor do realists offer explicit predictions about the relationships between security networks and other networks. However, the debate between realists and liberals on such matters as the democratic peace (Mearsheimer, 1990; Brown, Lynn-Jones,

<sup>6</sup> Chapter 9 below discusses the literature on this issue.

and Miller, 1996; Elman, 1997; Rosato, 2003) offers a window into the implicit realist notions about how these types of relations affect the formation of security and trade networks. Realists believe that political identity, institutional, or cultural networks have little or no effect on the formation of alliance networks.

The realist take on institutional networks – such as membership in, and international interactions through, international organizations – is highly dismissive. Such institutions and the networks that they form “largely mirror the distribution of power in the system” (Mearsheimer, 1994/5: 13). Accordingly, “the balance of power is the independent variable that explains war; institutions are merely an intervening variable in the process.” The balance of power is, in this respect, largely determined by capabilities and alliance structures. Whenever the actions or norms of these institutions clash with national interests, the latter almost always override institutional constraints. States are willing to risk their institutional affiliations or face “normative” sanctions if such institutional obligations damage their self-interests.

### 3. The Liberal Paradigm

The essence of this paradigm’s ideas about the origins and structure of cooperative international networks can be captured by a simple statement: “*States may seek interdependence, but they also cherish and welcome some forms of interdependence.*” The ideas that follow from this statement are captured by the following framework.

#### 3.1 The Determinants of Dyadic Cooperation

Relative to the realist paradigm, the liberal paradigm is often treated as alternative or competing. The truth is quite different. Liberal scholars accept most of the realist assumptions about the external sources of foreign policy. At the same time, the liberal paradigm supplements the realist assumptions with a slightly different take on the structure and nature of international relations. The liberal assumptions (LAs) include the following:

- LA1. *States are not unitary actors.* Both foreign and domestic policy decisions are often the result of bargaining and compromise among different elements within the government and society (Keohane and Nye, 1987).
- LA2. *Domestic political structures significantly impact foreign policy choices.* National behavior in general, and the behavior of democratic states, in particular, is governed by norms and

institutions that shape domestic politics. Democracies are less likely to be concerned with security issues when dealing with other democracies. Yet, democracies tend to adopt “realist” modes of behaviors when dealing with non-democratic states (Maoz and Russett, 1993).

- LA3. *Multiple motivations*. National security is a central, but not the only, concern of political leaders. States are driven by concerns about welfare of their societies and by political ambitions of leaders (Bueno de Mesquita, Smith, Siverson, and Morrow, 2003).
- LA4. *Institutions as solutions to anarchy*. Problems of free riding, relative gains calculations, and fear of cheating induce states to develop international institutions. The function of such institutions is to provide information and manage distributional issues, thus facilitating cooperation (Keohane and Martin, 1995: 45–46).<sup>7</sup>
- LA5. *Spillover effects*. Security cooperation may be the result of other types of cooperative (e.g., economic or administrative) experiences rather than independent of them or an antecedent thereof.

These assumptions point to the main divide between realist and liberal conceptions of foreign policy. Liberal scholars suggest that the structures of domestic political systems condition the ways in which states behave in international politics. Moreover, different domestic political structures and norms induce different behavioral patterns. Liberal scholars offer several – possibly competing – explanations of the particular mechanisms that induce regime-related differences in foreign policy. The *normative argument* (Maoz and Russett, 1993) focuses on the norms of governance that condition the behavior of states both internally and externally. The *institutional explanation* (Morgan and Campbell, 1991) focuses on the constraints imposed by domestic political institutions on foreign policy ventures. The *political survival theory* suggests that the ratio between the winning coalition and the selectorate define the kind of (public or private) goods that leaders need to provide in order to stay in power (Bueno de Mesquita et al., 2003). Realists, by contrast, tend to dismiss the role of domestic factors in shaping foreign policy.

Another aspect of the realist-liberal divide focuses on the impact of international institutions on state behavior. Liberal scholars contend that institutions constrain self-centered behavior and reduce states’ propensity to fight (Russett and Oneal, 2001: 161–167; Pevehouse and Russett,

<sup>7</sup> The institutionalist literature argues that institutions are necessary to mitigate the adverse effects of anarchy. They help overcome free riding and impose long-term “shadow of the future” constraints on egotistic and short-sighted behaviors (Axelrod and Keohane, 1985). These constraints operate even if institutions lack mechanisms to enforce compliance (Axelrod, 1986).

2006). The spillover assumption asserts that states are capable of learning and changing perceptions of friends and foes on the basis of multiple types of experiences. Spillover effects go from security to nonsecurity cooperation, but they could also go from nonsecurity cooperation to security ties. Beneficial experience in economic or institutional interactions may increase mutual trust that spills over into security cooperation, and vice versa. Beneficial security ties may influence increased economic or institutional cooperation.

These assumptions suggest the following story. The liberal paradigm agrees with the realist story about the motivations for security cooperation. States determine the need for alliances on the basis of the size and capabilities of their SRGs. Unlike the realist paradigm, however, the liberal paradigm suggests that states use principles other than “the enemy of my enemy” to select alliance partners. In particular, democracies seek other democracies as potential allies. Because democracies consider other democracies to be credible partners, the fear of cheating is lessened when two democracies are involved. Nondemocratic states are likely to assign primacy to the “enemy of my enemy” principle.

Second, states are more likely to trust other states with which they share a cooperative record on nonsecurity matters. Shared norms of cooperation and a history of cooperative relations – economic, institutional, or cultural – help forge mutual trust. Such trust can be converted to security cooperation. This implies that successful cooperative experience – security or nonsecurity-related – is likely to expand to other areas.

The pool of candidates for alliances exceeds the narrow conception of states with shared enemies advocated by the realist paradigm. Trustworthy allies are those who share common norms and mutually rewarding experience in economic or institutional settings (Axelrod and Keohane, 1985). The fact that many alliances have an excessive size in relation to the threats that induced their formation (such as the example of the United States’ alliance structure I discussed above) comes as no surprise to liberal scholars. A number of propositions regarding security cooperation follow from the liberal story.

- LP1. The principal drive for security alliances is the same as the realist paradigm posits: the wish to balance unfavorable state/SRG capability balances. However,
- LP2. The regime structure of would-be alliance partners dominates the “enemy of my enemy” principle for democracies. Specifically,
  - LP2.1. democracies are more likely to form alliances with other democracies than with nondemocratic states;
  - LP2.2. the alliance-seeking behavior of nondemocratic states is guided by the “enemy of my enemy” principle.



- LP3. *The spillover hypothesis*. Successful cooperation in one issue area tends to increase the likelihood of cooperation in other areas. Specifically,
- LP3.1. allies are likely to trade with each other both strategic commodities and nonstrategic commodities; and
  - LP3.2. states that share a long history of mutually beneficial trade are likely to form alliances with each other.

The first liberal proposition is identical to the equivalent realist proposition. However, this proposition leads into the second proposition. The underlying logic of LP2 is embedded in the normative model of democratic behavior (Maoz and Russett, 1993). This model asserts that political leaders seek to externalize the norms of conduct that they practice in their own domestic political systems. One of the key norms of political conduct in democratic systems is that a new government is committed to the pledges and policies of the previous government and cannot change them unless there is widespread support for such changes. On the other hand, political change in authoritarian systems is often followed by dramatic policy shifts. This implies that democratic polities typically show greater policy consistency across governments than is the case in autocracies. This makes democracies more reliable allies and hence more attractive alliance candidates than autocracies.

States seek allies as a matter of necessity. At the same time, they want to insure that their would-be allies are (a) *reliable* – honor their commitments, (b) *consistent* – loyal to their pledges across government or other domestic political changes, and (c) *credible* – refrain from taking advantage of their allies.<sup>8</sup> Democracies are considered more likely than autocracies to meet these desiderata.

Autocracies may seek democratic allies for the same reasons that democracies do. Yet, the likelihood of democratic states accepting offers from (or extending offers to) autocratic regimes is much lower than the likelihood of alliance offers being made (or accepted) between democratic states. These characteristics of democratic commitments are what prompt democracies to form alliances with each other whenever possible. When alliances with other democracies are insufficient, or when there are no relevant democracies around, only then do democracies apply the “enemy of my enemy” principle to the selection of allies.

The spillover hypothesis is the flip side of the realist motivation of alliance formation. Recall that realists argue that conflict with some states breeds cooperation with others; liberals, on the other hand, argue that

<sup>8</sup> In other words, states are concerned that their would-be allies do not use a defensive alliance as a springboard for attacking an enemy which they could not have attacked otherwise. This is what Maoz (1990b: 193–215) called “the ally’s paradox.”

past cooperation between states on nonsecurity matters breeds subsequent security cooperation, and vice versa.

Liberal scholars suggest a two-way causal relationship between trade and alignment. States look for signals of shared interest and mutual benefit as an indicator of whether they should cooperate with each other. An alliance treaty that members honor over a period of time serves as a signal to members that it is safe to engage in economic cooperation. The same applies to a successful trading experience. A mutually rewarding trade record suggests that the trading partner is reliable and does not try to exploit this relationship in an untoward manner. Moreover, a history of mutually rewarding trade also signals the presence of common interests that are costly to break. Supplementing a common economic interest by a security alliance sustains the mutual benefit from trade and contributes to both states' security. Therefore, states that have a history of successful trade relationship are more likely to forge security alliances than states that lack such a history.

### **3.2 The Systemic Implications of Dyadic Cooperation: The Liberal Story**

If democracies flock together and if a two-way relationship exists between alliances and international trade, what kind of international structures emerge? The following propositions focus on the network structures that are expected given these dyadic processes.

- LP4. Alliance cliques are likely to entail high levels of nonsecurity cooperation (e.g., trade and IGO) among states compared to non-alliance cliques.
- LP5. Initial patterns of economic cooperation within alliance cliques are limited to strategic commodities. Over time, however, alliance cliques and trade cliques tend to increasingly overlap regardless of the commodities being traded.
- LP6. Consequently, the level of polarization of alliance networks tends to decline over time.
- LP7. As the proportion of democratic states within alliance cliques increase, such cliques tend to be excessively large, thus violating the minimum winning coalition principle.
- LP8. Alliance cliques composed primarily of nondemocratic states tend to be minimum winning.

The first three propositions (LP4-LP6) follow directly from the spillover assumption. Liberals argue that initial security structures are based at least partially on security considerations. However, over time, security-related motives become less exclusive as determinants of the duration and sustainability of mature alliances. Spillover effects become more pronounced.

There is greater convergence between trade groupings and alliance groupings. Consequently, alliance polarization declines over time, and so does the convergence between alliance groups and strategic trade groups.

The last two propositions establish the consequences of alliance making by democratic and nondemocratic states. Democratic states may not stop their search of allies at the point where they achieve balance with their SRG if other democracies are available for alliance ties. Consequently, alliances dominated by democracies tend to be more than “minimally balancing.” This is a violation of the size principle (LP7). Nondemocratic alliances, however, induce cliques that are just what is required to balance against opposing SRGs (LP8).

The liberal story about security cooperation partly replicates and partly modifies the realist account of this process. States seek allies to balance against power or against threats. However, the logic by which states select allies causes some alliances to expand beyond what is needed to reach such a balance. An extension of this is that, if democratic alliances tend to be oversized, their countervailing alliances tend to grow as well. Authoritarian states that view themselves as possible targets of primarily democratic alliances feel increasingly threatened as the democratic alliance expands beyond what is required for balancing purposes. Their reaction may be to expand their own alliances. Thus, we may observe alliance-racing pattern of sorts. However, liberals argue that the spillover principle causes alliance cliques to increasingly overlap, thus leading to declining levels of polarization over time (LP6).

Let us demonstrate these processes via the example of the strategic reference network given in [Table 5.1](#). As we have seen, in this table state A needs to balance against B and E, and so does D. State C, however, does not have direct enemies, so it may not be concerned about balancing in the first place. Recall that the realist paradigm posits that C would join the weaker BE alliance and create a perfectly balanced system. Now, suppose states A, D, and C are democracies and B and E are autocracies. The alliance between A and D is “natural;” these two states are “attracted” to each other both because they have common enemies – as the realist model posits – and because they are democracies – as the liberal model expects. So far, the AD versus BE alliances are predicted by both paradigms. Where the realist and liberal paradigms part ways is in regard to their expectations about C’s behavior. Realists, as we have seen, expect C to join the weaker BE alliance in order to induce balance. Liberals, however, expect C to side with the stronger AD alliance because of the mutual regime-related attraction. This, of course, violates the size principle because the ACD coalition is much more powerful than the BE coalition.

The spillover proposition suggests that alliance structures should change over time. The realist paradigm suggests that the structure of

alliances should remain relatively stable. In this particular example, relations within alliances tend to be peaceful due to common interests, and relations between alliances are tense but nonviolent due to mutual deterrence, thus inducing stability in alliance structure. Liberals, however, suggest that economic or institutional relations between members of opposing alliances might affect the structure of cooperation in the system as a whole. Suppose that, in this particular example, states A, D, and E develop a long and mutually beneficial trade relationship. Over time, this relationship is apt to spill over into security cooperation and offset the mutual suspicion and threat perception that these states had in the past.

#### 4. The Constructivist/Cultural Paradigm

Several caveats must be stated at the outset. First, this paradigm does not have an explicit axiomatic structure. Nor does it offer well-defined and empirically testable propositions (Jervis, 1998). Second, this paradigm encompasses a diverse array of theoretical, philosophical, and methodological ideas (Wendt, 1999: 7–8). In this sense, constructivism is not strictly orthogonal to either the realist or the liberal paradigms (e.g., Adler, 1997; Keohane and Martin, 1995: 39, fn. 2). The boundaries separating constructivist approaches from materialist (realist, liberal) ones are quite blurred.

Third, many constructivist scholars are fundamentally opposed to the use of positivist research designs. By positivist epistemology we typically refer to an approach in which (a) we state explicitly the basic assumptions of a certain theory, (b) we deduce from these assumptions a set of testable propositions, (c) we identify conditions under which these propositions could be refuted through logical reasoning and/or empirical research, and (d) we apply rigorous criteria of logic or observation to establish the validity of these propositions. Quite a few constructivists claim that positivist methodology is part of the materialist and rationalist socially constructed paradigm. This paradigm is no more than an intersubjective belief system. Hence, we need other methods to study a paradigm that seeks to uncover the interrelations between ideas and behavior (Pouliot, 2007). We cannot study constructivism via the same methods that are used by people who think that there is some absolute physical reality out there which can be uncovered through research and observation or through rational logic. By implication, constructivists might strongly object to what I attempt to do in the following pages, that is, apply positivist principles to study constructivism in international relations.<sup>9</sup>

<sup>9</sup> Again, this is not necessarily true of several of the leading constructivist scholars (e.g., Adler, Barnett, Duvall, and especially Wendt).

Perhaps the most grievous sin that I will be committing is the marrying of the constructivist and cultural approaches. Such a wedding may seem unnatural, and both constructivists and culturalists would strenuously object to this combination. Tying arguments about the clash of civilizations (Huntington, 1996) with identity-based conceptions of world politics does not sound right. I respond to these points before going into an analysis of the constructivist/cultural ideas about network formation.

The argument that we cannot or should not test constructivist arguments via positivist strategies is a convenient escape hatch for constructivists. Virtually every constructivist text starts out by frontally attacking materialist approaches such as realism and liberalism. Many of these texts also attack positivism and rationalism as research paradigms. Then constructivists go on to develop their arguments and demonstrate them via their “own” empirical tools. When they do these kinds of empirical “tests,” they attempt to show simultaneously that (a) realist or liberal approaches do not provide adequate explanations of the phenomena under study, and (b) ideational explanations provide a better account of these phenomena. If constructivists should be allowed to devise their own tools and research strategies to disprove materialist explanations of world politics, why is it unfair to subject constructivist notions to positivist tests?

There is also an inherent contradiction in constructivist notions that we cannot use strategies designed to detect an “objective reality” that does not exist. If reality is shaped by behavior that is driven by ideational forces, then this idea itself is just that: an idea. It is no more valid than the notion that there exists an objective reality and that it is observable via empirical research or logical reasoning. In other words, if constructivists are right, then their ideas are just speculations and they cannot be ascertained. If these notions cannot be ascertained, then we have no way of knowing whether they are valid. What, then, separates constructivism from metaphysics, such as religious beliefs?

So, it is just as fair to apply positivist strategies in order to test constructivist ideas as it is to apply constructivist strategies to test materialist ones. What about the marriage of constructivism and culturalism? Despite claims to the contrary, there are some fundamental similarities behind the basic assumptions of these two approaches. First, both approaches emphasize the impact of identity on behavior. Constructivist ideas may differ from culturalist ideas about the particular factors that define identity but not about the basic premise that identity shapes behavior.

Second, the clash-of-civilizations thesis accepts the notion of the effect of social construction of reality and identity on behavior. Huntington’s (1993, 1996) key argument is that during the Cold War, states’ construction of reality was built around the struggle between the two superpowers. This was the dominant script that determined intersubjective perceptions

of reality, and this script shaped the behavior of both major powers and minor ones. The collapse of the Soviet Union and the end of the Cold War altered the social construction of the key elements of world politics. States now define their identity in civilizational rather than strategic terms. This reshapes perceptions of friends and foes, of good and evil, and of right and wrong. Consequently, the new divides in post-Cold War world politics are civilizational rather than ideological in nature.

Finally, the story I derive from these approaches aims to take account of both the commonalities of and the differences between constructivism and culturalism. The key point is that the implications of the two approaches are similar, and that justifies their merger into a single paradigmatic structure.

My response to charges of misrepresenting constructivist or culturalist ideas is rather simple. This is one person's effort to derive testable propositions from these two approaches with respect to network formation. If I made incorrect inferences, both constructivists and culturalists should specify (a) where I went wrong, and (b) what would be the "right" testable propositions that one should derive from this paradigm, and perhaps, (c) how to test these propositions. The alternative is to leave this paradigm in the realm of sheer speculation. The advantage of my approach over typical constructivist research designs is in its transparency and replicability. Critics are invited to use the same research strategy, applying their own substantive content.

#### 4.1 The Ideational/Cultural Microfoundations of International Cooperation

Constructivism focuses on three concepts: identity, affinity, and ideas. These concepts are embedded in the following assumptions:

- CA1. *What I do depends on who I am (or who I believe I am).* States operate on the basis of their understanding of their internal and external environment. This understanding is subjective, not objective (e.g., based on power and interests).
- CA2. *Subjective perceptions of reality are socially constructed.* The ways by which states define who they are and how they relate to their environment are "constructed" by a set of factors. Some of these factors are fairly constant; others are subject to change.
- CA3. *National identity is defined largely by cultural factors.* The relatively stable factors that determine national identity are its cultural characteristics, such as the linguistic, religious, and ethnic composition of its population.
- CA4. *The cultural affinity of states affects international relations.* States perceive other states in terms of shared/different identities

and ideas; they define states as similar or dissimilar in terms of cultural identity or in terms of convergent or divergent belief systems. These definitions affect the sense of affinity that a state feels toward other states, and thus their behavior.

- CA5. *States' experience in the international system defines the manner in which they construct their reality.* Important aspects of the perceived identity of states are shaped by their interaction with their international environment. These interactions affect states' perception of their identities. International interactions also affect states' perception of the environment, of friends, and foes. This, in turn, affects their behavior.

In the constructivist paradigm, the origins of national behavior lie in national self-perceptions and in perceptions of the environment. States' leaders use concepts, language, and ideas to assign meaning to their environment. These concepts are also used to distinguish between friends and foes. The factors that shape states' definition of the situation consist of both constant issues – that is, national identity defined in cultural terms – and of variable ones – that is, their international experience. This paradigm asserts that to understand behavior we need to understand how states construct their identity and how they perceive the environment in which they operate.

The identity of a state is a function of many things. Some of the factors that define national identity are relatively stable; others are subject to significant change. One of the most important conceptions of national identity views it as an outgrowth of the cultural (ethnic, religious, linguistic) attributes of the society. This conception of identity shapes the state's view of the world. It defines how a state positions itself in relation to other states. The cultural aspects of national identity shape – at least to some extent – the national interest of a given state and its perception of others. This notion is the common denominator of constructivist and cultural approaches.

The constructivist and cultural elements of this paradigm part ways when it comes to other factors that shape identity. Constructivists assert that states' identities are shaped not only by cultural attributes but also by their international experience: “Who I am depends on how I have interacted with other states.” Collective identities are a function of past experience. The last assumption (CA5) connects the constructivist paradigm to the realist and the liberal paradigms. Jepperson, Wendt, and Katzenstein (1996: 33), offer a constructivist conception of security-related environments:

“The security environments in which states are embedded are in important part cultural and institutional, rather than just material. ... [C]ultural environments affect not only the incentives for

different kinds of state behavior but also the basic character of states – what we call state “identity.”

Three layers define international cultural environments: formal institutions, world political culture (that includes norms such as sovereignty, international law, human rights, and the like), and international patterns of amity and enmity. The international patterns of amity and enmity can be interpreted – at least in part – as the state’s SRG.<sup>10</sup> I interpret the notion of an “institutional environment” to mean what liberals suggest – the extent to which the focal state shares institutional affiliations with members of its SRG.

These assumptions suggest that states define the challenges in their environment not necessarily in terms of power and interest, but rather in terms of affinities. Friends and foes are defined in part by cultural affinities, and in part by the cumulative experience due to past interactions. There are two different constructivist/culturalist stories about the formation of international networks. One is primarily static and radically different from the “realist” or “liberal” processes discussed above. The other is more dynamic and is based on the realist foundation of SRGs.

The first story emerges from the idea that states define their international environment in terms of cultural similarity or dissimilarity. Friends are those states that bear high levels of cultural similarity to the focal state, while culturally different states represent potential foes. Culturally dissimilar states cannot be trusted to be reliable allies or collective goods providers. In addition, states that share cultural attributes have strong incentives to institutionalize these affinities in international organizations. Such IGOs have primarily symbolic functions (e.g., cross-national religious institutions, IGOs promoting cultural collaboration, and so forth). However, they can also convert cultural affinities to institutional management of material interests (e.g., economic institutions or even security institutions). Moreover, because cultural characteristics of societies change very slowly over time, patterns of international cooperation within institutional networks that are based on shared identities tend to be stable. Consequently, states’ choices of allies are affected by cultural affinities. These propositions follow:

- CP1. States are likely to form both security and nonsecurity ties with states that share cultural (i.e., religious, linguistic, ethnic) affinities.

<sup>10</sup> I qualify this because international patterns of amity and enmity encompass general systemic trends beyond the historical experience of a given state. But the state’s own record of amity and enmity is an integral part of its security culture. Jepperson et al. (1996: 34) give an example that makes the same point as does the conception of SRG that we have advanced above: “Canada and Cuba stand in a roughly comparable position relative to the United States. But while one is a threat, the other is an ally, as a result... of ideational factors operating at the international level.”



- CP2. States that share cultural affinities are unlikely to fight one another; the degree of dyadic cultural affinity has a dampening effect on the probability of conflict.

Clearly, this is a rather crude formulation of the theory and its attendant propositions. For one thing, what constructivists have in mind when they talk about “culture” in an international context is not necessarily what students of culture have in mind. In other words, when we talk about the culture of a society, we often have in mind a set of characteristics that include language, religion, ethnicity, a common history and a common vision of the collective future. However, constructivists typically refer to culture in terms of a set of shared ideas about the world. The presence or absence of these ideas or the extent of agreement on them may coincide with linguistic, religious, or ethnic attributes of states. This does not have to be so.

Katzenstein (1996: 24) claims that “the identities of states emerge from their interaction with different social environments, both domestic and international.” The domestic aspect of national identity may well be shaped by language, religion, ethnicity, or even race. The international environment, however, is still believed to play a key role in shaping national identities over time. The cultural characteristics of states change more slowly than the rules, norms, and patterns of interaction in their environment.

Thus, the second constructivist story about the origins of network formation is more complex. It accepts the idea that states’ identities are shaped partially by cultural attributes of their societies. However, identities are subject to change, and this change is defined by “lessons” that states draw from their own experience and from the prevailing shared ideas of the environment in which they operate. I demonstrate this conception via a hypothetical story about a newly formed state. Once a state achieved independence, its leaders begin to shape their foreign and security policy. The ideas that guide these initial policies are shaped by the leaders’ self-perception – their sense of national identity – and their understanding of their international environment. Given that the new state does not have any prior experience to build on, its leaders draw from the dominant international culture that prevails at that time and follow the “rules” that this culture dictates.

Wendt (1999: 246–312, 2003: 517) identifies three international cultures. In a “Hobbesian” culture states work in the “absence of any mechanism to enforce cooperation (anarchy), and a mutual belief that they [i.e., all other states] are ‘enemies,’ with no rights and thus social constraints on what they may do.” States’ identities are defined by realist principles of national security. A “Lockean” culture is one that allows for limited cooperation due to some shared rules and norms. In this culture, limited war may still be part of states’ repertoire of policies, but the notion

of “warre of all against all” that prevailed in the Hobbesian culture is no longer acceptable. In the Hobbesian culture the relationship among units is characterized by inherent and permanent enmity; in the Lockean culture, it is characterized by strategic competition and rivalry.<sup>11</sup>

Finally, in the Kantian culture the idea of collective security and inherent “friendship” shapes much of the relations among states. The Kantian culture is an emergent culture; it evolves out of cooperative processes. Such processes – over time – “educate” participants that cooperation pays. In this culture states have a collective identity as members of a community of friends. They share norms of common defense, burden sharing, and spillover processes of economic, cultural, and institutional cooperation beyond the state-centric identity (Wendt, 1999: 298–299; 2003: 521–522).

Thus, states that emerge into a Hobbesian culture behave like people in the state of nature, or as realists suggest they do. This pattern of behavior continues to prevail even in a Lockean culture in which states subscribe to such common norms as mutual respect of sovereignty. Despite norms that regulate competition, conflict and war are still important instruments of policy. Yet, states that emerge into a Kantian international culture tend to forge or join institutional structures, such as security communities (Adler and Barnett, 1998), or broad collaborative structures (e.g., the European Union). Unfortunately, constructivists do not provide us with clear indicators of when and where a given international culture prevails. Nor do they tell us what factors induce transition from one international culture to another. Thus, some creative extrapolation is required.

Coming back to our new-state story, the constructivist approach suggests that the new state will essentially emulate the dominant pattern of behavior of other – older – members of the club of nations in its geographic neighborhood. The extent of cooperation with other members of its environment will depend on two principal factors: (a) the cultural similarity it bears with other states in its SRG, and (b) the dominant international culture that prevails in this environment. To the extent that states emerge into a Lockean environment their behavior will tend to correspond to the realist predictions about cooperation and conflict. Yet, the identity of friends and foes depends on the cultural composition of their environment. In a Kantian culture, new nations forge institutional and normative ties with their neighbors in general community structures regardless of shared societal characteristics.

The formation of states in two different regional systems at two different points in time illustrates these ideas. The first case concerns the

<sup>11</sup> Wendt (1999: 285, 313) argues that a Hobbesian culture characterized the international system in the pre-Westphalian period, but that the Westphalian state system is characterized by a Lockean culture.

reshaping of the Middle East in the late 1940s. The new states that were formed (e.g., Syria, Israel) emerged into a Lockean international culture. Since Syria is culturally similar to Egypt, Jordan, Iraq, and other Arab states, it joined the Arab League and participated in the 1948 Arab war against Israel. This pattern of cooperation with culturally similar states continues throughout the 1950s and 1960s. Israel, on the other hand, is culturally dissimilar to its Arab neighbors, who did not recognize its right to sovereignty and independence. Therefore, Israel found itself engulfed in numerous conflicts with its neighbors.

The second example is the breakup of the Soviet bloc in the late 1980s. The existing Eastern European states that regained their freedom and the newly formed states (e.g., the Baltic States, Ukraine) emerged into a Kantian European system. They were quick to adopt the democratic political structure of their Western European neighbors. They also adopted a capitalist market economy. Several states joined the institutionalized regional order in Europe (NATO and the European Union). The fact that they were also relatively similar in terms of religious and political structure to their Western European neighbors made this cooperation into the European order possible. On the other hand, Turkey had been trying for decades to join the European Union, only to be repeatedly rejected, even though it was a longtime NATO member. Despite the EU claims to the contrary, many believe that it is the cultural – especially religious – difference that causes the predominantly Christian Western European states to reject Turkey.

What does all this imply for network formation processes? The dynamic aspect of the constructivist/cultural paradigm suggests several points about how states come to forge cooperative ties.

- CP3. A state's choice of allies and of strategic trade partners is based on the international culture prevailing in its SRG. If the SRG of the state is characterized by a Lockean international culture, its alliance and strategic commodity trade choices are defined both by security considerations (enemy of my enemy) and by cultural similarity.
- CP4. On the other hand, if a state's SRG is predominantly Kantian, its cooperative ties are based on liberal principles, namely on democratic regime similarity and on their cooperative trade and institutional experience.
- CP5. As the SRG of a given state becomes increasingly Kantian, cultural aspects of cooperative alliance behavior diminish and liberal aspects of spillover effects increase.

The difference between Lockean and a Kantian international culture can be expressed in terms of three principal characteristics of a given state's international environment: (a) the level of trade between SRG members;

(b) the level of institutional ties among SRG members; and (c) a majority of democratic states in one's SRG. A Kantian culture is characterized by the presence of at least two of these characteristics; a Lockean environment is characterized by low levels of at least two characteristics.

The constructivist story of network formation suggests that states choose when, how, and with whom to cooperate on the basis of both the characteristics of their societies and the prevailing international culture in their environment. Under a Lockean culture, states' identities are dominated by realist notions of international anarchy. To paraphrase Wendt (1992), states make of anarchy what realist scholars make of it. Yet, security cooperation is constrained by cultural factors. Specifically, states are more likely to trust other states that are culturally similar to them than states that are culturally different. This means that the principal candidates for alliance and strategic trade cooperation are culturally similar states that share the same enemies as the focal state.

Kantian cultures reduce the impact of the domestic culture aspect of cooperative choices and of the "realist" calculations that prevail in a Lockean international culture. In a prevailing Kantian culture, states choose allies that are increasingly diverse in terms of the ethnic, linguistic, and religious characteristics of their societies. Moreover, they opt for partners with whom they share either a common political culture (joint democracy) and/or a history of successful cooperative experience.

This depiction of the constructivist/cultural paradigm combines elements from the two previous paradigms. In this sense, this paradigm offers a midway approach between realist and liberal perspectives. Yet, this paradigm adds the internal culture layer to the microfoundational processes of security cooperation. National identity – defined in terms of religious, linguistic, and ethnic characteristics of states – is more important for cooperative choices in some international cultures than others.

#### **4.2 The Systemic Implications of International Cooperation: The Social Construction of Networks**

Much like the realist and liberal paradigms, the constructivist paradigm envisions polarization and discord between distinct cliques and high levels of cooperation within cliques. However, constructivism accords a causal role to the structure of the international system, or – more specifically – to the prevailing "international culture." Neorealists define system structure in terms of the number of great powers and the distribution of capabilities among them. In constructivism, the structure of the system is also defined by two variables: the nature and extent of ideational convergence among states, and the prevailing "international culture" or "collective identity" (Wendt, 1994).

A well-defined system structure exists when most states have similar ideas about the principles and norms of conduct in international relations. In a well-defined structure, most states share ideas about such things as the meaning of anarchy (Wendt, 1992), power, or the prevalence of certain norms (e.g., sovereignty). The nature of shared ideas affects the structure of networks. Specifically, when these shared ideas are Lockean, states agree that the world is anarchic but not chaotic. This makes room for limited cooperation. Such cooperation is dominated by shared cultural affinities: Culturally similar states tend to bunch together. If cultural affinity does not cover the need for security cooperation, realist principles (e.g., “the enemy of my enemy”) may well apply. Therefore “Lockean” networks are characterized by high level of polarization along cultural fault lines.

In Kantian systems, states view themselves as parts of a community that is managed by common principles and self-enforced norms (Wendt, 1994; 1999: 299–302). Cultural aspects of national identity play a secondary role relative to institutional ones. Friends are defined in terms of membership in collective security communities. Other institutional affinities – economic, social, administrative – also serve to define aspects of collective identity, and affect patterns of cooperation across cultural fault lines.

When the level of ideational convergence is low, states tend to disagree regarding the type of prevailing international culture. In such cases, it is difficult to establish well-defined expectations about the structure of cooperative networks. One way out of this theoretical quagmire is to suggest a regionally-based conception of collective identity. Specifically, levels of ideational convergence may be low across the international system as a whole. Yet, states in specific regions might share a localized collective identity. Thus, we need to look for regional communities rather than for global network structures. For example, during most of the Cold War era, the prevailing collective identity of Western European states has been Kantian. Relations among Western European states were characterized by considerable ideational convergence, thus leading to high levels of cooperation on security and economic affairs. On the other hand, the dominant international culture in Asia, Africa, and the Middle East was primarily Lockean. Thus, patterns of cooperation and conflict in these regions corresponded to a Lockean international culture. The resulting networks were based on cultural and strategic principles. At the same time, no generalizable international culture existed such that a stable global network structure can be identified.

Deriving testable propositions from the constructivist/cultural paradigm confronts us with four major problems. First, how do we know whether there exists high or low ideational convergence regarding the

prevailing international culture? Second, we do not have clear propositions regarding the factors shaping transitions from one type of culture to another. Third, the causal sequence that defines the relationship between these two variables is vague. Does the actual emergence of a given international culture give rise ideational convergence? Or is it only when the ideas of a group of nations converge around a set of norms that an international culture emerges? Finally, what kind of structures emerge when there is widespread disagreement about the prevailing international culture?

Wendt (1999: 337) argues that “the mark of a fully internalized culture is that actors identify with it, have made it...part of their understanding of Self. This identification, this sense of being part of a group or ‘we,’ is the social or collective identity that gives actors an interest in the preservation of their culture.” So convergence depends on the number or type of states that share such collective identities. It is easy to lapse into a tautological slippery slope here: A prevailing international culture exists to the extent that many or most key states share a specific type of collective identity. However, many/most key states are likely to have convergent collective identities to the extent that a dominant belief – thus a prevailing culture – exists. Wendt recognizes this problem and argues that, in order to provide a dynamic explanation of shifts from one international culture to another, structural change supervenes identity formation (p. 338).

When trying to explain the interaction between identity formation and structural change, however, Wendt resorts to an interactionist explanation, which forms a logical cycle: “The ‘Crude Law of Social Relations’ is recursive: by engaging in certain practices, agents produce and reproduce the social structures that constitute and regulate these practices and their associated identities (p. 342).” States’ ideas converge when interactive practices suggest that a certain international culture prevails. Yet, an international culture can exist only when states – whose interaction with each other is guided by their ideas – have convergent ideas. The argument that agents and structures co-constitute each other reduces the constructivist theory of change to a chicken and egg problem.

Fortunately, Wendt is aware of this and argues that there are a number of “objective” factors that are responsible for creating collective identities over time. These include *interdependence*, *common fate*, and *homogeneity*.

Interdependence refers to a structure of relationships in which one’s actions affect the outcomes of other actors, and when this cross-unit effect is mutual. Interdependence is also a function of the cost of breaking this structure of relationships.<sup>12</sup> Collective identities are a result of

<sup>12</sup> I elaborate on this concept in [Chapter 9](#).

this condition: As interdependence increases, states become increasingly aware that they share a set of norms. This spills over to their security cooperation. This works the other way around as well: As states become increasingly interdependent in terms of shared security concerns, they come to form security communities. This leads to the formation of a collective identity, and causes them to forge trade or institutional ties.

Common fate means that states feel part of a community or group that shares a common fate or future: Either they hang together or they hang separately. This is an interesting observation. Wendt (1999: 349–353) argues that a common threat is one of the principal mechanisms that define a common fate. A common threat induces an initial group interest, which, over time, evolves into a sense of collective identity and feelings of altruism. The shared group identity helps sustain the group even when the common threat is no longer there. Post–Cold War NATO, which outlasted its main reason for being – the Soviet threat – is an example of these ideas. Here, too, there is a great deal of convergence between the factors that shape cooperation according to realism and those that shape cooperation under constructivism. However, constructivists add the concept of network stability that is sustained by common identity and shared cooperative experience even when the common threat diminishes or disappears.

Homogeneity refers to the extent to which states are “isomorphic with respect to basic institutional form, function, and causal power” (Wendt 1999: 353). This implies that all states are alike on a very basic level; they share the elements of sovereignty (territory, population, means of coercion). However, beyond these basic traits, other attributes cause some of these states to feel greater affinity to each other. Homogeneity implies that states may feel a greater affinity toward each other to the extent that they share cultural characteristics, a specific political culture – i.e., democracy – or a certain set of economic values – free trade and market economies. These constructivist notions of network formation and network evolution resemble liberal ideas. This discussion leads to the following propositions.

- CP6. In a Lockean international culture,
  - CP6.1. alliance networks are clustered along cultural lines;
  - CP6.2. subject to cultural constraints, alliance networks follow realist principles of balancing, with partnerships reflecting the “enemy of my enemy” rule;
  - CP6.3. strategic trade cliques match alliance cliques; and
  - CP6.4. institutional networks cluster along cultural lines.
- CP7. In Kantian international cultures,
  - CP7.1. alliance networks become culturally heterogeneous;

- CP7.2. spillover effects between trade and institutional networks reduce the polarization of alliance and strategic trade cliques;
- CP7.3. consequently, alliance cliques differ from strategic trade cliques; and
- CP7.4. institutional networks become larger, culturally diverse, and less polarized.
- CP8. Transition from Lockean to Kantian international cultures may happen within specific regions as well as in the international system as a whole. The key indicators of this transition include:
  - CP8.1. high intraclique similarity in terms of democracy;
  - CP8.2. high intraclique economic cooperation;
  - CP8.3. high intraclique institutional cooperation.

Note that these propositions do not resolve entirely the circular nature of the constructivist theory of change. Constructivists are willing to live with it. However, my aim is not to test the constructivist paradigm. Rather, it is to derive from it some ideas that may help in developing the theory of networked international politics. For that reason, I am also not too concerned with the circular logic of change. This will become apparent when I discuss how the theory of networked international politics envisions network evolution processes at different points in time.

### 4.3 Overlap and Differences among Paradigms

Table 5.3 offers a systematic comparison of paradigms in terms of their propositions about network formation processes and about the relations among networks. This table shows how each of the paradigms builds its explanation from the microfoundations that determine the pursuit of security cooperation at the individual nation level. It then shows how structures of security and other networks emerge.

As can be seen from Table 5.3, the three paradigms are not completely distinct. In some cases, they offer different answers to questions about the sources and processes of network formation. In other cases, they complement each other. Clearly, the realist paradigm is the most parsimonious. It also has the most limited scope of predictions, especially with respect to the interrelations among various types of networks. One of the more interesting insights that emerge from this comparison is that all three paradigms envision a spillover network effect: The structure of one type of network affects other networks. In realism this effect is a one-way street: Security cooperation spills over to strategic trade cooperation. In the other two paradigms, spillover effects are broader and bidirectional.

An important caveat must be stated. Not all propositions are straightforward: some are rather complex; others are extremely difficult to test



Table 5.3. *Network formation and network structure – predictions of the three paradigms*

| Question                                                                  | Propositions                                                                                                                                                                             |                                                                                                                                                                                                                  |                                                                                                                                                                                                                                  |
|---------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                           | Realist paradigm                                                                                                                                                                         | Liberal paradigm                                                                                                                                                                                                 | Constructivist/cultural paradigm                                                                                                                                                                                                 |
| <b>1. National origins of networks</b>                                    |                                                                                                                                                                                          |                                                                                                                                                                                                                  |                                                                                                                                                                                                                                  |
| Why do states opt for security cooperation?                               | <ul style="list-style-type: none"> <li>To pool resources in order to balance against challenges (opportunities/threats) in their strategic reference group (SRG)</li> </ul>              | <ul style="list-style-type: none"> <li>To pool resources in order to balance against challenges in their SRG</li> </ul>                                                                                          | <ul style="list-style-type: none"> <li>To pool resources in order to balance against challenges in their SRG</li> <li>As an expression of common identities with culturally similar states</li> </ul>                            |
| How do states define security challenges (threats and/or opportunities)?  | <ul style="list-style-type: none"> <li>By the size and aggregate capabilities of their SRG</li> </ul>                                                                                    | <ul style="list-style-type: none"> <li>By the size, aggregate capabilities their SRG</li> </ul>                                                                                                                  | <ul style="list-style-type: none"> <li>By the size, aggregate capabilities of their SRG.</li> <li>By the cultural differences between the focal state and its SRG members</li> </ul>                                             |
| When are states likely to seek allies?                                    | <ul style="list-style-type: none"> <li>The higher the difference between the capabilities of the SRG and those of the focal state</li> <li>The more states exist in one's SRG</li> </ul> | <ul style="list-style-type: none"> <li>The higher the SRG-State capability difference</li> <li>The more states in one's SRG</li> <li>For democratic states – the more democracies exist in the system</li> </ul> | <ul style="list-style-type: none"> <li>The higher the SRG-State capability difference</li> <li>The more states in one's SRG</li> <li>The lower the cultural similarity between the focal state and members of the SRG</li> </ul> |
| <b>2. Dyadic networking processes</b>                                     |                                                                                                                                                                                          |                                                                                                                                                                                                                  |                                                                                                                                                                                                                                  |
| Who are the candidates for alliance? (In descending order of importance.) | <ul style="list-style-type: none"> <li>Enemies of enemies,</li> <li>Non-SRG members</li> </ul>                                                                                           | <ul style="list-style-type: none"> <li>Democracies with other democracies</li> <li>Non-SRG members with whom the state had a history of cooperation</li> <li>Enemies of enemies</li> </ul>                       | <ul style="list-style-type: none"> <li>Culturally similar states</li> <li>Democracies with other democracies</li> <li>Non-SRG members with whom the state had a history of cooperation</li> <li>Enemies of enemies</li> </ul>    |
| <b>3. Cross-network spillover effects</b>                                 |                                                                                                                                                                                          |                                                                                                                                                                                                                  |                                                                                                                                                                                                                                  |
| Do environmental conditions affect patterns of alliance seeking?          | No: anarchy is ever present, conditions do not change over time                                                                                                                          | Yes. As SRGs become more interdependent and institutionalized, the need for security alliances declines.                                                                                                         | Yes. Lockean SRGs induce behavior consistent with realist expectations; Kantian SRGs induce behavior consistent with liberal expectations.                                                                                       |
| Do strategic considerations affect trade patterns?                        | Yes, trade of strategic commodities is limited to allies and to non-SRG members. Trade of other commodities not affected by security considerations                                      | Initially, yes. Over time, trade patterns dominated by economic considerations                                                                                                                                   | Yes, in Lockean SRGs; no in Kantian SRGs                                                                                                                                                                                         |

(continued)

Table 5.3 (*continued*)

| Question                                                                               | Propositions                                                                                                                                                                                              |                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                        |
|----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                        | Realist paradigm                                                                                                                                                                                          | Liberal paradigm                                                                                                                                                                                                                                  | Constructivist/cultural paradigm                                                                                                                                                                                       |
| Do other types of network-ing relations affect security networks?                      | No. Security networks are autonomous with respect to other dimensions of international relations                                                                                                          | Yes, economic and institutional coop-eration diversifies patterns of alliance making, creating large alliances beyond what is required by the balancing principle                                                                                 | Yes, economic and institutional networks socially construct transition from Lockean to Kantian cultures; alliances become culturally diverse                                                                           |
| What other networks are affected by these considerations?                              | <i>Strategic trade networks</i> : Alliance and strategic trade networks tend to overlap. No such overlap for general trade or institutional networks                                                      | Two-way spillover effect between alliances, trade, and institutional networks.                                                                                                                                                                    | Two-way spillover effect between alliances, trade, and institutional networks. Over time alliances become culturally diverse.                                                                                          |
| <b>4. Systemic implications – structural characteristics of international networks</b> |                                                                                                                                                                                                           |                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                        |
| What kind of alliance net-works emerge?                                                | <ul style="list-style-type: none"> <li>• Polarized – tendency toward bipolarity.</li> </ul>                                                                                                               | <ul style="list-style-type: none"> <li>• Polarized initially, but over time polar-ization declines.</li> <li>• Alliance cliques become strategically diverse and large as they mature</li> </ul>                                                  | <ul style="list-style-type: none"> <li>• Lockean Cultures: polarization along cultural lines</li> <li>• Kantian Cultures: polar-ization declines; clique membership does not match cultural affinities</li> </ul>      |
| What determines membership of states in alli-ance cliques/ blocks?                     | <ul style="list-style-type: none"> <li>• Clique member-ship determined by strategic factors.</li> <li>• Relative impor-tance of factors affecting clique/ block membership is stable over time</li> </ul> | <ul style="list-style-type: none"> <li>• Clique/block mem-bership determined initially by strategic factors but effects diminish as net-works mature.</li> <li>• Effects of liberal factors increasingly pronounced in mature networks</li> </ul> | <ul style="list-style-type: none"> <li>• Lockean cul-tures: Strategic and cultural factors determine clique/block membership</li> <li>• Kantian cul-tures: Liberal factors determine clique/bloc membership</li> </ul> |
| Overlap in membership across differ-ent networks                                       | <ul style="list-style-type: none"> <li>• Overlap in membership across alliance and trade networks</li> <li>• No specific prediction about other networks</li> </ul>                                       | <ul style="list-style-type: none"> <li>• Overlap in mem-bership across alliance, trade, IGO networks,</li> <li>• No specific predic-tion about cultural networks</li> </ul>                                                                       | <ul style="list-style-type: none"> <li>• Overlap in membership across all networks due to cultural affinity determinants of networks</li> </ul>                                                                        |

via straightforward empirical methods. This is unavoidable given the complexity of these paradigms, the partial convergence of their propositions, and the vagueness of some of these theories. This suggests the need for an integrative theory of the origins of international networks.

## 5. A Theory of Networked International Politics

The long discussion of the stories derived from the three paradigms was necessary for the development of an integrative theory. Such a theory builds on the more compelling ideas of these paradigms. In this section, I outline the theory and explain how it relates to the stories derived from these paradigms. I also discuss how the NIP theory differs from these paradigms and the ways in which the integration of the key ideas form a whole that is more than the sum of its parts.

The theory of networked international politics rests on a number of assumptions.

1. *Security under anarchy.* The principal concern of states in an anarchic environment is national survival and security.
2. *Power maximization.* States seek to maximize their power as the ultimate way of insuring security.
3. *Suspicion of others.* International anarchy and the principal motivations of states (power maximization, pursuit of relative gains, and fear of cheating) render states inherently suspicious about each other's intentions.
4. *National identity effects.* States' identities affect their perception of the international environment.
5. *Modifiers of anarchy.* The inherent suspicion of others (3) is modified by three sets of factors:
  - a. common interests,
  - b. common identity, and
  - c. beneficial past interaction experience.

A brief discussion of these assumptions is warranted. The first three assumptions adopt the realist worldview about the principal incentives of state action. These also share the inherent dilemma between the suspicion of others and the need to cooperate to insure security. The fourth assumption incorporates the constructivist/cultural axiom that national identity affects self-perceptions and the perceptions of one's environment. States seek partners with common interest to form security ties against common enemies (Mearsheimer, 1994/5: 12–13; Maoz et al., 2007a). At the same time, I adopt the ideas of the liberal and constructivist/cultural paradigms that common interests are not determined strictly by the presence of common enemies. Common identity, common

(democratic) norms, and experiential lessons serve to induce trust and common bonds among states. These factors, in turn, affect the incentives to cooperate with certain states and/or to refrain from cooperating with others.

The liberal perspective of common interests is both structural and evolutionary. Joint democracy is the structural factor that determines incentives to cooperate. Democracies do not always share common interests. Rather, they tend to trust each other more than they trust nondemocratic states – even nondemocracies with which they share enemies. Accordingly, joint democracy strongly affects the choice of alliance partners. This filter covers only a very limited set of states, however. The liberal paradigm suggests that just as states tend to define prospective threats through past experiences, they scan their environment for potential partners with whom they share mutually beneficial interactions. These other states become possible candidates for security cooperation.

The cultural/constructivist approach adds another layer to this definition of potential partners for security cooperation. It suggests that states filter each other by shared identities and shared ideas. These identities stem from cultural similarity and normative (democratic) affinity; this is the homogeneity factor that forges collective identities. States with similar cultural characteristics tend to trust each other more than do states that are culturally dissimilar. Concomitantly, states view culturally dissimilar states, not only as untrustworthy allies, but also as potentially hostile. Finally, constructivists agree that mutually beneficial experience makes states amenable to security cooperation.

The following story captures the process of network formation. The first part of the story follows the realist paradigm: States determine the magnitude of security challenges based on the aggregate capabilities of their strategic reference group. However, this is where the realist part of the story meshes with the stories of the other paradigms. The NIP theory asserts that cooperation has a meaningful value beyond the need to pool resources against common security threats. Cooperation in and of itself is a security booster. In other words, states seek to cooperate in order to promote trust, reduce suspicion, and promote a wide array of common interests and interdependencies, thereby increasing their security. Successful and mutually beneficial cooperative experiences help reduce future threats by converting would-be enemies to friends, or by imposing costs on defection. Cooperation also induces gradual emergence of collective identities, interdependence and common fate.

Moreover, security cooperation – like other forms of cooperation – signals to the international community that states share norms, world views, and ideas. This is a message to future enemies that the group of states that engage in frequent and sustained cooperation share values and have a common vision of the future. Security cooperation conceived as a way

of deterring or engaging current enemies tells only part of the story. States form security ties in order to deal with both present – visible – challenges and future – invisible and unforeseen – challenges. Alliances aimed at meeting future challenges can take place only between states that have common identities, ideas, and values beyond those that are captured by the presence of visible common enemies.

Finally, the story of networked international politics also covers spillover effects of cooperation. Spillover may go from successful security cooperation to economic and institutional cooperation. Successful economic or institutional cooperation also raises the prospects of security cooperation. The following propositions summarize the national and dyadic implications of this process:

- NIP1. The higher the capability gap between a given state and its SRG,
  - (a) the higher the level of alliance commitments a state is apt to seek;
  - (b) the more allies it is likely to seek; and
  - (c) the greater the capabilities of its allies.
- NIP2. The tendency of a state to seek allies decreases with
  - (a) the proportion of democracies in its SRG (for democracies);
  - (b) the level of trade between the focal state and its SRG;
  - (c) the extent of joint IGO membership between the state and its SRG;
  - (d) the level of cultural similarity between the focal state; and its SRG.
- NIP3. Consequently, democracies tend to have excessively large alliances, beyond those needed to balance against security threats.
- NIP4. The likelihood of any two states forming an alliance increases as
  - (a) they share common enemies;
  - (c) the higher the capability gap between each of the states and its respective SRG;
  - (d) the two states are democratic;
  - (e) the two states are culturally similar;
  - (f) the two states share a history of positive economic and institutional cooperation.
- NIP5. Security cooperation affects the extent and nature of trade between states.
  - (a) States that have security alliances are more likely to trade strategic goods than states that are not allied.
  - (b) States that are in each other's SRG are not likely to trade strategic goods with each other.
  - (c) The trade of nonstrategic goods is not bound by security considerations.

- NIP6. However, over time, economic and institutional cooperation reduces the likelihood of states considering each other to be potential security challenges. Thus,
- (a) as states share significant economic and institutional cooperation over a considerable stretch of history, they are increasingly likely to form security alliances, and
  - (b) the impact of cultural similarity on the probability of security alliances declines as states share significant economic and institutional cooperation.

How do international networks evolve? The story about dyadic alignment and cross-network spillover effects provides a general explanation of network evolution. Consider a network evolution process in a hypothetical system where all states were formed at about the same point in time. Such states do not have any historical experience to rely on in order to identify friends and foes. Nor are they confronted by a coherent international culture. Under such circumstances, each state defines its security environment on the basis of realist principles: The size of the state's PRIE defines the size of its security challenge. The difference between the capabilities of its PRIE and its own capabilities determines the need for allies and the magnitude of capabilities it needs to pool in order to balance those of its PRIE. When states have no history of conflict and cooperation with other states, their PRIEs are equivalent to their SRGs.

Absent a history of past conflict, the "enemy of the enemy" principle cannot be applied initially. A related principle – the neighbor of my neighbor – can. So the focal state seeks to form alliances with those states that share PRIE members. However, other factors serve as guides for alliance formation. Democracies seek other democracies to form alliances. States seek culturally similar partners. Initial patterns of alliance groupings follow geographical (neighbor of my neighbor), normative, and cultural lines. However, as the system matures, states accumulate interactive experience. This experience consists both of conflicts with some states and of cooperative ventures with others. Several things change.

First, the composition of the SRG changes. SRGs are now defined in terms of political factors – they consist of past enemies and of the allies of these enemies. Since enmity is correlated with geographical contiguity, the security environment of states still involves a geographical component.<sup>13</sup> Second, states accumulate cooperative experience: They have traded with other states and they share joint institutional experiences. These shape the identity of candidates for security cooperation.

<sup>13</sup> The overall correlations between PRIE and SRG memberships are Yule's  $Q = 0.868$ ; Tau-b = 0.355 ( $N = 674,692$ ). However, this correlation changes significantly with time. During the first ten years of a dyad's history, the correlation is Yule's  $Q = 0.980$ ; Tau-b = 0.674 ( $N = 170,454$ ); afterwards, it is Yule's  $Q = 0.790$ ; Tau-b = 0.270 ( $N = 504,238$ ).

If only realist factors were at work, security networks would be highly polarized. States that have common enemies would be in the same alliances. Even if two states do not share a history of conflict, over time they would find themselves either in opposing alliances or in the same alliance clique. Suppose states A and B have a common enemy, C. So they form an alliance. State A has another enemy D. Since now C may require an ally against both states A and B, it turns to D to form an alliance. States B and D had no conflict with each other. However, B is now an ally of D's enemy. This makes D a member of B's SRG. Now both A and B seek allies to balance against C and D, and so forth.

There is only one factor that prevents security ties from evolving into a strict bipolar structure in a realist world: Some states do not need allies. These may be states that are (a) sufficiently powerful to balance the capabilities of their SRGs with their own resources or (b) smart or lucky enough to avoid conflict. The need for allies is seen as very general and powerful in such an environment: Cooperation emerges from conflict even if states are egoistics, power-maximizing, suspicious animals.

As time goes by, states' cumulative cooperative experience and their norms act to modify their alliance-seeking patterns. We begin to observe greater levels of imbalance in the ways states define friends and foes. True, past conflict is still a strong marker of enmity. Yet, patterns of cooperation and shared normative structures (joint democracy) begin to have an increasingly important effect on security cooperation. Spillover effects also tend to reduce the effect of cultural similarity on alliance structures. Consequently, security structures become culturally diverse. Finally, the relationship between alliance networks and strategic trade networks tends to decline as alliances mature and become increasingly influenced by cooperative experiences. The system, in short, tends to become less cohesive, less transitive, and more diverse. The impact of one security network (alliance) on another (strategic trade) diminishes. The impact of nonsecurity networks on security networks increases.

One may glean from this story that as time goes by and as networks mature, cooperation sets in and reduces the level of discord in the system. The system appears to be gradually shifting from a Lockean culture to a Kantian one. This is hardly the case. Networks react to shocks. Major conflicts – such as world wars – restructure cooperative and conflictual interactions. These, in turn, reconfigure security and nonsecurity networks. Specifically, major shocks in the structure of the system induce a return to a more “realist” pattern of network formation. When conflict levels in the system diminish, cooperative networks (e.g., trade, institutions) have an increasingly large effect on security network.

Another shock that affects network structures results from dramatic change in the size of the international system. We know that state emergence has taken place in several major waves. In the nineteenth century,

the growth of the system in terms of the number of states has been gradual. The first major wave of growth in system size took place after World War I. The second wave took place in the years following World War II. The third wave took place in the first half of the 1960s, primarily in Africa. The final recognizable wave took place with the collapse of the Soviet Union in 1990–1991.

Many dramatic changes in the growth of the international system and its regional composition took place in the wake of imperial collapse. The South American system formed in the 1820s and 1830s following the collapse of the Spanish empire. East and Central Europe formed after World War I following the collapse of the Austro-Hungarian and Ottoman empires. The Middle East and South-East Asia formed after World War II on the ruins of the British and French empires. The emergence of Africa in the early 1960s also marked the end of imperial European control in these regions. Finally, the reemergence of the Baltic States, the formation of Ukraine and the Central Asian republics on the ruins of the Soviet Union is the last piece in the systemic puzzle. State formation processes have systemic implications (Maoz, 1989a, 1996). Rapidly changing regional systems form new networks. These new networks follow “realist” logic, at least initially. As regional systems mature, processes of network divergence, spillover effects, and reduced polarization seem to take hold.

Now, if we view these processes globally, the picture can get quite murky. Postwar periods tend to be accompanied by dramatic changes in system size. This induces growing levels of polarization globally, as well in the “newly formed” regions. However, system growth in the absence of conflict-related shocks results in regional variations in network evolution. Regions that are stable in terms of the size and identity of states display patterns of network evolution that are Kantian in nature. At the same time, other regions that experience dramatic changes in size and the composition of states show Lockean patterns of network formation and evolution. To get a better understanding of patterns of network evolution, we need to break up the system into regional subsets. Several propositions summarize this part of the story:

- NIP7. During early stages of network formation – following major shocks in the structure of the international system or after significant changes in its size, patterns of network formation and cross-network effect are based on realist principles. Specifically,
- (a) alliance networks tend to emerge as polarized structures;
  - (b) states group in cliques that have little overlap among them;
  - (c) alliance and strategic trade cliques tend to overlap;
  - (d) security and strategic trade cooperation cliques tend to overlap with culturally similar cliques.



- NIP8. As the international system stabilizes, network structure and cross-network effects are increasingly characterized by political affinity and positive past interaction experience in economics and institutional affairs; hence,
- (a) spillover effects from economic and institutional networks reduce the polarization of alliance and strategic trade networks;
  - (b) security cooperation cliques tend to become culturally diverse.
- NIP9. The correlation between key structural attributes of security networks (alliances, strategic trade) and economic or institutional networks change over time, such that
- (a) initial correlations (after major systemic shocks) are low or negligible; and
  - (b) these correlations increase significantly as the network matures and given absence of systemic shocks.
- NIP10. Cooperative subnetworks (e.g., cooperative cliques) have a significantly lower likelihood of conflict among members than the overall level of conflict in the system. Most conflicts occur between states belonging to different cooperative cliques, or between states that do not share cooperative clique membership.

The NIP theory started from the notion that at least some form of cooperation – security alliances and strategic trade – emerges due to the experience or anticipation of conflict. I now close the circle by positing the effect of networking on conflict patterns. States that share a large and complex set of cooperative network ties to each other are less likely to fight than states that share relatively few cooperative network ties. The complexity of cooperative ties reflects the extent to which states share clique or block membership across different cooperative networks. This cooperative complexity is a function of the profile of ties each of these states has with other states in the system. States that have similar profiles of cooperative relations can be said to share experiential affinities across dimensions of cooperation. These impose strict constraints and high opportunity costs and thus result in fewer conflicts, not only between individual states, but also within collective structures (e.g., cliques) marked by such ties.

The theory has another implication. Specifically, the emergent structures (e.g., cliques or communities) within cooperative networks are likely to exhibit very little conflict, as opposed to the level of conflict that emerges between states that do not share such groups.

The implications of this theory are quite far ranging. It is now time to see how they stand up against historical data. The next chapter tests some of the key proposition of the integrative theory of network formation.

## *Testing the Theory of Networked International Politics*

### 1. Introduction

The networked international politics (NIP) theory covers multiple levels of analysis and suggests quite a few hypotheses. In this chapter, I test key aspects of the theory and evaluate its main propositions, focusing on the central propositions concerning network formation, network evolution, and the structural consequences of these processes.

I provide only a general discussion of the empirical strategy in the body of the chapter. My main focus is on the discussion and interpretations of the results. The chapter's appendix contains a detailed discussion of methodology, measurement, and other technical matters concerning these analyses.

### 2. Cooperative Choices of Individual States

I start by examining patterns of security cooperation of individual states. Each analysis is based on one of the key questions in [Table 5.3](#).

#### **2.1. When, Why, and How Do States Choose to Forge Security Cooperation Ties?**

Networked international politics theory asserts that states seek security cooperation in the form of alliances,

- as the gap between the focal state's capabilities and the capabilities of its SRG increases;
- as the level of economic and institutional cooperation between the focal state and members of its SRG is low;
- for democracies, the lower the level of democracy in its SRG; and

Table 6.1. *Strategic, economic, institutional, and cultural determinants of national alliance formation choices, 1816–2001 – time-series cross-sectional analysis*

|                                      | No. of allies <sup>a</sup> | Allies-SRG cap difference <sup>b</sup> | No. defense pacts <sup>a</sup> | Def-off. cap SRG Diff <sup>b</sup> |
|--------------------------------------|----------------------------|----------------------------------------|--------------------------------|------------------------------------|
| No. states in SRG                    | 0.001**<br>(2.83e-04)      | 0.002**<br>(1.50e-04)                  | 0.003**<br>(3.46e-04)          | 0.004**<br>(1.70e-04)              |
| Cap. difference State-SRG            | 0.184**<br>(0.023)         | -0.081**<br>(0.014)                    | 0.347**<br>(0.029)             | 0.770**<br>(0.009)                 |
| Regime score of focal state          | 4.65e-04**<br>(1.16e-04)   | -7.89e-05<br>(4.89e-05)                | 4.99e-04**<br>(1.39e-04)       | 1.75e-04**<br>(5.42e-05)           |
| Democracy × prop. Democracies in SRG | -0.098**<br>(0.020)        | -0.110**<br>(0.011)                    | -0.164**<br>(0.017)            | -0.048**<br>(0.007)                |
| Trade with SRG                       | -0.582**<br>(0.149)        | -0.009<br>(0.072)                      | 0.232<br>(0.286)               | -0.196**<br>(0.091)                |
| Joint IGO membership with SRG        | 0.347**<br>(0.012)         | 0.016**<br>(0.005)                     | 0.463**<br>(0.016)             | 0.054**<br>(0.006)                 |
| Cultural similarity state-SRG        | -0.518**<br>(0.023)        | -0.023*<br>(0.010)                     | -0.576**<br>(0.027)            | -0.126**<br>(0.011)                |
| Constant                             | 1.088**<br>(0.057)         | -0.005<br>(0.003)                      | 0.556**<br>(0.093)             | 0.044**<br>(0.003)                 |
| N                                    | 12,471                     | 12,723                                 | 11,510                         | 12,805                             |
| No. of states                        | 194                        | 210                                    | 168                            | 211                                |
| Chi-square (F)                       | 81,838.49                  | 2,715.32                               | 51,372.62                      | 987.09                             |
| Adjusted R <sup>2</sup>              |                            | 0.383                                  |                                | 0.406                              |

<sup>a</sup> Negative binomial event-count time-series cross-sectional regression.

<sup>b</sup> Fixed-effects time-series cross-sectional regression.

Entries in parentheses are robust standard errors. This applies to all subsequent tables in this book.

\*  $p < 0.05$ ; \*\*  $p < 0.01$ .

- the lower the cultural similarity between the focal state and member of its SRG.

I examine several indicators of national alliance choices: the number of allies a state has at a given point in time, the number of defense/offense pacts the state has at a given point in time, and the respective capabilities of these allies. The results are displayed in [Table 6.1](#).

The results support the propositions of the theory, with some notable exceptions: First, the size of a state's SRG has a robust effect on its number of allies and defense/offense pacts. It also significantly impacts

the difference between the capabilities of the state's allies and those of the state's SRG. Second, the higher the cultural similarity between the focal state and its SRG, the fewer allies it seeks, and the lower the capabilities of its allies compared to those of its SRG. Third, the interaction between the regime score of the state and the proportion of democracies in its SRG also dampens the search for allies. As the SRG of democracies becomes increasingly democratized, the need for allies declines.<sup>1</sup> This is an important result, and we return to it in this and subsequent chapters. Finally, the degree of trade between the state and its SRG also negatively impacts the search for allies, but this effect is not robust across dependent variables.

Another important result that is consistent with the expectation of the NIP theory concerns the effect of regime type on the size of alliances. Democracies have almost twice as many allies than nondemocratic states (14.5 average allies for democracies as opposed to 8.3 allies for nondemocratic states,  $F = 548.25$ ,  $p < .000$ ). Democracies also have nearly 1.4 more defense pacts with other states than nondemocracies (an average of 8.2 defense pact partners for democracies as opposed to 5.9 defense pact partners for nondemocratic states,  $F = 124.37$ ,  $p < .000$ ). The combined capabilities of a democratic state and its allies are nearly twice (an average of 0.106 of the system's resources) those of a nondemocratic state and its allies (an average of 0.056 of the system's resources,  $F = 822.51$ ,  $p < .000$ ). This supports the argument of the NIP theory (which relies on the liberal paradigm) that democracies tend to be less concerned about a minimal winning coalition than nondemocratic states.

However, contrary to the theory's expectations, the gap between the state's capabilities and the capabilities of its SRG has a positive impact on the search for alliance partners. States whose capabilities match or exceed those of their SRGs tend to have more allies, more defensive and offensive pacts, with greater capabilities than would be required given the logic of the theory. The theory's expectations are supported only when we examine the difference between the capabilities of the focal state's allies and those of the members of the focal state's SRG. One interpretation of this discrepancy is that states with high capabilities are attractive alliance candidates, often sought after by other states. Despite the concern about being dragged into complex commitments, such states still end up forming more alliances than are necessary relative to security challenges they face. We return to this result later in the chapter.

<sup>1</sup> In analyses not displayed here, I replaced the democracy $\times$ proportion of democracies in the SRG variable with another interaction term: democracy $\times$ proportion of democracies outside the SRG of the focal state. This is consistent with the expectation that democracies tend to increase their alliance memberships when there are other democratic states that are not considered to be potential security challenges. The results of these analyses strongly and consistently support this hypothesis. Results of these analyses are displayed in the book's web site.

The degree of institutional cooperation between the focal state and members of its SRG has a robust positive impact on national alliance formation. This runs contrary to the expectations of the theory, but there is a plausible explanation for this discrepancy. Quite a few states share collective security institutional affiliations. This means that the joint institutional count and the alliance count overlap. In subsequent research, I explore the effect of nonsecurity-related institutional affiliations on the alliance profiles of states. Here, however, no such separation exists, and this may account for the discrepancy between the theory's expectations and the empirical findings.

These results offer mixed support to the NIP theory. Consistent with the theory, the size of the SRG has a motivating effect on the search for allies. On the other hand, the political structure of the SRG and the economic relations between the state and members of the SRG reduce threat perceptions and thus moderate the scope of this search. Likewise, cultural affinities between the focal state and members of its SRG also serve to reduce threat and the attendant search for security cooperation. In addition, democracies tend to form larger and more powerful alliances than nondemocracies, suggesting that the latter are more focused on the formation of minimal winning coalitions. The effect of other factors on the search for allies is inconsistent with the NIP theory, in particular, the moderating influence of the difference between the focal state's capabilities and those of its SRG on the search for allies. We will return to this point later.

## 2.2. Who Are the Candidates for Security Cooperation?

The NIP theory offers the following answers to this question:

- States that need each other in that both face high opportunity costs for alliances
- Enemies of one's enemies
- Democracies seek democratic allies
- States that share successful economic and institutional ties with the focal state
- States that share cultural identity with the focal state

The results of the analysis dealing with this question are given in Table 6.2.

Each set of columns in Table 6.2 performs a slightly different type of analysis. I discuss each block of columns separately. The two leftmost columns report the results of duration (Cox proportional-hazard) analysis. This model estimates the timing of alliance formation. It answers the question of whether two states form an alliance, and if so, at what point

Table 6.2. *Determinants of dyadic alliance ties, 1816–2001*

|                                  | Timing of<br>alliance onset <sup>a</sup> | Change in<br>prob. <sup>b</sup> | Alliance<br>persistence <sup>c</sup> | Change<br>in prob. <sup>b</sup> | Relative<br>commitment<br>level <sup>d</sup> |
|----------------------------------|------------------------------------------|---------------------------------|--------------------------------------|---------------------------------|----------------------------------------------|
| Joint democracy                  | 0.340**<br>(0.065)                       | 16.84%                          | 1.330**<br>(0.023)                   | 88.85%                          | 0.006**<br>(0.001)                           |
| Alliance<br>Opportunity cost     | 0.138**<br>(0.047)                       | 6.88%                           | 3.387**<br>(0.082)                   | 255.44%                         | 0.003**<br>(0.000)                           |
| Average trade in<br>past 3 Years | -7.185**<br>(1.997)                      | -99.85%                         | 1.038**<br>(0.323)                   | -45.08%                         | -0.130<br>(0.119)                            |
| Avg. joint IGO<br>membership     | -0.023<br>(0.103)                        | -1.14%                          | 2.785**<br>(0.030)                   | 36.09%                          | 0.032**<br>(0.004)                           |
| Cultural<br>similarity           | 0.633**<br>(0.068)                       | 30.65%                          | 3.242**<br>(0.036)                   | 64.93%                          | 0.116**<br>(0.006)                           |
| Enemy of enemy                   | 1.140**<br>(0.076)                       | 51.53%                          | 1.317**<br>(0.055)                   | 91.45%                          | 0.005**<br>(0.001)                           |
| Status of dyad                   | 0.026**<br>(0.003)                       | 1.29%                           | 1.364<br>0.023                       | 21.60%                          | 0.001<br>(0.001)                             |
| Distance                         | -3.02e-04**<br>(1.00e-05)                | -0.02%                          | -4.72e-04**<br>(3.75e-06)            | -0.10%                          | -8.79e-06**<br>(3.89e-07)                    |
| Constant                         |                                          |                                 | -0.331**<br>(0.008)                  |                                 | 0.057**<br>(0.003)                           |
| N                                | 623,613                                  |                                 | 621,070                              |                                 | 620,232                                      |
| Dyads                            | 19,204                                   |                                 | 18,780                               |                                 | 18,576                                       |
| No. of failures                  | 2883                                     |                                 |                                      |                                 |                                              |
| Chi-square                       | 3,079.97                                 |                                 | 45,345.59                            |                                 | 1,283.04                                     |
| R <sup>2</sup>                   |                                          |                                 | 0.634                                |                                 |                                              |

Notes: \*  $p < .05$ ; \*\*  $p < .01$ .

<sup>a</sup> Cox proportional-hazard duration analysis.

<sup>b</sup> Failures = frequency of ALLYONSET=1.

<sup>c</sup> Logit with cubic splines and no-alliance years (not reported to conserve space).

<sup>d</sup> Time-series cross-sectional regression with identity link function.

<sup>e</sup> R-squared based on basic equation without no-alliance years and cubic splines.

<sup>f</sup> Change in the probability of alliance formation and persistence when the independent variable moves from its 20th percentile value to its 80th percentile value, while all other variables are at their mean. For dichotomous variables (joint democracy, common enemies), this is the change in the probability of the dependent variable when the independent variable moves from zero (no) to one (yes).

in the history of a given dyad.<sup>2</sup> The leftmost column reports the coefficients that relate the independent variables to the hazard rate of alliance

<sup>2</sup> This analysis also includes cases of alliance re-formation, that is, dyads that have formed a new alliance after previous alliance commitments either expired or were voluntarily terminated.

formation (to the timing of alliance inception). The second-left column reports the change in the probability of alliance timing as a function of changes in the independent variables.

Consistent with the NIP theory, the formation and timing of alliances depends on the opportunity cost of both members of the dyad. As the gap between dyad members and their respective SRG widens, the incentive for forming an alliance goes up significantly. A unit increase in the minimum opportunity cost of members of the dyad reduces the timing of alliance formation by nearly 7 percent. In addition, the likelihood and timing of alliance formation depends on whether or not dyad members have common enemies. The timing of an alliance once a dyad comes to share common enemies drops by 51 percent compared to dyads that do not share common enemies.

Also consistent with the NIP theory, the time it takes two democracies to form alliances is 17 percent shorter than for other types of dyads. Likewise, the timing of alliance formation between culturally similar states is shorter by 63 percent than between culturally diverse states. However, in contrast to the expectations of the theory, the level of trade and shared IGO membership between dyad members seems to prolong the timing of alliance formation. Finally, neighbors are more likely to form alliances than are geographically distant states, but the timing of alliance formation does not change dramatically with geographic proximity.

In the second set of columns, we examine whether alliances form, and if so, how long they last. Most expectations of the NIP theory are supported. Alliances are both more likely to form and to last longer when both dyad members have high alliance opportunity costs and share common enemies. The effect of these variables on alliance persistence is especially strong. High alliance opportunity costs increase the probability of alliance formation and persistence by as much as 255 percent. Likewise, states that share enemies are more likely by 91 percent to form and maintain an alliance compared to dyads that do not share common enemies.

Democracies are 88 percent more likely to have persistent alliance ties than are other types of dyads. Culturally similar states are more likely to have alliance ties, and these ties last longer by 64 percent. A high degree of joint IGO membership between states increases the probability and persistence of alliance by 36 percent. Yet, a high level of direct trade between states reduces the probability of alliance persistence by 45 percent. Distance reduces the probability and duration of alliances, but the effect is minuscule.

The rightmost column estimates the level of commitment that is entailed in the alliance treaty between the states. As noted, levels of commitments may change significantly in the course of an alliance. So this variable taps (a) the presence or absence of an alliance, (b) its duration, and (c) the

changes in the level of commitment over the course of an alliance. The results of this analysis essentially replicate the other analyses in the table. All variables – except the degree of trade between dyad members – affect the level of alliance commitment in ways that are consistent with the propositions deduced from the NIP theory.

Taken as a whole, these data suggest that the dyadic aspect of the NIP theory is quite well supported. Several points are worth noting. First, these empirical analyses are crucial in assessing any network-related theory because dyadic ties are the basic building block of a network. Second, the results provide support for the argument that the formation and persistence of alliances is due to strategic factors (opportunity costs, common enemies), political factors (joint democracy), institutional factors (joint IGO membership), and cultural factors.

Third, direct levels of trade between states do not promote alliance formation. In fact, states that have high levels of trade are less likely to form alliances, and their alliances tend to be short-lived. However, the relationship between trade and alliance formation is not as simple as it seems on first blush. This will become evident in the next section.

### 3. The Network Implications of National Cooperative Choices

We now turn to examine how security cooperation affects and is affected by other types of interstate cooperation.

#### 3.1. Are Security Cooperation Networks Related to Strategic Trade Cooperation Networks? Does the Structure of Trade Networks Affect Security Cooperation?

These questions move us from patterns of monadic behavior – alliance seeking – to the emergent structural features of the networks that form as a result of national choices. The first set of analyses examines the extent to which states' membership in security cliques is related to their membership in strategic trade cliques.

For readers who skipped the discussion of cliques and joint clique membership in Chapter 2, I provide here a brief description of these concepts. A clique consists of a group of states, all of which have direct ties to each other. Cliques are not discrete groups, however. A state can belong to more than one clique. Any two cliques can share one or more states in common. However, no clique can be a proper subset of another clique. This means that any two cliques *a* and *b* must differ with respect to at least two states: At least one state that is a member of clique *a* is not a member of clique *b*, and at least one state in clique *b* is not a member of clique *a*.



A network can have a huge number of cliques, and such cliques may share a considerable number of nodes in common. The Standardized Clique Membership Overlap (CMO) index measures the extent to which any two nodes/states share clique memberships. This index is standardized by the number of cliques in which each of these states participates. Clearly, the higher the clique membership overlap of two states, the more common relations they tend to have with other states. This not only reflects their own direct ties but also suggests that they share similar ties with third parties.

The NIP theory envisions several types of relationships between security cooperation structures and economic (i.e., trade) cliques.

- States that are in the same security cliques are likely to be in the same strategic trade cliques. This means that security cooperation induces strategic trade cooperation and results in similar groupings of states within security and strategic trade cliques.
- At the same time, there is little or no convergence between states' position in security cooperation structures and their position in nonstrategic cooperation structures.
- The dynamics of security and economic clique structures are more complicated. When security networks are formed, they are likely to exhibit close similarity to strategic trade networks. However, over time, as networks "mature," spillover effects from general cooperative experiences tend to reduce the similarity between security cooperation networks and strategic trade networks.

It is important to emphasize that patterns of bilateral ties induce certain groupings of states. Some of these groupings may be unintended results of these ties. A clique may form from a set of bilateral alliances between three or more states. In large networks these emergent groupings may be even more complex than the network itself. [Table 6.3](#) examines the factors that affect joint membership in both security and nonsecurity cliques.

The results of [Table 6.3](#) suggest one central finding: The network structures that result from security cooperation ties have a consistent and fairly powerful effect on strategic trade and on institutional structures. When two states are members of a large number of alliance cliques, they are far more likely to find themselves in similar strategic trade clusters than would be expected based solely on chance. This is consistent with the expectations of both the realist and the liberal components of the NIP theory. More importantly, however, the higher the security-clique-membership overlap of states, the more likely they are to be connected in general trade and IGO cliques. This suggests a consistent cross-network spillover effect. Also, joint democracy has a consistent positive effect on joint clique membership in both security networks (alliances and strategic trade) and institutional and general trade networks.

Table 6.3. *The determinants of cooperative clique overlap – instrumental variables time-series cross-sectional analysis of directed dyads, 1950–2001<sup>a</sup>*

|                                   | Alliance<br>CMO | Arms trade<br>CMO | Strategic<br>trade CMO | General<br>trade CMO | IGO<br>CMO |
|-----------------------------------|-----------------|-------------------|------------------------|----------------------|------------|
| Alliance                          | 0.004**         | 0.012**           | 0.001**                | –                    | –          |
| Opportunity cost                  | (0.000)         | (9.73e-04)        | (2.29e-04)             |                      |            |
| Alliance clique<br>membership     | –               | 1.025**           | 0.189**                | 2.348**              | 15.873**   |
| Overlap (CMO) <sup>b</sup>        |                 | (0.081)           | (0.017)                | (0.073)              | (0.319)    |
| Minimum regime<br>score           | 0.002**         | 0.001**           | 1.34e-04**             | –1.21e-04**          | –0.007**   |
|                                   | (0.001)         | (3.78e-04)        | (8.173–06)             | (3.84e-05)           | (0.001)    |
| IGO CMO                           | 0.002**         | 0.020**           | –0.002**               | –0.021**             | –          |
|                                   | (8.48e-04)      | (0.002)           | (5.13e-04)             | (0.002)              |            |
| Arms trade CMO                    | –               | –                 | –                      | –0.057**             | –0.542**   |
|                                   |                 |                   |                        | (0.005)              | (0.036)    |
| General trade<br>CMO <sup>c</sup> | 0.003**         | 0.086**           | 0.006**                | –0.060               | –0.947**   |
|                                   | (0.001)         | (0.006)           | (0.001)                | .0045                | (0.028)    |
| Enemy of<br>my enemy              | 0.012**         | 0.079**           | 0.003**                | –0.185**             | –0.529**   |
|                                   | (0.001)         | (0.007)           | (0.001)                | (0.004)              | (0.021)    |
| Cultural similarity               | 0.125**         | 0.036**           | –0.007**               | –0.173**             | –0.057**   |
|                                   | (0.016)         | (0.003)           | (0.002)                | (0.009)              | (0.050)    |
| Constant                          | 0.058**         | 0.089**           | –0.002                 | 0.096**              | –1.101**   |
|                                   | (0.0013)        | (0.007)           | (0.002)                | (0.005)              | (0.028)    |
| Model statistics                  |                 |                   |                        |                      |            |
| N                                 | 1,247,864       | 1,054,812         | 934,610                | 1,048,348            | 1,052,929  |
| Dyads                             | 37,554          | 37,726            | 37,350                 | 37,726               | 37,114     |
| Chi-square                        | 298.7**         | 3,254.6**         | 38,267.6**             | 785,681.3**          | 17458.8**  |

<sup>a</sup> When nonalliance network structure is the dependent variable, the alliance CMO is endogenous and the analysis is based on a two-stage least squares with panel data.

<sup>b</sup> Endogenous variable when trade clique overlap is the dependent variable.

<sup>c</sup> Endogenous variable when alliance clique overlap is the dependent variable.

\*  $p < .05$ ; \*\*  $p < .01$ .

On the other hand, common enemies and cultural similarity have interesting sign reversals across different networks. When two states share common enemies they are likely to exhibit high levels of clique overlap in alliance, arms trade, and strategic trade networks. Surprisingly, however, sharing common enemies reduces the probability of general trade clique overlap. Likewise, cultural similarity tends to positively affect the degree of clique overlap in security and arms trade networks. Yet, cultural

similarity has a negative impact on general trade clique overlap. This suggests that strategic considerations as well as identity factors contribute to security and security-support (arms and strategic trade) groupings, but they do not affect common institutional or trade group membership.

The cross-network spillover effect is especially meaningful because security ties are used as endogenous variables in tests of joint clique membership in institutional and general trade networks. Likewise, the overlap of states in general trade cliques is endogenized in analyses of the determinants of security clique overlap between states, indicating a robust cross-network effect. Security structures affect trade structures – both strategic trade, which seems quite intuitive – and general trade structures, which is less intuitive and certainly less known to economists and students of international relations.

Overall, these tests suggest that the formation and evolution of strategic cooperation clusters is affected by both security considerations (alliance opportunity costs and political (regime type), as well as by economic (trade), institutional (IGO membership), and cultural factors. Likewise, economic cooperation clusters are affected by patterns of security cooperation. This suggests an interesting spillover effect across network structures. I return to this point in [Chapter 11](#). For now, however, let us see how the factors that shape patterns of cooperation change at different historical periods.

### 3.2. Do Different Factors Shape Network Formation at Different Points in Time?

The NIP theory suggests that “new” security cooperation networks are driven by “realist” factors and by cultural affinity factors. This is so because new states have little or no experience of cooperation with other states in nonsecurity realms. However, once networks become more established, spillover effects induce change in states’ calculations of states. Positive interaction experience from nonsecurity realms – for example, general trade experience and institutional cooperation experience – begin to affect the structure of security cooperation networks. The importance of “realist” and “cultural” factors in defining network structures diminishes, and the impact of “liberal” factors – for example, joint democracy, trade, and IGOs – becomes increasingly important. The following propositions emerge:

- In the early stages of security cooperation networks, the grouping of states in these networks is affected primarily by shared enemies and by cultural affinity.
- As security cooperation matures, and as states accumulate cooperative experience in economic, institutional, and political realms, the role of shared enemies and cultural affinity in the formation

of security networks diminishes, and the influence of shared democracy, trade, and institutional cooperation increases.

An empirical test of these propositions is somewhat complicated for several reasons. First, we do not have meaningful “start dates” for the networks under study here. Our analysis of network formation starts out not when these networks were actually formed, but when our data allow us to trace international ties. For example, our starting point for observation of alliances (and IGOs) is 1816, one year after the Congress of Vienna ended the Napoleonic Wars. However, the system of alliances that emerged following the Congress of Vienna is quite similar to the alliance system that existed during the Napoleonic Wars (especially the grand alliance that defeated Napoleon at Waterloo). The only exception is that post-Napoleonic France was added to the Holy Alliance. Likewise, our observation of trade networks starts in 1870 because this is how far back our data reach. However, international trade ties had existed far earlier. So, what we are actually observing is not a process of network formation but a process of network change.

A second complicating factor concerns the ways in which we distinguish between embryonic periods of network formation and periods of network “maturity.” One approach is to follow common practices in the field of international relations. This involves splitting the history of the international system into several subperiods. The periodic breakpoints are considered system transformations (Gilpin, 1981; Brecher, 2008). Systemic theorists are vague about what constitutes a system transformation (Maoz, 1996). They typically agree on some of the breakpoints in the history of the international system (e.g., the post-Napoleonic Wars period of 1815, the two world wars, and – possibly – the collapse of the Soviet Bloc in the late 1980s and early 1990s). Yet, they tend to disagree on other system transformations. The underlying assumption is that networks transform when the system transforms.

Accordingly, I divide the 1816–2001 period into two subperiods. The immediate few years following the Napoleonic Wars (1816–1825), World War I (1919–1925), World War II (1946–1954), or the collapse of the Soviet Union (1991–2001) constitute periods that – from a systemic perspective – reflect an opportunity for “new” network formation. On the other hand, all other years in the history of the international system are considered as periods of network “maturity.”<sup>3</sup>

Table 6.4 examines the dynamic network formation hypothesis by looking at the difference in the effects of various independent variables on clique overlap in several networks. The test is a difference of effects

<sup>3</sup> It may make sense to use a three-level split, adding the two world war periods as periods of turbulence that are different from the system transformation periods. Analyses of this split produces similar results to those reported below.

Table 6.4. *Effects of factors on clique membership overlap (CMO): difference of effects (two-sample t-statistics) between formative network periods and normal periods*

| Independent variable      | Difference between effects: formative network period – “Normal” period |               |                     |                   |              |  |
|---------------------------|------------------------------------------------------------------------|---------------|---------------------|-------------------|--------------|--|
|                           | Alliance CMO                                                           | Armstrade CMO | Strategic trade CMO | General trade CMO | IGO CMO      |  |
| Alliance CMO              | –                                                                      | –1,183.272**  | –923.141**          | 101.906**         | –1,833.704** |  |
| Trade CMO                 | –1,611.861**                                                           | –             | –                   | –                 | 1,226.399**  |  |
| IGO CMO                   | –2,066.103**                                                           | 2,318.856**   | –1,067.944**        | 3,135.738**       | –            |  |
| Alliance opportunity cost | 659.254**                                                              | –758.822**    | 474.243**           | –974.216**        | 291.451**    |  |
| Minimum regime score      | –42.406**                                                              | 12.530**      | 21.050**            | 40.006**          | 49.471**     |  |
| Cultural similarity       | 80.336**                                                               | –439.585**    | 147.774**           | –2,005.500        | 241.425**    |  |
| Enemy of enemy            | 61.016**                                                               | 6.940**       | 81.776**            | 441.313**         | 219.297**    |  |
| Distance                  | –0.388                                                                 | 1.348         | 1.689               | 13.659**          | –1.574       |  |

Notes: Entries in the table are t-statistics of the differences between parameter estimates across periods.

\*\* T-statistics significant at  $p < 0.01$ .

Boldface entries indicate that the difference is consistent with the expectation of NIP.

test (with the effects being the parameter estimates and the standard errors are the standard errors of these estimates). Those differences that are consistent with the test hypotheses are boldfaced.

As we can see, the results in [Table 6.4](#) are not fully consistent with the dynamic effects hypotheses. The effects of alliance opportunity costs, cultural similarity, and common enemies are more pronounced during formative periods than during periods of system stability. Arms trade and strategic trade dynamics, for the most part, do not match the theory's expectations. Alliance CMO, opportunity costs, and cultural similarity have higher effects on joint arms clique membership during periods of network maturity, while IGO CMOs and regime scores have stronger effects during formative network periods. The fit between the theoretical expectations and the data is slightly better in strategic trade network in general and IGO trade networks. But here, too, the effects are not consistent with the expectations of the theory across variables.

The only variable that has stronger effect on joint clique memberships during formative periods across networks is the enemy of one's enemy. States that have a common enemy are much more likely to end up in common alliance, strategic trade, general trade, and institutional cliques during formative periods than during periods of systemic stability. Alliance opportunity costs are also relatively robust with respect to the theory's expectations.

The strategy of distinguishing between embryonic and mature networks has a number of fairly serious drawbacks. First, the results of such an analysis depend on how the historical period is broken down into "formative" or "mature" networking periods. Different breakdowns may well yield fundamentally different results. Second, it assumes – quite arbitrarily – that a systemic shock such as a world war or the collapse of a great power erases the history of network ties that existed prior to this shock. This assumption is questionable on both empirical and theoretical grounds. Third, and most importantly this approach imposes a systemic, top-down approach (Maoz, 1990b: 547–564) on a theory that is based on a bottom-up conception of network formation. In other words, it suggests that certain global events have a ripple effect that fundamentally alters the logic by which states choose allies, arms-trade partners, or strategic trade partners.

The upshot is that a more detailed and theoretically informed analysis of the dynamics of network evolution over time is required. This kind of analysis is, however, beyond the scope of the present chapter. I will discuss some desirable properties of such an approach in [Chapter 11](#). I now turn to the final element of the theory: The impact of network participation on the conflict behavior of states.

Table 6.5. *Effects of cooperative network ties on dyadic conflict, 1870–2001: time-series cross-sectional analysis of politically relevant dyads – change in probability of conflict*

| Independent variable | MID initiation | MID involvement | War involvement |
|----------------------|----------------|-----------------|-----------------|
| Joint democracy      | –61.92% **     | –66.26% **      | –100.00% **     |
| Capability ratio     | –0.09% *       | –0.10% **       | 78.44% **       |
| Distance             | –0.02% **      | –0.01% **       | 0.00% *         |
| SRG members          | 184.24% **     | 198.33% **      | 179.45% **      |
| Cultural similarity  | –15.19% **     | –7.41%          | –27.75% **      |
| Cooperative CMO      | –19.83% **     | –13.09% **      | –31.14% **      |

Notes: Negative numbers mean that the probability of conflict is reduced by xx percent given the change of the independent variable from its 20th percentile value to its 80th percentile value. (For the binary independent variables – joint democracy and SRG members – the change is from zero to one.) Positive numbers indicate an increase in the probability of conflict.

\*  $p < 0.05$ ; \*\*  $p < 0.01$ .

### 3.3. Does the Participation in Cooperative Networks Reduce the Propensity for Conflict?

The NIP theory contends that the origins of cooperative networks lie in the reality or anticipation of conflict in an anarchic system. States attempt to fill the gap between what they need to confront these external challenges and what they actually have by forming security alliances. This has behavioral implications, some of which concern the conflict behavior of states.

The NIP theory suggests that as states come to share an increasingly large level of overlap in cooperative cliques of various types, the probability of conflict between these states declines. This applies not only to the direct ties between states; it also applies to the degree to which these states share membership in cooperative cliques of various sorts. The test of this hypothesis is provided in Table 6.5.

The results shown in Table 6.5 clearly suggest that the degree to which states overlap in cooperative cliques has a significantly dampening effect on the probability of MID and war outbreak. These results are based on the population of politically relevant dyads, these dyads that are theoretically more likely to engage in conflict (Maoz and Russett 1993). If we run the same analysis on the entire population of dyads, cooperative network ties tend to have a stronger dampening effect on the probability of dyadic conflict. This provides robust support to the propositions of the NIP theory regarding the pacific implications of cooperative network structures.

#### 4. Conclusion

The NIP theory started out from a conception of a world characterized by anarchy with a built-in potential element of conflict. The theory postulates a process that characterizes the alliance choices of states and the implications of these choices for other types of networks. Building on this conception of alliance formation, the theory speculates about the kind of security cooperation networks that might form and how they relate to other types of networks.

Before assessing the empirical performance of the NIP theory, we need to summarize the principal results of the analyses in this chapter:

1. National alliance formation.
  - States opt for alliance formation due to both security and non-security-related reasons. The key motivation for alliance formation is a widening capabilities gap between a state and its SRG.
  - The political and cultural composition of a state's SRG might serve to diminish the state's threat perception and, as a result, its search for allies. The factors that diminish the threat emanating from one's SRG include the following:
    - (a) Increased democratization
    - (b) Extensive trade of the focal state with members of its SRG
    - (c) Cultural similarity between the focal state and its SRG.
  - Yet, a high level of institutional cooperation between the focal state and its SRG does not appear to reduce the motivation of the focal state to seek allies.
2. The choice of allies.
  - The choice of alliance partners is also affected by both strategic factors and identity variables. The likelihood of alliance formation between states increases to the extent that
    - (a) they share high opportunity costs for alliance formation;
    - (b) they share common enemies;
    - (c) they are both democracies;
    - (d) they had high levels of trade and institutional cooperation in the past; and
    - (f) they are culturally similar.
3. Spillover effects of clique membership.
  - The cooperative choices of states evolve into different types of cohesive groups. Some of these groups are institutional – for example, collective security organizations like NATO or the Arab League. Other types of groupings are “emergent” in the sense that they do not represent formal institutions or groups. One type of emergent group is the clique. The NIP theory contends that such cliques induce important spillover effects on



states. The most important argument here is that cooperative cliques in one network induce spillover effects on the behavior of states in other networks or contexts. This spillover effect was found to have a number of characteristics:

- (a) States that share a large number of common memberships in alliance cliques also tend to share membership in the same arms trade and strategic trade cliques. This is a reasonable expectation in a world dominated by realist principles. While novel, this result is not all that surprising. What is more surprising, however, is the two-way spillover from security to nonsecurity cooperation. Specifically, the level of joint clique membership of states in security cliques (both alliance and strategic trade cliques) is affected by the level of their joint clique membership in trade groupings and vice versa.
  - (b) Some of the security and identity factors that affected the likelihood of states forming alliances also have a fairly robust effect on the level of joint clique membership in security cliques. These factors include: common enemies, joint democracy, and similar cultural traits. However, these factors have an inverse effect on the degree of clique overlap in general trade and institutional cliques.
4. The evolution of networks over time.
- The NIP theory contends that processes of network formation and evolution vary at different points in time. During periods of systemic turbulence, network formation processes are dominated by security factors and cultural similarity. However, as networks evolve, cross-network spillover effects increase, and the importance of security and cultural factors diminishes. The empirical results are not always consistent with the theory's expectations. We also find that different approaches for distinguishing between embryonic networks and mature ones produce different results. Our findings therefore are not conclusive regarding the dynamic aspects of the theory. Clearly, additional research is required that entails both a more coherent theoretical specification and possibly better empirical tests. Specifically, the following results emerge in the cross-period comparison.
  - Alliance opportunity costs, common enemies, and cultural similarity have stronger effects on alliance clique overlap during periods of network transformation than during periods of network stability. Joint democracy has a stronger effect on alliance network formation during periods of network stability. This is consistent with the theory's expectations. However, joint trade experience and joint IGO history have stronger effects on alliance clique overlap during periods of network transformation. This is the opposite of what the theory expects.

- The effects of various factors on clique overlap in arms trade and strategic commodity trade networks across time are not consistent with the effect of these factors on alliance clique formation.
  - Results are generally not robust across different network types. Factors that have effects consistent with the theory's expectations in one network tend to have effects that are inconsistent with the theory's expectations in other networks.
5. Network structures and international conflict.
- Finally, the stronger the cooperative network ties between states, the lower the probability of subsequent conflict between them. The degree of overlap in alliance, trade, and IGO cliques (suggesting a similar pattern of cooperative ties with other states), significantly diminishes the probability of low-level conflict and of war between states.
  - This closes the circle addressed by the theory of network formation: Cooperative (principally – but not exclusively – security) networks are formed because states experience or expect to engage in conflict. As network ties become increasingly strong and increasingly complex they serve, in turn, to reduce the probability of conflict among members.

Where does the theory stand in light of these results? How do the different components of the theory perform? A few caveats are necessary before we address these questions. First, what follows is an interim assessment of the theory's explanatory power. A number of central aspects of the theory will be examined in the coming chapters. A more comprehensive discussion of the extent to which the data support the theory can be found in Chapter 12.

Second, the NIP theory draws upon the central paradigms of international relations. Thus, when we assess the performance of the theory in light of the historical record, it is not only important to assess the parts of the theory we have adopted from these paradigms, but also the parts of the paradigms that are not reflected in the theory.

Overall, it seems that most of the key predictions of the theory have received fairly consistent support. This applies, in particular, to the theory's predictions about the factors that shape individual alliance choices and the choice of alliance partners. The theory's predictions with respect to the cross-network spillover effects seem also to have received fairly robust support. However, the arguments of the theory regarding the factors that shape structure at different phases in the lifetimes of networks are less consistently supported. This raises an important set of issues that requires further exploration.

The theory tells us – and the data analyses conducted herein seem to confirm this – that a reality or an expectation of conflict in an anarchical international system induces cooperation. This is not only true for cooperative ties that seem to directly deal with this reality – such as security alliances or arms trade; it also spills over to nonsecurity cooperation in such areas as trade and international organizations. The theory also tells us that, while security concerns and strategic considerations are important determinants of cooperation, they are not the only factors that matter. Nor are they the most important and consistent factors. In particular, political factors (regime structure), cultural identity, and economic factors play an important role in determining when and why security cooperation takes place.

Finally, the results confirm a central aspect of the NIP theory: Seemingly different networks are related to each other. The factors that affect the formation of one network also tend to affect the formation of other networks. The structure of one network – examined here in terms of the structure of groups that are formed by the pattern of ties in that network – have a consistent and powerful effect on the structure of other networks.

As noted at the beginning of this section, the NIP theory considers other effects of network membership. One such aspect concerns the factors affecting the centrality of individual states in various networks. This is the topic of the next chapter.

## **Methodological Appendix to Chapter 6**

This appendix covers the research design of the analyses conducted in [Chapter 6](#).

### **Data Sources and Empirical Domain**

I use the same datasets as in previous chapters. These include the alliance network, the IGO network data, the cultural network data, the regime data, and the capability dataset. I also use the two trade datasets discussed in the appendix to [Chapter 3](#). In addition to these datasets, I employ here two new datasets to test the hypotheses about strategic trade networks.

1. The SIPRI (2007) arms trade dataset covers the 1950–2001 period and contains data on dyadic arms transfer measured in constant dollar amounts. This dataset refers only to the sale of weapons and weapon systems.
2. A more general dataset that is based on commodity trade allows classification of trade into three categories: (a) nonstrategic trade

includes purely economic commodities such as food, farm animals, cosmetics, and so forth; (b) dual-use commodities include gas, oil, fertilizers, automobiles, metals such as iron, and so forth; and (c) strategic commodities such as explosives, weapons, and raw materials such as uranium. Note that the strategic commodities dataset is much broader than finished weapons that are contained in the SIPRI dataset. The Feenstra et al. (2005) dataset covers the 1962–2000 period. The dataset is on the project's Web site.

*Units of analysis.* The first set of analyses uses the state-year as its principal observation. The second set of analyses uses the dyad-year as the principal unit of analysis. However, the data for most of the dyad-year variables are derived from endogenous group (cliques) structures that are derived in the manner discussed in [Chapter 2](#).

I discuss the designs of each of the tables reported in this chapter.

### Measures and Methodology for [Table 6.1](#)

*Dependent Variables.* In [Table 6.1](#), I use four dependent variables. First, the *number of allies* of a given state is the (raw) alliance degree (or the size of the alliance egonet) of a given state. The number of allies is the total number of dyadic alliance commitments regardless of the type of alliance.<sup>4</sup> Second, *the capability difference between a state's allies and that of its SRG* requires some elaboration. Since alliances are seen as a capability pool to balance or outweigh expected challenges in one's SRG, the argument is that the number of allies is not really what states are after. A state with a high deficiency between its own capabilities and those of members of its SRG may opt for alliance partners that can fill this gap. If a state can form alliances with fewer but stronger allies, this might actually be preferable to forming alliances with many weak states.

The *number of dyadic defense/offense* pacts that the state has is probably more in line with what the realist model has in mind when it discusses security cooperation. In contrast to the raw number of allies, the number of defense/offense pacts excludes those agreements that stipulate neutrality or nonintervention. It focuses on real efforts at capability pooling. Accordingly, the fourth variable – *the difference in capabilities between the state's defense and offense-pact allies and the capabilities of its SRG* – measures the extent to which the state was successful in balancing its SRG by pooling capabilities with its allies within defense or offensive pacts.

<sup>4</sup> I exclude what Leeds (2005) calls shared obligations which covers indirect alliance commitments (states A and B have treaty obligations to state C but do not have an alliance with each other).

*Independent Variables.* A general note applies to all independent variables in all analyses conducted in this chapter: All are lagged one year back for each state-year or dyad-year. In some cases – and this is specified below – independent variables are calculated as moving averages over a previous (specified) number of years.

*Alliance opportunity cost.* This variable was defined in [Chapter 2](#).

*Characteristics of the state's SRG:* The process by which the following variables are measured consists of two steps. First, for each state and for each year we identify its SRG. Second, we average the values of the variable in question across all members of the state's SRG. The following SRG characteristics are included.<sup>5</sup>

*Regime score of SRG.* This is the average Maoz-Russett (1993) regime score of the members of a given state's SRG.

*Democracy score of focal state.* A dichotomous breakdown of the regime score following Maoz (1998: 78–79).

*Proportion of democracies in SRG.* The number of democratic states in one's SRG divided by the number of states in the SRG.

*Trade with SRG.* The average level of trade of the state with members of its SRG.<sup>6</sup>

*Joint IGO membership with SRG.* Following [chapters 2 and 3](#), IGO membership is the average normalized joint IGO membership of a state with members of its SRG.

*Cultural similarity with SRG.* The average cultural similarity score between a given state and its SRG members. The procedure for calculating the cultural similarity score is similar to the IGO conversion procedure (see [Chapter 2](#)). I start with an  $n \times k$  LA (linguistic affiliation) matrix, with  $n$  states and  $k$  languages. Entries in this matrix  $l_{ij}$  reflect the proportion of state  $i$ 's population that speaks language  $j$ . This matrix is converted into a  $n \times n$  sociomatrix via the SNA conventional conversion algorithm where  $LS = LA \times LA'$ . Each entry  $ls_{ij}$  in the linguistic sociomatrix reflects the joint proportion of the population of states  $i$  and  $j$  that speak the same language.<sup>7</sup> The LS matrix is then converted into a dyadic dataset. The same procedure is repeated for the religious affiliation matrix RA which is converted into a religious similarity matrix RS. Once the two dyadic datasets are merged with the SRG dataset, religious and linguistic similarity scores are averaged across a state's SRG. An average of both

<sup>5</sup> Note that in some of the analyses I report in the book's Web site, I also have measures for the same variables based on states that are not in the focal state's SRG. These measures complement the variables reported herein.

<sup>6</sup> Note: data for this variable are available only for the 1870–2001 period.

<sup>7</sup> Note that the main diagonal of the LS matrix reflects the linguistic homogeneity of the state. A state in which all of the population speaks one and only one language will get a diagonal score of 1. A state that has  $k$  linguistic groups of equal size will get a score of  $1/k$ .

religious and linguistic similarity index serves as the state/SRG cultural similarity index.

*Estimation.* The data in Table 6.1 are all time-series cross-sectional data. However, the measurement level of the left-hand variable depends on the specific definition of the dependent variable. Therefore the link function used to estimate each of the columns of this table is different. In general the estimation equation for this table takes on the following form:

$$\begin{aligned}
 Y_{it} = & \alpha + b_1 NOSRG_{i(t-1)} + b_2 REGIME_{i(t-1)} \\
 & + b_3 CAPDIFF_{i-SRG(t-1)} + b_4 DEM \times SRGDEM_{i(t-1)} \\
 & + b_5 AVGTRDSRG_{i(t-1)} + b_6 JOINIGOSRG_{i(t-1)} \\
 & + b_7 CULTSIMSRG_{i(t-1)} + \varepsilon
 \end{aligned} \quad [6.1]$$

Where *NOSRG* is the size of the state's SRG, *REGIME* is the focal state's regime score, *CAPDIFF<sub>i-SRG</sub>* is the alliance opportunity cost (the difference between the capabilities of the focal state and those of its SRG), *DEM* × *SRGDEM* is the interaction between the democracy score of the focal state and the proportion of democracies in its SRG, *AVGTRDSRG* is the average level of trade of the state with members of its SRG, *JOINIGOSRG* is the average joint IGO membership of a state with members of its SRG, and *CULTSIMSRG* is the average level of cultural similarity between the focal state and members of its SRG.

For the number of allies and the number of defense pacts, I apply a negative binomial link function. For the alliance capabilities (defense-pact capabilities), I use a simple identity link function. To control for high levels of autocorrelations I employ a population-averaged model with an AR(1) autoregressive term.

### Who Becomes an Ally? (Table 6.2)

*Unit of analysis.* Since we are examining here who gets to become a partner in a security cooperation enterprise, the unit of analysis is a nondirected dyad-year (dyad-year *ij<sub>t</sub>* is equal to dyad-year *ji<sub>t</sub>*). I use all dyads in the international system over the 1816–2001 period. Since trade data cover only the 1870–2001 period, the effective population when trade variables are used is limited to this temporal domain. However, analyses were repeated for the entire period, with trade data omitted. Results are robust for such analyses.

*Dependent Variables.* I use three dependent variables here. One is an ALLYONSET variable. This variable gets a value of one for the first year of an alliance, is missing for each year an alliance is underway, and it is assigned a value of zero when no alliance exists for dyad members.

The second variable is an alliance underway variable (ALLYUNDER). This is a binary variable that assumes a value of one for each year an alliance was underway, and zero otherwise. This variable allows examining both the onset and duration of alliance ties between states. The third variable is a continuous variable specifying the level of commitment embedded in an alliance treaty. This variable, labeled relative commitment (ALYCOMMIT) is defined in [Chapter 2](#) (equation [2.1]). Clearly, the higher the level of alliance commitment, and the more commitment types two states share, the higher the ALYCOMMIT score.

The advantage of this index is twofold. First, it is a continuous index of commitment that incorporates both the type of commitments and the different forms of commitments two states share over time. The presence of a defense pact, an offensive pact, and a consultation pact indicate a far higher level of commitment than either one of them together. This is not reflected in the binary alliance variable that assigns the same weight to one type of commitment as to other and to one commitment as to many. Second, the ALLYUNDER variable does not vary as long as an alliance treaty of any kind is effective. This causes some problems of bias in the estimation of this variable. The relative alliance commitment variable may vary in value over the duration of an alliance. This is so because either the level of commitment may change over time (while some commitment is constantly present), or that some commitments are added and other dropped so that the number of commitments at any given point in time may change. This offers greater variability of alliance commitment within a given time span where a certain level of commitment is present.

*Independent Variables.* The independent variables are similar to those discussed in the previous section, but now these variables are measured at the dyadic level. There are two sets of variables in dyadic analysis. One type of variables concerns direct (or indirect) relations between members of the dyad. This poses no particular measurement problem because each such variable describes a property of the dyad. The second type of variable concerns a set of national attributes that are transformed into a dyadic characteristic. This type of conversion is always a subject for debate. The basic principle for conversion that I propose using is also the most commonly used in the empirical literature in international relations. This is the *weak link* principle. Simply stated, the weak link principle suggests that each member of the dyad is characterized by some property (regime, economic development, political stability, and so forth). The lowest score of the two individual scores is then selected as the dyadic attribute.<sup>8</sup>

*Minimum alliance opportunity cost.* The alliance opportunity cost is the weak link of the individual state opportunity costs. This variable

<sup>8</sup> In some cases, when theoretical considerations require, the strong link principle substitutes for the weak link one. For example, when we convert the minor/major power

indicates the mutual drives to form an alliance by members of the dyad. The higher the value of this variable, the more driven the dyad members are to seek allies. If both states making up the dyad enjoy a low opportunity cost for forming alliances, then according to the realist paradigm (and this is usually backed up by the other two paradigms as well), we do not have a reason to expect this dyad to form an alliance in the first place.

*Minimum regime score.* The weak link of the individual Maoz-Russett (1993) regime scores of the two states making up the dyad.

*Enemy of my enemy.* The definition of this variable follows Maoz et al. (2007a). For each year, I use an enmity sociomatrix  $E$  of order  $n \times n$  (where  $n$  is the number of states for that year), with entries  $e_{ij}$  defined as  $-1$  if states  $i$  and  $j$  had a MID during the year and zero otherwise. This matrix is raised to the second power such that  $EE = E^2$ , and the entries of the new matrix  $ee_{ij} \geq 0$  assume a positive number if states  $i$  and  $j$  had one or more common enemies. (The value of  $ee_{ij}$  is the number of common enemies that the two states have. The diagonal entries of this matrix  $ee_{ii}$  denote the number of dyadic MIDs that state  $i$  was involved in at a given year.) The entries of the  $EE$  matrix are dichotomized such that the modified entries assume the value of one if the original entries are nonzero, and zero otherwise.<sup>9</sup>

*Proportion joint IGO membership* (see previous section). These are the entries of the diagonally standardized IGO sociomatrix. Each entry reflects the number of joint IGO memberships for states  $i$  and  $j$  divided by the smallest of the total number of IGO memberships of these states.<sup>10</sup>

*Joint trade.* The volume of trade between dyad members divided by the sum of their GDPs (Russett and Oneal, 2001: 135–138).

*Cultural similarity.* This is the cultural similarity index of members of the dyads as defined in the previous section.

*Status of Dyad.* Assigned a value of 0 if both states are minor powers, 1 if at least one of the states is a regional power, 2 if one of the states is a

status of individual states into a dyadic measure, we want to get to the state with the highest status in the dyad.

<sup>9</sup> The reason for using dichotomized values for the enemy of my enemy and ally of my enemy variables is that the realist paradigm specifies a threshold effect of these variables on alliance formation. In other words, it is sufficient for two states to have one common enemy to become candidates for alliance formation, according to the realist paradigm. Likewise, a state that is an ally of one enemy is no less likely to become a candidate for alliance formation than an ally of several of one's enemies.

<sup>10</sup> Note a difference between the normalization procedure here and the normalization procedure I used for the state-level analysis. Since I am using nondirected dyads here (because dyadic alliances and alliance commitments are symmetrical by definition), I need to convert the non-normalized IGO matrix into a symmetric normalized matrix. This means that I need to normalize the number of joint IGO memberships for a given dyad by the smallest number of IGO memberships of the states making up the dyad (here too the weak link principle is invoked in normalization).



major power, 3 if both are major powers. Definitions of major, regional, and, minor powers is provided in the next chapter.

*Estimation.* For the estimation of *alliance underway* variable I use a binary logit model with cubic splines and no-alliance years (Beck, Katz, and Tucker, 1998). Since the onset of alliance (ALLYONSET) is specified once for each new alliance tie between states (additional alliance commitments are not counted), I apply a Cox proportional-hazard model with re-entries to estimate this variable.<sup>11</sup> Finally, I estimate the continuous alliance commitment variable via a population-averaged time-series cross-sectional regression model with correction for first-order autocorrelation.

### Security Cooperation and Strategic Trade Networks (Table 6.3)

The principal complexity in these analyses (Table 6.3) resides in the measurement of the various variables, using new endogenously defined groupings of states within different networks. The unit of analysis is still the dyad-year. However, the measures of the dependent and independent variables are derived from the standardized Clique Membership Overlap CMO indices for each of the networks separately. The alliance, arms trade, strategic trade, general trade, and IGO CMOs are derived using the procedure outlined in Chapter 2.

#### *Dependent Variables.*

*Alliance Clique Overlap.* For any given dyad and for any given year, the proportion of cliques shared by members of dyad  $ij$  to the number of clique memberships of state  $i$  at that year. The CMO matrix is asymmetrical, and so all alliance clique overlap values are directional ( $cmo_{ij} \neq cmo_{ji}$ ).

*Arms trade clique overlap.* Same as for alliances, this is the proportion of arms trade cliques shared by two states to the number of clique memberships of the first state.

*Strategic trade clique overlap.* Same as above using cliques derived from the strategic trade dataset.

*General trade clique overlap.* Same as above using the general trade dataset.

*IGO clique overlap.* Same as above using the IGO dataset.

*Cultural similarity.* The degree of religious and linguistic similarity between two states.

<sup>11</sup> Re-entries are defined if a dyad had an alliance over a given period, then stopped its alliance ties for a while, and subsequently renewed them.

*Estimation Methods.* The hypotheses tested in this table stipulate that network membership has spillover effects across different networks. Accordingly, I use instrumental variable panel regression to test for endogeneity of some of the CMO variables. Thus, when estimating alliance CMO, I use trade as an endogenous variable. Likewise, when using arms trade, strategic trade, general trade, and IGO CMOs, I use alliance CMO as an endogenous variable. Because of the need to test endogeneity, the models are fixed-effect panel regressions.

### Dynamic Network Effects (Table 6.4)

The unit of analysis for Table 6.4 is the dyad-year. The analyses in this table use the same variables and the same methods as in Table 6.3. The entire 1870–2001 period is divided into two sub-periods as discussed in the relevant section. A two-sample T-test is performed on the parameter estimates and robust standard errors of each variable across both periods. Thus, for example, we expect that the alliance opportunity costs, enemy of my enemy, and cultural similarity variables will have a stronger effect (higher positive parameter estimate and lower standard error) on alliance CMO during formative periods than during periods of network maturity. If this is the case, then the difference between these two periods – measured by the Student's T-statistic – should be positive and statistically significant. Likewise, we expect trade and IGO CMOs and joint democracy, to have a weaker effect on alliance CMO during formative periods than during periods of network maturity. Consequently, the T-statistics for these comparisons should be negative and statistically significant. Table 6.4 shows the results of these analyses, with boldface figures indicating where the data support the theory's expectations.

### Effects of Cooperative Network Membership on Conflict (Table 6.5)

The unit of analysis is the dyad-year. Dependent variables were defined in previous chapters; control variables were also defined previously. The only variable that needs to be defined here is the Cooperative CMO variable. Briefly, this variable is simply the mean of alliance, general trade, and IGO CMOs. Analyses conducted with the individual CMO scores suggest a general support for the theory's hypotheses and are presented in the book's Web site.

The table reports percent change in the probability of conflict as a function of changes in the values of the independent variables. The procedure is the same as that used in Table 4.5 in Chapter 4.

## *Nations in Networks: Prestige, Status Inconsistency, Influence, and Conflict*<sup>1</sup>

### 1. Introduction

States care about power, security, and wealth. These goals have tangible and sometimes measurable properties. But power, security, and wealth do not depend only on the internal attributes and characteristics of states; they have intangible elements that derive from the interaction of states with their environments. It is commonly assumed that power is an important determinant of states' security. Clearly, power has tangible elements. However, the most widely accepted conception of power views it as the ability of an actor to influence outcomes (Maoz, 1989b). In that vein, an important, and often neglected, element of power concerns the structure of exchange relations between a unit and other units (Barnett and Duvall, 2005). In this context, a state's power derives from the position it assumes in its interactions with other states. Related to this is the conception of *psychological power*, which has to do with the ability of a state to bring about favorable outcomes or to prevent unfavorable outcomes *without using force* (Fuller and Arquilla, 1996). In effect, the use of force is seen as a power failure (Tang, 2005).

But beyond power, security, and wealth, states care about their reputation and prestige. A state's status and prestige may contribute to its national security and well-being. This corresponds to a widely held belief that a state's status and prestige help it to accomplish its foreign policy objectives. But there is more to the pursuit of status and prestige than a lust for power and influence. When people root for their national soccer team in the World Cup competition, or for their state's athletes in the Olympic Games, they opt for status and prestige that go beyond the

<sup>1</sup> This chapter builds on and expands the study of Maoz et al. (2007b). I wish to thank Lesley Terris, Ranan Kuperman, and Ilan Talmud, my collaborators on that project for their help and suggestions.

tangible components of security. The same applies to the highly contentious international competition that takes place every four years to host the World Soccer Championship Series and the Olympic games. To understand the totality of international relations, we need to understand the factors that define status and prestige in world politics. More importantly, because states work to increase their status and prestige, it is important to understand how a state's status and prestige affects its behavior in the international system.

This chapter focuses on the determinants of national status and prestige in various networks and examines the effects of national status and prestige on national behavior. The key point of this chapter is that the choices that states make have important – in some cases counterintuitive – consequences for their position in international networks. One of these is that status and prestige affect national behavior and a state's ability to accomplish its foreign policy objectives.

As a background for a discussion of the meaning of status and prestige in international relations – especially because these concepts are seen in the context of the theory of NIP – it is important to reiterate two principles about the rules that define most cooperative international networks. First, these networks are discretionary: Ties reflect the outcomes of state choices. Second, whether the network in question is symmetric or asymmetric, it takes two to tango. To form a security alliance, trade with each other, or share IGO memberships, two states have to make identical (or complementary) choices. An alliance implies that both states must be willing to sign the treaty; for state  $i$  to actually export goods or services to state  $j$ , the former must be willing to sell and the latter must be willing to buy. With IGO membership, this principle seems less obvious, but in fact, it is equally applicable: Both states must be willing to sign the IGO charter. In some cases, IGO members refuse to admit a state to the IGO, even if the latter is willing to sign the IGO charter.

These principles suggest several important points that guide our discussion. First, the status and prestige of a state is not defined strictly by its attributes or by its choices; it is also defined by the choices of other states to forge cooperative ties with the focal state. Second, the concepts of status and prestige do not have a single definition. In fact, there are several different ways to conceive of a nation's status and prestige. Each of these conceptions offers a different dimension of the position of a given state within a network. Consequently, there are considerable differences between a state's position in a network based on one conception of status or prestige and the same state's position in the same network given another conception of status and prestige.

This chapter explores two important facets of the NIP theory. First, we examine the implications of networking choices on the status and prestige of nations. Second, we study the behavioral implications of status

and prestige in a number of different settings. I focus on the following issues:

1. What are the dimensions of status and prestige? How are status and prestige related to influence in international relations?
2. How can these different meanings of status and prestige be derived from the pattern of ties that states forge with other states?
3. What are the factors that determine the status and prestige of states across different cooperative networks?
4. Are the factors that affect the status of states also the same as those that affect their prestige? If so, why? If not, what accounts for the differences?
5. What are the behavioral implications of status and prestige across levels of analysis?
  - a. Does the status of a state as conceived by international relations scholars converge with social network conceptions of prestige?
  - b. Can high reputation and prestige increase the ability of a state to exert influence through peaceful means?
  - c. What are the implications of gaps between the status of states and their prestige?
  - d. What are the implications of widespread discrepancies between states' status and their respective prestige at the systemic level?

A key focus that is closely related to these issues concerns the definition and identification of “great” or “major” powers in international relations. The distinction between major powers and other states in the international system is an important element of the central paradigms in the field. In structural realism, for example, the number of major powers is taken to be one of the two key determinants of the structure of the international system. Consequently, realists view the number of major powers as one of the most important determinants of the ebb and flow of international relations (Waltz, 1979; Mearsheimer, 2001). Yet, most realist scholars do not spend too much time on systematic operationalization of this variable. They typically identify the great powers on the basis of “historical consensus.” Ironically, empirically inclined international relations scholars also tend to rely on “historians’ consensus” regarding the definition of great powers. Consequently, we do not have a clear operational definition of this concept that can systematically distinguish between major and other powers.<sup>2</sup> The operational indicators of great/major powers that

<sup>2</sup> Most empirical studies that use a distinction between major and other powers rely on the Correlates of War definition. The COW definition follows the work of Singer and Small (1972) that identifies major powers based on the “consensus of diplomatic historians.” (See e.g., Fordham and Asal, 2007: 37.) In the present study (e.g., Chapter 4)

do exist are based almost exclusively on military capabilities (e.g., Rasler and Thompson, 1994).

Here I compare the attribute-based conceptions of international status to a prestige-based conception. This prestige-based conception is framed in terms of the relative centrality of states within a system of cooperative networks. The argument is straightforward: If power is the capacity to influence outcomes, then this capacity may well depend on the position of the state in a system of interaction and exchange. This position affects a state's ability to control and influence relationships between itself and other states and also to broker and mediate relations between third parties. Thus, what distinguishes a great power from an "ordinary" state is its position in a set of cooperative networks. If we assume a relationship between centrality and status, the pecking order of states is determined not only by their relative capabilities or wealth, but also in terms of their international status, which is also a function of the structure of exchange relations among states.

This chapter is organized as follows. The next section explores different conceptions of status and prestige in general and relates these conceptions to the various concepts of centrality I discussed in [Chapter 2](#). Section 3 explores the key ideas of the NIP theory with respect to the sources and consequences of network centrality. Section 4 examines the empirical implications of the theory and presents the results of analyses focusing on the determinants of national status and prestige across different cooperative networks. Section 5 examines the relationship between the network centrality of states and their reputational status as assessed by diplomatic historians and political scientists. Section 6 examines the effect of network centrality on states' ability to influence international outcomes in international organizations. Section 7 examines the effects of status inconsistency – a concept I discuss at length in Section 3 – on conflict behavior of states. Section 8 explores the implications of these results for the analysis of international relations.

## 2. Different Conceptions of Status and Prestige

Status often refers to elements of the position that an organism (person, group, institution) captures within a particular social system (Weber, 1924). This meaning has legal and social implications. A man who marries a woman assumes the legal status of husband. When the couple

and in previous work (e.g., Maoz, 1996) I offered more operational criteria for distinguishing between major and regional powers, but the baseline definition relies on the same logic as that of the COW project. See also Levy and Thompson (2005: 19) for an extended list of great powers (based primarily on army size) going back to 1495. This list follows the principles for coding major powers in Rasler and Thompson (2005).

bears children, they assume the status of parents, which has legal implications. At some level, all husbands have the same legal status, and all parents have the same legal status. This meaning of status affords only a conceptual (or nominal) distinction among units. In the international system, the status of states may be – at some levels – identical, regardless of their attributes. Weak states and strong states are said to have the same rights and obligations under international law. Nonstate entities may have neither.

However, status may have comparative and evaluative implications that allow us to place organisms on a measurable scale. When we talk about socioeconomic status (SES), we compare the positions of individuals within social groups (their education, income, and profession) on a scale. Socioeconomic status is used in the social sciences as a key indicator of a wide range of behaviors (violence, political participation, drug and alcohol abuse, mental health, or even obesity). We often talk about “high” or “low” status. Status categories do not only differentiate between individuals or groups in society; they rank order them, or even place them on a cardinal scale. This suggests that there is considerable confusion about what, exactly, the concept of status implies.

Sociologists distinguish between two types of status. *Ascribed status* is the role or position a person assumes in a society by virtue of his/her biological or hereditary traits (e.g., race, gender, ethnicity). *Attained status* is the role or position a person holds by virtue of things he or she has done or is doing (e.g., education, income, profession).<sup>3</sup> We will get back to this distinction. At this point, however, both ascribed and attained status are based on the traits or actions of the individual.

In international relations, we use both conceptions of status interchangeably. In many cases, we assume that one conception implies the other. The distinction among states in terms of size, capabilities, or wealth allows us to rank or measure them along one or more scales. When we talk about superpowers, regional powers, or mini-states, we use explicit or implicit criteria to measure them. A common measurement of international status is based on one or more indicators of national capabilities. Development theorists often look at per-capita GDP as an indicator of development status.

In contrast to these conceptions of status, prestige concerns the degree of respect that one is accorded by others, by virtue of either one’s ascribed or attained status. The prestige of a person, group, institution, or nation may be related to status, but this relationship is complex. Status depends on different types of roles and positions that a unit captures at a given point in time. A person may be a son/daughter, husband/wife, a professional, a member of a specific ethnic group, and so forth. Sociologists

<sup>3</sup> Linton (1936) is probably the first to have made this distinction.

refer to this collection of roles and positions as *status set* (Merton, 1957; Hensin, 2007: 83; Macionis, 2007). A unit's prestige is a function of what others consider as valued, important, noticeable, or instrumental. When people consider physical attractiveness to be important, movie stars, beauty queens, or other physically attractive individuals are accorded high prestige. In such a setting, people such as Steven Hawking will not be admired and may even be ridiculed. However, if people consider ideas and knowledge to be desirable traits, movie stars may be accorded less prestige than scientists, philosophers, or other intellectuals. Steven Hawking's prestige under such circumstances may be very high.

The concept of international prestige does not feature prominently in theories of international relations or foreign policy. Very old – and often forgotten – conceptions of the national interest (e.g., Cook and Moos, 1954: 138; Wolfers, 1962: 67–80) talk about self-aggrandizement as one of the key goals of states in the international arena. Actions aimed at gaining prestige therefore become a part and parcel of the foreign policy repertoire of states. We really do not have, however, any empirical evidence suggesting that states pursue such goals or about how they go about establishing prestige. Nor do we know how to separate actions aimed purely at attainment of prestige from those designed to serve more tangible objectives.

The modern literature on international relations and foreign policy claims that states seek to establish a reputation and preserve it. Reputation is a commonly used concept in deterrence theory, conflict analysis, and negotiation behavior. Deterrence theory suggests that states seek to establish a reputation of resolve and capability as an important building block of their ability to deter future aggressors. To this end, they are willing to pay high costs in current conflicts – to engage in costly signaling that indicates a will and capacity to defend their interests (Huth, 1988; Fearon, 1997; Danilovic, 2002).

But reputation is also an important asset for other transactions. To form an alliance, the would-be ally must trust the state's willingness and ability to honor its treaty commitments. If a state has a reputation of reneging on its commitments, other states will be reluctant to form alliances with it. To establish trade relations, a state and its institutions must be trusted to honor contracts. To be admitted to an IGO, a state must be trusted to follow the IGO's mission. In such transactions, there is a relationship between reputation and prestige. Prestige is a result of a reputation of credibility – the proven ability and willingness of a state to face up to its commitments. In strategic interactions, it was suggested that it is irrational for states to bluff – that is, to issue signals of credibility and then not follow through on threats when it is important to do so (Fearon, 1997). In alliance politics, it was shown that members of defense or offense pacts tend to honor their commitments in about 75 percent



of cases (Leeds, 2003). So, one would expect that states that had established – through their past behavior – a reputation of credibility would be more attractive candidates for future cooperative arrangements than states that do not have a reputation for keeping promises and honoring contracts. Consequently, the former state would be sought after more than the latter.

How do the concepts of status, reputation, and prestige, relate to the network analytic concepts of centrality? In network analysis, centrality is a function of the number of (incoming and/or outgoing) ties that a node has. As we saw in [Chapter 2](#), there are different conceptions, each of which captures a different dimension of centrality. I now relate these different conceptions to the notions of status, reputation, and – especially – prestige.

First, the prestige and reputation of a given state are based on how others perceive its intentions, capabilities, and character. Reputation and prestige do not depend strictly on what the focal state does or whom it chooses to connect with. In that sense, the alliance-related prestige of a state is a function of whether or not others wish to form alliances with it and not only of how many allies the state needs or wants to have. Likewise, one can have a surplus of a certain commodity, but whether or not one ends up selling it is based on demand. It also depends on the willingness of others to purchase the commodity from the specific person. As I pointed out in [Chapter 2](#), prestige is a function of the number of nodes that choose a particular node. This means that the prestige of a state in a given network depends on whether or not other states choose it. However, the networks that are the focus of this study are typically symmetrical. The centrality of a state in such networks is the result of the choices of both the focal state and of other states.

The degree centrality of a given state in an international network measures how many or what types of other states choose to have ties with the focal state. This reflects – at least to some degree – the extent to which other states trust the focal state to honor its commitments under the rule that defines ties in this network. However, different measures of centrality tap different aspects of this prestige. I illustrate this by discussing the interpretation of prestige and reputation in the context of alliance centrality indices. Degree centrality has the simplest and most straightforward interpretation of prestige: The more states choose to have alliances with the focal state, the better the reputation of the state for its willingness and ability to honor alliance treaty obligations.

The closeness centrality of a state reflects its reputation in a different manner: the extent to which states are willing to form alliances, not only directly with the focal state, but also with states that have alliances with the focal state. For a wide variety of reasons, states may not need to form alliances with the focal state, not because they do not trust it, but because

they do not need it. However, in considering alliance partners that they do need, they may be interested to know who the allies of their allies are (or the allies of the allies of their allies, and so forth). One reason for that is that states do not wish to be dragged into unwanted military adventures by the allies of their allies. Alternatively, they may question the judgment of would-be allies that have unreliable partners.

Betweenness centrality examines the reputation of the state in potentially brokering between different allies. It focuses on the type of ties a state has, as well as the number of ties. In this sense, what matters is not only how many states trust the focal states but also what types of states do. A state has a higher betweenness centrality score if it is trusted by states that do not trust each other more than if it is trusted by states that do. Finally, states that get high scores on eigenvector alliance centrality are those that are trusted by states that are central, that is, by states who have high prestige. The same logic applies to the interpretation of state centrality in other types of cooperative networks.

This discussion serves to make an important point: There are different conceptions of status, reputation, and prestige. Prestige is typically measured or assessed as the number or type (the centrality or the closeness) of people choosing to have ties with a given person. Status is based on both. In networks that are symmetrical (such as alliance networks or symmetrical trade networks), the concepts have equivalent meaning. Empirically, the correlation between each of these measures of centrality is not very high. This means that both conceptually and empirically each of these notions conveys a different dimension of status and prestige. We can now discuss these conceptions as different implications of the states' networking choices across a wide set of international interactions.

### 3. Network Centrality, Reputational Status, Influence, Status Inconsistency, and International Conflict

We can think of the prestige-related implications of networking choices in two ways. One approach assumes that states choose network partners based on prestige-related considerations. These may not be the only considerations that drive such choices, or even the most important ones. Nevertheless, given two potential partners for alliance or two potential trading partners, a state may choose the one that gives it the most prestige. The idea is that prestige can be converted into influence-related currency. This means that states incorporate into their decisions strategic considerations involving the expected prestige they derive from a given course of action. One consequence is that states attach themselves to more prestigious states rather than to less prestigious ones. This may have important implications for the emergent structures of networks.

Network analysts are familiar with this approach, referring to it as the *preferential attachment* model of network dynamics. This model contends that the probability of a new tie between an existing node and a new node increases with the centrality of the existing node. Thus, new nodes are more likely to attach themselves to central nodes than to marginal ones.<sup>4</sup> Under certain circumstances, the network structure that results from this logic can be described by a power-law distribution (Barabási and Albert, 1999).

The other way to think about networking choices is that status and prestige are unintended consequences of states' decisions to form ties with other states. The factors that affect the choice of alliance partners may be unrelated to the status and prestige that go along with them. However, these choices – once made – result in a pattern of ties that determines the position of the focal state in the system. This position is a function not only of the choice of the state but also of the choices of other states about forming alliances with that focal state, trading with it, and/or participating with it in international forums. Yet, even if networking choices are based on considerations that are not related to prestige, the resulting level of prestige may affect the influence that a given state can exert in its future interactions.

These two conceptions of the determinants and consequences of international prestige are not mutually exclusive. The NIP theory views a state's prestige as a result of the interaction between the state's choices and the choices of others. The factors that affect a state's choice of alliance partners, trading partners, and some of its organizational affiliations are prestige-related, although they do not necessarily operate on these choices in an immediate, conscious way. However, the outcomes of networking choices are not determined only by a state's intentions; the choices others make about forming ties with a given state have to do with some aspects of the state's status and prestige as well. Thus, deliberate prestige-related considerations and unintended prestige-related outcomes complement each other. I now turn to a discussion of the factors that affect a state's prestige in the international networks that form the core of this study.

### 3.1. The Antecedents of Status and Prestige in International Networks

What are the determinants of network centrality? The NIP theory suggests that security ties are due to strategic considerations and identity and

<sup>4</sup> International relations theorists do not incorporate explicitly the notion of preferential attachment into their theories of cooperation and conflict. However, the concept of bandwagoning in alliance politics (Walt, 1988) is logically related to the idea of preferential attachment in network analysis.

affinity factors. This theory also suggests that there is a two-way spillover effect from security ties to economic and institutional ties. This has a number of implications when we attempt to explain why some states are more central than others in different international networks.

I start with the factors that affect alliance-related prestige. The theory and the empirical results in [Chapters 5 and 6](#) suggest that a state's choice of allies is a function of the security challenges it faces: the size and capabilities of its SRG. Its alliance choices are also affected by political and cultural factors. Regime type has an important effect on states' alliance choices. This may be so because democracies have a reputation for being both more credible and less exploitative allies than nondemocratic states. Democracies – as we have seen – are more likely to seek larger coalitions, in violation of the size principle (Riker, 1962). Thus, democracies are likely to be more sought after as allies. Concomitantly, other states are more likely to accept the security cooperation offers made by democracies than those made by authoritarian regimes.

Similarly, politically unstable states are suspect as credible alliance partners because regime change may result in breach of contractual obligations. Therefore other states often shy away from forming alliances with politically unstable states. The more stable a state's political system, the more likely other states are to view it as a potentially credible ally; thus, granting it higher alliance status.

But credibility is not only, and perhaps not even chiefly, a function of a state's domestic structure and political stability. Rather, it is a reputational attribute whose value is determined by past behavior. If a state is known to have fulfilled its alliance-treaty obligations in the past, then it accumulates credibility points. If it has a record of failing to honor its obligations, then it is probably seen as a non-credible ally. It follows that the state's past alliance credibility is a key factor that affects its alliance-related prestige.

Finally, spillover effects that affect the choice of allies come into play here as well. States that are central actors in other cooperative networks tend to enjoy high prestige in terms of their pattern of alliance ties. As a result, we can make the following propositions about alliance centrality:

- ACP1. The factors that affect alliance-seeking patterns of states (size of their SRG, alliance opportunity costs) also affect their alliance-related centrality.
- ACP2. National alliance centrality increases with a state's level of democracy.
- ACP3. The better the track record of a state in terms of its tendency to fulfill alliance treaty obligations in the past, the higher its alliance centrality.

- ACP4. The status of states in other cooperative networks has a spillover effect on their alliance-related status. Thus alliance centrality related to the state's trade and institutional centrality.

The spillover effect operates not only on alliance-related centrality. Alliance reputation may well affect the centrality of states in other networks. In the current study, I do not focus on the causal mechanisms that determine status and prestige in other international networks. Regardless of the determinants of status and prestige in trade and institutional networks, the spillover principle suggests that a state's status in alliance networks affects its status in other cooperative networks; hence,

- ACP5. the higher the alliance-related prestige of a state, the higher its prestige in trade or institutional networks.

### 3.2. Network Centrality and International Status

The major theories of international relations suggest that the actual status of states has an important effect on their worldview. More specifically, international status affects states' perception of their responsibilities, threats, opportunities, and consequently, their behavior. As noted, the realist paradigm conceives of international status in terms of national power and assigns this hierarchy a central role in determining the course of international politics. However, the identity of major powers is not based on explicit and replicable operational definitions. The closest we come to an operational definition of status is some dichotomous breakup of the international system in terms of the military capabilities of states.

Status is also an important factor in other approaches to the study of international systems. Dependency theories – introduced in greater detail in [Chapter 10](#) – focus on a wealth-related stratification of the international system. They suggest that the location of states in this hierarchy affects their ability to develop economically and politically. In some important respects, realist scholars and dependency theorists are in agreement regarding the factors that distinguish between major powers and minor powers – both view the distribution of capabilities over states as a key determinant of the pecking order in international relations. Realists readily acknowledge economic power is an important determinant of national power (e.g., Kennedy, 1987; Rasler and Thompson, 1994; Mearsheimer 2001). Realists and dependency theorists also agree that economic power and military power tend to go hand in hand. When one dimension of power lags behind the other, a state's status is adversely affected by this imbalance (Kennedy, 1987).

What, then, are the implications of international status and prestige? There are several issues involved in this question. The first concerns the extent to which traditional conceptions of status converge with the SNA conceptions of prestige. The second concerns the implications of the discrepancies between these two conceptions. Let me address each of these issues in the context of theories of status inconsistency.

Historians and political scientists designate international status (great/major power versus minor power) based on an implicit set of criteria. Great/major powers are typically states that have (a) significant military capabilities, (b) a span of security and economic interests that goes far beyond their immediate boundaries, and (c) the capacity to project power across a significant distance. Specifically, this implies a capacity to transfer a large number of troops and munitions across distance in a relatively short time (Maoz, 1996). One of the historical characteristics of great powers was their possession of colonial territories far away from their home state, although that was not a general rule. Quite a few states were considered great powers (e.g., Russia, Austria-Hungary, Prussia), despite having few or no colonial possessions. On the other hand, states with significant colonial possessions (e.g., Portugal, Holland) were not considered great powers by the nineteenth century.

The first and third criteria above can be, in fact, quantified. This may allow us to apply certain thresholds of capabilities and power-projection capacity to the classification of international status. For example, that a state is considered a major power if it possesses a minimum proportion (e.g., 10%) of the system's power resources. We can also define operationally the concept of power projection capacity. For example, in the pre-World War II era, for a state to qualify as a major power, it had to possess a large navy with a global reach capacity as well as a capacity to carry at least one ground forces division across the globe. In the post-World War II era, a significant capacity to project power via a large air transport force may be required. We may also insist on possession of nuclear weapons and intermediate and/or intercontinental ballistic missiles. These criteria may seem somewhat arbitrary, but they are nevertheless useful in that they seem empirically more meaningful than the ad hoc practice of designating major/minor powers in the field.

However, the second criterion, span of interests, is not as easily quantified as the other two criteria. Using it runs the risk of tautology: Major powers are states with a wide span of strategic interests, but states that expand the span of their interests also develop the capabilities and the means of power projection that allow them to pursue these interests. Given this difficulty, it is useful to think of a state's attained status – as measured by various indicators of network centrality – as a possible proxy of the span of interests. If we consider alliances as indicators of security interests (e.g., Bueno de Mesquita, 1981; Farber and Gowa, 1995, 1997;

Signorino and Ritter, 1999; Gowa, 1999; Maoz et al., 2006), then alliance centrality measures the span of strategic interests. Similarly, if the span of international economic interests is related to patterns of trade, then a state's trade centrality measures its span of economic interests, and so forth. It follows that

ACP5: *ceteris paribus*, a state's reputational status as a major, regional, or minor power is a function of its alliance, trade, and institutional network centrality.

### 3.3. Network Centrality and Peaceful Influence

If states obtain prestige by virtue of their network ties, they should be able to convert that prestige to influence. The need to threaten and exercise power in international relations, then, should represent a failure in the peaceful exercise of influence. Psychological power is the size of the shadow that a state casts by virtue of its attributes and reputation. It follows that a state's reputation should allow it to wield influence peacefully. The study of peaceful influence is not simple. For one thing, it is difficult to find a single arena in which states try to exert influence by peaceful means. In many cases, these settings are primarily dyadic – for example, bilateral trade agreements, military bases, or other bilateral transactions. Different states may also care about different things. Some may be willing to create linkages between issues they care about more and those they care about less. Consequently, in international negotiations states might be willing to grant more concessions on an issue that is less important to them in order to get their way on issues of greater importance. In such trade-off settings, it is extremely difficult – if not impossible – to test who has more influence on an overall outcome (Brams, 2007).

Nevertheless, the pivotal place the concept of power and power-based approaches captures in the study of international relations suggests that an analysis of the relationship between physical power, network centrality, and peaceful influence has important empirical, theoretical, and policy implications. This analysis focuses on international settings wherein all states count the same – at least in a formal sense. The resolutions of international organizations offer a natural setting for such an analysis. In some cases (e.g., the European Union) weighted voting schemes reflect – at least to some extent – the relative (power-based) status of members (Felsenthal and Machover, 1998). This does not provide a fair test of the effect of centrality on outcomes. Nor is the United Nations Security Council a fair setting for such an analysis. This is due to the veto power of the five permanent members. The votes in the UN General Assembly do, however, provide a good opportunity to gauge peaceful influence. Motions for a specific resolution, the precise phrasing of the resolution,

and the ultimate vote on this resolution are all the result of multilateral negotiations. In these negotiations there is no a priori difference among large or small, strong or weak states. Ultimately, every state has only one vote. Now, it is possible that the stakes involved in proposing a resolution or in supporting or opposing it differ substantially across members. Yet, if we assume that more “important” states have a wider array of interests, they would care about more issues. They might be interested in preventing untoward resolutions from coming to the table in the first place, or if they are proposed, from being adopted. Likewise, states with a wider array of interests might be interested in pushing other resolutions through the UN General Assembly.

Do status and prestige translate to influence in the UN General Assembly? We distinguish between status – defined in terms the formal position of the state in the system (major power/minor power) – and its reputation – defined in terms of network centrality. The NIP theory claims that what matters is the nature and magnitude of the cooperative ties a state has. This is the case whether or not a state has a formal status. Accordingly,

- ACP6. the higher the network centrality of a given state, the more likely it is to affect voting outcomes in the UN General Assembly; and
- ACP7. the formal status of a given state (major or minor power) has less impact on its ability to affect voting outcomes in the UN General Assembly.

The argument here is straightforward. States that have multiple or strategically important connections in cooperative networks can use their connections to affect voting outcomes in the UN. Consequently, the higher the state’s status, the more likely it is to be on the winning side of such resolutions. In contrast, formal status matters less in such settings because states that have high status but are poorly positioned lack peaceful instruments of incentive or sanctions (other than military ones) to affect voting. Since we do not have data on initiating or sponsoring resolutions that were tabled, we cannot assess the influence on states on the process of determining which resolutions actually come to the floor of the General Assembly and which are tabled. We can, however, examine the extent to which the resolutions that are voted on converge with the state’s preferences.<sup>5</sup> If network centrality in cooperative networks matters, then – controlling for other factors that might affect a state’s ability to exert influence in multilateral negotiations settings such as the UN General assembly – the more likely it is to get its way.

<sup>5</sup> Gartzke (1998, 2000, 2007) among others used the UN voting data to measure affinity and national preferences.



### 3.4. The Trials and Tribulations of Network Centrality: Status Inconsistency and International Conflict<sup>6</sup>

The behavioral implications of international status and prestige are spelled out by one of the most interesting theories of international conflict: the status- inconsistency argument. Drawing on sociological and psychological theories, this argument is based on two concepts: *achieved status* and *ascribed status* (Galtung, 1964). Achieved status is what a person, an organization, or a state accomplishes through its own attributes and efforts. This is equivalent to the concept of attained status. Ascribed status, as Galtung uses the term, concerns the prestige accorded to an actor through the recognition by others of these achievements. This is different from the concept of ascribed status as a sociologist uses it. Rather than confuse the two usages, I refer to Galtung's notion of ascribed status as *prestige*. *Status inconsistency* refers to a discrepancy between achieved status and prestige. There is consistent evidence in psychology (Eagly and Karau, 2002), sociology (Berger, Norman, Balkwell, and Smith, 1992), and organizational behavior (Bacharach, Bamberger, and Mandell, 1993) that status inconsistency correlates with violent, abnormal, or dysfunctional behavior. This behavior is an expression of some form of aggression induced by the fact that a person's achieved status is not matched by his or her prestige.

International relations scholars were interested in the effects of status inconsistency at the national or systemic level on international violence. However, the evidence on this hypothesized relationship is mixed. East (1971), Wallace (1973), Midlarsky (1975), and Volgy and Mayhall (1995, 2000) find that status inconsistency at the systemic level (measured as a correlation between capabilities or GDP-based ranking of states and their ranking in terms of the number of diplomatic missions received) has a positive effect on the level of systemic conflict. On the other hand, studies focusing on the national level of analysis found no evidence of a relationship between status inconsistency (again, measured as a discrepancy between a state's power ranking and its diplomatic missions ranking) and conflict behavior (Ray, 1974; Gochman, 1975, 1980). Organski and Kugler (1980) also regarded status inconsistency as a source of dissatisfaction with the status quo. They argued that such inconsistency – in combination with a power transition process – a source of major wars in the international system. Yet they did not measure status inconsistency. Later applications of the power transition theory (e.g., Lemke and Kugler, 1996; Lemke and Reed, 1996) focused on other factors as proxies for dissatisfaction with the status quo.

<sup>6</sup> Elements in this section draw on Maoz et al. (2007b).

There are several problems with the international relations theorizing and empirical testing of the effects of status inconsistency on behavior. First, the measurement of achieved status in terms of capabilities and/or economic wealth is quite sensible. This is so for reasons that should be obvious by now given the factors that drive cooperative and conflictual behavior according to the NIP theory. Yet, the assessment of prestige in terms of diplomatic representation is quite problematic. Diplomatic relations are cheap to make and break. On the other hand, a state's standing in the network of alliances, trade, or international institutions is a more general and more meaningful measure of the reputation of the focal state as a credible ally, a viable trading partner, or a valuable member of international institutions. The making or breaking of alliances, trade relations, and even institutional affiliations is far more costly than sending and receiving ambassadors. Thus a state's standing in any of these networks – or in all of them – is probably a better indicator of its attained status than its standing on the diplomatic missions received networks.

Second, different states may be concerned about different aspects of prestige. For example, states whose economy is highly dependent on trade may be concerned about their trade-related prestige. For example, Japan in the 1930s was concerned about its ability to import raw materials and energy. The fact that it saw itself as a major power (or at least a regional one) on the one hand, but had trouble getting the kind of raw materials it required to sustain its economy and military power added to its frustration. Other states, however, may worry about their alliance status. When they possess a great deal of power they may also accumulate a lot of enemies. As the NIP theory suggests, they seek allies to balance against their SRG. However, if other states turn down the focal state's offer to form alliances, its isolation state may drive it into conflict. This may happen even if its trading or institutional reputation matches its military capabilities. It follows that a study of the international implications of status inconsistency should be sensitive to different types of prestige. It also follows that different types of status inconsistency may operate in different ways for different states.

Third, it may be important to capture the discrepancy between acquired status and prestige by integrating different dimensions of prestige. Low alliance-related prestige may be offset by high trade-related prestige. Or low prestige on one dimension may be compounded by low prestige on other dimensions. Thus an integrated perspective of status inconsistency may yield different effects than any of its components taken separately.

Fourth, theorizing about the effect of status inconsistency and conflict is incomplete and scattered. A more coherent notion of ascribed status is necessary for the derivation of propositions about these matters. What follows is an extension of the NIP theory to the relationship between status inconsistency and international conflict.

The decisions of states to join different networks are based on different considerations. Some of these considerations are utilitarian. For example, the wish to balance against one's SRG motivates decisions to form alliances; the wish to maximize one's welfare motivates trading decisions. Other considerations may be cultural or normative – this may well affect the choices of states in joining cultural and/or humanitarian international organizations. At any rate, the volume of one's international interactions typically correlates with one's power. States that are more powerful are typically more active in international networks, and if they are not, they wish to be. Being more powerful typically means having a bigger and more powerful SRG; having greater wealth means having more surplus capital to invest and requiring more markets for one's goods and materials and more trading partners. States that have a wide span of interests face a greater need to coordinate with others. This entails affiliations in a larger number of international institutions. Thus, powerful states require – by necessity or by design – a complex web of security, economic, and institutional relations. This induces a need to balance their power with their prestige, as measured by various indicators of network centrality.

Exerting one's influence in cooperative networks requires either more ties or more ties of a special kind (e.g., brokerage-type ties that insure that the focal state can influence more states in a shorter order, ties to other powerful states). Thus, as states grow stronger, they want their ties to reflect their ability to influence. When this happens, their status is said to be consistent: attained status is matched by prestige. When this is not the case, states might resort to other means of demonstrating their importance. Because prestige is based on the cooperation of others, it cannot be accomplished solely via the actions of the focal state. What the focal state can do to affect the gap between its attained status and its prestige is to stir up the system. Conflict initiation is one way to accomplish this.

But what about states whose prestige far exceeds their acquired status? These are also status-inconsistent states, but they are probably happy about it. Their ascribed status far outweighs their real weight in the system of power and resources. They can exert influence far beyond what one would expect based on their power. They have little or no reason to upset this state of affairs by starting costly fights, which they might well lose, and which might – regardless of how they end – reduce their prestige.

Two propositions result from this argument:

- ACP8. The higher the level of status inconsistency – the discrepancy between the ranking of a state based on its capabilities and its ranking based on incoming centrality in various cooperative networks – the more likely is the state to initiate or get involved in international conflicts.

ACP9. The higher the level of status inconsistency of members of a politically relevant dyad, the higher the likelihood of conflict in that dyad.

These hypotheses are not new. They generally match the arguments made in the literature on status inconsistency in general, and on the linkage between status inconsistency and international conflict in particular. Yet, as noted above, one of the issues in this literature has to do with level-of-analysis problems. This refers to the discrepancy between the findings about the significant correlation between systemic versions of status inconsistency and systemic conflict and the lack of such correlation at the monadic level. One of the arguments of this chapter is that the level-of-analysis problem is due to flawed conceptualization of prestige in international relations. Using incoming centrality in cooperative networks as an indicator of ascribed status can provide a more coherent theoretical conception of the linkage between status inconsistency and conflict across levels of analysis. Accordingly, the hypothesis concerning the systemic version of this linkage is given by:

ACP10. The higher the level of status inconsistency in the system, the higher the frequency and magnitude of systemic conflict.

The NIP theory offers several ideas about states' relative status and prestige. First, it suggests that there are generalizable determinants of states' prestige across cooperative networks. Second, that states' centrality in various cooperative networks predicts their reputational status as reflected in the intuitive assignment of states' roles by historians and political scientists. Finally, states' status and prestige have important implications for their conflictual behavior. We now proceed to empirical tests of these ideas. (The research design and methodology used for the next section are outlined in the appendix at the end of this chapter.)

## 4. The Empirical Determinants and Implications of Centrality

### 4.1. The Determinants of National Status

We start by examining the interrelations between the various indices of centrality. [Table 7.1](#) provides the results of this analysis. The data in this table confirm the results of random network runs: With few exceptions, the correlations between measures of centrality are generally low within each given network. The exceptions are the moderately high correlations between degree and eigenvector centrality. This is because both rely on degree centrality. More importantly, however, the cross-network correlations between centrality indices are very low. Had it not been for the high

Table 7.1. *Correlations among centrality measures (incoming centrality measures only)*

|                      | Alliance     |              |                | Trade        |              |              | IGO            |              |              |
|----------------------|--------------|--------------|----------------|--------------|--------------|--------------|----------------|--------------|--------------|
|                      | Degree cent. | Close. cent. | Between. cent. | Eigen. cent. | Degree cent. | Close. cent. | Between. cent. | Eigen. cent. | Degree cent. |
| Alliance degree      | 1.000        |              |                |              |              |              |                |              |              |
| Alliance closeness   | 0.279        | 1.000        |                |              |              |              |                |              |              |
| Alliance betweenness | 0.032        | 0.010        | 1.000          |              |              |              |                |              |              |
| Alliance eigenvector | <b>0.627</b> | 0.081        | 0.022          | 1.000        |              |              |                |              |              |
| Trade degree         | 0.124        | 0.322        | 0.025          | 0.099        | 1.000        |              |                |              |              |
| Trade closeness      | 0.041        | 0.020        | -0.005         | 0.029        | 0.057        | 1.000        |                |              |              |
| Trade betweenness    | 0.089        | 0.173        | 0.015          | 0.033        | <b>0.580</b> | 0.033        | 1.000          |              |              |
| Trade eigenvector    | 0.042        | 0.009        | 0.025          | 0.111        | 0.352        | 0.080        | 0.272          | 1.000        |              |
| IGO degree           | 0.007        | 0.006        | -0.001         | 0.013        | 0.023        | 0.337        | 0.014          | 0.035        | 1.000        |
| IGO closeness        | 0.093        | 0.040        | -0.007         | -0.026       | 0.110        | 0.098        | 0.038          | 0.140        | 0.069        |
| IGO betweenness      | -0.040       | -0.010       | 0.004          | -0.005       | 0.027        | 0.008        | 0.011          | 0.036        | 0.003        |
| IGO eigenvector      | -0.003       | -0.014       | 0.025          | 0.102        | 0.162        | 0.056        | 0.027          | 0.260        | 0.045        |
|                      |              |              |                |              |              |              |                |              | <b>0.462</b> |

Note: Ns vary between 11,205 and 13,826. Correlations above 0.020 are significant at  $p < .001$ .

number of cases, none of these cross-network correlations between measures of centrality would have been statistically significant.

This confirms two important points about the concepts of centrality and prestige as these show up in the international system. First, one dimension of a nation's prestige is not the same as another dimension of the prestige of that nation. A state that considers its incoming degree centrality as the key indicator of its security-related prestige may derive very different conclusions about its international standing than it would using its closeness or betweenness centrality as the key indicators of its prestige. Second, a state's status as measured by its security-related network ties is very different from its status due to its economic or institutional networks. Each network tells a different story about the pecking order of states. This may suggest that there is little or no relationship between the alliance-related prestige of a state and its economic or institutional prestige. However, as we saw in [Chapter 6](#), the volume of trade has a statistically significant effect on the number of allies of states. This calls for an analysis of the determinants of alliance centrality in which the trade and institutional centrality of a state are endogenized. This is shown in [Table 7.2](#).

The results reported in [Table 7.2](#) show significant variations over the specific measure of alliance centrality. The model estimating alliance closeness centrality performs quite poorly. The other indicators of alliance centrality provide a more coherent picture of the determinants of a state's security-related prestige. First, the focal state's regime, its political stability and its credibility have a positive effect on alliance degree, betweenness, and eigenvector centrality. The size of the focal state's SRG has a similar effect on degree, betweenness, and eigenvector centrality. The capabilities of the focal state positively affect its degree and eigenvector centrality but negatively affect its betweenness centrality.<sup>7</sup>

Second, the most important aspect of these results is the consistent spillover effect from a state's trade-related status to its alliance-related status. States that are central members of trade networks are also likely to be central members of alliance networks. The spillover effects from IGO networks to alliance networks are less robust and consistent.

All in all, these results support the theory quite well. With the exception of the determinants of closeness centrality, the factors emphasized by the theory to determine alliance-related prestige have the predicted effect, and these appear to be fairly robust across measures of centrality.

We now turn to an analysis of the factors affecting trade centrality. This analysis is exploratory. A theory of the economic prestige of

<sup>7</sup> Note that when the same runs are conducted without endogenizing trade and IGO centrality, the effects of trade and IGO centrality on alliance centrality are consistently positive and statistically significant across dependent variables (except closeness centrality).

Table 7.2. *Determinants of alliance centrality indices – instrumental variable time-series cross-sectional analysis, all states 1870–2001*

| Independent variable          | Incoming alliance centrality |                         |                      |                         |
|-------------------------------|------------------------------|-------------------------|----------------------|-------------------------|
|                               | Degree                       | Closeness <sup>b</sup>  | Betweenness          | Eigenvector             |
| Trade centrality <sup>a</sup> | 0.133**<br>(0.016)           | –1.27e-14<br>(1.09e-14) | –1.812**<br>(0.313)  | 1066.224**<br>(163.823) |
| IGO centrality <sup>a</sup>   | 0.010**<br>(0.003)           | 1.06e-16<br>(1.11e-16)  | –0.406**<br>(0.098)  | –0.810**<br>(0.137)     |
| Regime score                  | 1.00e-04**<br>(1.08e-05)     | –0.155<br>(0.130)       | 0.009**<br>(0.002)   | 0.045**<br>(0.009)      |
| Regime persistence            | –5.07e-04**<br>(1.97e-04)    | –0.102<br>(0.211)       | 0.018**<br>(0.002)   | 0.106**<br>(0.011)      |
| No states in SRG              | 1.72e-04**<br>(3.48e-05)     | –0.001<br>(0.333)       | 0.057**<br>(0.003)   | 0.050**<br>(0.021)      |
| Capabilities                  | 0.131**<br>(0.032)           | –91.993<br>(251.799)    | –11.416**<br>(2.072) | 158.114**<br>(12.030)   |
| Alliance credibility          | 0.029**<br>(0.002)           | –57.210<br>(60.617)     | 0.588**<br>(0.206)   | 5.172**<br>(1.185)      |
| Constant                      | –0.006**<br>(0.002)          | 7.835<br>(8.999)        | 1.252**<br>(0.206)   | 0.585<br>(1.941)        |
| Model statistics              |                              |                         |                      |                         |
| N                             | 10,636                       | 7,052                   | 10,636               | 10,636                  |
| No. of states                 | 165                          | 156                     | 165                  | 165                     |
| Chi-square                    | 8,757.95**                   | 9.85                    | 972.05**             | 2,631.38**              |

<sup>a</sup> Endogenous variable<sup>b</sup> Analysis conducted on connected states only. Isolates were deleted.+  $p < 0.10$ ; \*  $p < 0.05$ ; \*\*  $p < 0.01$ .

nations is beyond the scope of this study. The key reason for examining trade-related prestige is to test the spillover hypothesis of the NIP theory. Thus, the focus of the results of Table 7.3 is on this aspect of trade centrality.

We ignore most of the control variables in Table 7.3 and focus on the spillover effects of alliance and institutional centrality on states' trade-related status. The results confirm a network spillover effect: States that have a high alliance-related and institutional prestige tend to have high trade-related prestige. The effects of IGO centrality on trade are less robust. This adds another layer to the notion that seemingly distinct networks of cooperation tend to be interrelated, and that the cross-network relationship operates on different levels of analysis. We will come back to this point in other parts of this study.

Table 7.3. *Factors affecting trade centrality – instrumental variables time-series cross-sectional analysis of trade centrality indices, 1870–2001*

| Independent variable             | Trade centrality measure |                          |                           |
|----------------------------------|--------------------------|--------------------------|---------------------------|
|                                  | Degree                   | Betweenness              | Eigenvector               |
| Alliance centrality <sup>a</sup> | 0.004**<br>(0.001)       | 0.182**<br>(0.066)       | 0.026**<br>(0.004)        |
| IGO centrality                   | 0.004**<br>(0.001)       | 7.301**<br>(2.610)       | 5.92e-07<br>(6.16e-07)    |
| Regime score                     | 3.57e-06**<br>(8.51e-07) | 0.007**<br>(0.002)       | -1.43e-07**<br>(1.75e-08) |
| Regime persistence               | 9.35e-06**<br>(1.98e-06) | 5.31e-04<br>(1.51e-03)   | -8.52e-08*<br>(3.84e-08)  |
| Per capita GDP                   | 6.01e-09**<br>(2.10e-09) | -7.73e-06*<br>(3.40e-06) | -5.25e-10**<br>(5.31e-11) |
| Iron steel production            | 1.40e-03*<br>(7.39e-04)  | 7.706**<br>(1.020)       | 3.56e-04**<br>(2.98e-05)  |
| Constant                         | -0.002*<br>(0.001)       | -0.074<br>(0.126)        | -7.23e-06<br>(8.58e-06)   |
| Model statistics                 |                          |                          |                           |
| N                                | 10,674                   | 10,674                   | 10,637                    |
| No. of states                    | 165                      | 165                      | 165                       |
| Chi-square                       | 9,582.23                 | 351.85                   | 3,200.61                  |

<sup>a</sup> Endogenous variable.

\*  $p < 0.10$ ; \*  $p < 0.05$ ; \*\*  $p < 0.01$ .

## 4.2. Centrality and Reputational Status of States

We turn now to an analysis of the effect of network-related status on power or “historical reputation” status. Specifically, we examine whether states that have been designated by historians and political scientists as major powers – by virtue of their power-related attributes or the role they played in international politics – have also tended to be central players in cooperative networks. Table 7.4 provides the results of this analysis.

Clearly, the best and most consistent predictor of states’ reputational position is their military capabilities, suggesting that indeed these intuitive rankings of states are based on some power-based hierarchy.<sup>8</sup> However,

<sup>8</sup> An analysis of variance of status on power shows that the average CINC score of COW minor powers was 0.85 percent as opposed to 11.74 percent of the system’s resources for major powers. A similar analysis on the Maoz Major/Regional/Minor classification shows that the mean capability score of minor powers was 0.61 percent, of regional powers it was 6.1 percent and of major powers it was 13.83 percent. All differences are statistically significant with F-scores in the thousands.



Table 7.4. *Network prestige and international status – a bootstrap logit analysis of major, regional, and minor powers, 1870–2001*

| Independent variable  | Cow major/minor power status <sup>a</sup>           |                                                  |                                                  |                                                  |
|-----------------------|-----------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|
|                       | Degree centrality                                   | Closeness centrality                             | Betweenness centrality                           | Eigenvector centrality                           |
| National capabilities | 35.860**<br>(6.528)                                 | 40.598**<br>(6.450)                              | 38.063**<br>(6.201)                              | 39.3847**<br>(5.471)                             |
| Regime score          | -0.014**<br>(0.005)                                 | 0.006+<br>(0.004)                                | 0.001<br>(0.004)                                 | 0.007<br>(0.005)                                 |
| Regime persistence    | 0.022**<br>(0.009)                                  | 0.027**<br>(0.008)                               | 0.028**<br>(0.009)                               | 0.022**<br>(0.007)                               |
| Alliance centrality   | 8.157<br>(5.924)                                    | 6.81e-18<br>(6.68e-04)                           | 0.228*<br>(0.106)                                | 0.032**<br>(0.009)                               |
| Trade centrality      | 5.606**<br>(0.929)                                  | 3.19e-19<br>(1.28e-17)                           | 0.244**<br>(0.085)                               | 0.015**<br>(0.018)                               |
| IGO centrality        | 1.563<br>(3.135)                                    | 2.45e-17<br>(0.135)                              | 0.097<br>(1.838)                                 | 0.027<br>(0.032)                                 |
| Constant              | -7.099**<br>(1.532)                                 | -4.532**<br>(0.518)                              | -5.147**<br>(0.550)                              | -5.376**<br>(0.613)                              |
| Model statistics      | N = 1,000<br>Rep = 100<br>R <sup>2</sup> = 0.621    | N = 1,000<br>Rep = 100<br>R <sup>2</sup> = 0.512 | N = 1,000<br>Rep = 100<br>R <sup>2</sup> = 0.578 | N = 1,000<br>Rep = 100<br>R <sup>2</sup> = 0.555 |
|                       | Maoz major/regional/minor power status <sup>b</sup> |                                                  |                                                  |                                                  |
|                       | Degree centrality                                   | Closeness centrality                             | Betweenness centrality                           | Eigenvector centrality                           |
| National capabilities | 53.676**<br>(9.166)                                 | 62.955**<br>(8.951)                              | 53.699**<br>(7.138)                              | 55.023**<br>(7.095)                              |
| Regime score          | 0.012*<br>(0.006)                                   | 0.023**<br>(0.004)                               | 0.021**<br>(0.005)                               | 0.025**<br>(0.005)                               |
| Regime persistence    | 0.008<br>(0.005)                                    | 0.007+<br>(0.004)                                | 0.013**<br>(0.005)                               | 0.009*<br>(0.005)                                |
| Alliance centrality   | 11.135**<br>(3.720)                                 | -0.006<br>(0.009)                                | 0.232**<br>(0.079)                               | 0.025**<br>(0.007)                               |
| Trade centrality      | 3.349**<br>(0.827)                                  | -1.07e-19<br>(1.05e-17)                          | 0.184**<br>(0.054)                               | 0.011<br>(0.010)                                 |
| IGO centrality        | 5.670+<br>(3.195)                                   | 5.73e-18<br>(0.132)                              | 0.191<br>(0.934)                                 | 0.006<br>(0.024)                                 |
| Constant 1            | 7.266**<br>(1.335)                                  | 3.809**<br>(0.456)                               | 4.460**<br>(0.353)                               | 4.555**<br>(0.478)                               |
| Constant 2            | 9.240**<br>(1.402)                                  | 5.696**<br>(0.585)                               | 6.528**<br>(0.505)                               | 6.420**<br>(0.557)                               |
| Model statistics      | N = 1,000<br>Rep = 100<br>R <sup>2</sup> = 0.534    | N = 1,000<br>Rep = 100<br>R <sup>2</sup> = 0.505 | N = 1,000<br>Rep = 100<br>R <sup>2</sup> = 0.520 | N = 1,000<br>Rep = 100<br>R <sup>2</sup> = 0.498 |

Notes: Data are bootstrapped into samples of 1,000 observations randomly drawn from the 13,019 cases (with replacement). Each logit regression was run 200 times. Results are the robust parameter estimates (standard errors in parentheses) of these runs.

<sup>a</sup> Binary logit <sup>b</sup> Ordered logit

+  $p < 0.10$ ; \*  $p < 0.05$ ; \*\*  $p < 0.01$ .

the results in Table 7.4 also suggest that both alliance centrality and trade centrality are fairly good predictors of the status of states as ascribed to them by scholars.<sup>9</sup> The fact that institutional status does not predict a state's reputational ranking is interesting but not surprising. This supports one aspect of the realist conception of the role of international institutions, while, simultaneously, refuting another. Specifically, this result supports the argument that institutions do not play an important role in the shaping of international politics (Mearsheimer, 1994/5). Apparently major powers do not care all that much about their institutional prestige. However, realists also argue that international institutions are a mere reflection of the distribution of power. These results suggest that this is hardly the case.

### 4.3. Status and Peaceful Influence

We now turn to an analysis of the relationship between a states' network prestige and their ability to get their way in the United Nations General Assembly. The chapter appendix discusses important methodological issues concerning the data and measurement, as well as the logic of the control variables that are used in this analysis. Table 7.5 presents the results.

The results in Table 7.5 are self-evident in some respects but highly surprising in others. First, past performance in UN voting is a powerful predictor of present success. This is due to block behavior – especially among Third World states (Kim and Russett, 1996). This is neither a surprising nor a novel result. A second, also not surprising, result is that national capabilities have a consistent effect on voting success: Stronger states tend to do better than weaker states. There is a catch, however. The reputational status of states apparently does not matter, or if it does, it has a negative effect on voting success. Specifically, regional powers do not do better than minor powers; major powers tend to do less well than minor powers.<sup>10</sup>

<sup>9</sup> Because the insertion of the trade-based centrality indices reduces the sampling space, alliance degree centrality does not have a statistically significant effect on COW reputational status. However, once we expand the sample to cover the entire 1816–2001 span, alliance degree centrality has now a significant effect on COW major/minor power status at the  $p < .001$  level.

<sup>10</sup> A methodological note is in order here. There is a moderately high correlation between the binary variable of major power and capabilities ( $r = 0.698$ ,  $p < .01$ ), but it is not high enough to eliminate the negative effect of major power status on voting success. Alternative specifications omitting the capability variable or using the COW reputational status variable produced similar results: reputational status either has no effect or has a negative effect on voting success. A simple analysis of variance shows that the average voting success of minor powers was 67.7 percent, that of regional powers was 64.5 percent (not significantly different from minor powers), and that of major powers was only 48.2 percent (significantly lower than both minor and regional powers).

Table 7.5. *Network centrality and peaceful influence: time-series cross-sectional analysis of UN General Assembly voting outcomes, 1946–2001*

| Independent variable    | Network centrality index                                           |                                                                    |                                                                    |                                                                    |
|-------------------------|--------------------------------------------------------------------|--------------------------------------------------------------------|--------------------------------------------------------------------|--------------------------------------------------------------------|
|                         | Degree centrality                                                  | Closeness centrality                                               | Betweenness centrality                                             | Eigenvector centrality                                             |
| Pct. win ( <i>t</i> -1) | 0.650**<br>(0.010)                                                 | 0.700**<br>(0.009)                                                 | 0.692**<br>(0.009)                                                 | 0.697**<br>(0.009)                                                 |
| National capabilities   | 1.722**<br>(0.288)                                                 | 1.462**<br>(0.289)                                                 | 1.461**<br>(0.288)                                                 | 1.388**<br>(0.292)                                                 |
| Regime score            | 1.18e-04<br>(8.02e-05)                                             | 6.44e-05<br>(8.06e-05)                                             | 4.90e-05<br>(8.09e-05)                                             | 9.76e-05<br>(8.18e-05)                                             |
| No. states in SRG       | -2.01e-04<br>(1.38e-04)                                            | -1.245e-04<br>(1.39e-04)                                           | -1.18e-04<br>(1.39e-04)                                            | -8.82e-05<br>(1.39e-04)                                            |
| Alliance centrality     | -0.017<br>(0.147)                                                  | -4.78e-20<br>(2.48e-20)                                            | -0.003*<br>(0.001)                                                 | -0.002*<br>(0.001)                                                 |
| Trade centrality        | 0.122**<br>(0.023)                                                 | -3.75e-20<br>(2.11e-20)                                            | 0.006**<br>(0.002)                                                 | 9.86e-04*<br>(4.67e-04)                                            |
| IGO centrality          | 0.336**<br>(0.033)                                                 | 2.48e-20<br>(9.53e-20)                                             | -0.159**<br>(0.040)                                                | 0.002*<br>(7.88e-04)                                               |
| Regional power          | -0.019<br>(0.017)                                                  | 0.001<br>(0.017)                                                   | 1.84e-04<br>(0.017)                                                | 0.007<br>(0.018)                                                   |
| Major power             | -0.209**<br>(0.061)                                                | -0.164**<br>(0.061)                                                | -0.149*<br>(0.061)                                                 | -0.152*<br>(0.061)                                                 |
| Constant                | 0.095**<br>(0.012)                                                 | 0.202**<br>(0.007)                                                 | 0.206**<br>(0.007)                                                 | 0.188**<br>(0.011)                                                 |
| Model statistics        | N = 5,380<br>States = 191<br>F = 708.0**<br>R <sup>2</sup> = 0.674 | N = 5,380<br>States = 191<br>F = 676.0**<br>R <sup>2</sup> = 0.703 | N = 5,380<br>States = 191<br>F = 680.9**<br>R <sup>2</sup> = 0.706 | N = 5,380<br>States = 191<br>F = 678.0**<br>R <sup>2</sup> = 0.697 |

\*  $p < 0.10$ ; \*  $p < 0.05$ ; \*\*  $p < 0.01$ .

A state's regime score and its number of enemies do not have a significant effect on its voting success. This may come as surprise to some but as no surprise to others. What is important for the key subject of our analysis is that we cannot find consistent support for the proposition that network centrality positively affects voting success. Trade centrality seems to be the only fairly consistent predictor of voting success. Alliance centrality tends to have either a nonsignificant or a negative effect on a state's performance in UN roll-calls. IGO degree centrality has a positive effect on its voting performance, but IGO betweenness centrality negatively affects this performance. The proposition suggesting a linkage between prestige

and peaceful influence receives only weak and conditional support. The answer to the question whether prestigious states influence outcomes of international organizations depends on how one conceptualizes prestige. Different measures of prestige and status yield quite different answers. The bottom line is that we cannot find a consistent and significant effect of network-related prestige on peaceful influence, at least not when measuring voting success in the UN General Assembly.

#### **4.4. Status Inconsistency and International Conflict Across Levels of Analysis**

One important implication of the analysis of the relationships between centrality and reputational status is the possibility that there may be fundamental discrepancies between the power-based pecking order of states and their reputational status. This brings us to the analysis of the hypotheses linking status inconsistency to conflict behavior. The results of these analyses at the state and dyadic levels are displayed in [Table 7.6](#).

The results of [Table 7.6](#) show that, controlling for other variables that are commonly said to affect the conflict behavior of states (and that have already been analyzed in previous chapters), the degree of a state's status inconsistency has a significant and robust impact the probability that it will initiate conflict or that it will otherwise get involved in MIDs and wars. Concomitantly, the minimum level of status inconsistency in a dyad also affects the probability of a MID or war outbreak. These results support propositions ACP8 and ACP9. It seems that as states become increasingly dissatisfied with the gap between their acquired capability-related status and their prestige (measured by various centrality indices), they become increasingly likely to fight. When one or both members of a politically relevant dyad become status inconsistent, the probability of conflict in the dyad rises by as much as 35 percent.

We now turn to an analysis of the effect of systemic levels of status inconsistency on the extent of conflict in the international system as a whole. This is given in [Table 7.7](#).

The results of the analysis shown in [Table 7.7](#) suggest that status inconsistency increases both the absolute magnitude and duration of systemic conflict, as well as the proportion of the states in the system that are engaged in such conflict. The breakdown of the entire period into the two centuries reveals that status inconsistency has a positive effect on conflict in the nineteenth century and on MIDs during the twentieth century. The results of these analyses suggest that – although less than fully robust with respect to time and dependent variables – status inconsistency tends to increase the magnitude and frequency of international conflict. This provides support to proposition ACP10.

Table 7.6. *Status inconsistency and conflict involvement, 1816–2001: percent change in the probability of conflict as a function of change in independent variable*<sup>11</sup>

| Independent variable         | Monadic analysis   |        |         |            | Dyadic analysis              |            |         |         |            |
|------------------------------|--------------------|--------|---------|------------|------------------------------|------------|---------|---------|------------|
|                              | Initiation         | MIDs   | War     | Escalation | Independent variable         | Initiation | MIDs    | War     | Escalation |
| Regime score                 | 4.82% <sup>a</sup> | -0.33% | 10.60%  | 2.51%      | Minimum regime score         | -22.96%    | -20.83% | -42.58% | -14.21%    |
| No. states in SRG            | 9.30% <sup>b</sup> | 11.36% | 1.46%   | -12.04%    | Capability ratio             | -4.82%     | -4.17%  | -64.18% | -4.64%     |
| Prop. democracies in SRG     | -0.89%             | -2.50% | -29.92% | -18.68%    | distance                     | -93.80%    | -58.83% | -7.94%  | 19.86%     |
| Major power                  | 94.79%             | 78.93% | 47.58%  | 29.23%     | SRG members?                 | 592.82%    | 506.23% | 349.55% | -5.28%     |
| Regional power               | 68.57%             | 50.70% | 54.51%  | 31.57%     |                              |            |         |         |            |
| Status inconsistency         | 38.70%             | 47.23% | 92.44%  | 52.93%     | Min. status inconsistency    | 86.95%     | 78.14%  | 132.12% | 44.47%     |
| Baseline prob. dep. variable | 16.19%             | 22.34% | 1.86%   | 19.56%     | Baseline prob. dep. variable | 0.38%      | 0.93%   | 0.01%   | 14.53%     |

<sup>11</sup> Results reflect percent change in the probability of occurrence of the dependent variable as a function of a shift from the 20th percentile to the 80th percentile value of the independent variable. For binary independent variables, results reflect the effect of change from one level of the independent variable to the maximum level. Statistically significant effects are bold faced. The actual results of these analyses are given in the book's website.

Table 7.7. *Status inconsistency and systemic conflict, 1816–2001: two-stage least squares analysis*

| 1st Stage Dep. Variable  | Status inconsistency |                     |                     |
|--------------------------|----------------------|---------------------|---------------------|
|                          | 1816–2001            | 1816–1899           | 1900–2001           |
| Independent Variable     |                      |                     |                     |
| Prop. Dem. Cliques       | 0.882**<br>(0.124)   | 0.498*<br>(0.220)   | –0.209<br>(0.245)   |
| Capability Concentration | –4.327**<br>(0.595)  | –7.307**<br>(1.853) | –4.116**<br>(0.677) |
| No. Major Powers         | –0.001<br>(0.001)    | –0.054<br>(0.030)   | –0.026<br>(0.018)   |
| No. States               | 0.007<br>(0.013)     | 0.017**<br>(0.003)  | –0.003**<br>(0.001) |
| Constant                 | 1.791**<br>(0.268)   | 2.493**<br>(0.782)  | 2.390**<br>(0.384)  |
| Model Statistics         |                      |                     |                     |
| N                        | 185                  | 84                  | 101                 |
| F                        | 46.810**             | 68.990**            | 22.300**            |
| Adj. R-Squared           | 0.605                | 0.801               | 0.613               |

| Period                            | Entire Period: 1816–2001 |                       |                       |                     |                     |                     | Prop. MIDs        |                     | Prop. Wars          |                     |
|-----------------------------------|--------------------------|-----------------------|-----------------------|---------------------|---------------------|---------------------|-------------------|---------------------|---------------------|---------------------|
|                                   | 2nd Stage Dep. Variable  | No. MIDs              | No. Wars              | Escalation          | Prop. MIDs          | Prop. wars          | 19th Century      | 20th Century        | 19th Century        | 20th Century        |
| Status inconsistency <sup>a</sup> |                          | 53.465**<br>(14.751)  | 23.185**<br>(6.942)   | 0.215**<br>(0.147)  | 1.319**<br>(0.326)  | 0.480**<br>(0.156)  | 0.297*<br>(0.181) | 2.074**<br>(0.794)  | 0.224<br>(0.136)    | 0.369<br>(0.302)    |
| Capability concentration          |                          | 202.450**<br>(40.415) | 108.796**<br>(22.358) | 1.613**<br>(0.397)  | 4.878**<br>(0.898)  | 2.109**<br>(0.476)  | 1.125<br>(1.452)  | 6.300**<br>(1.819)  | 1.758*<br>(0.642)   | 1.803**<br>(0.734)  |
| Prop. dem. cliques                |                          | -41.195**<br>(16.223) | -20.258**<br>(7.069)  | -0.219<br>(0.178)   | -0.921**<br>(0.336) | -0.387*<br>(0.150)  | -0.185<br>(0.295) | -0.420**<br>(0.095) | -0.155**<br>(0.002) | -0.551**<br>(0.194) |
| Lagged no. MIDs                   |                          | 0.696**<br>(0.097)    | 0.240**<br>(0.044)    | 0.002*<br>(0.001)   | 0.014**<br>(0.002)  | 0.004**<br>(0.001)  | 0.003<br>(0.004)  | 0.014**<br>(0.003)  | 0.002*<br>(0.001)   | 0.004**<br>(0.001)  |
| Constant                          |                          | -80.212**<br>(16.825) | -42.149**<br>(9.211)  | -0.444**<br>(0.166) | -1.870**<br>(0.383) | -0.813**<br>(0.200) | -0.302<br>(0.533) | -2.942*<br>(1.227)  | -0.636**<br>(0.239) | -0.541<br>(0.477)   |
| Model statistics                  |                          |                       |                       |                     |                     |                     |                   |                     |                     |                     |
| N                                 |                          | 185                   | 185                   | 185                 | 185                 | 185                 | 84                | 101                 | 84                  | 101                 |
| F                                 |                          | 127.55**              | 40.84**               | 25.45**             | 91.08**             | 31.13**             | 11.59*            | 54.47**             | 11.42*              | 65.77**             |
| R-squared                         |                          | 0.383                 | 0.140                 | 0.089               | 0.187               | 0.039               | 0.001             | 0.129               | 0.001               | 0.277               |

<sup>a</sup> Endogenized — See first stage equation.

\*\*  $p < .01$ ; \*  $p < .05$ ; +  $p < .10$ .

I defer discussion of the effect of control variables on measures of systemic conflict to Chapter 8, especially the discussion of democratic cliques, which captures an important space in the study of democratic networks. It is worth noting, however, that the proportion of democratic cliques – SRG cliques dominated by democratic states – has a consistent and robust dampening effect on the level of systemic conflict. We will come back to this point. For now, however, we note that the effect of status inconsistency on conflict receives consistent support at the national and dyadic levels of analysis. The propositions linking status inconsistency to conflict at the systemic level also receive fairly consistent support.

### 5. Conclusion: Does It Pay to Be Important?

This chapter focused on the relative standing of states in cooperative networks, defined in terms of different conceptions of centrality. It examined the factors that affect this standing. It then explored the effects of status and reputation on both peaceful influence and on conflict behavior. Several interesting and perhaps counterintuitive findings emerge.

1. *There is a consistent spillover effect of a state's centrality ranking across some cooperative networks.* Trade and IGO centrality consistently affect the alliance centrality of states. Alliance – and to a lesser extent – IGO centrality significantly affect states' trade centrality. This adds another layer to the results reported in [Chapter 6](#) about spillover effects across different types of cooperative networks.
2. *States' prestige, defined in terms of different indicators of network centrality affects their international status, but this effect is neither consistent nor robust.* The network-related centrality of states is not a powerful predictor of their status as a minor, regional, or major power. Surprisingly, trade centrality, which indicates an economic position within the system, is a far better indicator of a state's reputational ranking than its position within security (i.e., alliance) networks. Institutional position is not a valid predictor of a state's reputational ranking.

So, does it pay to be important? Does a central or strategically important position within different networks translate into peaceful influence? Does a central position within a network substitute for the need to use force?

3. *States' network centrality does not consistently affect their ability to exert influence in international organizations.* The ability



to get one's preferences in UN General Assembly resolutions depends on the specific indicator of network centrality and the specific network in question. However, neither indicators of network centrality nor a specific network position have a consistent effect on the state's ability to exert peaceful influence. It is interesting to note, in this context, one specific result: namely, the negative effect of a state's alliance eigenvector centrality on its voting results. The fact that a state is connected to powerful allies actually reduces the probability that voting results would match its preferences. This is somewhat counterintuitive. Yet, on second thought, it is not surprising. States with many and powerful allies tend to pursue policies and take positions that are globally unpopular. Some of them can also disproportionately get their way in the UN Security Council by virtue of their veto power. The UN General Assembly is the only arena in which weak, nonaligned states, or states with few and sparsely connected allies can offset this excessive influence of the powerful and centrally positioned powers.

4. *The status of states within cooperative networks can be both a source of peace and a source of conflict.* States with network-based status that exceeds or matches their power-based status tend to be less likely to resort to forceful influence attempts. States whose power exceeds their network-based status are likely to be far more belligerent. This applies to dyadic relations as well. Dyads composed of one or more status-inconsistent states are far more likely to experience conflict than status-satisfied dyads or dyads made up of states whose prestige exceeds their power status.
5. *The frequency and magnitude of conflict in the international system is affected by the systemic level of status inconsistency.* As the gaps between the power-based ranking of states and their ranking based on their centrality in cooperative network widens, the level of systemic conflict increases. The correlation between status inconsistency and absolute levels of conflict again suggests that the relative position of states in cooperative networks can be both a source of conflict and a source of international peace. This has important implications for theories of international politics in general, and of international security, in particular.

These points suggest that having high prestige – in the sense of obtaining high centrality scores in cooperative networks – may have contradictory implications. Network-related status does not always translate into peaceful influence. At the same time, high prestige (whether it is accompanied by high or low capability) tends to dampen the propensity

to use force. In previous chapters, we have emphasized the fact that some network structures seem to have pacifying effects. The findings of the present chapter seem to qualify these arguments. At the same time, the relationships between status inconsistency and conflict suggest that structural features of cooperative networks do not always form consistent effects across levels of analysis. What occurs at one level of analysis does not always generalize (either through aggregation of units' traits and behaviors or through decomposition of entire structures into distinct elements) to other levels of analysis. This is what we call the levels-of-analysis problem in international relations (Ray, 2001). It is also the principal puzzle explored in the next two chapters.

## Methodological Appendix to Chapter 7

### Data Sources and Empirical Domain

The data for this chapter, with one notable exception, are the same as those used in previous chapters. The empirical domain is also generally the same: All states over the period of 1816–2001 (for alliance and IGO networks) and over the 1870–2001 period (for trade networks).

The new dataset employed in this chapter is the UN General Assembly Roll Call dataset compiled originally by Erik Gartzke (Gartzke, 1998) and updated by Erik Voeten (Voeten, 2004). The dataset contains voting records of all members of the United Nations across all UN resolutions over the 1946–2003 period. In some future uses of this dataset, it could be viewed as a set of affiliational networks, such that each year is seen as an  $n \times k$  matrix with  $n$  rows (states) and  $k$  columns (resolutions). However, since the coding of each vote is nominal and contains multiple categories (“aye,” “nay,” “abstain,” “not present”), one would need to convert each of these affiliational matrices in some ways so that a sociomatrix conversion of these matrices would produce meaningful entries. Here, the measurement of UN voting outcomes is done differently, as explained in the following sections.

*Measures of centrality.* All measures of centrality are based on conventional SNA indices of centrality. They were all discussed in Chapter 2.

In the data used for this chapter, the alliance and IGO networks are defined as valued networks. The alliance network is defined by the level of commitment entailed in a given alliance. The commitment score of a given dyad is defined in Chapter 2. The IGO network is based on the normalized proportion of joint IGO memberships (normalization is done on the basis of each state's IGO membership as a baseline) as defined in the appendix to Chapter 5. The IGO network is asymmetric.

Trade networks were binarized for the extraction of centrality scores. The rationale for that is straightforward. The maximum values for

alliance and IGO networks are meaningful. A maximum level of commitment in an alliance setting, or a maximum level of IGO overlap between two states has a substantive meaning. In contrast, trade is a function of a given economy. No society trades all it produces. The extent to which one state trades with other states depends on a wide array of factors, including the size of the economy, the nature of the commodities produced, internal and external demand for those commodities, international market prices, and government policy, to name just a few. Therefore, maximum values of trade within a given network are not interpretable in a global fashion. This implies that centrality scores cannot be meaningfully interpreted. Consequently, I binarized the trade network such that any export of commodities from state  $i$  to state  $j$  that exceeds one tenth of one percent of the former's GDP is assigned a value of 1 and zero otherwise. Centrality scores are then extracted from the binarized trade networks.

*International status.* As noted, I use two reputational status coding of states: the COW typology and the Maoz (1996) typology. The COW typology, originally developed by Singer and Small (1972), relies on "the consensus of diplomatic historians." States are designated as either major powers or minor powers. There are no specific operational criteria for determining what makes a given state a major power at a given point in time. The Maoz (1996) typology uses the three criteria: national capabilities, span of interests, and "reach capacity," that is, the capacity to project significant military forces over distance. The reach capacity criterion implies that several states that are designated as major powers in the COW typology are "demoted" to the role of regional powers. The same criterion elevates some minor powers to the role of regional powers. Table A3.2 (in the book's Website) compares the list of major/regional powers as they appear in the two typologies.

*UN voting outcomes.* I assume that UN voting is sincere, that is, it reflects true preferences (Gartzke, 2000). Accordingly, I count a voting success for a given resolution as a match between the state's vote on this resolution and the outcome of the resolution. I code success as 1 if a state voted aye and the resolution carried, or if it voted nay and the resolution fell through. All other votes, abstentions, or no show cases are coded as zero. For every given state and every given year voting outcome is measured as the proportion of successful votes to the total number of resolutions for that year.

### Independent and Control Variables

The key independent variable used in this chapter and not defined in previous chapters is that of *status inconsistency*. Status inconsistency is defined as the discrepancy between a state's acquired status by virtue of its national capabilities and its ascribed status, measured as an average

of its incoming centrality scores across the three networks. Specifically, status inconsistency is measured as

$$SI_i = \left[ r(CINC_i) - \frac{1}{3} \sum_{r=1}^3 r(ICENT_{ir}) \right] / n \quad [7.1]$$

where  $r(CINC_i)$  is state's relative ranking in the system in terms of its national capabilities index (CINC), and  $r(ICENT_{ir})$  is the state's average relative ranking over the three networks examined in this chapter: alliances, trade, and IGOs, and  $n$  is the number of states.<sup>12</sup> A state is said to be highly status-inconsistent to the extent that its capability-based rank is much higher than its average centrality rank. This corresponds to the measurement of this concept in other studies on this subject that were cited in the chapter.

*Systemic status inconsistency.* I employ two measures of systemic status inconsistency. The first is the correlation, across all states in the system at a given year, between the relative ranking of states on CINC scores and their relative ranking on an average centrality score across the three networks: alliances, trade, and IGOs. Relative centrality ranking of a state is given by:

$$CENTR_{ic} = \frac{\frac{1}{3} \sum_{q=1}^3 R_{iq}}{n} = \frac{\sum_{q=1}^3 R_{iq}}{3n} \quad [7.2]$$

where  $q$  is a network index (alliance, trade, IGO),  $R$  is the centrality rank (most central state receives a score of  $n$ , second most central receives a score of  $n-1$ , and so forth). The numerator of this ratio is therefore the average centrality ranking of a state across different networks. Normalization by the number of states in the system at a given year puts this index between zero and 1 and controls for the size of the system. This allows comparability of the status-inconsistency index over time. We then compute the Spearman correlation coefficient between a state's CINC rank and its CENTR. This index reflects the degree of consistency between power rank and the average centrality rank of the states in the system. To reflect *status inconsistency*, the Spearman  $\rho$  is multiplied by  $-1$ . (High values of this index reflect high inconsistency, and negative values reflect high consistency.)

<sup>12</sup> Ranks are inverted such that in a system with  $n$  states, the highest-rank state receives a rank of  $n$  and the lowest-ranked state receives a score of 1. Tied ranks receive the midpoint between the top and bottom rank such that for any  $k$  states that have the same rank at a given level, their rank is defined as  $r_i = \sum_k r_{it} / k$  where  $r_{it}$  is the rank of a given state in a seemingly non-tied series. Thus, for example, if states  $i, j, k$ , and  $l$  are tied at ranks 4–7 in the series, their rank will be 5.5.

### Control Variables

*Regime persistence.* This variable is simply the number of years a given regime was in place within a given state. A regime change constitutes a change in the type of governmental institutions as well as in the relationship between the government and society (corresponding to the three regime types – democracy, anocracy, and autocracy). Thus, a revolution that topples a government but does not change the type of regime does not constitute a regime change (e.g., the Iranian Revolution of 1979 is not a regime change because it moved Iran from one type of authoritarian political system to another). A regime change that is accomplished through ordered transfer of power from one type of government to another counts as a regime change (e.g., the transfer of power in Argentina in 1983 from the military junta to the democratically elected Alfonsín).

*Capability concentration (CAPCON).* I use the Singer-Bremer-Stuckey (1972) capability concentration index – measured over all states in the interstate system (Maoz, 2006b). This measure is defined as

$$CAPCON = \sqrt{\frac{\sum_{i=1}^N cinc_i^2 - 1/n}{1 - 1/n}} \quad [7.3]$$

*Number of major powers.* The number of COW major powers in the system.

*Proportion of democratic cliques.* I defer a more detailed discussion of this index to the next chapter. Briefly, the operational definition of this variable is the proportion of SRG cliques that have a majority of democratic state members.

### Estimation

1. *Estimates of alliance and trade centrality.* Some of the methods used in this chapter differ from the ones used in previous chapters. Given the spillover findings in Chapter 6, it is clear that an endogeneity problem is probable. Consequently, the estimates of analyses that use alliance and trade centrality as dependent variables consisted of instrumental variables time-series cross-sectional regressions. In each such analysis, the endogenous variables were estimated independently using instrumental variables as well as the typical covariates. The instrumental variable for trade centrality as an endogenous variable was per capita GDP. The instrumental variable for alliance as an endogenous variable was lagged CINC score. The results given in Tables 6.2 and 6.3

treat the trade centrality (in Table 7.2) and the alliance centrality (in Table 7.3) scores as endogenous variables.

2. *Estimation of major/regional/minor power status.* The key problem in attempting to estimate the effect of various centrality indices on the major/regional/minor power status of states is that in most cases there is little or no variation of the dependent variable within a series. For example, the United Kingdom is designated as a major power throughout the 1816–2001 period. (This applies both to the COW designation and to the Maoz designation.) Many minor powers remain minor powers throughout their history. In order to test both within-state variation and between-state variation in ascribed status, I used bootstrapped sampling. Specifically, I extracted 200 random samples of size 1,000 (of about 8–10% of the state-year population) and then regressed the international status of the state-years that came up in the sample on the covariates shown in Table 7.4. The analysis in each iteration is then a simple logit analysis. The sampling distribution of the parameter estimates and the robust standard errors is then used as the estimates of the effects of covariates on the dependent variables (major/regional/minor power status). For the COW designation of states as major/minor powers, a simple binary logit analysis was applied. The estimation of the Maoz major/regional/minor power designation relied on ordinal logit analysis.
3. *Estimation of UN General Assembly voting outcomes.* These are based on fixed-effects time-series cross-sectional regressions with lagged dependent variables. Past performance in the UNGA has substantive meaning; it does not only reflect high autocorrelation. A more detailed analysis of the determinants of UN voting performance is required, in which trends in voting are specifically modeled. This, however, is not of primary interest here. Therefore rather than dismissing past success as merely a statistical artifact, I introduce it as an explicit control variable in the estimated equations.
4. *Estimation of status inconsistency and conflict.* This issue requires some discussion. Early analyses using status inconsistency as an explanatory variable in studies of deviant or aggressive behavior in sociology were sharply criticized by methodologists (e.g., Blalock, 1966, 1967; Hope, 1975). The key argument was that status inconsistency was endogenous. However, there are no simple solutions for the endogeneity problem. The jury is still out on how to best estimate status inconsistency (e.g., Hembroff, 1983; Whitt, 1984; Brown, Crester, and Lasswell, 1988; Zhang, 2008). My approach is to assume that status inconsistency is an endogenous variable that is accounted for by other variables.

Accordingly, in Table 7.6 and 7.7, I use instrumental variable regressions (probit models in Table 7.6 and two-stage least squares in Table 7.7). In the tabular appendix on the book's Web site, I present a number of alternative analyses for the systemic level based on autoregressive Poisson. The results shown in Table 7.6 reflect the percent increase in the probability of conflict as a result of a shift of the independent variable from its 20th to its 80th percentile (or from its minimum to its maximum value for binary independent variables), when all other variables are fixed at their mean. For that purpose, too, I rely on the *Clarify* program (Tomz, Wittenberg, and King, 2001).





## Part III

### *The Implications of the Networked International Politics Theory*



## *Democratic Networks: Resolving the Democratic Peace Paradox*

### 1. Introduction

The popularity of the democratic peace research program is probably second to none in contemporary international relations research.<sup>1</sup> Much of this popularity (and the program's controversial nature) is due to the finding that democracies are unlikely to engage each other in short-of-war militarized disputes and almost never fight one another in full-scale wars. However, this result overshadows an important paradox that is summarized by the three following empirical statements:

1. Democracies are about as conflict prone as nondemocracies.
2. Democracies rarely clash with one another in militarized disputes and almost never fight one another in full-scale war.
3. The proportion of democracies in the international system is either unrelated, or positively related, to the amount of systemic conflict.

These empirical statements are supported by the analyses in [Table 8.1](#).<sup>2</sup>

The data in [Table 8.1](#) provide fairly convincing evidence for what I label as the *democratic peace paradox*: The relationship between democracy and peace exhibits a fundamental instability across levels of analysis.

<sup>1</sup> A search in the Web of Science since 1980 yielded 839 entries with the phrase "democratic peace" in the title or the abstract. A search in Google Scholar for the same period yielded 7,190 entries.

<sup>2</sup> There is some disagreement on the monadic (state-level) and systemic-level relationship between democracy and peace. Some (e.g., Ray, 1995; Benoit, 1996; Rousseau et al., 1996; Rioux, 1998) suggest that democracies are significantly less conflict-prone than other regimes. Gleditsch and Hegre (1997) suggest a curvilinear relationship between the proportion of democracies and the rate of conflict in the international system. The results in [Table 8.1](#) corroborate the bulk of the literature on the subject (Small and Singer, 1976; Maoz and Abdolali, 1989; Pickering, 2002; Chiozza and Ghoemans, 2003) suggesting cross level of analysis discrepancies in the relationship between regime type and conflict. The methodological issues pertaining to this table are discussed in the appendix.

Table 8.1. *The level-of-analysis puzzle and the democratic peace: relationship between democracy and conflict at different levels of analysis, 1816–2001*

| Democracy measure                                                                     | Dependent variable                 | Parameter estimate | $p \leq$ (two tailed) | No. of cases |
|---------------------------------------------------------------------------------------|------------------------------------|--------------------|-----------------------|--------------|
| <b>National level of analysis: unit of observation – nation-year</b>                  |                                    |                    |                       |              |
| Regime score                                                                          | Dispute involvements               | –0.007             | 0.430                 | 12,291       |
|                                                                                       | War involvements                   | –0.013             | 0.155                 | 12,291       |
|                                                                                       | Dispute initiation                 | –0.001             | 0.371                 | 12,291       |
|                                                                                       | No. disputes as target             | 0.001              | 0.146                 | 12,291       |
| <b>Dyadic level of analysis: unit of observation – dyad-year (all possible dyads)</b> |                                    |                    |                       |              |
| Joint-democracy                                                                       | No. dispute involvements per year* | 0.932              | 0.000                 | 728,639      |
|                                                                                       | No. war involvements per year*     | 0.935              | 0.000                 | 728,639      |
| <b>Dyadic level of analysis: dyad-year (politically relevant dyads)</b>               |                                    |                    |                       |              |
| Joint-democracy                                                                       | No. dispute involvements per year* | 0.834              | 0.000                 | 91,699       |
|                                                                                       | New dispute involvements per year* | 0.864              | 0.000                 | 91,699       |
| <b>Systemic level of analysis: Year</b>                                               |                                    |                    |                       |              |
| Proportion democratic states in system                                                | No. dispute dyads per year**       | 0.602              | 0.000                 | 186          |
|                                                                                       | No. wars underway per year         | 0.104              | 0.160                 | 186          |
| Avg. regime score in system                                                           | No. dispute dyads per year**       | 0.586              | 0.001                 | 186          |
|                                                                                       | No. wars underway per year         | 0.188              | 0.010                 | 186          |

\* Correlations are modified  $m_b$  coefficients defined in Chapter 4 below. Significance scores are based on the Chi-Square distribution. Positive coefficients indicate results consistent with the democratic peace expectations.

\*\* Correlations are standardized regression coefficient in Poisson or OLS time-series regression controlling for serial correlation.

Virtually none of the correlations between regime score and conflict is statistically significant at the monadic level. On the other hand, the dyadic results clearly sustain the dyadic democratic peace proposition. The system-level findings exhibit both statistically insignificant and *positive* correlations between democracy and conflict. These inconsistencies across levels of analysis are not a mere intellectual puzzle; they carry important theoretical and policy implications.

Some scholars describe the democratic peace proposition as “the closest thing to a law of international relations” (Levy, 1988). Yet, the evidence implies that this proposition has, in fact, limited generalizability. Unfortunately, most studies of the democratic peace focus on the dyadic level of analysis. The few general studies on the subject find the kind of levels-of-analysis disconnect that Table 8.1 suggests (e.g., Maoz and Abdolali, 1989; Bennett and Stam, 2004). Without a meaningful

explanation that accounts for the entirety of the relationships between democracy and conflict across levels of analysis, the democratic peace result is just a result without much substantive theoretical import. It is far from a “law” of international relations.

The policy implications of this paradox are even more significant. Policy makers have bought the democratic peace “law,”<sup>3</sup> using it to promote (sometimes through violence) global democratization. In many cases, political leaders inverted the dyadic democratic peace from a sufficient condition of peace (war does not occur if both states are democracies) to a necessary condition of peace (peace cannot be maintained unless the two states are democracies).<sup>4</sup> President Clinton made democratization one of the pillars of U.S. foreign policy in the 1990s. President Bush converted this into a proactive goal of his administration, thus justifying the two wars waged by the United States since 2001 (Miller, 2010). Even politicians who use the democratic peace proposition in a logical manner tend to misinterpret it, often generalizing from the dyadic level to the systemic one. Yet, without a proper explanation of this paradox, it is not evident that the quest for global democratization is indeed the key to world peace.

This chapter develops and tests a network-based explanation of the democratic peace paradox. Using the SRG concept as a foundation, I develop the democratic networks model. I derive from this model propositions establishing a relationship between democracy and peace across levels of analysis. Section 3 tests these propositions empirically. Section 4 assesses the implications of the findings for the theory and practice of world politics. The data and methodology are discussed in the chapter appendix.

## 2. Democratic Networks and International Conflict

The democratic networks model relies on the assumptions of the normative explanation of the democratic peace (Maoz and Russett, 1993: 625; Dixon, 1993, 1994; Doyle, 1983, 1986).

1. States externalize the norms of behavior that are developed within, and characterize their domestic political processes and institutions, yet
2. The anarchic nature of international politics implies that a clash between democratic and nondemocratic norms is dominated by the latter, rather than the former.

<sup>3</sup> See Brown, Lynn-Jones, and Miller (1996), Maoz (1998); Mansfield and Snyder (1995). See also the references to the democratic peace issue in the UN Millennium Conference (Maoz, 2004) for examples of political uses of the democratic peace.

<sup>4</sup> See, for example, Sharansky (2006).

These assumptions suggest that all states are driven by security-related concerns. Yet, these concerns have different effects on different states. Following the arguments of NIP theory about network formation, democracies have a selective perception of their SRGs. They tend to treat nondemocratic members of their SRGs as potential enemies, just as nondemocratic states do. However, democracies tend to apply norms of cooperation and compromise and to utilize peaceful resolution methods in their dealings with other democracies. This is due to anticipation of the principles that guide the behavior of other states in international interactions (Bueno de Mesquita and Lalman, 1992). Democracies expect other democracies to be *prima facie* cooperative, even if they are past enemies (or allies of enemies). In contrast, democracies perceive the behavior of nondemocratic states to be based on conflictual and competitive norms, no matter whom they interact with.

Since the relationship between internal and external norms is common knowledge, there is no reason for democracies to expect nondemocratic states to be cooperative. Even if a nondemocratic state wants to behave as a “liberal” state would, it is not expected to do so by members of its SRG. Thus, typical strategic spirals (Jervis, 1976) follow.

The democratic networks model contends that democratization induces spillover effects. The evolutionary theory of cooperation (Axelrod, 1984; Axelrod and Hamilton, 1981) is a useful metaphor for understanding this process. Axelrod attempted to find which strategies do well – relative to other strategies – in iterative plays of the Prisoner’s Dilemma, a game that depicts the fundamental paradox of cooperation among rational egoists. He distinguishes between “nice” strategies – which are never the first to defect – and “mean” strategies – which might defect first. As a general rule, a cooperative strategy is effective against other nice strategies, but it is not very effective against a “meanie” because the latter could exploit it. Hence, when confronted with defection, effective nice strategies retaliate by defection, lest they perish in an anarchic environment. Axelrod’s analysis suggests that effective strategies have five principal attributes:

1. They are relatively transparent. One can identify the kind of strategy against which one is playing fairly early in the process.
2. They are forgiving. They do not hold grudges for a long time. If one has defected for a certain amount of time and then switched to cooperation, he/she would be rewarded almost immediately for the switch.
3. They are quick to punish. They retaliate quickly against defection.
4. They are difficult (or impossible) to penetrate. A given counter-strategy cannot cause successful strategies to change. They do not adapt to their opponent’s strategies.

5. They have the capacity to penetrate other strategies. An effective nice strategy causes some of the mean strategies to revert to cooperation in order to survive.

The TIT-FOR-TAT strategy, which is considered the most effective long-term strategy in an iterated Prisoner's Dilemma game, epitomizes all five properties. It is based on a very simple principle. It starts by cooperating in the first iteration and then emulates its opponent's previous move throughout the game. Because it combines all five of the effective properties just named, strategies that confront TIT-FOR-TAT need to adapt to its "idiosyncrasies" if they want to do well, or they are done in.

The democratic networks model works along similar lines. Democracies usually allow other states to enjoy the benefit of the doubt when interaction starts, but if the opponent tries to exploit them, they are quick to react. Now, if the SRG of a given democracy is dominated by states that attempt to exploit cooperation, democratic norms cannot be externalized. However, if, and as long as, other states play by the same rules, cooperation can emerge. Hence, there needs to be a critical mass of states that apply democratic norms to affect conflict levels within a strategic reference subset of the network.

To understand the impact of democratization on the entire system, consider [Figure 8.1](#). This figure displays two stages in the lifetime of a strategic reference network, where ties (bidirectional arrows) indicate strategic relevance. This network consists of four strategic reference cliques, as shown in the table below stage I. Clique 1 is composed of six states (and fifteen dyads), one of which is a democracy. Clique 2 has also six states, of which three are democracies, and so forth. On the whole, only one-ninth of the interaction opportunities in the network are jointly democratic. In stage II, state 6 has become a democracy. The centrality of this state (it is a member of all four cliques) causes its democratization to have a significant impact on the system. Now almost a third of all interaction opportunities are jointly democratic, more than twice the number of jointly democratic interaction opportunities in stage I. However, the impact of democratization varies across cliques. It has no effect on the interactions in Clique 3, a marginal effect on the interactions in Clique 1, a substantial effect on Clique 2, and a profound effect on Clique 4. If state 1 – instead of state 6 – converts to democracy, it is easy to ascertain that this would have little impact on the system.

This evolutionary process suggests the following story. Two political factors determine the manner in which a state interacts with its environment: (a) the regime type of the focal state and (b) the regime type of the states that make up its SRG. This implies that the pacifying spillover effects of democratization depend not only on *how many* states democratize, but also on *who* democratizes. Democratization of strategically

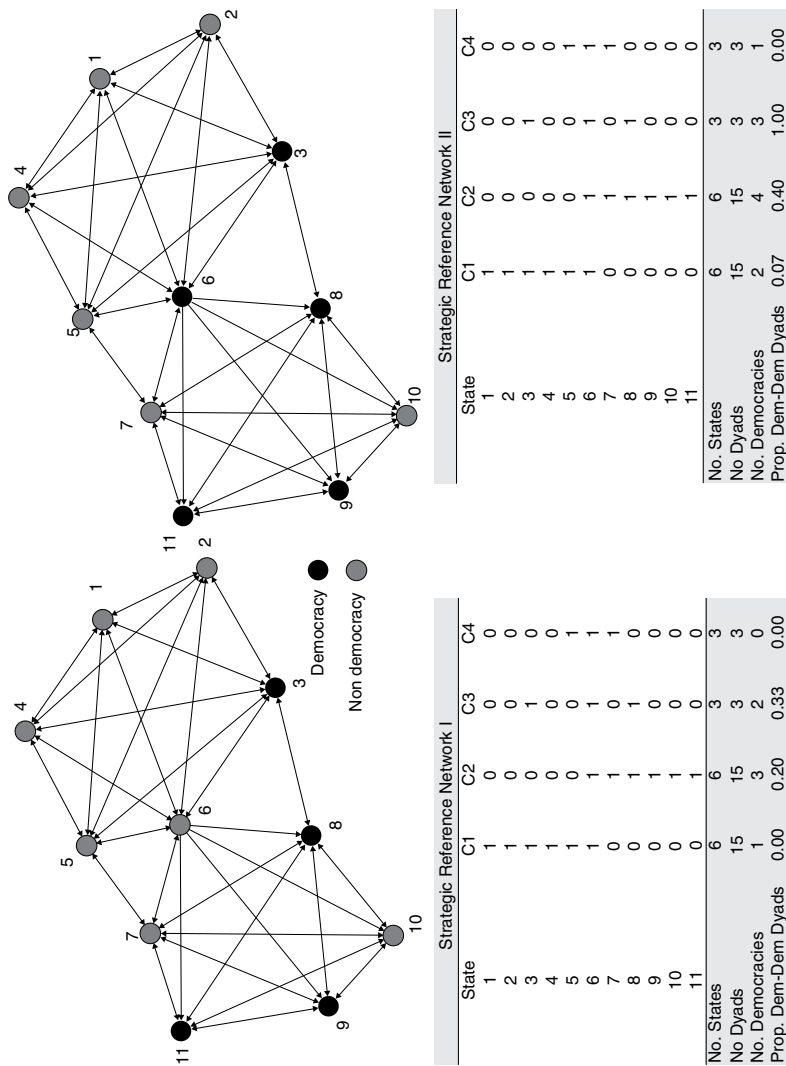


Figure 8.1. Strategically relevant networks and democratization – two hypothetical examples.



marginal states has little effect on systemic conflict, even if such states dampen conflict in the strategic reference cliques to which they belong. Democratizing states with geo-strategic ties to many other states have profound impact both on specific subsystems and on the system as a whole, even if their effects on some of the cliques to which they belong are quite limited.

The democratic networks model has several implications. First, it connects states to their security environment. It maintains that the “invasion” of a critical mass of democracies into highly contentious cliques generates spillover effects within and across cliques.

Second, to establish a consistent relationship between democracy and peace across levels of analysis, we need to look at an intermediate level – the strategic reference clique – that lies between the dyadic and the systemic level. This requires examining the effects of democracy and democratization on strategic reference cliques. Such cliques are characterized by frequent conflicts between members. If the spillover effect of democracy and democratization is meaningful, then it should first operate within these cliques. This is not only a new – endogenous – level of analysis; it also constitutes a litmus test of the democratic peace proposition as a whole. The spillover effects of democratization are most meaningful in settings that are, *ex ante*, most immune to such effects.

Third, at the systemic level, the democratic networks model departs from the expectation that higher proportions of democratic states should reduce global conflict. This model asserts that isolated democratization may not lead to reduction of systemic conflict. Many democracies concentrated in one clique, or democracies that constitute a small minority in their respective strategic reference cliques do not have a dampening effect on systemic conflict. Rather, it is the proportion of democratically dominated strategic reference cliques that affects global levels of peace. As an increasingly large number of strategic reference cliques come to be dominated by democracies, levels of global conflict are expected to decline. These propositions thus follow:

- DN1. The higher the proportion of democracies in the strategic egonet (the SRG) of a democracy, the less likely is the state to initiate or become involved in international conflict.
- DN2. The proportion of democracies in the egonet of a non-democratic state has no impact on its conflict-initiation or involvement patterns.<sup>5</sup>

<sup>5</sup> These hypotheses bear some resemblance to Gleditsch's (2002a: 89–118), but the focus in the present study is on a combination of geographical and functional elements of SRGs. The operationalization of the variables and the definition of levels of analysis is also different.

- DN3. The joint regime of a dyad and the level of d in its respective SRGs have a negative impact on the probability of dyadic conflict.
- DN4. The level of democratization (the average regime score or the proportion of democratic states) in a given strategic reference clique has a dampening effect on the magnitude of conflict within the clique.
- DN5. The higher the proportion of strategic reference cliques that have a majority of democratic states as members, the lower the frequency and severity of international conflict in the system as a whole.
- DN6. The higher the proportion of networked democracies in strategic reference cliques (that is, the number of democracies within strategic reference cliques to the size of such cliques), the lower the frequency and severity of systemic conflict.

Taken together, these propositions offer an explanation that extends the democratic peace proposition from the national to the systemic level. Democratic states apply norms of peaceful conflict resolution when they believe that their partners would reciprocate. When the strategic environment of democratic states becomes increasingly conducive for such norms, they are less likely to apply violent solutions to international problems. As strategic reference cliques – typical hotbeds of conflict – become increasingly democratized, zones of peace tend to emerge (Kacowicz, 1995, 1998; Archer, 1996; Singer and Wildavsky, 1993; Gleditsch, 2002a). Finally, democratization of such cliques tends to reduce global levels of conflict. When democratization occurs outside of such clique structures, it will have little or no effect on systemic stability. I turn to the empirical analysis of these ideas.

### 3. Results

I start the democratic networks model at the national level of analysis. Table 8.2 displays the effect of democratic networks on state behavior.<sup>6</sup>

The leftmost column in each block of Table 8.2 displays the baseline effects on states' conflict behavior. As I showed in Chapter 4, the size of the SRG raises the probability of dispute initiation by the focal state.<sup>7</sup>

<sup>6</sup> The results displayed here are based on all states with SRGs consisting of at least two members. This is designed to make the SRG-related measures meaningful. Analyses of the conflict behavior of states – regardless of the size of the SRG – yielded generally similar results. Table 8.2 presents the effects of the independent and control variables as changes in the probability of conflict. The book's website contains the full tables.

<sup>7</sup> Note that the results of this table differ slightly from a similar set of analyses conducted in Chapter 4. The reason for that is the focus here on state-years in which the focal state's SRG is composed of two or more members.

Table 8.2. *The effect of SRG structure on national conflict behavior, 1816–2001*<sup>a</sup>

| Independent variable                          | MID initiation       |                      |                      | War involvement      |                      |                      |                      |                      |
|-----------------------------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
|                                               | Baseline model       | All states           | Non-Democracies      | Democracies          | Baseline model       | All states           | Non-Democracies      | Democracies          |
| No. of states in SRG                          | 16.5% <sup>**</sup>  | 17.6% <sup>**</sup>  | 14.3% <sup>**</sup>  | 29.1% <sup>**</sup>  | 8.6% <sup>**</sup>   | 26.0% <sup>**</sup>  | 24.3% <sup>**</sup>  | 17.1% <sup>**</sup>  |
| Capability ratio state/SRG                    | 0.1%                 | 0.1%                 | 0.0%                 | 0.4%                 | -0.3%                | -0.3%                | -0.1%                | -2.0%                |
| Proportion of allies in SRG                   | -14.5% <sup>**</sup> | -11.8% <sup>**</sup> | -13.5% <sup>**</sup> | -2.4%                | -25.7% <sup>**</sup> | -19.1% <sup>**</sup> | -28.9% <sup>**</sup> | -6.05%               |
| Regime score                                  | -                    | 23.4% <sup>**</sup>  | 9.5%                 | -9.1% <sup>+</sup>   | -                    | 42.9% <sup>**</sup>  | 50.2% <sup>*</sup>   | 3.1%                 |
| Average regime score in SRG                   | -                    | -11.2% <sup>**</sup> | -8.8% <sup>*</sup>   | -13.1% <sup>*</sup>  | -                    | -62.9% <sup>**</sup> | -91.5% <sup>*</sup>  | -63.0% <sup>*</sup>  |
| Regime × (pct. democs in SRG)                 | -                    | -11.2% <sup>**</sup> | -9.9% <sup>*</sup>   | -19.8% <sup>**</sup> | -                    | -28.6% <sup>**</sup> | -34.0% <sup>**</sup> | -53.7% <sup>**</sup> |
| Baseline probability of conflict <sup>b</sup> | 31.4% <sup>**</sup>  | 31.3%                | 29.4%                | 37.4%                | 3.5%                 | 3.5%                 | 2.35%                | 4.0%                 |

<sup>a</sup> Entries in the table reflect percent change in the baseline probability of conflict (listed in the bottom row), as a function of the shift of the independent variable from its 20th percentile to its 80th percentile value, leaving all other variables at their mean.

<sup>b</sup> Baseline probabilities of conflict are not the actual relative frequencies of conflict in the data, but rather simulated baseline probabilities of conflict when all independent variables are at their mean.

<sup>\*\*</sup>  $p \leq .01$ ; <sup>\*</sup>  $.01 < p \leq .05$ ; <sup>+</sup>  $.05 < p < .10$ .

Large SRGs also raise the probability that the focal state will be involved in all-out wars. At the same time, the proportion of SRG members that form alliances with the focal state tends to dampen the probability of both MID initiation and war involvement. The most noticeable result in these analyses is that the regime structure of a state's SRG consistently reduces its conflict involvement. Likewise, the interaction between a state's regime and the political structure of its SRG also reduces its propensity for MID initiation and war involvement. Surprisingly, (see DN2), the level of SRG democratization dampens the probability conflict for democratic and non-democratic states alike. This suggests that the democratic networks spill-over effect is even stronger than the theory expects. Yet, in line with the democratic networks explanation, the dampening effect of SRG democratization on the conflict behavior of democracies is more pronounced than its effect on the conflict behavior of nondemocratic states.

These results suggest that the level of democracy in the SRG of democratic states has a consistently dampening effect on their conflict behavior. However, the results obtained for the nondemocratic sample require some clarification.

The regime score of nondemocratic states ranges from -100 (absolute totalitarianism) to about +29 (low democracy), with an average of -27 (low authoritarianism). The mean interaction score between a state's regime and the level of SRG democratization is -4.45 (with a standard deviation of 12.16). However, the range between authoritarianism and democracy is a nonlinear. High authoritarianism (regime scores of -25 or less) or high democracy (regime scores of 30 and higher) form well-defined political structures. States with regime scores ranging between -25 and +30 are *anocracies*. An anocracy can be either a state possessing mixed features of democracy and authoritarianism (for example, a constitutional monarchy with very restricted separation of powers, such as England in the early nineteenth century), or a state undergoing significant political changes with weak or ineffective political institutions (e.g., states in civil wars, collapsed states).

For nondemocratic states, a high value of the interaction between regime score and level of SRG democratization may mean one of two things: First, that a highly authoritarian state is facing a strategic environment with few democracies. In such cases, the negative impact of the regime  $\times$  SRG regime interaction could be interpreted to mean that authoritarian states feel less threatened when their environment is not infiltrated by democracies. Second, a high score on the interaction between a regime and the democratization of its SRG may mean that a state that democratizes (with a regime score that is positive but below the democracy threshold) faces a highly democratized SRG. Here, the decline in the probability of dispute initiation is consistent with the democratic networks model. A test of these two cases suggests that the first

interpretation holds. Autocracies feel highly challenged by the democratization of their SRGs and tend to respond to such environments with a relatively high probability of the use of force.<sup>8</sup>

This result offers a fundamentally different, and considerably more nuanced, image than previous studies (e.g., Mansfield and Snyder, 1995, 2006) of the effect of democratization on the conflict behavior of nations. These studies suggest that democratization breeds conflict. The instability of the democratizing regime often prompts political elites to establish legitimacy through diversionary tactics. These arguments were challenged by several studies (e.g., Thompson and Tucker, 1997; Maoz, 1998; Gleditsch and Ward, 2001). My argument was that the definition of democratization in those studies consisted – in most cases – of transition processes from authoritarianism to anocracy. The results of Mansfield and Snyder indicated, in fact, that political instability breeds external conflict. The transition of states from nondemocratic regimes – autocracies or anocracies – to full-fledged democracies is typically peaceful and dampens the probability of conflict involvement. The findings of the present study tend to support this argument.

These results suggest that the monadic element of the democratic peace is consistent with the democratic networks model. We now turn to the dyadic aspect of the democratic networks explanation. This analysis, shown in Table 8.3 resembles scores of other analyses of the dyadic democratic peace. The novelty of the current results compared to other analyses of the dyadic democratic peace is that they reveal the effects of SRG structures on the probability of dyadic conflict.

The results shown in Table 8.3 are consistent with the expectations of the theory. Most control variables significantly affect the probability of dyadic MIDs and wars in a manner consistent with previous dyadic analyses (Maoz and Russett, 1993; Bremer, 1992, 1993; Russett and Oneal, 2001). The effect of the minimum regime score of the dyad on the probability of conflict is also consistently negative. However, this analysis adds two significant elements to the results reported in other studies: First, the regime score in the SRGs of states making up the dyad has a negative effect on the probability of conflict in the general population. SRG democratization also has a dampening effect on the probability of conflict between democratic states. Second, when the dyad is made up of mixed regime types or joint autocracies, SRG democratization actually increases the probability of war between dyad members.

<sup>8</sup> A separate set of logit analyses of the probability of conflict using an independent variable that assigns a state its SRG democratization score if the state is an autocracy, and zero otherwise reveal a significant positive effect of SRG democratization on the probability of MID initiation. This supports the first argument made above. The effect of democratization on the probability of conflict initiation by anocratic states is also statistically significant but less robust.

Table 8.3. *The dyadic democratic networks explanation – effects of regime type and SRG democratization on the probability of dyadic conflict – politically relevant dyads, 1816–2002<sup>a</sup>*

| Independent variable | Change in probability of dyadic conflict <sup>b</sup> |            |           |                 |            |           |                 |            |           |            |
|----------------------|-------------------------------------------------------|------------|-----------|-----------------|------------|-----------|-----------------|------------|-----------|------------|
|                      | Initiation                                            |            |           | MID involvement |            |           | War involvement |            |           | Escalation |
|                      | All dyads                                             | Non-democs | Democs    | All dyads       | Non-democs | Democs    | All dyads       | Non-democs | All dyads |            |
| Alliance?            | -17.67%**                                             | 2.3%       | 7.25%     | -23.05%**       | -19.66%**  | -19.20%** | -20.83%**       | -17.90%**  | -43.10%** |            |
| Distance             | -62.87%**                                             | -63.20%**  | -33.75%** | -71.33%**       | -80.36%**  | -21.36%** | -84.79%**       | -86.71%**  | -14.02%** |            |
| SRG?                 | 265.16%**                                             | 261.13%**  | 319.90%** | 339.29%**       | 333.49%**  | 378.43%** | 343.41%**       | 378.85%**  | 37.82%**  |            |
| Status state A       | 66.39%**                                              | 74.26%**   | 77.60%**  | 72.92%**        | 79.71%**   | 19.56%**  | 79.68%**        | 35.66%**   | 64.08%**  |            |
| Status state B       | 33.09%**                                              | 37.30%**   | 35.94%**  | 37.76%**        | 46.01%**   | 10.16%    | 52.78%**        | 39.69%**   | 28.62%**  |            |
| Minimum regime       | -21.12%**                                             | -7.61%     | -54.38%** | -20.36%**       | -4.02%     | -33.33%** | -37.11%**       | -15.47%**  | -22.17%** |            |
| Maximum regime       | 11.92%**                                              | 17.08%**   | -4.33%    | -               | -          | -         | -               | -          | -         |            |
| Min. regime in SRG   | -56.26%**                                             | 56.43%**   | -83.13%** | 29.93%**        | 33.67%**   | -72.68%** | -50.56%**       | -34.34%**  | -48.92%** |            |
| Baseline probability | 0.03                                                  | 0.03       | 0.01      | 0.07            | 0.07       | 0.02      | 0.01            | 0.01       | 10.93     |            |

<sup>a</sup> Table A8.3 in book's Web site reports the full analysis.

<sup>b</sup> Pct. change in the baseline probability of the dependent variable when the focal independent variable changes from its 20th percentile to its 80th percentile value and all other independent variables are at their mean level.

Recall the strong results concerning the effect of SRG democratization on the conflict behavior of individual states – suggesting that democratization in one’s strategic environment dampens the tendency of the state to fight regardless of whether the state is a democracy. These results have actually exceeded the theory’s expectations. In contrast, the dyadic analysis shows results that are consistent with the expectation of the theory: SRG democratization affects only the probability of conflict between democracies, but it has no significant effect on the probability of conflict in other types of politically relevant dyads.

The most interesting and novel aspect of the democratic networks model concerns the effect of democratization on strategic reference cliques. This level of analysis captures the notions of “security complexes” (Buzan, 1983), “security webs” (Rosh, 1988), or even the constructivist notion of Hobbesian culture (Wendt, 1999). This is an important test of the democratic networks explanation. Recall the argument that democracies have a pacifying spillover effect on their environments. If this argument is meaningful, then this effect should be tested in the kind of environments that are particularly prone to conflict. Strategic reference cliques are just those types of environments. The results of this analysis are given in Table 8.4.

These analyses suggest that democratization in strategic reference cliques has a significant and consistent pacifying effect. The only interesting exception to this result is that democratization raises the proportion of MIDs in strategic reference cliques that are made up of a vast majority of authoritarian states. However, in the same context, increased democratization in nondemocratic cliques reduces the likelihood of war and the proportion of MIDs that escalate to war. Overall, however, democratization seems to have a consistently pacifying effect in the population of strategic reference cliques as a whole, as well as in the subset of cliques dominated by democratic states.

The control variables also yield some interesting insights about conflict levels within strategic reference cliques.<sup>9</sup> First, consistent with most quantitative analyses on international conflict in the last two decades, the capability ratio of states in strategic reference cliques has a pacifying effect. When a given clique is made up of states having similar capabilities (regardless of whether they are equally powerful or equally weak), the number of MIDs and wars in the clique increases, and so does the proportion of MIDs that escalate into full-blown wars.

Interestingly, and largely in contrast to expectations, reputational status and alliances have contradictory effects on conflict levels within

<sup>9</sup> I do not discuss the effect of clique overlap on conflict because this variable is used primarily in order to control for clique dependence, and it has no real substantive interpretation.

Table 8.4. *The effect of democratization on strategic reference cliques – a clique-year analysis of all SR cliques, 1816–2001*

| Independent variable                         | Baseline model                                                          | All cliques                                                             | Nondemocratic cliques<br>(AVGREG≤0)                                   | Democratic cliques<br>(AVGREG>0)                                      |
|----------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------|-----------------------------------------------------------------------|
| <b>Proportion of MID dyads in clique</b>     |                                                                         |                                                                         |                                                                       |                                                                       |
| Degree of clique overlap with other cliques  | –0.015*<br>(0.001)                                                      | –0.014*<br>(0.001)                                                      | –0.010*<br>(0.002)                                                    | –0.013*<br>(0.001)                                                    |
| Prop. clique dyads in alliance               | 0.019**<br>(0.005)                                                      | 0.021**<br>(0.001)                                                      | 0.041**<br>(0.007)                                                    | 0.002<br>(0.007)                                                      |
| Average capability ratio across clique dyads | –9.28e–06*<br>(1.03e–06)                                                | –8.78e–06**<br>(1.04e–06)                                               | –1.35e–05**<br>(2.09e–06)                                             | –7.74e–06**<br>(1.13e–06)                                             |
| Prop. major/regional powers in clique        | 0.048**<br>(0.005)                                                      | 0.049**<br>(0.005)                                                      | 0.027**<br>(0.009)                                                    | 0.065**<br>(0.008)                                                    |
| Average regime score of clique               | –                                                                       | –1.6e–04**<br>(4.2e–05)                                                 | –                                                                     | –                                                                     |
| <b>Proportion democracies in clique</b>      |                                                                         |                                                                         |                                                                       |                                                                       |
| Constant                                     | –                                                                       | –                                                                       | 0.078**<br>(0.013)                                                    | –0.058**<br>(0.008)                                                   |
| Model statistics                             | 0.127**<br>(0.003)<br>N=29,447<br>Cliques = 834<br>$\chi^2=466.24^{**}$ | 0.115**<br>(0.003)<br>N=29,447<br>Cliques = 834<br>$\chi^2=535.92^{**}$ | 0.111**<br>(0.003)<br>N=15,826<br>Cliques=757<br>$\chi^2=126.84^{**}$ | 0.138**<br>(0.006)<br>N=13,536<br>Cliques=793<br>$\chi^2=517.52^{**}$ |
| <b>Proportion of war dyads in clique</b>     |                                                                         |                                                                         |                                                                       |                                                                       |
| Degree of clique overlap with other cliques  | 0.002**<br>(3.2e–04)                                                    | 0.003**<br>(3.3e–04)                                                    | 0.009**<br>(0.001)                                                    | 0.001*<br>(3.65e–04)                                                  |
| Prop. Clique dyads in alliance               | –0.027**<br>(0.002)                                                     | –0.026**<br>(0.002)                                                     | –0.033**<br>(0.002)                                                   | –0.023**<br>(0.002)                                                   |
| Average capability ratio across clique dyads | –2.60e–06*<br>(2.77e–07)                                                | –2.20e–06**<br>(2.71e–07)                                               | –4.51e–06**<br>(7.49e–07)                                             | –2.15e–06**<br>(2.67e–07)                                             |



|                                              |                                                                         |                                                                         |                                                                       |                                                                       |  |
|----------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------|-----------------------------------------------------------------------|--|
| Prop. major/regional powers in clique        |                                                                         |                                                                         |                                                                       |                                                                       |  |
| Average regime score of clique               | -0.006**<br>(0.002)                                                     | -0.005*<br>(0.002)                                                      | -0.016**<br>(0.003)                                                   | 0.007**<br>(0.003)                                                    |  |
|                                              | -                                                                       | -1.3e-04**<br>(1.6e-05)                                                 | -                                                                     | -                                                                     |  |
| Proportion democracies in clique             |                                                                         |                                                                         |                                                                       |                                                                       |  |
| Constant                                     | -                                                                       | -                                                                       | -0.005<br>(0.005)                                                     | -0.024**<br>(0.004)                                                   |  |
| Model statistics                             | 0.023**<br>(0.001)<br>N=29,447<br>Cliques = 834<br>$\chi^2=276.62^{**}$ | 0.022**<br>(0.001)<br>N=29,447<br>Cliques = 834<br>$\chi^2=324.47^{**}$ | 0.025**<br>(0.001)<br>N=15,826<br>Cliques=757<br>$\chi^2=253.30^{**}$ | 0.028**<br>(0.003)<br>N=13,536<br>Cliques=793<br>$\chi^2=122.14^{**}$ |  |
| Proportion of wars to MID's in clique        |                                                                         |                                                                         |                                                                       |                                                                       |  |
| Degree of clique overlap with other cliques  | 0.011**<br>(0.002)                                                      | 0.015**<br>(0.002)                                                      | 0.045*<br>(0.004)                                                     | 0.004*<br>(0.002)                                                     |  |
| Prop. clique dyads in alliance               | -0.192**<br>(0.010)                                                     | -0.187**<br>(0.010)                                                     | -0.280**<br>(0.014)                                                   | -0.107**<br>(0.014)                                                   |  |
| Average capability ratio across clique dyads | -1.20e-05**<br>(1.45e-06)                                               | -9.69e-06**<br>(1.35e-06)                                               | -2.33e-05**<br>(4.10e-06)                                             | -9.18e-06**<br>(1.48e-06)                                             |  |
| Prop. major/regional powers in clique        | -0.112**<br>(0.010)                                                     | -0.106**<br>(0.010)                                                     | -0.131**<br>(0.015)                                                   | -0.055**<br>(0.013)                                                   |  |
| Average regime score of clique               | -                                                                       | -0.001**<br>(7.7e-05)                                                   | -                                                                     | -                                                                     |  |
| Proportion democracies in clique             |                                                                         |                                                                         |                                                                       |                                                                       |  |
| Constant                                     | -                                                                       | -                                                                       | -0.119**<br>(0.021)                                                   | -0.066**<br>(0.015)                                                   |  |
| Model statistics                             | 0.172**<br>(0.006)<br>N=17,756<br>Cliques = 758<br>$\chi^2=475.44^{**}$ | 0.162**<br>(0.006)<br>N=17,756<br>Cliques = 758<br>$\chi^2=486.17^{**}$ | 0.189**<br>(0.009)<br>N=8,578<br>Cliques=629<br>$\chi^2=509.56^{**}$  | 0.149**<br>(0.011)<br>N=9,088<br>Cliques=697<br>$\chi^2=122.88^{**}$  |  |

strategic reference cliques. As the proportion of alliances within such cliques increases, the proportion of MIDs also increases. However, as more clique members are allied with each other, the probability of war declines, and so does the probability of escalation. The proportion of major or regional powers in a given strategic reference clique tends to increase the proportion of MID dyads in the clique but reduces the proportion of war dyads or the probability of escalation. Apparently, alliances and major/regional powers increase the proneness of states to engage in low-level conflict. At the same time, both alliances and major/regional powers tend to constrain escalation. This contradictory effect is not a central topic for the present chapter, but it calls for further research focusing on the clique level of analysis.

This analysis suggests that the increase in the size of strategic reference cliques and in the amount of conflict were offset in some of these cliques by the rise of democracy during the latter part of the century. The rate of conflict in strategic reference cliques with a majority of jointly democratic dyads was half the rate of conflict in those with few or no democratic dyads.

Given these results, we can now examine the effect of the regime structure of states in strategic reference cliques on the extent of conflict in the international system. Before going on to a statistical analysis of these sets of relationships, it is instructive to explore the evolution of the international system over time in terms of the number and characteristics of strategically relevant cliques. Figure 8.2 provides a brief glimpse into this issue.

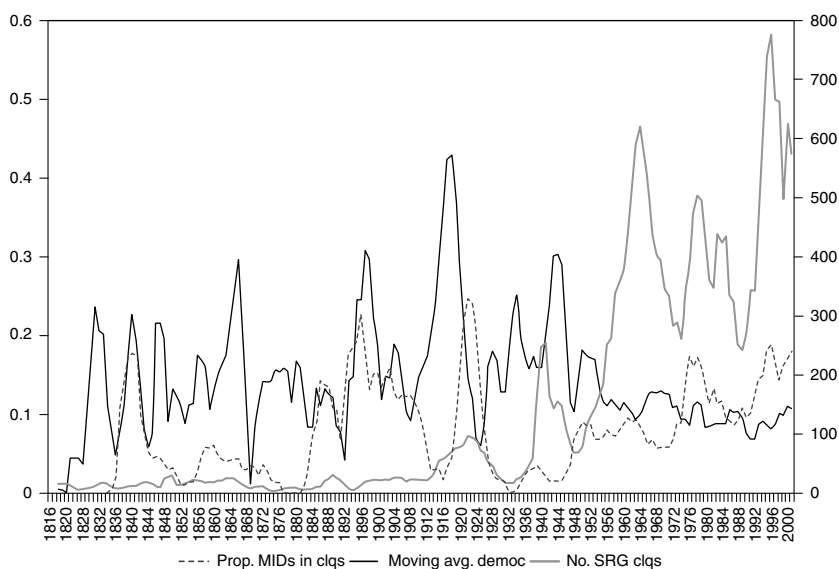


Figure 8.2. Strategic reference cliques and their attributes, 1816–2001.

*Note:* No. SRG cliques measured on right-hand Y-axis.

Figure 8.2 shows an upward trend in the number of strategic reference cliques over time.<sup>10</sup> This is not surprising given the size of the system. There is also a more moderate upward trend in the proportion of strategic reference cliques that have a majority of democratic states.<sup>11</sup> Yet, no obvious secular trend exists either in the proportion of MIDs, the proportion of wars, or the proportion of MID-to-war escalation strategic relevance cliques. What we are interested in, however, is how the nature and characteristics of these security complexes affected the overall level of conflict in the system. Did the proportion of democratic cliques – that is, strategic reference cliques dominated by democratic states – affect the level of conflict in the system as a whole? The answer to this question is shown in Table 8.5.

The results in Table 8.5 are generally consistent with the democratic networks model's expectations. The proportion of democracies in strategic reference cliques tends to systematically reduce the degree of conflict in the system. This is true for analyses covering either the entire 1816–2001 period or the twentieth century. The results for the nineteenth century are not statistically significant for any of the variables. The average proportion of strategic reference cliques that had a majority of democratic states in the nineteenth century was 0.01 percent, as opposed to an average of 7.5 percent of the cliques in the twentieth century.

The proportion of allied dyads in strategic reference networks had a positive effect on the number of MIDs and wars in the system, contrary to what the realist paradigm would have us believe. While the effects of alliances in SRG cliques on the level of systemic conflict is beyond the scope of the present study, this finding is consistent with the results of the clique-level analyses regarding the relationships between alliance networks and conflict. Capability concentration also had a positive effect on the number of MIDs and wars in the system. However, neither of these control variables had a robust effect on the dependent variables across measures of conflict and over time.

## 5. Conclusion

This chapter offers a systematic explanation of the level-of-analysis paradox of the democratic peace. The democratic networks model contends that democracies can express norms of peaceful conflict management when their

<sup>10</sup> An autoregressive Poisson analysis of the number of cliques on time yielded a highly significant time effect: No. Clqs =  $-37.51(1.262) + 0.022(0.0006)\text{Year} + 0.637(0.056)\text{AR}(1)$ ;  $F=652.81$ ;  $R^2 = 0.876$ .

<sup>11</sup> A time-series regression of the proportion of cliques that have a majority of democratic states in them on time yielded a significant but moderate effect: Prop. Dem. Clqs =  $-1.522(0.856) + 0.001(4.5\text{e-}04)\text{Year}$  ( $\rho = 0.679$ ; D-W statistic = 2.291;  $F = 4.37$ ;  $R^2 = 0.018$ ).

Table 8.5. *The effect of democratization in strategic reference cliques on systemic conflict: time-series analysis, 1816–2001*

| Independent variable                            | Number of MID dyads <sup>a</sup> |                               |                                | Proportion of MID dyads <sup>b</sup> |                               |                                |
|-------------------------------------------------|----------------------------------|-------------------------------|--------------------------------|--------------------------------------|-------------------------------|--------------------------------|
|                                                 | Entire period                    | 19th Century                  | 20th–21st Century              | Entire Period                        | 19th Century                  | 20th–21st Century              |
| No. of strategic reference cliques              | 0.001**<br>(4.61e–04)            | 0.031**<br>(0.007)            | 0.001**<br>(5.26e–04)          | 9.98e–05*<br>(5.54e–05)              |                               |                                |
| Capability concentration                        | 5.208**<br>(1.558)               | –8.552<br>(11.895)            | 4.341**<br>(1.718)             | 0.333<br>(0.321)                     | –0.007<br>(0.064)             | –0.014<br>(0.070)              |
| Prop. allies in politically relevant cliques    | 1.162*<br>(0.653)                | 2.551<br>(2.087)              | 2.123**<br>(0.822)             | –0.055<br>(0.086)                    | –0.007<br>(0.014)             | 0.024<br>(0.020)               |
| Avg. prop. major powers in sr cliques           | –0.011<br>(0.131)                | –0.216<br>(0.207)             | –0.011**<br>(0.004)            | 0.005<br>(0.011)                     |                               |                                |
| Prop. dem. dyads in strategic reference cliques | –2.447*<br>(1.051)               | 3.609<br>(3.055)              | –3.223**<br>(1.190)            | –0.159*<br>(0.077)                   | –0.048<br>(0.162)             | –0.009**<br>(0.002)            |
| AR(1)                                           | 0.662**<br>(0.075)               | 0.132<br>(0.117)              | 0.583**<br>(0.083)             | 0.601**<br>(0.115)                   | 0.050<br>(0.105)              | 0.024<br>(0.025)               |
| Constant                                        | –23.935*<br>(3.721)              | 3.998<br>(23.267)             | 23.654*<br>(9.156)             | 1.291*<br>(0.684)                    | 0.014<br>(0.025)              | 0.741**<br>(0.083)             |
|                                                 | N=184<br>R <sup>2</sup> =0.641   | N=83<br>R <sup>2</sup> =0.234 | N=101<br>R <sup>2</sup> =0.510 | N=185<br>R <sup>2</sup> =0.026       | N=83<br>R <sup>2</sup> =0.000 | N=101<br>R <sup>2</sup> =0.106 |

|                                                 | Number of War Dyads    | Proportion of War Dyads |
|-------------------------------------------------|------------------------|-------------------------|
| No. of strategic reference cliques              | -0.003*<br>(0.001)     | 7.25e-04<br>(0.002)     |
| Capability concentration                        | 8.589**<br>(3.156)     | 8.843*<br>(3.775)       |
| Prop. allies in politically relevant cliques    | 3.409*<br>(1.582)      | 0.006<br>(0.018)        |
| Avg. prop. major powers in SR cliques           | 12.923**<br>(3.118)    | 0.008<br>(0.012)        |
| Prop. dem. dyads in strategic reference cliques | -0.364<br>(0.249)      | 0.001<br>(0.006)        |
| AR(1)                                           | -8.928*<br>(3.939)     | -0.017**<br>(0.006)     |
| Constant                                        | 0.391**<br>(0.058)     | 0.002<br>(0.020)        |
|                                                 | -26.754**<br>(8.666)   | 0.499**<br>(0.082)      |
|                                                 | N = 183                | N = 83                  |
|                                                 | R <sup>2</sup> = 0.432 | R <sup>2</sup> = 0.011  |
|                                                 |                        | N = 185                 |
|                                                 |                        | N = 101                 |
|                                                 |                        | R <sup>2</sup> = 0.000  |
|                                                 |                        | R <sup>2</sup> = 0.029  |

<sup>a</sup> Poisson event count regression with correction for autocorrelation and overdispersion.

<sup>b</sup> Time-series regression with correction for autocorrelation.

<sup>c</sup> Model (F statistic) not statistically significant.

\* $p < 0.10$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ .

strategic reference group is highly democratic. However, when democracies face an undemocratic SRG, they adapt to the predominantly “realist” norms of their strategic environment. The democratization of strategic reference cliques induces a spillover effect, leading to significant reduction of both “local” (within cliques), and global (general systemic) levels of conflict.

What are the implications of the democratic networks explanation for peace and war in world politics? The most important conclusion is that it is not simply the *numeric spread* of democracy that makes a specific regional system or the global system more or less war prone. Rather, it is *where and how this spread takes place*. Certain patterns of regional or global democratization fundamentally alter the rules of interaction among members of strategic networks. This engenders a “normative” spillover both within these cliques and in the international system as a whole. Thus, the democratization of central members of the system – for example, Russia or China – will generate systemwide spillover. The democratization of Iraq may have regional effects in the Middle East, but its impact on the level of systemic conflict may be marginal at best. This is not only because the former states are far more powerful than the latter. Rather, it is because the geostrategic status and location of the former states makes them members in far more strategic reference cliques than the latter.

These results have significant implications for the future of war and peace in the international system. In several regional contexts, conflict and war will continue to decline as the democratic networks in these regions, which have grown and matured in recent years, and as democratic norms become dominant in determining the interactions among states. Latin America and the western hemisphere as a whole are likely to emerge as regions of increased stability. As democracy spreads to Central and Eastern Europe, ethnic and other tensions may well decline. Conflicts such as the clashes between Peru and Ecuador in the winter of 1995 may occasionally break out, but they are likely to be few, far between, and to entail limited violence.

Low-level conflict and high-intensity wars may well persist in regions where democratization is slow or when it takes place in non-networked patterns. The potential for conflict in Middle East, East and South Asia, and Africa is as great as ever and perhaps even growing, for reasons that are not typically strategic. In the absence of a pacifying force entailed in democratic networks, the future in these regions is quite bleak.

## Appendix to Chapter 8

### Levels of Analysis

I focus on four levels of analysis. At the monadic state level, I focus on the *state-year* observation. At the dyadic level, I use the *dyad-year*. The

system-year is the unit analyzed at the system level. All the variables are measured differently at each level of analysis, as specified below.

I introduce a new level of analysis: the clique-year. All variables are normalized by the number of dyads in each clique. The example in [Figure 8.1](#) displays four cliques (with considerable overlap of clique membership, a point to which I return below). The number of dyads in each clique is given in the third row from the bottom of the tables in that figure. The proportion of democratic dyads in each clique is given in the bottom row of the tables. Thus, if stage I of this figure represents one year, and stage II represents another year, then we have eight clique-year observations, four cliques for each year. I now discuss the operationalization of strategic reference cliques and their characteristics.

Using the definition of SRGs from [Chapter 4](#), I construct for each year a strategic reference network (**R**). Each entry  $r_{ij}$  receives the score of 1 if states  $i$  and  $j$  are in each other's SRG, and zero otherwise. This matrix is symmetric ( $r_{ij} = r_{ji}$ ). From this matrix, I derive all strategic reference cliques for that year, and write them in a  $n \times k$  clique affiliation matrix (**RC**). Rows in the **RC** matrix are states and columns represent cliques (see tables in [Figure 8.1](#)).

For some of the measures discussed below, I partition the **RC** matrix into a set of  $k$  vectors –  $\mathbf{RC}_1, \mathbf{RC}_2, \dots, \mathbf{RC}_k$  (each column is a separate vector). Each vector is then converted into an  $n \times n$  matrix by multiplying it by its transpose such that  $\mathbf{RC}_1 \hat{= \mathbf{RC}_1'}$ . This converts each clique into a subset of the network that consists of nonzero entries for its connected dyads and zeros for all other entries. Each of these matrices is matched with various attributes of the dyads making up the clique (e.g., whether or not they had a MID, whether they had an alliance, etc.).

## Measurement of Variables

The discussion below covers only the variables that have not been defined in [Chapter 2](#) or in the appendices of previous chapters.

### Dependent Variables

Conflict Measures:

- (1) The  $\mathbf{RC}_1$  matrix is multiplied elementwise by an  $n \times n$  MID/war matrix whose entries  $mid_{ij}/war_{ij}$  are one if states  $i$  and  $j$  had a MID/war during that year, and zero otherwise. The product matrix is summed over all of its elements and divided by the number of dyads making up this clique. This measures the proportion of dyads in any given strategic reference clique that were engaged in a MID/war at a given year. An escalation

variable is defined as the ratio of the MIDs in the clique that escalated into dyadic wars.

This set of measures entails a significant problem: the double counting of MIDs when dyads overlap across several cliques.<sup>12</sup> In order to ameliorate the possibly biasing effect of double-counting on the results I considered using the clique overlap matrix to eliminate overlapping dyadic MIDs/wars across cliques. However, this forces an arbitrary decision of which MID “belongs” to what clique. If two states are members of three cliques and have a MID, the rule must arbitrarily assign this dyad a conflict score of one in a specific clique and a conflict score of zero in all other cliques of which this dyad is a member. This does not provide an adequate solution to the problem. The solution I employ is twofold: First, in order to test the sensitivity of this result to cross-clique dependence due to double counting, I relied on bootstrapped sampling of the analyses at the clique level. This allowed resampling with repetition, reducing cross-clique overlap and thus, double counting, to a negligible minimum. The estimated coefficients and standard errors are then examined for stability across samples. The results of these analyses are presented in the book’s website.<sup>13</sup> The second strategy was to add a control variable that measures the average degree of overlap between the focal clique and all other cliques for that year. The assumption here is that the greater this overlap, the less likely are the other independent variables to affect the level of within-clique conflict. This provides a certain degree of control for double-counting on the dependent variable.<sup>14</sup>

- (2) *System-level conflict measures.* I employ two sets of measures: (a) the number of MIDs/wars per year, and (b) the proportion of the number of MIDs/wars to the number of politically relevant dyads for that year. The latter controls for the size of the relevant dyadic population of the system.

*Independent variables.* Most of the independent variables have already been discussed in previous chapters. Here, I focus on (a) newly defined variables, and (b) existing variables measured on a new level of analysis.

<sup>12</sup> For example, a MID between states 5 and 6 in Figure 8.1 is counted twice, once as a MID in clique 1 and once as a MID in clique 3.

<sup>13</sup> <http://psfacyu/ucdavis.edu/zmaoz/networksofnations.htm>.

<sup>14</sup> Yet a third strategy was to rerun the analyses only on cliques that exhibited low levels of inter-clique overlap. This set of analyses yielded a number of changes in the effects of the control variables on the level of inter-clique conflict. However, the effect of clique democratization on clique conflict remained significant and negative.



*Regime score.* All of the monadic and dyadic-level measures of regime scores, democracy score, SRG regime and democracy score, and dyadic regime and democracy scores were defined in the appendix to [Chapter 6](#). I discuss here the clique-related extensions of regime score measures.

*Average regime score of clique.* The average regime scores of states making up a strategic reference clique. Each clique vector is multiplied elementwise by a regime score vector of all states and averaged over clique members.

*Proportion of democracies in a SR clique.* This measure is obtained by multiplying elementwise an  $n \times 1$  binary democracy vector by the clique vector and dividing the result by the number of clique members.

*Proportion of democratic dyads in a SR clique.* This is the number of democratic-democratic dyads ( $SRDEM(SRDEM-1)/2$ ) divided by the number of dyads in the clique ( $SRDYG(SRDYG-1)/2$ ).

*Systemwide democratic network score.* This measure reflects the average level of democratization of strategic reference cliques in the system, by averaging the proportion of democracies over all cliques at any given year.

*Proportion of democratic cliques.* The proportion of strategic reference cliques that have a majority of democratic members.

### Control Variables

The control variables are specified by the baseline realist model of conflict in the appendix to [Chapter 6](#).

### Clique-Level Controls

*Degree of clique overlap.* This was mentioned above. The average degree of overlap in terms of membership between a given clique and all other cliques for that year.

*Proportion of clique dyads that have alliance ties.* Again, this measure is obtained by taking each of the clique membership vectors converted into matrices ( $\hat{C}_1, \hat{C}_2, \dots, \hat{C}_k$ ) and multiplying each matrix elementwise by a binary alliance matrix  $A_{n \times n}$  with entries  $a_{ij}=1$  if states  $i$  and  $j$  had an alliance and zero otherwise. The sum of the product matrix is divided by its dimension.

*Average capability ratio in clique.* This is the average capability ratio across all possible dyads in a clique. This measure is obtained by multiplying each clique membership matrix elementwise by a capability ratio matrix  $CR$  with entries  $cr_{ij}$  denoting the ratio of the capabilities of state  $i$  to the capabilities of state  $j$  and dividing the sum of this matrix by the number of dyads in the clique.

*Proportion of major/regional powers within clique.* The proportion of the states in a given clique that are either major or regional powers. (See definitions of these types of states in the appendix to [Chapter 4](#).)

### Systemic Controls

*Capability concentration (CAPCON).* I defined this measure in [Chapter 7](#).

*Average proportion of allies in strategic reference cliques.* The proportion of allied dyads in strategic reference cliques. If strategic cooperation – measured by alliance ties – is said to reduce conflict, then when a greater proportion of dyads in strategic reference cliques are allied, the level of conflict in the system is said to decline (Singer and Small, 1968; Oren, 1990).

*Average proportion of major/regional powers in strategic reference cliques.* Average, over all cliques for a given year, of the proportion of major or regional powers in SR cliques.

### Estimation

Since the democratic networks model rests upon a realist foundation, I start each state-level analysis by testing the realist baseline model. I then examine the contribution of the democratic networks model to the realist conception.

The baseline model to be tested at the state-level of analysis is given below.

$$MID_{it} = \alpha_i + \beta_1 SRG_{it} - \beta_2 CAPRAT_{it} - \beta_3 ALLIES_{it} + \beta_4 NOYRSPEACE_{it} + \sum_{k=5}^7 \beta_k SPLINE_k + \epsilon_i \quad [8.1]$$

where  $MID_{it}$  is assigned a score of 1 if state  $i$  initiated or was involved in a MID at year  $t$ ,  $SRG$  is the number of states in its strategic reference group (egonet),  $CAPRAT$  is the ratio of the state's capabilities to the sum of the capabilities of the states making up its  $SRG$ ,  $ALLIES$  is the number of states in one's  $SRG$  that have security alliances with the focal states,  $NOYRSPEACE$  and  $SPLINE$  are the number of years of peace and three cubic splines variables (Beck, Katz, and Tucker, 1998).

I then add to this model the regime score of a state and the regime score (proportion of democracies) of its  $SRG$ , as well as the interaction between a state's democracy score and its  $SRG$  regime score. This analysis is stratified by democratic/nondemocratic breakdown of states due to expected differences between democratic and other regimes in terms of their response to environmental structures.

The baseline model at the dyadic level for directed dyads is given in equation [8.2].

$$\begin{aligned}
MID_{ijt} = & \alpha_t - \beta_1 CAPRAT_{ijt} + \beta_2 NOSRG_{ijt} \\
& - \beta_3 ALLY_{ijt} - \beta_4 DISTANCE_{ijt} \\
& + \beta_5 STATUS_{it} + \beta_6 STATUS_{jt} \\
& - \beta_7 MINREGIME_{ijt} - \beta_8 MINSRGREG_{ijt} \\
& - \beta_9 PEACEYRS_{ijt} + \sum_{k=1}^t \beta_k SPLINE_k + \varepsilon_t
\end{aligned} \tag{8.2}$$

where  $MID_{ijt}$  is the initiation of a MID by state  $i$  against state  $j$  or the occurrence of a MID in the  $ij$  dyad at year  $t$ .  $CAPRAT$  is the capability ratio in the dyad,  $ALLY$  is the presence or absence of an alliance between members of the dyad,  $DISTANCE$  is the distance between capitals of the states in the dyad, status is the major  $\neq$  regional  $\neq$  minor power of each member of the dyad,  $MINSRGREG$  is the minimum average regime score of dyad members' respective SRGs, and peace years and splines are the same as for equation [8.1] (defined at the dyad-year level). I stratify the dyadic level of analysis into democratic/nondemocratic dyads.

When the dependent variable is MID initiation, I use a directed dyadic analysis. This is done over all dyads such that dyad  $ij$  is not equal to dyad  $ji$  (because any state in the dyad has the opportunity of initiating a MID against the other). When the dependent variable is MID/war involvement or escalation, I use a nondirected dyad sample in which  $d_{ij} = d_{ji}$ .

The clique level offers again a cross-sectional time-series design. However, the dependent variables are all measured on a ratio scale, thus requiring a simple cross-sectional time-series regression. Again, the baseline model for this level is.

$$\begin{aligned}
PRMID_{it} = & \alpha_t + \beta_1 OVRLP_{it} - \beta_2 PRALLY_{it} \\
& - \beta_3 CAPRAT_{it} + \beta_4 NOMAJORS_{it} + \varepsilon_{it}
\end{aligned} \tag{8.3}$$

where  $PRMID_{it}$  is the proportion of dyads in clique  $i$  experiencing a MID at year  $t$ ,  $OVRLP$  is a measure of average overlap between clique  $i$  and all other cliques of size 2 and above ( $j \neq i$ ) for year  $t$ . This controls for possible dependencies between clique  $i$  and the other cliques in the system during this year.  $PRALLY$  is the proportion of dyadic alliances.  $CAPRAT$  is the average capability ratio across dyads in clique  $i$  and  $NOMAJORS$  is the proportion of clique members that are major powers. Here, too, we add clique democratization indices (average regime score of clique members or proportion of democracies in the clique) as independent variables, thus testing whether democratization reduces the rate of conflict in strategically relevant cliques.

The system-level data have a longitudinal structure, thus I estimate it via a time-series regression with correction for serial correlation. The count nature of the dependent variables requires using Poisson time-series regression. When the dependent variables are measured as proportions (of states in MIDs/Wars), I use a simple time-series regression.

## *Interdependence and International Conflict: The Consequences of Strategic and Economic Networks*<sup>1</sup>

### 1. Introduction

This chapter focuses on structural implications of certain types of dependencies for the behavior of individual states, dyads, cliques, and systems. The key question concerns the extent to which strategic or economic interdependence affects patterns of international conflict. I also study whether the interdependence-conflict nexus is present across multiple levels of analysis. My approach to these questions is different than that taken in many studies of the subject, both within international relations and within network analysis. It represents several important innovations: First, it applies new strategies to tackle traditional ideas about influence in networks (e.g., Katz, 1953; Hubbell, 1965; Taylor, 1969). In particular, the ways in which I extend these indices are more consistent with international networks than are the more traditional approaches in SNA. Second, the novel measures of dependence and interdependence I developed and discussed in Chapter 2 allow assessment of interdependence across levels of analysis. Third, this approach allows measurement of interdependence across different types of exchange relations. Finally, it allows integration of interdependencies across multiple networks into a single set of measures.

As important as these methodological innovations may be, however, they are not the main focus of this chapter. Rather, the chapter seeks to explore the implications of strategic and economic interdependence for international relations. In particular, it examines the effects of

<sup>1</sup> This is a slightly modified version of an article entitled “The Effects of Strategic and Economic Interdependence on International Conflict across Levels of Analysis,” *American Journal of Political Science*, 53(1): 223–240 (January 2009), adapted with permission of the *American Journal of Political Science*. This version adds a comparative analysis of the interdependence measures I have developed here with the more traditional measures of influence that have been used in SNA as indices of centrality and dyadic influence.

interdependence on conflict across levels of analysis. Chapter 10 then examines differential rates of dependence and their implications for development and peace. Let us first introduce the key issues of the present chapter.

The concept of interdependence features prominently in the study of world politics. It is considered to be both a key trait of international relations and a factor affecting international outcomes. National survival and well-being depends on power and influence acquired and maintained by interaction (Barnett and Duvall, 2005). A large number of studies have examined the relationship between economic interdependence and dyadic conflict and cooperation. Yet, there is no agreement on the nature and direction of this relationship. Some of this disagreement stems from fundamental problems in the theoretical and empirical literatures.

Ideas about structural features of international politics are embedded in dependency theories (Wallerstein, 1974, 1979; Chase-Dunn and Robinson, 1977; Caporaso, 1978). These center on uneven levels of economic dependence and their impact on states' status and mobility. Most studies equate interdependence with economics and trade, but interdependence can take on different forms. Accordingly, the present chapter explores the following issues:

1. What are the different dimensions of dependence and interdependence in world politics?
2. How do the realist and liberal paradigms view the effects of economic and strategic interdependence on conflict at the state, dyadic and systemic levels of analysis?
3. How do the expectations of these paradigms stand up against empirical reality?

The next section explores different meanings of interdependence and some of the shortcomings of the literature on this topic.

## 2. Interdependence and World Politics – the State of the Art

Two common usages of interdependence pervade the literature. "Sensitivity interdependence" reflects the mutual effects of a relationship. "Vulnerability interdependence," is the opportunity cost of disrupting it (Keohane and Nye, 1987: 11–19; Baldwin, 1980: 486–487).

A review of the literature on international interdependence is beyond the scope of this chapter.<sup>2</sup> Much of this literature is focused on the growth

<sup>2</sup> Barbieri and Schneider (1999); Barbieri (2002: 4–48); Crescenzi (2005: 23–45); Mansfield and Pollins (2001; 2003) offer good reviews of this literature.

of interdependence and its various implications for world politics. One strand of this literature discusses the institutional aspects of interdependence. Specifically, interdependence is thought to be both a cause and an effect of institutionalization. Another aspect of this literature, which is the subject of Chapter 10, focuses on effects of unequal dependence on economic development and growth. Here, my focus is on the literature tying interdependence to matters of conflict and peace. These studies have contributed to our understanding of a number of aspects of world politics. Yet, they are marred by several problems.

1. *Interdependence as trade relations.* Most studies equate interdependence with trade relations. Conceptual discussions pay lip service to other forms of interdependence (e.g., Keohane and Nye, 1987: 9–10, 11–13; Baldwin, 1980: 481–483); but only a few empirical studies conceptualize and estimate other forms of interdependence. Yet, the nature and implications of changes in the international system require studying different types of exchange relations. Different forms of interdependence have a meaningful effect on the evolution of world politics; not all are economic. Therefore, we need to study how economic and security interdependence affect matters of war and peace.
2. *Disintegrated interdependence.* International interdependence may be multidimensional: Economic interdependence could be reinforced or offset by strategic or institutional ties. Unfortunately, there exists little research conceptualizing integrated interdependence in world politics.<sup>3</sup> Different paradigms have drastically different conceptions about the interdependence-peace linkage, covering multiple types of exchange. Integration of these different dimensions may allow for a more nuanced understanding of the effects of multidimensional interdependence on peace and war.
3. *Interdependence as dyadic relations.* Major theories hypothesize about the effects of interdependence at various levels of analysis. Political theorists (e.g., Rousseau, Adam Smith, Comte, and Kant) speculated about the effects of systemic interdependence on world peace. Realist conceptions about the effects of strategic interdependence are framed in systemic terms. Yet, most empirical investigations center on the dyadic effects of interdependence on conflict. This suggests a major disconnect between theory and empirical testing of the interdependence-conflict nexus. We do not know whether relations between interdependence and conflict are generalizable from the dyadic to other levels of analysis.

<sup>3</sup> Benson (2004) integrates security and trade similarity scores using a multidimensional scaling procedure, testing the effects of this integrated measure on conflict.

4. *First-order interdependence.* Most studies of interdependence and conflict focus on *direct* ties. However, interdependence may reflect both direct and *indirect* relations. A system is interdependent if a change in state *A*, which is tied to state *B*, which is tied to state *C*, causes a noticeable change in *C*, even though *A* and *C* do not have a direct relationship. Focusing only on direct ties ignores an enormously important feature of interdependence.

To overcome these problems, we need a general framework that: (a) conceptualizes and measures interdependence across different relationships (b) enables analysis of the causes and consequences of interdependence across levels of analysis, (c) captures both direct and indirect dependencies, and (d) allows for a multidimensional and integrative assessment of the effects of interdependence on conflict and cooperation. Before discussing this framework, I explore the linkages between dependence, interdependence, and international conflict in different paradigms of world politics.

### 3. Dependence, Interdependence, and International Conflict

Some of the central ideas about the relationship between interdependence and conflict date back to Machiavelli and Rousseau. Liberal hypotheses originate probably with Adam Smith, August Comte and Immanuel Kant. Neo-Marxists focus on the economic and political implications of structural dependence.

We must state at the outset that the relationship between interdependence and conflict may be recursive: Interdependence may affect conflict, but conflict may have an effect on interdependence across different relationships and at different levels. This study explores only the effect of interdependence on conflict for two reasons: First, this has been the focus in the literature over the last two decades. Second, the empirical record of such investigations was decidedly mixed. Subsequent research will explore possible recursive effects.<sup>4</sup>

<sup>4</sup> Criticisms of the trade-peace linkage include arguments that this relationship is due to simultaneous effects of conflict on trade (e.g., Keshk et al., 2004), or that it is due to endogeneity (i.e., peace causes trade which confounds the effect of trade on peace – Thompson, 1996). Others argue that the trade-peace linkage is mediated by Preferential Trade Agreements (Mansfield and Pevehouse, 2000) or by trade symmetry (Hegre, 2004). All criticisms, however, subsume an empirical relationship between interdependence and peace; without it, arguments about endogeneity or other confounding factors are fundamentally moot.

### 3.1. Realism and Interdependence

Alliances represent arguably the single most important expression of interdependence in political realism. Realists view alliances as a necessary evil; a means of safeguarding one's security that comes at a price of reduced autonomy (Walt, 1988; Morrow, 1991; Mearsheimer, 1994/5: 13). Machiavelli (1987 [1541]: 90) argues that "a prince must beware never to associate himself with someone more powerful than himself so as to attack [offend] others, except when necessity presses ... For when you win, you are left his prisoner, and *princes should avoid as much as they can being at the discretion of others.*" [Italics added.]

For Rousseau, strategic interdependence implies that even "the most frail man has more force for his own preservation than the most robust State has for its" (Rousseau, 2005 [1754]: 68). Interdependence is the source of security dilemmas (Hoffmann, 1965: 62–63; Knutsen, 1994: 250–253) and thus a key cause of conflict. World peace can exist only under "the ideal world of small, self-sufficient, self-centered states governed by the general will" (Hoffmann, 1965: 80), that is, only in a world composed of self-contained units avoiding contact with each other. Neorealists (e.g., Waltz, 1979; Mearsheimer, 2001) concur. In an anarchic world where contact is unavoidable, the greater the level of strategic interdependence, the more likely is the ever-present potential conflict to be converted into an actual reality of conflict.

What does this logic imply for the behavior of individual states? A state's strategic interdependence is typically a function of its alliance commitments. Alliances increase security through the pooling of resources. But they render members' choices contingent on their allies' choices or the actions of the allies' enemies (Maoz, 2000: 113; Morrow, 2000: 65; Snyder, 1997). Two seemingly contradictory mechanisms suggest that strategic interdependence has a positive effect on war (Christensen and Snyder, 1990). Buck passing – a state's failure to deter an aggressor in the hope that its allies will do so – tends to encourage aggression. "Chain ganging" induces escalation because states are drawn into conflict by their allies. Empirical studies support this argument (Siverson and King, 1979; Colaresi and Thompson, 2005).

Realists argue that strategic interdependence increases the likelihood of conflict at both the monadic and systemic levels of analysis. At the same time, they suggest that strategic interdependence *reduces* the likelihood of dyadic conflict. States form alliances because they have common enemies (Mearsheimer, 1994/5: 13; Farber and Gowa, 1995, 1997; Maoz et al., 2006, 2007a). This reduces pressure for conflict between allies. However, empirical findings on this proposition are mixed.<sup>5</sup>

<sup>5</sup> Some evidence exists of a *positive relationship* between dyadic alliance ties and conflict (Bueno de Mesquita, 1981). Others find that this evidence is either mixed (e.g.,



Realists dismiss liberal notions about the trade-peace linkages. As long as strategic interests demand it, states will clash with each other even at the price of disrupting trade. England and France traded with Germany, yet this did not prevent them from fighting two world wars. Nor did Japan's trade dependence on the United States deter the Japanese from attacking it.<sup>6</sup>

### 3.2. Interdependence and Conflict in the Liberal Paradigm

The liberal paradigm regards both strategic and economic interdependence as a good thing. Although Keohane and Nye (1987: 8–9) discuss arms races as an example of “bad interdependence,” they do so in passing. Most liberal theorizing on interdependence and conflict is focused on economic ties. However, liberal institutionalist ideas allow inferences about the effects of strategic interdependence on conflict and cooperation.

Strategic interdependence is more than a common capability pool. Alliances are institutions that reduce uncertainty and manage distributional issues (Keohane and Martin, 1995). Strategically interdependent states are unlikely to engage in conflict because of their increased security and ability to deter aggression (Kegley and Raymond, 1982). Finally, as strategic interdependence in the international system increases, the incentives for conflict decline.<sup>7</sup>

Liberal scholars tie economic interdependence to rational positivism and peace.

[T]he international operation of the industrial spirit is as remarkable as any part of its actions ... Whatever may have been the original effect of the military spirit in extending human association, it not only had then completely exhausted, but it could never have been comparable to the industrial spirit in admitting the total assimilation of the human race (Comte, 2000 [1854]: 181–182).

The effect of economic interdependence on peace extends from the state to the system. States are reluctant to initiate conflict against enemies

Bremer, 1992; Maoz et al., 2007a) or *negative* (e.g., Farber and Gowa, 1997; Russett and Oneal, 2001).

<sup>6</sup> In 1913 and 1938, England was Germany's second-largest trading partner (after the U.S.). France was also one of Germany's top five trading partners in both years. The U.S. was Japan's largest trading partner prior to the outbreak of World War II. See Barbieri and Levy (1999).

<sup>7</sup> This is a central idea in the security community paradigm: “If the entire world were integrated as a security-community, wars would be automatically eliminated” (Deutsch et al., 1957: 5). Starr (1992: 211) argues that within a security community “[t]he interdependent bonds of mutually rewarding transactions and the creation of feeling of community raise the costs of using force to a prohibitive level.” See also Starr (1997).

with whom they do not have direct trade ties because the uncertainty and instability associated with conflict may cause their trading partners to look for other markets, adding an indirect cost to the direct cost of conflict (Polacheck, 1980, 1997; Gasiorowski and Polacheck, 1982; Gasiorowski, 1986; Russett and Oneal, 2001; Crescenzi, 2005). Global interdependence increases coordination, cooperation, transparency, and trust, thereby reducing global levels of conflict.

Table 9.1 summarizes the hypotheses of these paradigms. The realist paradigm posits that strategic interdependence reduces the likelihood of dyadic conflict. Yet, strategic interdependence challenges third parties, thereby increasing the likelihood of conflict between dyad members and third parties. This increases the probability that strategically interdependent states would engage in conflict at the monadic level (Maoz, 2000). Elevated strategic interdependence in the system is associated with high polarization and thus with interblock conflict. Economic interdependence has little effect on international conflict across levels of analysis (Barbieri, 2002: 37–38). The liberal paradigm expects both strategic and economic interdependence to reduce the frequency of monadic, dyadic, and systemic conflict. Thus, integrated interdependence – a combination of strategic and economic ties – is also expected to dampen down conflict. Realists, on the other hand, do not expect such integrative interdependence to have a significant effect on conflict behavior.

In short, it appears that the relationship between interdependence and conflict is more nuanced than we have been led to believe. I now turn to a network-analytic conceptualization of dependence and interdependence.

#### 4. Conceptualizing Dependence and Interdependence

I discussed the development of the network-analytic indices of dependence and interdependence in Chapter 2. In this Chapter I also discuss the advantages and liabilities of the measures of dependence and interdependence compared to more traditional SNA measures of influence. Just as a reminder, the measures of dependence and interdependence I will be using to test the propositions of these two paradigms have several advantages over existing measures and conceptual paradigms relating to these concepts.

1. *Specificity and integration.* These are general sets of measures; they enable measurement of dependence and interdependence across a variety of different exchange relations, as well as across multiple relations. Most other measures of these concepts are tied to a single type of exchange relations – typically trade. Other

measures do not allow for integration of dependence or interdependence relations across multiple types of interactions.

2. *Direct and indirect relations.* The measurement scheme allows incorporation of dependence and interdependence across both direct and indirect relations. It allows uncovering dependencies that exist in the absence of direct ties between nodes (states). Most other measures focus on dependence and interdependence that are due to direct dyadic relations. (However, SNA measures of influence do not have this problem.)
3. *Comprehensiveness across levels of analysis.* The measurement scheme developed in [Chapter 2](#) uses the same methodology and conceptualization to assess dependence and interdependence at the monadic (nodal), dyadic, and systemic level of analysis. In contrast, most existing measures of dependence and interdependence focus exclusively on the dyadic level of analysis.
4. *Conceptual inclusiveness.* The current measures combine the two meanings of interdependence – sensitivity and vulnerability interdependence.
5. *Multiple forms of monadic dependence.* The concepts of on-and out-dependence expand existing notions of dependence in a way that allows us to differentiate between a node's dependence on other nodes in the network and the dependence of other nodes in the network on a focal node. In our context, a state may be relatively autonomous in that it can accomplish its security or economic goals without the help of others. At the same time, other states may well depend on the focal state for their security or economic well-being. Likewise, a state may require a lot of help to accomplish its security or economic objectives, but other states may not need the focal state for the same purposes. Interdependence at the national level is conceptualized in a novel manner: it consists of the extent to which the focal state depends on others as well as on the extent to which other states depend on the focal state. This is a far more nuanced approach to nodal dependence than exists in other measures of the concept.
6. *Nonlinearity in cross-level transformation.* The transformation of interdependence from one level of analysis to another is not a simple linear aggregation of units' characteristics. Systemic interdependence reflects a ratio between the actual interdependencies of dyads (including indirect self-dependence) and some theoretically derived maximum.

With these attributes in mind, we can now proceed to test the effects of strategic and economic interdependence on international conflict behavior across levels of analysis.

Table 9.1. *Realist and liberal hypotheses: the effect of interdependence on conflict across levels of analysis*

| Paradigm | Strategic interdependence |        |          | Economic interdependence |        |          | Integrated interdependence |        |          |
|----------|---------------------------|--------|----------|--------------------------|--------|----------|----------------------------|--------|----------|
|          | Monadic                   | Dyadic | Systemic | Monadic                  | Dyadic | Systemic | Monadic                    | Dyadic | Systemic |
| Realist  | +                         | -      | +        | 0                        | 0      | 0        | NA                         | NA     | NA       |
| Liberal  | -                         | -      | -        | -                        | -      | -        | -                          | -      | -        |

+ Interdependence increases the probability of conflict.

- Interdependence reduces the probability of conflict.

<sup>0</sup> Interdependence does not significantly affect the probability of conflict.

## 5. Results<sup>8</sup>

The appendix to this chapter lists the key methodological issues covered by the following analysis. It reviews the specific methodology used to measure economic interdependence, the missing data in some of the economic datasets, and the estimation methods used to evaluate the propositions of the realist and liberal paradigms.

Table 9.2 displays the results of the effects of monadic interdependence on national conflict patterns. These analyses suggest that both strategic and economic interdependence consistently dampen the propensity for MID initiation, MID and war involvement. Integrated interdependence also has a dampening effect on conflict behavior. These results hold for the entire period as well as for the post-WWII era. Also, the results for the economic interdependence index that employs the opportunity cost (elasticity) measure are consistent with the results that do not incorporate this index, suggesting that economic interdependence has a robust dampening effect on national conflict behavior.<sup>9</sup> These results provide clear support to the liberal paradigm but fly in the face of the realist paradigm. Contrary to the realist expectation that strategic interdependence would increase states' involvement in conflict, the effect of strategic interdependence on conflict is consistently negative. Moreover, economic interdependence seems to have a consistent dampening effect on conflict – which is not what realist scholars would expect.

Table 9.3 displays the results of the dyadic relationships between interdependence and conflict. These results are less robust than those of the monadic analyses. Strategic interdependence in a dyad does not have a significant impact on the probability of MID initiation or MID outbreak, but it does reduce the probability of war or MID escalation. Economic interdependence consistently reduces the probability of dyadic conflict regardless of the dependent variable used. This is also true for the elasticity-based measures of economic interdependence. Integrative interdependence also has a robust dampening effect on the probability of dyadic conflict.

Taken together, these results further strengthen the arguments derived from the liberal paradigm. Note that the arguments of the realist paradigm about the impact of strategic interdependence at the dyadic level are not distinguishable from those of the liberal paradigm. Therefore, it is not possible to evaluate the relative merits of the liberal and realist arguments

<sup>8</sup> The book's website contains descriptive statistics and correlations among interdependence indices. All correlations are low. Thus, strategic and economic interdependence reflect rather distinct concepts.

<sup>9</sup> This is so despite the fact that the trade dependence variable that is based on the elasticity data is only marginally correlated with the sensitivity trade dependence variable ( $r = 0.153$ ,  $N = 3,283$ ;  $p < .001$ ).

Table 9.2. *Interdependence, and national conflict involvement, 1870–2001: time-series, cross-sectional analysis<sup>a</sup>*

| Independent variable       | Entire period (1870–2001)                                             |                                                                     |                                                                     |                                                                     | 1946–2001                                                           |                                                                     |                                                                     |                                                                    | 1982–2000                                                            |
|----------------------------|-----------------------------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|--------------------------------------------------------------------|----------------------------------------------------------------------|
|                            | MID involvement                                                       | MID initiation                                                      | War involvement                                                     | War involvement                                                     | MID involvement                                                     | MID initiation                                                      | War involvement                                                     | War involvement                                                    | MIDs (trade elasticity)                                              |
| No. states in SRG          | 0.073**<br>(0.003)                                                    | 0.051**<br>(0.002)                                                  | 0.029**<br>(0.002)                                                  | 0.025**<br>(0.002)                                                  | 0.069**<br>(0.003)                                                  | 0.045**<br>(0.002)                                                  | 0.022**<br>(0.003)                                                  | 0.029**<br>(0.003)                                                 | 0.020**<br>(0.003)                                                   |
| Regime score               | –0.000<br>(0.000)                                                     | –0.001<br>(0.001)                                                   | 0.004**<br>(0.001)                                                  | 0.003**<br>(0.001)                                                  | –0.001<br>(0.001)                                                   | –0.001<br>(0.000)                                                   | 0.004**<br>(0.001)                                                  | 0.002<br>(0.001)                                                   | –0.004*<br>(0.002)                                                   |
| Regime in SRG              | –0.006**<br>(0.001)                                                   | –0.007**<br>(0.001)                                                 | –0.015**<br>(0.002)                                                 | –0.014**<br>(0.001)                                                 | –0.007**<br>(0.001)                                                 | –0.007**<br>(0.002)                                                 | –0.018**<br>(0.003)                                                 | –0.018**<br>(0.003)                                                | 0.001<br>(0.001)                                                     |
| Strategic interdependence  | –1.124**<br>(0.082)                                                   | –0.902**<br>(0.002)                                                 | –0.854**<br>(0.154)                                                 | –                                                                   | –1.018**<br>(0.098)                                                 | –0.732**<br>(0.109)                                                 | –0.395**<br>(0.201)                                                 | –                                                                  | –0.474**<br>(0.129)                                                  |
| Economic interdependence   | –0.254**<br>(0.086)                                                   | –0.324**<br>(0.100)                                                 | –0.089<br>(0.146)                                                   | –                                                                   | –0.476**<br>(0.124)                                                 | 0.624**<br>(0.140)                                                  | –1.471**<br>(0.225)                                                 | –                                                                  | –6.491**<br>(1.523)                                                  |
| Integrated interdependence | –                                                                     | –                                                                   | –                                                                   | –1.538*<br>(0.657)                                                  | –                                                                   | –                                                                   | –                                                                   | –24.234**<br>(5.677)                                               | –                                                                    |
| Peace years                | –0.070**<br>(0.007)                                                   | –0.052**<br>(0.006)                                                 | –0.107**<br>(0.014)                                                 | –0.177**<br>(0.014)                                                 | –0.067**<br>(0.010)                                                 | –0.061**<br>(0.009)                                                 | –0.112**<br>(0.024)                                                 | –0.661**<br>(0.057)                                                | –0.362**<br>(0.055)                                                  |
| Constant                   | –0.978**<br>(0.065)                                                   | –1.516**<br>(0.084)                                                 | –1.689**<br>(0.141)                                                 | 0.296<br>(0.529)                                                    | 0.852**<br>(0.086)                                                  | –1.299**<br>(0.108)                                                 | –1.404*<br>(0.216)                                                  | 18.471**<br>(5.600)                                                | 6.152**<br>(1.492)                                                   |
| Model statistics           | N = 9,702<br>States=166<br>$\chi^2=1,006.2$<br>R <sup>2</sup> = 0.204 | N = 9,702<br>States=166<br>$\chi^2=878.2$<br>R <sup>2</sup> = 0.180 | N = 9,702<br>States=166<br>$\chi^2=366.2$<br>R <sup>2</sup> = 0.249 | N = 9,679<br>States=166<br>$\chi^2=367.3$<br>R <sup>2</sup> = 0.278 | N = 6,261<br>States=165<br>$\chi^2=791.1$<br>R <sup>2</sup> = 0.229 | N = 6,261<br>States=165<br>$\chi^2=726.9$<br>R <sup>2</sup> = 0.207 | N = 6,261<br>States=165<br>$\chi^2=248.8$<br>R <sup>2</sup> = 0.278 | N= 6,168<br>States=165<br>$\chi^2=577.7$<br>R <sup>2</sup> = 0.383 | N = 2,844<br>States=164<br>$\chi^2=413.14$<br>R <sup>2</sup> = 0.160 |

<sup>a</sup> Cubic splines omitted due to space constraints.

\*  $p < 0.05$ ; \*\*  $p < 0.01$ .

Table 9.3. *Interdependence and conflict in directed and nondirected, politically relevant dyads, 1870–2001*

| Independent Variable                            | MIDs                                                   |                                                       |                                                       |                                                     | War                                                 |                                                    | MID-to-War escalation                              |                                                    |
|-------------------------------------------------|--------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------|----------------------------------------------------|----------------------------------------------------|----------------------------------------------------|
|                                                 | MID initiation <sup>a</sup>                            | MID underway                                          | MID underway                                          | MID (with trade elas.)                              | War underway                                        | War (with trade elas.)                             | MID escalation                                     | MID escalation                                     |
| Capability ratio                                | -0.001**<br>(0.000)                                    | -0.002**<br>(0.000)                                   | -0.001**<br>(0.000)                                   | -0.001<br>(0.001)                                   | -0.007**<br>(0.002)                                 | -0.217<br>(0.140)                                  | -0.006*<br>(0.003)                                 | -0.006**<br>(0.001)                                |
| Initiator's regime score/min. reg. <sup>b</sup> | -0.004**<br>(0.000)                                    | -0.004**<br>(0.001)                                   | -0.005**<br>(0.001)                                   | -0.002*<br>(0.001)                                  | -0.010**<br>(0.002)                                 | 0.006<br>(0.016)                                   | -0.006**<br>(0.002)                                | -0.005**<br>(0.001)                                |
| Distance                                        | -0.001**<br>(0.001)                                    | -0.001**<br>(0.000)                                   | 0.001**<br>(0.000)                                    | -0.001**<br>(0.001)                                 | -0.001*<br>(0.000)                                  | — <sup>d</sup>                                     | 0.001**<br>(0.000)                                 | 0.001**<br>(0.000)                                 |
| Size of initiator's SRG/min. SRG <sup>c</sup>   | 0.135**<br>(0.003)                                     | 0.266**<br>(0.010)                                    | 0.067**<br>(0.004)                                    | 0.316**<br>(0.018)                                  | 0.262**<br>(0.020)                                  | 0.122<br>(0.098)                                   | 0.053*<br>(0.027)                                  | 0.083**<br>(0.013)                                 |
| Strategic interdependence                       | -0.009<br>(0.015)                                      | 0.011<br>(0.015)                                      | —                                                     | -0.007<br>(0.021)                                   | -0.271*<br>(0.111)                                  | -0.158<br>(0.251)                                  | -0.344**<br>(0.107)                                | —                                                  |
| Economic interdependence                        | -0.212**<br>(0.063)                                    | -0.445**<br>(0.055)                                   | —                                                     | -0.056*<br>(0.030)                                  | -0.856**<br>(0.167)                                 | -3.405*<br>(1.525)                                 | -1.309**<br>(0.177)                                | —                                                  |
| Integrative interdependence                     | —                                                      | —                                                     | -0.003**<br>(0.001)                                   | —                                                   | —                                                   | —                                                  | —                                                  | -0.496**<br>(0.152)                                |
| No of years without conflict                    | -0.030**<br>(0.002)                                    | -0.068**<br>(0.004)                                   | -0.067**<br>(0.004)                                   | -0.135**<br>(0.008)                                 | -0.041**<br>(0.009)                                 | — <sup>d</sup>                                     | —                                                  | —                                                  |
| Constant                                        | -3.136**<br>(0.058)                                    | -1.945**<br>(0.068)                                   | -1.921**<br>(0.043)                                   | -1.758**<br>(0.086)                                 | -3.979**<br>(0.203)                                 | -1.756<br>(1.440)                                  | -1.581**<br>(0.195)                                | -1.911**<br>(0.084)                                |
| Model statistics                                | N=121,838<br>$\chi^2=1,303.4$<br>R <sup>2</sup> =0.119 | N=59,745<br>$\chi^2=1,820.0$<br>R <sup>2</sup> =0.222 | N=75,602<br>$\chi^2=1,367.7$<br>R <sup>2</sup> =0.172 | N=8,410<br>$\chi^2=664.35$<br>R <sup>2</sup> =0.270 | N=59,745<br>$\chi^2=416.1$<br>R <sup>2</sup> =0.209 | N=1,744<br>$\chi^2=361.2$<br>R <sup>2</sup> =0.144 | N=2,757<br>$\chi^2=212.4$<br>R <sup>2</sup> =0.174 | N=4,276<br>$\chi^2=136.0$<br>R <sup>2</sup> =0.047 |

<sup>a</sup> Directed dyads ( $d_{ij} \neq d_{ji}$ )

<sup>b</sup> For nondirected dyads, only low regime score (MINREG) used

<sup>c</sup> For nondirected dyads only low SRG score (MINSRG) used.

<sup>d</sup> Dropped due to convergence problems.

at this level. At any rate, none of the findings at this level damage in any noticeable manner the liberal predictions about dyadic (strategic or economic) interdependence and peace. We now turn to the systemic level of analysis.

The systemic analyses are given in [Table 9.4](#). Both strategic interdependence and economic interdependence significantly reduce the frequency of conflict in the system. These results are fairly robust across dependent variables and temporal breakdowns. The negative impact of economic interdependence on systemic conflict replicates the results of Maoz (2006b). However, the negative impact of strategic interdependence on systemic conflict contradicts Maoz's findings of a positive effect of strategic interdependence on conflict. This is possibly due to the difference in the measure of systemic interdependence. Integrated interdependence tends to consistently reduce the frequency of conflict, as the liberal model suggests.

Taken as a whole, these results consistently support the liberal paradigm and largely contradict the hypotheses of the realist paradigm ([Table 9.1](#)). The dampening impact of economic interdependence on conflict at the monadic, dyadic, and systemic level is robust and significant. This is so regardless of the data used to measure economic interdependence, and regardless of the method used to treat missing data. The impact of strategic interdependence on national, dyadic, or systemic patterns of conflict is less robust. However, the consistently negative impact across levels of analysis of strategic interdependence on conflict is consistent with the expectations of the liberal paradigm and inconsistent with the expectations of the realist paradigm. This impression is bolstered by the negative effect of integrative interdependence on conflict. The robust and consistently negative impact of economic interdependence on conflict across levels of analysis also raises questions about the realist dismissal of these effects. One may, of course, challenge the hypotheses I deduced from the realist paradigm with respect to the effect of strategic interdependence on national and systemic conflict. Yet, even as a first cut, these results raise important questions about the relative validity of these paradigms – at least as they treat the concept of interdependence and its implications for world politics.

As noted at the outset, several studies have indicated that the effect of economic interdependence on conflict washes out if one considers endogeneity effects (e.g., Keshk et al., 2004). It is therefore important to control for the effects of conflict on strategic and economic interdependence. [Table 9.5](#) provides the results of a set of instrumental variable regressions in which the key interdependence variables are regressed on a set of instrumental variables, and the predicted values of the results of this set of regressions are used then to estimate the various conflict variables. These are just a sample of the analyses that were displayed in the previous tables, but they generally replicate those in [Tables 9.2 to 9.4](#).



Table 9.4. *Interdependence and conflict in the international system, 1870–2001: autoregressive poisson regression (with clustering on number of dyads)*

| Independent variable          | Entire period                                          |                                           |                                           |                                           | 1946–2001                                 |                                         |                                          |                                          |
|-------------------------------|--------------------------------------------------------|-------------------------------------------|-------------------------------------------|-------------------------------------------|-------------------------------------------|-----------------------------------------|------------------------------------------|------------------------------------------|
|                               | No MIDs<br>1885–2001                                   | MIDs<br>1816–2001                         | No wars<br>1885–2001                      | No wars<br>1816–2001                      | Duration<br>1885–2001                     | No. MIDs                                | No wars                                  | No. wars                                 |
| Capability concentration      | 3.814**<br>(1.379)                                     | 1.197<br>(0.722)                          | 18.447**<br>(3.594)                       | 13.571**<br>(3.443)                       | –1.089<br>(1.412)                         | 0.998<br>(1.153)                        | 17.023*<br>(7.815)                       | 18.825**<br>(3.742)                      |
| Proportion democratic cliques | –2.913**<br>(0.977)                                    | –3.716**<br>(1.222)                       | –9.252**<br>(3.180)                       | –3.186**<br>(1.099)                       | –0.059<br>(0.062)                         | –0.008<br>(0.014)                       | –0.001<br>(0.033)                        | –5.203<br>(4.152)                        |
| Strategic interdependence     | –31.149**<br>(6.731)                                   | –<br>–                                    | –26.516*<br>(11.808)                      | –<br>–                                    | –0.404**<br>(0.104)                       | –0.748*<br>(0.327)                      | –0.004<br>(0.537)                        | –<br>–                                   |
| Economic interdependence      | –100.436*<br>(50.896)                                  | –<br>–                                    | –102.09**<br>(39.429)                     | –<br>–                                    | –249.384**<br>(51.489)                    | –328.423**<br>(118.301)                 | –299.445**<br>(114.734)                  | –<br>–                                   |
| Integrative interdependence   | –<br>–                                                 | –0.421**<br>(0.131)                       | –<br>–                                    | –3.083*<br>(1.451)                        | –<br>–                                    | –<br>–                                  | –<br>–                                   | –0.953*<br>(0.373)                       |
| AR(1)                         | 0.873**<br>(0.050)                                     | 0.888**<br>(0.0.9)                        | 0.637**<br>(0.060)                        | 0.717**<br>(0.047)                        | 0.891**<br>(0.052)                        | 0.431**<br>(0.115)                      | 0.543**<br>(0.123)                       | 0.599**<br>(0.127)                       |
| Constant                      | 2.740**<br>(0.469)                                     | 3.811**<br>(0.410)                        | –3.377**<br>(1.153)                       | –2.436*<br>(1.182)                        | 9.367**<br>(0.479)                        | 0.990<br>(0.960)                        | 4.518<br>(2.629)                         | –6.414**<br>(2.351)                      |
| Model statistics              | N=130<br>F=64.00<br>R <sup>2</sup> =0.212 <sup>a</sup> | N=184<br>F=135.9<br>R <sup>2</sup> =0.232 | N=130<br>F=36.34<br>R <sup>2</sup> =0.267 | N=184<br>F=61.70<br>R <sup>2</sup> =0.167 | N=130<br>F=64.32<br>R <sup>2</sup> =0.112 | N=56<br>F=4.38<br>R <sup>2</sup> =0.049 | N=56<br>F=15.53<br>R <sup>2</sup> =0.433 | N=56<br>F=11.95<br>R <sup>2</sup> =0.244 |

<sup>a</sup> Pseudo R<sup>2</sup> scores are based on the pre-adjusted Poisson regressions (without the AR(1) term). R<sup>2</sup> scores are at least 50% higher than those reported here for the full equations with the AR(1) term.

Table 9.5. *Interdependence and conflict involvement – tests of endogeneity (instrumental variables probit analysis)*

| Independent variable                    | National level of analysis                                  |                                                              |                                                             | Dyadic level of analysis                     |                                                            |                                                            | Systemic level of analysis     |                                            |
|-----------------------------------------|-------------------------------------------------------------|--------------------------------------------------------------|-------------------------------------------------------------|----------------------------------------------|------------------------------------------------------------|------------------------------------------------------------|--------------------------------|--------------------------------------------|
|                                         | MID involvement                                             | War involvement                                              | War involvement                                             | Independent variables                        | MID involvement                                            | War involvement                                            | Independent variables          | War involvement                            |
| No. states in SRG                       | 0.073*<br>(0.003)                                           | 0.019**<br>(0.001)                                           | 0.018*<br>(0.002)                                           | Capability Ratio                             | -1.6e-03**<br>(3.1e-04)                                    | -0.003**<br>(8.1e-04)                                      | Capability<br>Concentration    | 86.907*<br>(44.200)                        |
| Regime score                            | 0.001<br>(0.000)                                            | 0.003**<br>(0.001)                                           | 0.002**<br>(0.001)                                          | Min Regime<br>Score                          | -0.002**<br>(3.3e-04)                                      | -0.004*<br>(0.001)                                         | Proportion Dem.<br>Cliques     | -87.120**<br>(26.922)                      |
| Regime in SRG                           | -0.005**<br>(0.001)                                         | -0.005**<br>(0.001)                                          | -0.007**<br>(0.001)                                         | Min. SRG                                     | -0.075**<br>(0.008)                                        | 0.120**<br>(0.012)                                         | Strategic<br>Interdependence   | 700.995<br>(439.742)                       |
| Strategic interdependence <sup>b</sup>  | -1.946**<br>(0.255)                                         | –                                                            | -0.541<br>(0.345)                                           | Strategic Inter-<br>dependent <sup>b</sup>   | 2.701**<br>(0.676)                                         | –                                                          | Economic<br>Interdependence    | -469.981**<br>(104.716)                    |
| Economic interdependence <sup>b</sup>   | -1.373**<br>(0.167)                                         | –                                                            | -0.592**<br>(0.193)                                         | Economic<br>Interdependent <sup>c</sup>      | -20.524**<br>(4.196)                                       | –                                                          | Integrative<br>Interdependence | –                                          |
| Integrated interdependence <sup>b</sup> | –                                                           | -15.339*<br>(2.330)                                          | –                                                           | Integrative Inter-<br>dependent <sup>b</sup> | –                                                          | -2.935**<br>(0.469)                                        | Peace Years                    | –                                          |
| Peace years                             | -0.009**<br>(0.001)                                         | -0.030**<br>(0.001)                                          | -0.032**<br>(0.002)                                         |                                              | -0.235**<br>(0.006)                                        | -0.413**<br>(0.028)                                        | Constant                       | 32.756**<br>(13.528)                       |
| Constant                                | 0.460**<br>(0.150)                                          | 10.898**<br>(1.855)                                          | -0.747**<br>(0.165)                                         |                                              | -0.617**<br>(0.035)                                        | 2.395**<br>(0.615)                                         | Model Statistics               | Years=126<br>$\chi^2=55.89$<br>$R^2=0.278$ |
| Model statistics                        | N = 9,512<br>States=166<br>$\chi^2=1149$<br>$W^b=91.9^{**}$ | N = 9,542<br>States=166<br>$\chi^2=565.3$<br>$W^b=44.5^{**}$ | N = 9,512<br>States=166<br>$\chi^2=560.7$<br>$W^b=8.45^{*}$ | Model Statistics                             | N=59,745<br>Dyds=1716<br>$\chi^2=4,746$<br>$W^b=30.3^{**}$ | N = 53,735<br>Dyds=1716<br>$\chi^2=581$<br>$W^b=29.2^{**}$ |                                |                                            |

<sup>a</sup> W: Wald test for exogeneity. Significant chi-square statistics indicates rejection of the exogeneity hypothesis.

<sup>b</sup> Endogenous variables. First stage equations not shown due to space considerations.

First, it is important to note that in the analyses displayed in [Table 9.5](#) there is significant endogeneity in the relationships between interdependence and conflict. This endogeneity applies to strategic interdependence, to economic interdependence, and to integrative interdependence. The Wald Chi-Square tests of exogeneity lead to rejection of the hypothesis that the effects of interdependence on conflict are not subject to endogenous effects. In fact, both strategic and economic interdependence are significantly affected by levels of conflict. Past conflict tends to have a positive effect on strategic interdependence at the national, dyadic, and systemic levels. In contrast, past conflicts tend to have a negative impact on economic interdependence, as well as on integrative interdependence. This is not surprising, and it corroborates previous analyses (e.g., Keshk, Pollins, and Reuveny, 2004).<sup>10</sup>

Second, the results of the simple set of analyses are for the most part retained when we control for endogeneity. Specifically, the effects of economic interdependence on conflict remain consistently negative across levels of analysis. The same applies to the negative impact of integrative interdependence on conflict. There are a few notable exceptions, however. Most importantly, in contrast to the results shown in [Table 9.3](#), the results for the dyadic level of analysis show that strategic interdependence has a significant *positive* effect on dyadic conflict once we endogenize strategic interdependence. This positive effect is only marginally significant, but it does repeat across dependent variables. This is curious because it turns out that the higher the number of past MID's between a pair of states, the more strategically interdependent they are likely to be, and the more strategically interdependent they are, the more likely they are to fight. This cannot be easily explained by a realist model that suggests that enemies are more likely to look for other allies than to form alliances with each other.

One possibility is that states with a long history of conflict end up making short-term commitments when they confront third parties that are common enemies of both (Maoz et al., 2007a). These tend to lead to short-term and ad hoc strategic interdependence. However, the issues that lead to protracted past conflicts seem to catch up at some point, despite this interdependence. The systemic analyses also show that the effect of endogenized strategic interdependence on conflict is not statistically significant. These create a curious puzzle: The endogenized effect of strategic interdependence at the dyadic level on the probability of conflict is

<sup>10</sup> It is also interesting to note that past values of economic interdependence have a positive effect on strategic interdependence and past values of strategic interdependence tend to have a positive effect on economic interdependence. This is in line with the results reported in [Chapter 6](#) about the origins of economic and security networks. A more elaborate discussion of this particular feature of international networks will be provided in [Chapter 10](#).

positive and inconsistent with both the expectations of the realist and the liberal paradigms. This suggests a more thorough analysis of the structure of different types of interdependence is needed in order to shed additional light on these complex effects of interdependence on international conflicts across levels of analysis.

In most cases, however, the results of the two-stage analyses seem to corroborate the single-stage results: Economic interdependence seems to consistently dampen the probability of conflict at the national, dyadic, and systemic levels of analysis. The effect of strategic interdependence on conflict is not robust, nor is it consistent across levels of analysis. It does not seem to match the expectations of the realist paradigm, which accords it a great deal of importance.

## 6. Conclusion

The analytical framework of this chapter opens a wider window into the relationship between interdependence and conflict than the extant literature on the subject had thus far. It offers a comprehensive test of the hypotheses on these matters that are derived from leading paradigms of world politics. It is also a pioneering effort to examine a more integrative concept of interdependence that incorporates strategic and economic dimensions into a single set of measures. Finally, it offers a multilevel-of-analysis perspective on interdependence and conflict. The empirical analyses seem to support the expectations of the liberal paradigm, while raising questions about the empirical validity of the realist paradigm's explanations concerning the effects of strategic and economic interdependence on international conflict.

This study opens up as many questions as those as it attempts to answer: First, the measurement framework developed herein opens up opportunities for the study of some of the causes and effects of dependence – uneven levels of interdependence – across a wide variety of exchange relations. Second, it raises questions about possible endogenous or simultaneous relationships between interdependence and conflict. Third, other dimensions of interdependence that feature prominently in the realist-liberal debate – such as institutional interdependence – have yet to be investigated and their relationship to international conflict has to be explored. Taken together, these questions seem to suggest that the present study is but a first step on the road toward a more detailed and complex inquiry of the relationships between different types of international dependence or interdependence and different forms of interstate interactions.

Yet, as far as first steps go, the framework developed herein demonstrates a number of the properties of SNA and the insights it can bring to the systematic study of international politics. Clearly much more work is

necessary here, but the present chapter offers a great deal of potentially useful tools, substantive ideas, and empirical results about an important and central aspect of evolving world politics.

## Methodological Appendix to Chapter 9

### Data Sources

Most of the datasets used for this chapter have been discussed in the previous chapters. These include the conflict data, alliance data, capability data, the distance data, the trade data, and the regime data. An additional dataset central to this chapter is the *import elasticity set* (Kee, Nicita, and Olareagga, 2008). These data serve as a robustness check for some of the analyses. The manner in which they are incorporated in the present chapter is discussed below.

*Spatial and temporal domain:* Here, too, the population of cases consists of all states in the international system over the period of 1870–2001.

*Units of analysis.* I use three sets of units. The monadic unit of analysis is the state-year. The dyadic units of analysis are the directed dyad-year (MID initiation) and the nondirected dyad-year (MID and war occurrence). The systemic unit of analysis is a system-year.

*Measurement of dependent variables: international conflict.* At the monadic level  $NATMID_t$  is set to one if a state was involved in at least one dyadic MID at year  $t$  and zero otherwise.  $NATWAR_t$  is set to one if the state was involved in at least one war.<sup>11</sup>  $NATINIT$  equals one if the state MIDs initiated at least one MID. At the dyadic level  $MID_{ijt}$  receives a score of one if state  $i$  initiated a MID against state  $j$  at year  $t$ , and zero otherwise ( $MID_{ijt} \neq MID_{jit}$ ). For nondirected dyads,  $DYDMID_t$ ,  $DYDWAR_t$  are set to one if states  $i$  and  $j$  engaged in at least one MID (War) at year  $t$ .  $ESCALAT$  is defined as zero for each MID that did not escalate to war, and 1 for a MID that escalated to war. At the systemic level,  $YSMID/YSWAR$  is the number of dyadic MIDs/Wars at a given year.  $DURATION$  is the number of MID days in the international system per year.

### Independent Variables

*Strategic interdependence.* In Chapter 2, I demonstrated the measurement of this variable across levels of analysis via an example of an alliance network. There is no need to repeat this here.

<sup>11</sup> These concepts are defined in Jones, Bremer, and Singer (1996) and Gochman and Maoz (1984).

*Trade dependence/interdependence.* The heated debate about the best measures of economic dependence and interdependence indicates a significant empirical and conceptual disarray indicates a significant empirical and conceptual disarray (e.g., Russett and Oneal, 2001: 138–145; Barbieri, 2002: 53–62; Barbieri and Peters, 2003; Gartzke and Li, 2003a, 2003b; Oneal, 2003; Crescenzi, 2005: 119–123). Mansfield and Pollins (2001: 15–16) note that “[c]alls for better measures of interdependence are hardly new....But relatively little has been done to heed such calls and the need for better measures of interdependence is pressing if we are to resolve debates over the relationship between interdependence and conflict.” The social networks framework offers a significant contribution in this respect, whether we use trade data, monetary flow data (Gartzke, Lee, and Boehmer, 2001), foreign direct investment (Souva and Prins, 2006) or preferential trade agreements (Mansfield and Pevehouse, 2000, 2003).

The measure of trade dependence is based on equation [2.29] in Chapter 2, where  $R[\rho_1, \rho_2, \dots, \rho_k]$  is a set of commodities,  $\beta_{jil\rho}$  is the proportion of  $i$ 's imports from state  $j$  on commodity  $\rho_k$ , and  $oc_{il\rho}$  is the complement of the elasticity of demand for commodity  $\rho_k$  (Crescenzi, 2005: 119–120). The trade matrix  $D^1_T$  reflects the weighted (by opportunity cost and sensitivity) aggregate of all commodities exported by state  $i$  to state  $j$ . While mathematically straightforward, this operation is extremely complex, because the generation of trade elasticity by commodity is inordinately tedious.<sup>12</sup> Therefore, I focus on sensitivity interdependence. I define trade dependence as:

$$d^1_{ij|T} = \frac{\text{Imports}_{ij}}{\text{Total Imports}_i} \times \frac{\text{Total Imports}_i}{\text{GDP}_i} = \frac{\text{Imports}_{ij}}{\text{GDP}_i} \quad [9.1]$$

As a robustness check, I use the import elasticity data from Kee et al. (2008) who estimate import demand elasticities for over 7,000 goods across 117 states. Unfortunately, these estimates do not vary over time, as they are based on average prices over the entire temporal span (1982–2000). I use their sample to measure dyadic trade dependence as:

$$d^1_{ij|T} = \frac{\text{imports}_{ji}}{\text{GDP}_j} \times \left( 1 - \frac{e_j}{\max(e)} \right) \quad [9.2]$$

where  $e_j$  is the import demand elasticity of state  $j$  and  $\max(e)$  is the maximum demand elasticity in the Kee et al. (2008) sample. This normalizes the demand elasticity of a given state in the [0,1] range due to the

<sup>12</sup> Crescenzi's (2005: 119–121) measures approximate most closely the framework offered here. He used a limited dataset (Marquez, 1990) that covered a small set of dyads, limited time frame (1973–1984), and fixed elasticity scores over time.

invariance of the sample over time. The product of the complement of elasticity and the relative imports proportion integrates *sensitivity* and *vulnerability* interdependence. The indices of trade interdependence at the monadic and systemic level of analysis are calculated in the same way as the strategic interdependence measures.

*Treatment of missing data.* Since the measurement of monadic and systemic interdependence requires completely filled matrices, missing data represent a problem. With the alliance and capability data used to generate strategic interdependence indices, the problem of missing data is negligible. There are no missing values in the alliance dataset, and the capability dataset contains less than 1.7 percent missing data. The trade datasets present a significant problem, however. The Oneal-Russett (2005) trade dataset contains roughly 16 percent missing data. The Barbieri et al., (BKP 2008) dataset contains nearly 49 percent missing data. I used three methods to deal with missing data. First, I assigned missing data a score of zero, under the assumption that trade levels between states with missing data are negligible. Second, I used the Honaker and King (2007) multiple imputation method for time-series cross-section data and the AMELIA software (Honaker, King, and Blackwell, 2006) to replace missing data for the BKP dataset. Third, I replicated the dyadic analyses using valid data only for the BKP trade data. Results reported herein are based on the first method and the Oneal-Russett dataset. Appendix 9B in the book's website contains results with data obtained via the two other methods of treating missing values.

### Control Variables

*Number of states in the SRG.* Defined as in Chapter 4.

*Capability concentration index.* Defined as in Chapter 7.

*Regime score:* The monadic Maoz-Russett regime score is defined in Chapter 6. At the dyadic level, I use the lowest regime score of dyad members (MINREG). For the systemic level, I use the proportion SRG cliques dominated by democracies, as defined in Chapter 8.

*Capability ratio.* This is the capability ratio of the strongest to weakest member of the dyad.

*Distance.* A distance between capitals, defined in Chapter 6 above.

*Estimation methods.* At the monadic and dyadic levels I use a set of simple logit models with cubic splines and years of peace (Beck, Katz, and Tucker 1998). For the systemic level I use an autoregressive Poisson model.

*Tests for endogeneity.* The general equation estimated in the analyses below is:

$$\begin{aligned} \text{CONF}_{[i(j)]t} = & \alpha + \beta_1 \text{STRTINDP}_{[i(j)]t-1} + \beta_2 \text{ECNINTDP}_{[i(j)]t-1} \\ & + \beta \text{CONTROLS}_{[i(j)]t-1} + \varepsilon_{[i(j)]t} \end{aligned}$$

Where CONF is a specific measure of conflict, *STRTINTDP* and *ECNINTDP* are measures of strategic and economic interdependence, respectively, and CONTROL is a matrix of control variables. The  $[i(j)t]$  subscript is varied by level of analysis (for monadic analyses this is *it*, for dyadic analyses it is *ijt*, and for the systemic analyses it is just *t*). Because the values of both key independent variables may be affected by prior levels of conflict (as well as by other factors), it is important to investigate the potentially endogenous effects of these variables. Therefore, I ran a set of instrumental-variable regressions at all three levels of analyses. The equations for these estimates are given as:

$$\begin{aligned}
 STRTINTDP_{[i(j)t-1]} &= \alpha + \beta_1 TARGET_{[i(j)t-2]} + \beta_2 STRTINTDP_{[i(j)t-2]} \\
 &\quad + \beta CONTROL_{[i(j)t-2]} + \varepsilon_{[i(j)t-2]} \\
 ECNINTDP_{[i(j)t-1]} &= \alpha + \beta_1 TARGET_{[i(j)t-2]} + \beta_2 ECNINTDP_{[i(j)t-2]} \\
 &\quad + \beta CONTROL_{[i(j)t-2]} + \varepsilon_{[i(j)t-2]} \\
 CONF_{[i(j)t]} &= \alpha + \beta_1 STRTINDP_{[i(j)t-1]} + \beta_2 ECNINTDP_{[i(j)t-1]} \\
 &\quad + \beta CONTROL_{[i(j)t-1]} + \varepsilon_{[i(j)t-1]}
 \end{aligned}$$

These equations allow us to estimate the extent to which endogeneity removes the single-equation effects of strategic and economic interdependence on conflict. The tests of endogeneity are displayed in Appendix 9C of the book's Web site.



*Evolution and Change in the World System:  
A Structural Analysis of Dependence,  
Growth, and Conflict in a Class Society*

1. Introduction

There are many different ways to think about the structure of the international system. International relations scholars – mostly neorealists – argue that system structure is defined by the number of major powers and the distribution of capabilities in the system (Waltz, 1979; Mearsheimer, 2001). Structural sociologists and Marxist scholars view the international system in terms of a division of labor – some sort of international class structure (Galtung, 1971; Wallerstein, 1974; Chase-Dunn, 1975). These approaches focus on different issues and are therefore treated distinctly. International relations scholars think of systemic stability or change as variations in the relative standing of individual states and in the distribution of capabilities. Structural sociologists focus on changing patterns of dependence, economic wealth and inequality. Their view of stability or change concerns movement of states across social classes. Both approaches, however, are predicated on the idea that the international system is composed of different classes. The class affiliation of states has an important impact on their behavior. Moreover, the specific class structure of the system is said to affect its stability.

These approaches have rarely been discussed under a common theoretical umbrella. Economic relations constitute the core element of systemic stratification according to the world systems approach. Military capabilities constitute the key identifier of political stratification in international system theories. Yet, economic and military power typically correlate, so one would expect the division of labor in world system analysis to correlate with the division of the world into great (or major) powers, middle (or regional) powers, and minor powers. Moreover, the mobility of states across classes should be characterized by both patterns of economic growth or decline and parallel patterns of capability change (Kennedy, 1987). Unfortunately, we desperately lack systematic evidence

of overlap between the economic class structure of the system and its stratification in terms of military capabilities.

In addition, most empirical tests of world system theories have rarely examined the political implications of class position. Likewise, most empirical tests of international system theories have ignored the class position of states as envisioned by world system theorists. Accordingly, this chapter addresses the following questions:

1. How has the international system been divided into economic and reputational military classes over time?
2. To what extent did states experience mobility across these classes?
3. How does the location of a state within a given social class affect its economic growth and wealth?
4. How does the location of a state within a given social class affect its conflict behavior?
5. Are states belonging to the same social class likely to fight each other? Are we more likely to observe conflicts between states from different social classes than between states within the same class?

The next section provides a brief review of the key ideas found in world system literature, including empirical tests of this theory that rely on SNA. Section 3 evaluates and critiques these studies and offers an alternative perspective for testing world system propositions. Section 4 discusses the empirical results. Section 5 concludes this study by discussing the implications of this research for world system and international politics.

## 2. World System and International Systems Approaches: Theory and Evidence

In a manner of speaking, world system approaches take Marxism to the international level. Just as any society is functionally divided into social classes, there exists an economic stratification of states in the international system (Wallerstein, 1974; Shannon, 1996). This division may differ over time and space as a result of the changing factors that define the modes of production in history (Mahgutga, 2006), but at a given time, it is possible to identify two or three classes: center (or core), semiperiphery, and periphery.<sup>1</sup> These groups are distinguished primarily by their economic

<sup>1</sup> Some world system scholars skip the middle category of semiperipheral states (e.g., Galtung, 1971).

wealth. Related characteristics of each class consist of the structure of their economies and their dependence relations with other classes.

Both economic development and political structure are a consequence of the position of states in the global division of labor. The position of states is determined by the dominant mode of production in the world economy. This, in turn, defines the structure of relations among states. Chase-Dunn and Hall (1997: 52) suggest that such positions are determined by four types of relational networks: a bulk-good network, a prestige-good network, a political/military network, and an information-network. World system theorists argue that the core states establish a pattern of structural dependence on these exchanges among periphery states, thus perpetuating the existing class structure and preventing upward mobility.

World system theory is a highly complex framework of global development. Reducing it to a few simple precepts and empirical propositions does it an injustice. Yet, this theory does offer a comprehensive account of the evolution of the world system – in some cases, from the early dawn of social history (Chase-Dunn and Anderson, 2005) – and so it may be possible to extract some of its key propositions without doing too much harm. I focus on two key arguments: First, the division of labor in the system accounts for differential rates of economic and political development of various societies. Specifically, core states tend to develop economically, socially, and politically at faster, steadier rates than semiperipheral states. Likewise, the rates of development of states on the semiperiphery are also significantly faster and steadier than those of peripheral states. This is so because core and (to a lesser extent) semiperipheral states employ and sustain a pattern of exploitation of the periphery, which is made possible by the economic, cultural, political, and military structural dependence of periphery states on core states.

Second, the rate of mobility of states across classes is minimal (Galtung, 1971; Wallerstein, 1974). This is so as long as the factors that determine the dominant mode of production in the world economy remain fixed.<sup>2</sup> The very same dependence of peripheral states on core states dampens the rate of political and economic development of the former, widens the gaps between itself and the core subsystem, and reduces the capacity of its society to deal with the challenges of modernity. Once these factors are set, a state's role in the system is pretty much fixed. Fundamental shifts may occur when technological or other changes transform the dominant mode of production, allowing states having a competitive advantage

<sup>2</sup> As Mahgutga (2006) suggests, there is far less agreement on this proposition – especially about the current degree of actual mobility – given the “new division of labor,” the shift from a traditional capitalist system into a more modern one that allows a greater degree of mobility (e.g., Wade, 2004).

with respect to these factors to move up the social ladder. However, such changes are uncommon.

Most of the empirical studies of the world system approach have been largely qualitative. Some used limited quantitative data to support some aspects of these theories (e.g., Chase-Dunn, 1975; Chase-Dunn and Anderson, 2005). Yet, few sociologists attempted to systematically study the structure and implications of the world system approach. These latter studies relied heavily on SNA. The principal strategy of these empirical studies has been twofold: First, they used a set of relational data to endogenously derive the position of states in the world system. Second, they used the position of states in the world system to account for their level of economic growth.

The key difference among these studies concerns the empirical strategy for positioning states within the different classes. Given structures of interstate relations, two conceptions in particular have emerged regarding the composition of these clusters. The first approach (Snyder and Kick, 1979) focuses on the structural equivalence of interstate relations. Specifically, states that have similar profiles of relations across a number of dimensions (e.g., trade, military interventions, diplomatic exchanges, and joint treaty membership) are considered to have high structural equivalence scores, that is, similar profiles of relations with other states in the system. Using different network relations, Snyder and Kick derived endogenous groupings of states into blocks via Convergence of Iterated Correlations (CONCOR) techniques.<sup>3</sup> They showed that structurally equivalent blocks differed significantly in terms of their GDPs. Moreover, block location had a significant negative effect on the rate of economic development as measured by average annual GDP growth rates.

Kick and Davis (2001) conduct a similar analysis using a larger set of networks and different time periods. They regress average annual changes in GDP over the periods 1965 to 1980 and 1975 to 1990 on a number of control variables and block membership. They find that block membership has a significant dampening effect on GDP growth. They conclude also that these results confirm the notion of the world system model: “world system position and the dynamics in it produce enormous and increasing national wealth gaps between the capitalist core and the rest of the system.”

Van Rossem’s study (1996) criticizes this approach. He argues that groupings based on structural equivalence do not capture the functional role of states in the global division of labor implied in world system theory. The more appropriate basis for such a breakdown is the concept of role equivalence (see Chapter 2). Accordingly, he models the world system via both role- and structural equivalence-related groupings of states. In contrast to other studies, he finds that neither role positions nor

<sup>3</sup> See Chapter 2 for an explanation of this method.

structural equivalence positions have a significant effect on rates of GDP growth over the period of 1980–1989.

These studies suggest an interesting and quite innovative approach to the modeling of world system theories. They assume that the position of states in a world system is endogenous to the pattern of relations among states. At the same time, these studies suffer from methodological and conceptual problems. I discuss some of these in the next section and offer an alternative modeling approach to world system theory.

As noted above, international relations scholars define the global class structure quite differently. First, they define political “class structures” in terms of national capabilities rather than relational factors (Singer, Bremer, and Stuckey, 1972; Waltz, 1979; Mearsheimer, 2001). As I pointed out in [Chapter 7](#), the “conventional” designation of reputational status in international politics – major (or great) powers, regional powers, or minor powers – is based on very general and intuitive criteria. Very few efforts exist to group states into reputational classes based on clearly articulated empirical criteria.

Second, international relations scholars focus on matters of war and peace; they largely ignore the effects of power positions on economic growth. Kennedy (1987) was one of the few to connect economic capacity with reputational and strategic position. However, he did not examine the effects of class position on economic development and growth. His argument is that states that overextend themselves militarily beyond their economic infrastructure are bound to lose their leading role. This suggests that – both theoretically and historically – the mobility of states across “social” classes – defined by elements of power – was possible.

The implicit logic that characterizes the power-based class structure of the international system seems analogous to that of world system theorists: A dominant set of factors determines the power position of a given state in the pecking order. These factors are equivalent to the factors that determine the dominant mode of production in the world economy, which are used to define the global class structure. When these factors change (or when their relative weights change), mobility of states across social or power classes takes place. As long as these factors are stable, so is the position of states within these classes. Thus, for example, in the nineteenth and early twentieth centuries, military power was defined largely by military personnel, military expenditures, and – most importantly – strategic reach capacity via a strong navy. After World War I, the factor of strategic air power was added to this equation. Following World War II, as nuclear weapons and missile technology became the dominant factors of national power, although the more traditional factors were still important determinants of states’ position in the international power structure (Gat 2006: 512–569).

Much of the literature on world system theory focuses on the capitalist mode of production and the dominant relational networks that define it (Chase-Dunn and Hall, 1997). Economic revolutions such as the

industrial revolution of the nineteenth century, the technological revolution of the second half of the twentieth century, or the information revolution of the last two decades of the same century may have altered the fundamental capitalist mode of production, although this is debatable. However, to the extent that the key factors that determine the dominant mode of production persist, so does the class structure of the world system and the location of individual states within that structure.

The question then becomes how different are “social” classes based on economic factors from “political” classes based on military capabilities (but which must also rely on economic infrastructure for these capabilities)? Unfortunately, we do not have good answers to this question. This is especially puzzling given the story of the Soviet Union, which has been considered a great power almost since its emergence in 1918, primarily because of its military power and its industrial capacity. However, the widening gap between the military hardware that defined Soviet reputational status during the Cold War and its economic foundations finally brought about the collapse of the Soviet Union. On the other hand, states that chose not to invest in military capabilities after World War II (e.g., West Germany and Japan) emerged as leading economic powers. We might find numerous other discrepancies of this sort when we consider the entire spectrum of states. Unless we more precisely define how states are to be divided into “social” or “political” classes, however, it is not possible to provide a credible response to this question.

One of the key insights we can take from this rather brief review of these two rich bodies of literature is that, although they contains overlapping ideas, they do not really “talk” to one another. World system theorists recognize the role of politics and security in the stratification of the international system. Some of them (e.g., Galtung, 1971) have repeatedly mentioned the military instrument as a form of political intervention of the core in the periphery and as a means by which the core maintains its influence over the periphery when all else fails. Both realist and liberal scholars recognize the importance of economics in the class structure of the world, but they rarely talk about the interrelations between economic and political-strategic classes. This suggests that a more coherent understanding of the international system requires a merging or integration of these two perspectives.

### 3. Problems with Existing Approaches to World System Analysis

The need for an alternative approach to world system modeling arises from problems with the theoretical and empirical literature on the subject. I discuss these problems and then move to an outline of the analytical framework that guides this chapter.

### 3.1. Theoretical Problems

World system theories focus on dependence relations among states. Such dependence is multifaceted: It includes economic dependence, strategic dependence, and institutional dependence. The studies discussed in the previous section incorporate aspects of these dependencies, but the manner in which these data are used does not necessarily reflect the theory. As I argued in [Chapter 8](#), relational data do not directly reflect dependence relations. Thus, states' positions or roles in the global division of labor derived from straightforward relational data do not necessarily reflect their true dependency-related positions. A more direct specification of dependence is required if one is to test the key propositions of the world system theory.<sup>4</sup>

Another issue has to do with the implications of world system theories. One implication of the theory is that the position of a state in the global division of labor has a significant effect on its welfare and its ability to grow. However, this implication is based on another central notion of the theory: States are unlikely to move up the ladder of development. This is particularly true for states that find themselves on the periphery because of structural (social and/or economic) conditions. The lack of social mobility is amplified by the dependent structure of relations between peripheral and core states. There may be limited movement of some states from the core to the semiperiphery, but the theory does not expect any significant change in the structure of the core. It is this lack of mobility, as well as the position of the state that determines its differential rate of economic growth. This, however, was not really tested in the empirical studies of world system theories.

Finally, as Van Rossem (1996) points out, the structure of interactions between states defines their position in the system. However, both world system theorists and the scholars who test such theories fail to discuss the behavioral implications of these positions. Specifically, to what extent does the position of states affect their political stability? How does this position affect the way they treat each other? Do dependencies that place states within a given class affect their behavior toward their class members? Does class position determine the way states treat members of other classes? Once the class position of states is defined, and if it is fairly stable over time, "group" solidarity might form. If so, then these classes will behave in structurally predictable ways within and across groups. For example, in international relations theories, the location of states within certain classes has a significant impact on their conflict behavior. We have seen aspects of this point in [Chapter 7](#), but there is significant evidence to this effect in the literature (Gochman and Maoz, 1984; Bremer, 1992;

<sup>4</sup> Van Rossem (1996: 512) criticizes previous studies for failing to capture trade dependence in terms of opportunity costs and substitutability, but he conflates opportunity cost with sensitivity dependence when using a binary measure of trade.

Maoz, 2004). Theoretical works on systemic aspects of world politics that focus on great powers also make this point (Mearsheimer, 2001). Yet, world system studies tend to ignore the behavioral implications of class positions – especially with respect to matters of political stability within states or war and peace among them.

Several points follow from this discussion: First, the study of mobility across social classes requires dynamic tests of the theory's implications. In other words, one must examine whether and to what extent the roles and positions of states change over time. Kick and Davis (2001) present two periods of the world system (1960–1965, 1970–1975), but their networks are based on either averaged or single-observation data within each of these periods. They do find some movement of states across blocks, but they do not discuss either the extent or the direction of movement of states from one block to another in their cross-period breakdown. More important, their estimates of GDP change are based on simple ordinary least-squares (OLS) regressions with block dummies. This ignores both block dynamics (i.e., cross-block mobility over time) and dynamic changes in GDP over relatively short periods of time.

Second, we need a more systematic understanding of the convergence or divergence of “social” classes of states that are based on relational dependencies and “political” classes of states that are based on structural attributes such as military capabilities. We also need to consider the theoretical and practical implications of any relationship between “social” class and “political” class.

### 3.2. Methodological Issues

Methodologically, the key problems with these studies are fourfold. First, the empirical tests of the world system model use continuous data as the key input variables (e.g., trade, military interventions, arms trade), but when generating distinct networks, they binarize these data. This is necessary if one derives endogenous groups (social classes) via role equivalence because this index is based on a triadic census that requires binary data. Yet, binarization leads to considerable loss of information. Two units may have an identical profile of relationship when a valued network is binarized. Yet, the magnitude of these relationships might differ significantly. For example, states A and B may export to states C, E, F, and G, so that when a binary network in which any level (or a minimal level) of exports constitutes a tie is used, their role equivalence score may be very high. However, the magnitude of exports of state A to these other states may be dramatically different from the magnitude of exports by state B. Any partitioning method that assigns states to “social” classes based on binarized networks would yield dramatically different results compared to the same methods applied to valued networks. Structural equivalence



methods do not require binarization of valued networks, which makes these methods advantageous in this particular sense.

Second, averaging data over long periods creates considerable methodological biases as well as substantive problems. Long-term trends in economic development may hide both short-term recessions and short-term growth spurts. They can also hide the frequent movement of states across social classes. The choice of the span of the period is arbitrary, and most of the studies focus on a relatively short span. Even if a study (e.g., Kick and Davis, 2001) compares two periods, this comparison has relatively limited generalizability because of the limited temporal domain (Chase-Dunn, 1975). The availability of data covering much larger time spans allows far more dynamic analyses of trends in the class structure of the system than anything that has been published thus far.

Third, virtually all analyses use simple cross-sectional OLS regressions that estimate effect of class position on economic growth and dependence. These kinds of models are justified only at the cost of ignoring the dynamic aspects of class mobility, and are enabled by averaging of data within extended time periods. But this practice distorts the nature of the pooled time-series cross-sectional data structure. This suggests a need to replicate these studies via alternative methods that allow for a more dynamic approach to modeling.

Fourth, the generalizability of these studies is limited primarily because of their relatively short temporal domain: they all cover the post-World War II era, and most of them are based on data from the 1960s or 1980s. However, most world system theorists talk about much longer spells of time for these processes to take effect. What we get is a disconnect between theory and empirical tests. World system theories talk about long-term dynamics; empirical tests provide snapshots of brief periods.

My approach to modeling world system theory focuses on four fundamental aspects of the theory: (a) the structure of dependence in the system that (b) defines the location of states within the global division of labor, which (c) affects the rate and magnitude of economic development of these states; (d) allows systematic comparison of class positions based on relational data to reputational positions that are based on capability attributes; and (e) explores the political and international implications of class position of states.

## 4. An Alternative Approach to World System Modeling

### 4.1. Social Class and Economic Growth

In [Chapter 9](#), I employed a new set of network analytic measures of dependence that reflect both sensitivity and vulnerability dependence. The logic underlying these measures forms the foundation of the theoretical

and analytic approach to modeling world systems. The foundation of the conception of dependence is dyadic: A state *i* depends on another state *j* with respect to a relationship *R* to the extent that a change in *j* affects a change in *i*, and to the extent that *i*'s opportunity cost of breaking this relationship is high. The effect of *j* on *i* might be direct or indirect; *i* and *j* may have both direct relations and relations that pass through another actor *k* with whom both *i* and *j* have direct ties. The strength of the effect of a change in *j* on *i* depends on the "directness" of this relationship; the more direct the relationship, the stronger the effect.

This conception connects a relational perspective to world system approaches. Dependent relationships serve as the backbone of world system analysis. Thus, we need to rely on measures of dependence to examine the (role or structural) equivalence of states and to model their class positions. States that have similar profiles of relations with other states are not necessarily equivalent in terms of dependence relations.<sup>5</sup>

I restate the key ideas of world system theories in a manner that follows deduction of empirically testable propositions. Hence, we must start by specifying the principal assumptions of these approaches.

1. *Modes of production determine the structure of the world economy.* A set of factors – physical, human, or technological – are the principal determinants of the driving economic forces in the system. These factors may vary over time. In the distant past, the ability to grow food was a key to economic success. Control over arable land, water, and labor defined wealth of economic units (families, tribes, or nations). At other times, access to natural resources, capital, and technology was the key to success, because industry was what made an economy tick. Human capital may well be the magic that fuels the present information-based economies.
2. *The ways in which states produce wealth affects economic relations among them.* The ways in which states adjust their economies to fit into these dominant modes of production defines how they interact with each other. States with similar forms of control over production factors are likely to have similar economic structures. These economic structures induce similar patterns of trade relations between these states and other states in the system.
3. *Economic considerations dominate politics; patterns of economic ties induce political ties.* In world system models, economics drive politics. States' elites come to power and survive in power to the extent that they serve the interests of the leading economic classes in their society. The policies of such elites are aimed at serving

<sup>5</sup> This is even more so if we binarize such relations for the measurement of role equivalence.

these economic interests. This means that states pursue foreign policies that are meant to advance their economic standing. Thus, states whose economic interests converge tend to pursue similar foreign policies.<sup>6</sup>

4. *The stability of the factors that determine the dominant mode of production limits the mobility of states across the social class ladder of the global world system.* Since the dominant mode of production determines patterns of economic and political relations among states, it is very difficult for the states in a given social class to move up the ladder of economic development. Likewise, as long as a dominant mode of production persists, states at the top pursue policies that are designed to keep them there. This means that states rarely move across social classes.

These assumptions suggest that certain factors in the dominant mode of production advantage some states and disadvantage others. This defines an initial class breakdown of the world system. However, this breakdown is perpetuated by the economic and foreign policies that states follow. States at the top adopt military and economic policies that seek to manifest the structural dependence of states in the periphery. The political and economic elites in the periphery also benefit from this structural dependence. In many cases, elites in peripheral states owe their political survival to ties with the core states. The middle and lower classes in the core also benefit from this pattern of dependence because their standard of living increases due to uneven dependence. The only element that is disadvantaged in this equation is the lower classes on the periphery. They end up being politically and economically marginalized (Galtung, 1971).

This pattern persists as long as the key factors that determine the dominant mode of production remain fixed. Periphery states cannot escape this pattern of dependence, even if local elites seek to change the structure of their economies. When a radical change in the dominant mode of production occurs, significant upward or downward mobility may follow. Who moves where depends on the ability of states to adapt to structural economic changes or to capitalize on the new opportunities that such changes afford.

Structural dependence – although driven by economic factors – is multifaceted in nature. Core states may exert influence and induce dependence along a wide array of political, social, cultural, and military relationships. In fact, multidimensional dependence of one state on another makes it all the more difficult to break out of a given social class. The wider the

<sup>6</sup> By “similar” foreign policies I mean that states with similar foreign policies have *functionally similar* patterns of relations with other states. I elaborate on the empirical implications of this idea below.

web of dependence relations between core and periphery states, the more entrenched the structural order of the world system.

These propositions follow from this story:

- WS1. The position of states in the global division of labor due to the pattern of their economic, strategic and, institutional dependence on other states affects their level of economic growth.
- a. States' core-periphery position has a significant impact on their economic growth: the more peripheral the state, the slower its rate of economic growth.
  - b. States are unlikely to move across social classes; class mobility is more likely to happen when a structural change occurs in the factors that determine the dominant mode of production in the system.
  - c. Economic factors form a major pillar of military capabilities and thus of a state's international reputation. Thus, the position of states in the world system correlates with their reputation: minor powers tend to be in the periphery; regional, and major powers are more likely to be in the core of the system.

#### 4.2. Social Classes and Conflict Involvement

World system theories are not very explicit when it comes to theorizing about the effects of class position on various forms of conflict. By implication, however, it is possible to deduce some interesting propositions on how the division of the world into social classes is likely to affect patterns of domestic and international conflict.

a. *Social Class, Domestic Political Stability, and Intervention in Civil Wars.* One of the more interesting questions that emerge from world system approaches concerns the effect of the social position of states on their internal stability. For example, Galtung (1971: 83–84) breaks up each state into a center and a periphery. The center consists of the economic, political, and social elite, and the periphery consists of the lower classes. There is fundamental disharmony of interests between the center and the periphery of a given state, but the level of disharmony is higher in periphery states than in core states. By implication, the position of a state in the world system may affect its level of political instability.

States in the core are invested in the regime stability of peripheral states that are dependent upon them. Regime change in peripheral states risks the structure of continued dependence on their core patrons. Thus, when the regime in a periphery state is at risk, the core patron is likely to intervene militarily in support of that regime. In contrast, peripheral

states are less likely to intervene in domestic conflicts going on in other states. Yet, to the extent that peripheral states choose to intervene in such conflict, they are more likely to intervene on the side of the rebels. This suggests the following hypotheses.

- WS2. The class position of states in the world system affects the level of political stability within states.
  - a. States in the periphery are more likely to exhibit political instability than semiperipheral states.
  - b. Semiperipheral states are likely to be less politically stable than core states.
- WS3. Class position affects the propensity of states to intervene in civil wars.
  - a. Core states are more likely to intervene in civil wars in general, and highly likely to intervene in peripheral civil wars. Peripheral states are less likely to intervene in civil wars in general.
  - b. Core states are more likely to intervene on the government's side than on the rebels' side in civil wars.
  - c. To the extent that peripheral states intervene in ongoing civil wars, this is likely to be on the side of the rebels.

b. *Social Class and International Conflict: Two Interpretations.* There is no explicit statement connecting the position of states in the world system to their propensity to fight or regarding the identity of their rivals.<sup>7</sup> However, there are several reasons to expect such a relationship. First, if a dominant mode of production advantages some states and disadvantages others, then relational class structure should bear a close relationship to power structures. The principal core states are likely to be what international relations theorists label as great powers. Likewise, peripheral states are likely to be minor powers.

Second, we know from previous chapters and from other studies of conflict that national capabilities have a powerful effect on the probability of national dispute involvement. The same applies to the effect of reputational standings of states on their propensity to initiate conflict.

<sup>7</sup> The SNA studies of world systems use various conflict networks (military interventions, positioning of troops) as a basis for endogenous block formation. This implies that if two states share the same pattern of enemies, they are likely to be in the same block. One inference from this is that states in the same block are unlikely to fight each other, but are likely to fight members from other blocks. This, of course, fudges both theoretical issues, such as whether this is the "right" deduction from the theory, as well as the empirical question of whether this is indeed the case. Since I focus on the effect of class position on both patterns of intervention and on patterns of international conflict, I do not include the intervention and conflict relations in deriving class positions of states.

Given that power-related status correlates with class position, then states in the core are likely to fight more than states in the periphery. This is also consistent with the implications of world system theories. Following hypothesis WS3 above, core states are more likely to engage in all kinds of conflict, not only in interventions in the domestic conflict of peripheral states. Because core states have competing interests with other core states, they have both the capacity and the will to engage in structuring the system in line with their interests. This invariably invites resistance of other core states and semiperipheral states. Thus, core states are more likely to initiate conflict in general, not only against peripheral states.

The effect of class position on the probability of dyadic conflict involvement is more nuanced, however. It is also subject to several competing interpretations. One of the earliest versions of world system approaches stem from Lenin's and Hobson's theories of imperialism (Hobson, 1965 [1902]; Lenin, 1989 [1916]). According to these theories, the process of capitalist expansion leads to an inevitable conflict between core states as they complete their imperial expansion. Moreover, rising capitalist powers (presumably semiperipheral states seeking to become core states) undergoing late development find themselves in a divided world where there is no room for imperial expansion without clashing with other states. In the neo-imperial world (Galtung, 1971; Wallerstein, 1989: vol. 3), this clash is also a derivative of the competition between core states over newly established states and over markets. This converges with realist ideas about the great powers' struggle for hegemony. It is also supported by numerous empirical findings about the effect of states' reputational status on their propensity for conflict.

In addition, core states may resort to military force to sustain the peripheral states' dependence on them. There are a number of ways they do this. One is by initiating conflict or intervening in conflicts that take place on the periphery. Another – more subtle and perhaps less costly – strategy to sustain dependence is by fueling conflicts between peripheral states by providing weapons and political support to their peripheral clients.

However, another interpretation of the world system approach is also possible. Core states may come to realize that they benefit jointly from a certain system of dependence wherein each has its own sphere of influence. Disruption of this system may harm their interests more than a competitive strategy in which they attempt to gain additional protégés at the margin. This is consistent with interpretation of world system theorists regarding the *modus vivendi* between the superpowers during the Cold War, as well as the generally cooperative run of the Great Powers on imperial territories during the second half of the nineteenth century. In contrast, the need to acquire influence among peripheral states induces a conflict between core and periphery (or between core and non-core social classes).

On the periphery, other processes are at work. Resource scarcity and lack of opportunities for upward mobility induce a competitive structure of relations among states. The economies of these states are based principally on agricultural production; hence, land and water are crucial for subsistence. Population growth in peripheral states creates lateral pressure that pushes states into conflicts (Choucri and North, 1975).

This ambiguity in the predictions of the world system approach with respect to the effect of social class position on conflict propensity is understandable given the richness and versatility of this approach. But from a positivist perspective, it is confusing. One way of reconciling these differences is by thinking about the effects of social class positions on conflict in more dynamic terms. States that have a relatively stable social class position over time are less likely to engage in conflict than states that experience frequent cross-class mobility. Rapidly changing structures of dependence – that account for frequent movement of states across social classes – induce high levels of instability in the relations of highly mobile states with former class members and new class members. This induces a great deal of uncertainty into the manner in which it will behave. In contrast, states that are established members of a given block for a fairly long time tend to have stable patterns of relations within and across social classes. Thus they are expected to resolve external problems through negotiations rather than through the initiation or involvement in international conflict.

This discussion suggests the following hypotheses:

- WS4. The social class identity of a state has a significant impact on its conflict propensity. States in the core have a higher probability of conflict initiation than states in the semiperiphery, and semiperipheral states have a higher probability of conflict initiation than peripheral states.

With respect to the effect of social class on dyadic conflict, I offer hypotheses that are derived from the two different interpretations discussed above.

- WS5. The social class identity of a dyad has a significant impact on the probability of dyadic conflict.
- a. The probability of dyadic conflict increases when the members of the dyad are peripheral states.
  - b. The probability of dyadic conflict increases when one member of the dyad is a peripheral state and the other is not.
  - c. The probability of conflict declines when both states are core states.
- WS6. Social class stability has a negative impact on the probability of conflict at the monadic as well as dyadic level.

These hypotheses offer new insights regarding the effect of world class position on the behavior of states. They take us beyond the traditional ideas concerning patterns of economic development and allow us

to connect the sociological world system theories with the international relations literature. We now turn to the empirical tests of these ideas.

## 5. Results<sup>8</sup>

I start with the analysis of the hypotheses concerning the effects of class position on economic growth. In order to highlight some of the differences between blocks and across methods for deriving block positions, I present the mean per capita GDPs (and standard deviations) by blocks, first averaged over the three periods tested in this study, and then for two representative years. This is given in [Table 10.1](#).

The data in [Table 10.1](#) suggest several interesting insights: First, generally speaking, the level of wealth in the core and the semiperiphery are significantly higher than the level of wealth in periphery states. Note that because the data presented here are based on block assignments due to centrality scores (rather than GDP scores),<sup>9</sup> these results are substantively meaningful and support notions about wealth-related differences among social classes. Second, the differences in wealth between the core and the semiperiphery are not always statistically significant. Third, the representative years suggest that these patterns of wealth are maintained over time and for most individual years in our study. The 1816–1870 period reflects little variation in wealth over blocks, but the number of states in each class is very small; thus these differences are not very meaningful.

[Table 10.2](#) examines the relationship between social class position and reputational status. The top part shows a representative contingency table analysis relating social class position to Maoz's reputational status index ([Chapter 7](#)). The bottom part of the table provides summary statistics of the various contingency tables across methods of measurement of social classes and over different time periods and network base data. The results shown in this table suggest a fairly robust relationship between social class position and reputational status. Regardless of the relational networks used to measure social class position, and regardless of the methods of block assignment (role or structural equivalence), major powers tend to be disproportionately in the core, and minor powers tend to be in the periphery. Regional powers also tend to be disproportionately in the core and underrepresented in the periphery and semiperiphery classes. The standard correlation measures (Gamma and Tau-b) are moderate and low. However, the  $m_b$  statistics, which measure the contribution of the fit between consistent and inconsistent frequencies to the Chi-Square (and assume that it is consistent to expect regional powers to be part of

<sup>8</sup> The research design is discussed in the appendix to this chapter.

<sup>9</sup> See appendix for the method of block derivations and block assignments.



Table 10.1. *Economic wealth of world economic classes<sup>a</sup>*

| Class                                                                                 | Role equivalence blocks         |             | Structural equivalence blocks   |             |
|---------------------------------------------------------------------------------------|---------------------------------|-------------|---------------------------------|-------------|
|                                                                                       | Mean per cap.<br>GDP (std. dev) | State-years | Mean per cap.<br>GDP (std. dev) | State-years |
| Average over the entire 1816–2001 period<br>(Alliance and IGO Networks)               |                                 |             |                                 |             |
| Core                                                                                  | \$6,161.3<br>(5,481.7)          | 2,897       | \$4,930.0<br>(4,716.5)          | 2,202       |
| Semiperiphery                                                                         | 3,329<br>(4,165.6)              | 2,104       | 4,906.3<br>(5,471.0)            | 3,424       |
| Periphery                                                                             | 2,449.7<br>(2,923.5)            | 5,223       | 2,173.7<br>(2,270.5)            | 4,589       |
| Average over the 1870–2001 Period<br>(Alliances, IGO, and Trade Networks)             |                                 |             |                                 |             |
| Core                                                                                  | \$6,101.1<br>(5,717.5)          | 2,624       | \$6,642.4<br>(4,998.3)          | 3,763       |
| Semiperiphery                                                                         | 3,127.5<br>(3,346.4)            | 5,283       | 5,592.4<br>(5,167.2)            | 2,047       |
| Periphery                                                                             | 2,928.5<br>(4,373.7)            | 1,324       | 2,189.9<br>(2,465.1)            | 3,421       |
| Average over the 1950–2001 Period<br>(Alliances, IGO, trade, and arms trade networks) |                                 |             |                                 |             |
| Core                                                                                  | \$11,044.2<br>(6,222.3)         | 744         | \$8,035.4<br>(5,819.8)          | 1,154       |
| Semiperiphery                                                                         | 6,435.2<br>(5,369.1)            | 2,014       | 4,951.9<br>(5,059.0)            | 1,212       |
| Periphery                                                                             | 2,385.4<br>(2,578.9)            | 3,544       | 3,647.6<br>(4,549.2)            | 3,936       |
| Average for 1913                                                                      |                                 |             |                                 |             |
| Core                                                                                  | \$3,255.3<br>(1,276.2)          | 16          | \$2,892.2<br>(1,542.3)          | 11          |
| Semiperiphery                                                                         | –                               | –           | 3,005.7<br>(1,133.4)            | 10          |
| Periphery                                                                             | 1,567.5<br>(874.3)              | 15          | 1,373.6<br>(750.0)              | 10          |
| Average for 2000                                                                      |                                 |             |                                 |             |
| Core                                                                                  | \$17,830.6<br>(7,010.3)         | 15          | \$13,246.4<br>(8,385.1)         | 21          |
| Semiperiphery                                                                         | 8,009.3<br>(6,892.2)            | 59          | 9,375.5<br>(7,442.1)            | 28          |
| Periphery                                                                             | 2,865.2<br>(2,402.9)            | 80          | 4,081.3<br>(4,867.5)            | 105         |

<sup>a</sup> Ns lower than actual block affiliations due to missing GDP data.

Table 10.2. *Social class and international reputation*10.2.1. *Role equivalence and international reputation, 1816–2001*

| International reputation | Social class (role equivalence base) |               |            | Total  |
|--------------------------|--------------------------------------|---------------|------------|--------|
|                          | Periphery                            | Semiperiphery | Core       |        |
| Minor power              | 6,190                                | 2,506         | 2,811      | 11,507 |
| Expected freq.           | (5,876.80)                           | (2,440.30)    | (3,189.90) |        |
| Regional power           | 344                                  | 147           | 404        | 895    |
| Expected freq.           | (457.1)                              | (189.80)      | (248.10)   |        |
| Major power              | 115                                  | 108           | 394        | 617    |
| Expected freq.           | (315.1)                              | (130.9)       | (171)      |        |
| Total                    | 6,649                                | 2,761         | 3,609      | 13,019 |

$\chi^2 = 620.765$ ; Gamma = 0.457; Tau-b = 0.179;  $m_b = 0.884$

10.2.2. *General correlations between social class and reputational class*

| Model and Period                  | Statistic   |         |         |         |
|-----------------------------------|-------------|---------|---------|---------|
|                                   | $\chi^2$    | Gamma   | Tau-b   | $m_b$   |
| Role equivalence, 1816–2001       | 620.765**   | 0.457** | 0.179** | 0.884** |
| Role equivalence, 1870–2001       | 1,120.750** | 0.692** | 0.258** | 0.902** |
| Role equivalence, 1950–2001       | 1,147.41**  | 0.709** | 0.244** | 0.997** |
| Structural equivalence, 1816–2001 | 378.369**   | 0.382** | 0.151** | 0.830** |
| Structural equivalence, 1870–2001 | 264.743**   | 0.243** | 0.087** | 0.670** |
| Structural equivalence, 1950–2001 | 774.281**   | 0.777** | 0.296** | 0.900** |

\*\*  $p < 0.001$ .

the core) shows a strong relationship between social class and reputational status. This is an important result. It answers affirmatively one of the key questions of this study – the extent to which ideas derived from world system analysis match ideas derived from more “mainstream” international relations theories.

Another important but largely untested issue in empirical studies of the world system concerns block stability. The argument of block stability in world system approaches applies primarily to peripheral states. Thus, states that are “stuck” on the periphery are likely to stay there for long periods of time. Table 10.3 displays measures of block stability (the percentage of state years where there was no movement across block types) for the three periods and for the two measures of equivalence.

Table 10.3. *Social class and block stability – proportion of state years in the same block by class position*

| Block position | Block stability: Proportion of state years in the same block |                 |        |                 |        |                 |        |                 |        |                 |
|----------------|--------------------------------------------------------------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|
|                | RE1816                                                       | No. state years | SE1816 | No. state years | RE1870 | No. state years | SE1870 | No. state years | RE1950 | No. state years |
| Periphery      | Mean                                                         | 73.6%           | 6,649  | 55.8%           | 5,940  | 36.6%           | 2,081  | 39.5%           | 4,454  | 80.3%           |
|                | SD                                                           | 35.8%           |        | 39.8%           |        | 37.4%           |        | 40.6%           |        | 31.8%           |
| Semiperiphery  | Mean                                                         | 29.6%           | 2,761  | 26.2%           | 4,080  | 34.3%           | 6,386  | 16.7%           | 2,439  | 53.4%           |
|                | SD                                                           | 29.9%           |        | 30.9%           |        | 32.0%           |        | 23.8%           |        | 37.7%           |
| Core           | Mean                                                         | 20.8%           | 3,609  | 24.5%           | 2,999  | 36.7%           | 2,743  | 15.5%           | 4,317  | 55.3%           |
|                | SD                                                           | 25.9%           |        | 29.9%           |        | 31.6%           |        | 23.3%           |        | 45.0%           |
| Entire sample  | Mean                                                         | 49.6%           | 13,019 | 39.3%           | 13,019 | 35.3%           | 11,210 | 25.3%           | 11,210 | 69.4%           |
|                | SD                                                           | 40.5%           |        | 38.2%           |        | 33.0%           |        | 33.5%           |        | 37.5%           |

Notes: RE1816 = Role equivalence class over the 1816–2001 period; SE1816 = Structural equivalence class over the 1816–2001 period.  
 RE1870 = Role equivalence class over the 1870–2001 period; SE1870 = Structural equivalence class over the 1870–2001 period.  
 RE1950 = Role equivalence class over the 1950–2001 period; SE1950 = Structural equivalence class over the 1950–2001 period.

The results in [Table 10.3](#) suggest that block position is significantly more stable for peripheral states than for either core or semiperipheral states. The difference between the block stability of core and semiperipheral states is for the most part not statistically significant. Another important result is that the level of stability of peripheral states is significantly higher in the post-1950 era than in the previous periods.

There may be two explanations for this greater stability in the post-WWII era. One explanation is data-related. Increased block stability in the post-WWII era is due to the fact that the measurement and assignment of block position is based on more network dependencies after 1950 than prior to that. Consequently, we have more data to gauge the role or structural equivalence of states for the post-1950 period than for prior periods. The alternative explanation – consistent with the expectation of the world system approach – is that this relatively fixed block structure is due to greater structural stability in the post-WWII international system. This stems from the fact that the post-WWII era involved accelerated decolonization and state formation in areas that had been controlled by the core states under imperial systems. This process induced structural dependence of the peripheral states on their former colonial occupiers, and this dependence remained fairly constant over time.

An analysis of variance on block stability using the network data for only the post-WWII era reveals that it is the structural stability of the international system rather than variation in measurement of role and structural equivalence that accounts for these changes. This, too, provides tentative support for the expectations of the world system approach with respect to the division of the global system into social classes.

We now examine the effect of structural class position of states on their economic growth ([Table 10.4](#)).

The results of the [Table 10.4](#) analysis provide partial support for the hypotheses derived from world system approaches. When we measure economic growth in terms of absolute annual changes in per capita GDP, class position has a strong effect on growth: Core states grow at much higher absolute rates than semiperipheral states, and semiperipheral states grow at higher rates than peripheral states.<sup>10</sup> These results are highly robust. They hold regardless of the type of networks used to measure equivalence, and regardless of the method of measurement. They also hold regardless of the temporal sample. However, when measured in terms of percent annual change in per capita GDP, class position has a significant positive effect on growth rates over the 1950 to 2001 period, but not at earlier periods.

<sup>10</sup> On average, core states grow at double the rate of periphery states and the growth of semiperiphery states is about 35% higher than that of periphery states.

Table 10.4. *Effects of class position on economic growth: time-series cross-sectional analysis of nations, 1816–2001*

| Independent variable                       | Role equivalent<br>1816–2001                        | Role equivalent<br>1870–2001                       | Role equivalent<br>1950–2001                       |                                                    |
|--------------------------------------------|-----------------------------------------------------|----------------------------------------------------|----------------------------------------------------|----------------------------------------------------|
| Absolute Change in GDP $t-1 \rightarrow t$ |                                                     |                                                    |                                                    |                                                    |
| Regime score                               | 1.238**<br>(0.100)                                  | 1.226**<br>(0.113)                                 | 1.337**<br>(0.109)                                 | 1.204**<br>(0.157)                                 |
| Past MID as target                         | 21.094<br>(12.788)                                  | 21.892<br>(14.032)                                 | 22.224<br>(14.056)                                 | 18.399<br>(18.999)                                 |
| Military burden                            | 131.427<br>(186.288)                                | 160.431<br>(195.900)                               | 160.906<br>(196.677)                               | -4.451<br>(274.727)                                |
| Civil war involvement                      | -61.183**<br>(18.415)                               | -62.843**<br>(18.387)                              | -72.298**<br>(20.655)                              | -74.070**<br>(25.575)                              |
| Class position                             | 14.033**<br>(4.954)                                 | 12.490*<br>(5.226)                                 | 3.098<br>(4.482)                                   | 68.342**<br>(9.581)                                |
| Constant                                   | 39.547**<br>(10.395)                                | 42.677**<br>(10.658)                               | 60.572**<br>(11.063)                               | -20.827<br>(16.963)                                |
| Model statistics                           | N = 10,056<br>States = 155<br>$\chi^2 = 203.4^{**}$ | N = 9,088<br>States = 155<br>$\chi^2 = 191.9^{**}$ | N = 9,088<br>States = 155<br>$\chi^2 = 178.5^{**}$ | N = 6,210<br>States = 155<br>$\chi^2 = 211.3^{**}$ |
|                                            |                                                     |                                                    |                                                    | N = 6,210<br>States = 155<br>$\chi^2 = 177.7^{**}$ |

(continued)

Table 10.4. (*continued*)

| Independent variable                                         | Role equivalent<br>1816–2001                       | Role equivalent<br>(1870–2001)                    | Role equivalent<br>(1950–2001)                    |
|--------------------------------------------------------------|----------------------------------------------------|---------------------------------------------------|---------------------------------------------------|
| <b>Relative change in GDP <math>t-1 \rightarrow t</math></b> |                                                    |                                                   |                                                   |
| Regime score                                                 | 7.78e-05**<br>(1.66e-05)                           | 6.47e-05**<br>(1.89e-05)                          | 1.26e-04<br>(2.44e-04)                            |
| Past MID as target                                           | 0.005*<br>(0.002)                                  | 0.005**<br>(0.002)                                | 0.007*<br>(0.003)                                 |
| Military burden                                              | -0.031<br>(0.032)                                  | -0.046<br>(0.034)                                 | -0.066<br>(0.043)                                 |
| Civil war involvement                                        | -0.015**<br>(0.003)                                | -0.015**<br>(0.003)                               | -0.018**<br>(0.004)                               |
| Class position                                               | -0.001<br>(0.001)                                  | 0.001<br>(0.001)                                  | 0.007**<br>(0.002)                                |
| Constant                                                     | 0.018**<br>(0.002)                                 | 0.014**<br>(0.003)                                | 0.008**<br>(0.002)                                |
| Model statistics                                             | N = 10,056<br>States = 155<br>$\chi^2 = 51.7^{**}$ | N = 9,088<br>States = 155<br>$\chi^2 = 43.0^{**}$ | N = 6,210<br>States = 155<br>$\chi^2 = 64.8^{**}$ |
|                                                              |                                                    |                                                   | N = 6,210<br>States = 155<br>$\chi^2 = 68.4^{**}$ |

Notes: \*  $p < 0.05$ ; \*\*  $p < 0.01$ .

It is useful to discuss briefly the effects of the control variables on economic growth. Civil war occurrence in a state is the only variable that has a robust negative effect on economic growth across strata and across measures of the dependent variable. Regime score has a robust positive effect on absolute growth, but its effects on relative growth are less robust. Neither past MID involvement nor military burdens appears to have a significant effect on economic growth.

I now turn to the analysis of the effects of class position on political stability of states. The first test examines the effect of class position on the probability of civil war and civil conflict. The results of this set of tests are displayed in [Table 10.5](#). The results of this table provide mixed support to WS2: Class position has a negative effect on the probability of civil war occurrence, meaning that core states are less likely to engage in civil wars than peripheral states. However, this effect is not robust across datasets and across the method used to designate states to social classes. Class position seems to be related to the probability of civil war in the Fearon and COW datasets but not in the PRIO dataset, which focuses on both large-scale civil conflicts and low-intensity civil conflict. Moreover, in the COW civil war dataset, only the block position based on structural equivalence scores affects the probability of civil war. The stability of states within social classes has a significant and fairly robust negative impact on the probability of civil war. States that have recently moved from one social class to another are much more likely to experience civil wars than states that have stayed in the same block position for a while.

Most of the control variables affect the probability of civil war as expected. Higher GDPs, economic growth, and regime type reduce the likelihood of civil war. Past involvement in MIDs has a robust positive effect on the probability of civil war outbreak. Other control variables do not show a robust pattern of effects on measures of civil war.<sup>11</sup>

The results of an analysis regressing the side on which states intervene on their social class position (along with the same control variables as in [Table 10.5](#)) shows that, generally speaking, core states tend to support the government side when intervening in ongoing civil wars, whereas periphery states tend to support opposition sides. These results are not robust. They hold only for social class positions of states based on post-1950 data but not for previous periods. This provides partial support for WS3.<sup>12</sup>

<sup>11</sup> The cultural diversity variable has varied effects on the probability of civil war depending on the set of independent variables and the time period used. Culturally homogeneous states are less likely to experience civil war, in general, but are more likely to experience civil war when controlling for class position based on structural equivalence and for the post-1950 period.

<sup>12</sup> The results of this analysis are displayed in the book's Web site.

Table 10.5. *Block position of states and civil war outbreak, 1950–2001*

|                          | PRIO civil conflict data          |                                   | Fearon et al. data              |                                 | COW civil war data            |                                 |
|--------------------------|-----------------------------------|-----------------------------------|---------------------------------|---------------------------------|-------------------------------|---------------------------------|
|                          | Role eq. 1950                     | Struc eq. 1950                    | Role eq. 1950                   | Struc eq. 1950                  | Role eq. 1950                 | Struc eq. 1950                  |
| Cultural cohesion        | 0.155<br>(0.280)                  | -0.073<br>(0.289)                 | -1.193**<br>(0.376)             | -0.850*<br>(0.397)              | -1.045**<br>(0.285)           | 0.613*<br>(0.308)               |
| Per capita GDP           | -7.54e-05**<br>(2.18e-05)         | -1.01e-04**<br>(2.18e-05)         | -1.20e-04**<br>(4.19e-05)       | -7.07e-05*<br>(3.76e-05)        | -6.98e-05**<br>(2.45e-05)     | -1.73e-04**<br>(3.67e-05)       |
| Change in per capita GDP | -2.048*<br>(1.004)                | -2.316*<br>(1.034)                | -6.336**<br>(1.241)             | -5.999**<br>(1.361)             | -6.715**<br>(1.063)           | -7.052**<br>(1.119)             |
| MIDs as target           | 0.531**<br>(0.162)                | 0.413**<br>(0.165)                | 0.510*<br>(0.228)               | 0.429<br>(0.248)                | 0.785**<br>(0.175)            | 0.434*<br>(0.175)               |
| Regime type              | -0.206**<br>(0.083)               | -0.263**<br>(0.086)               | -0.746**<br>(0.229)             | -0.930**<br>(0.237)             | -0.299**<br>(0.090)           | -0.323**<br>(0.092)             |
| Regime persistence       | 0.003<br>(0.002)                  | 0.003<br>(0.003)                  | -0.012*<br>(0.005)              | -0.010*<br>(0.005)              | 0.009*<br>(0.004)             | 0.011*<br>(0.005)               |
| Class position of state  | -0.065<br>(0.111)                 | 0.047<br>(0.081)                  | -0.650**<br>(0.133)             | -0.827**<br>(0.130)             | -0.477**<br>(0.147)           | -0.024<br>(0.098)               |
| Prop. years in position  | -0.362*<br>(0.167)                | -1.026**<br>(0.191)               | -0.442**<br>(0.124)             | -0.909**<br>(0.246)             | -0.367*<br>(0.188)            | -1.272**<br>(0.202)             |
| Years W/O civil war      | -1.494**<br>(0.091)               | -1.454**<br>(0.091)               | -1.134**<br>(0.189)             | -1.830**<br>(0.153)             | -0.036**<br>(0.010)           | -0.042**<br>(0.010)             |
| Constant                 | 1.983**<br>(0.357)                | 2.297**<br>(0.324)                | 2.950**<br>(0.497)              | 3.243**<br>(0.338)              | -0.0935<br>(0.329)            | 0.502<br>(0.353)                |
| Model statistics         | N = 5,570<br>$\chi^2 = 1,412.8**$ | N = 5,570<br>$\chi^2 = 1,399.4**$ | N = 4,828<br>$\chi^2 = 721.3**$ | N = 4,828<br>$\chi^2 = 747.9**$ | N = 4,992<br>$\chi^2 = 351.5$ | N = 4,992<br>$\chi^2 = 357.4**$ |
|                          | R <sup>2</sup> = 0.564            | R <sup>2</sup> = 0.570            | R <sup>2</sup> = 0.619          | R <sup>2</sup> = 0.629          | R <sup>2</sup> = 0.424        | R <sup>2</sup> = 0.426          |

\*  $p < 0.05$ ; \*\*  $p < 0.01$



I now turn to the international consequences of social class position. Table 10.6 shows the results of the state-level analyses of the effects of social class position on conflict behavior. Table 10.7 shows the dyadic analyses of class position effects on the probability of dyadic conflict. The results are quite interesting and depart significantly from some of the hypothesized relationships. At the national level, class position does not appear to have a noticeable effect on conflict initiation and war involvement. One exception is the positive effect of class position on the war involvement of states when class position is determined via structural equivalence using all four dependence networks (over the 1950–2001 period).

The dyadic analyses also show inconsistent results. The effect of social class position on dyadic conflict depends on the method of block assignment and on the period. For the most part, however, dyadic class position had a positive effect on the probability of conflict initiation and war outbreak. The longevity of dyadic placement in a given social class had robust negative impact on the propensity of states to initiate conflicts and to get involved in wars. The same applies to the effect of class duration on dyadic conflict, but here, the results are far less robust than in the monadic analyses.

All in all, the association between social class position and international conflict involvement is not all that clear. The results do not consistently support any of the hypotheses on these matters. Nevertheless, there is some evidence that core states are more conflict-prone than peripheral states. Moreover, class position has a significant impact on the probability of dyadic conflict. However, more research on these matters is certainly warranted before any definitive conclusions can be made.

## 6. Conclusion: Theoretical and Policy Implications

This chapter offers a new conceptualization of the key propositions of the world system approach, as well as a set of tests of these propositions. It extends previous tests relying on SNA by connecting ideas from the theory to structural and behavioral aspects of international politics and domestic political stability. I develop an alternative approach to modeling the position of states in the world system, building on the notion that a state's position is a function of its dependence relations across a number of dimensions – economic, strategic, and institutional. I also contend that tests of world system theories entail dynamic approaches and methods, allowing for cross-block mobility of states.

Although there have been implicit and explicit speculations about conflicts within and between social classes,<sup>13</sup> the present study is – to

<sup>13</sup> Wilkinson (1987), for example, argues that conflict is an integrating mechanism among core states, and as such is likely to be fairly common.

Table 10.6. *Effects of class position on national conflict initiation and war involvement: binary time-series cross-sectional analysis*

|                            | MID initiation                                             |                                                            |                                                           | War involvement                                            |                                                            |                                                         |
|----------------------------|------------------------------------------------------------|------------------------------------------------------------|-----------------------------------------------------------|------------------------------------------------------------|------------------------------------------------------------|---------------------------------------------------------|
|                            | Role eq.<br>1816–2001                                      | Role eq.<br>1870–2001                                      | Role eq.<br>1950–2001                                     | Structural eq.<br>1816–2001                                | Structural eq.<br>1870–2001                                | Structural eq.<br>1950–2001                             |
| Regime score               | –0.001<br>(0.001)                                          | –0.003**<br>(0.001)                                        | –0.002*<br>(0.001)                                        | 0.000<br>(0.001)                                           | 0.000<br>(0.001)                                           | 0.001<br>(0.002)                                        |
| Size of SRG                | 0.012**<br>(0.002)                                         | 0.011**<br>(0.002)                                         | 0.010**<br>(0.003)                                        | –0.005<br>(0.004)                                          | –0.004<br>(0.004)                                          | 0.001<br>(0.005)                                        |
| Reputational status (Maoz) | 0.497**<br>(0.051)                                         | 0.578**<br>(0.057)                                         | 0.491**<br>(0.094)                                        | 0.304**<br>(0.078)                                         | 0.318**<br>(0.092)                                         | 0.127<br>(0.169)                                        |
| No. MID as target          | 0.764**<br>(0.086)                                         | 0.832**<br>(0.089)                                         | 0.850**<br>(0.113)                                        | 0.911**<br>(0.138)                                         | 0.825*<br>(0.156)                                          | 0.753**<br>(0.211)                                      |
| Civil war underway         | 0.389**<br>(0.109)                                         | 0.386**<br>(0.116)                                         | 0.301**<br>(0.130)                                        | 0.331*<br>(0.166)                                          | 0.246<br>(0.185)                                           | 0.706**<br>(0.212)                                      |
| Class position             | –0.030<br>(0.038)                                          | –0.043<br>(0.036)                                          | 0.062<br>(0.054)                                          | 0.004<br>(0.062)                                           | –0.077<br>(0.058)                                          | 0.452**<br>(0.094)                                      |
| Persistence in position    | –0.538**<br>(0.086)                                        | –0.332**<br>(0.099)                                        | –0.801**<br>(0.111)                                       | –0.691**<br>(0.137)                                        | –0.959**<br>(0.176)                                        | –0.797**<br>(0.219)                                     |
| No. peace years            | –1.059**<br>(0.051)                                        | –1.037**<br>(0.053)                                        | –1.030**<br>(0.068)                                       | –0.721**<br>(0.041)                                        | –0.739**<br>(0.044)                                        | –0.700**<br>(0.060)                                     |
| Constant                   | –0.153<br>(0.115)                                          | –0.341**<br>(0.103)                                        | –0.253*<br>(0.135)                                        | –0.433**<br>(0.172)                                        | –0.123<br>(0.181)                                          | –1.249**<br>(0.297)                                     |
| Model statistics           | N = 12,787<br>$\chi^2 = 2,515.2$<br>R <sup>2</sup> = 0.281 | N = 11,025<br>$\chi^2 = 2,210.2$<br>R <sup>2</sup> = 0.278 | N = 6,946<br>$\chi^2 = 1,463.8$<br>R <sup>2</sup> = 0.291 | N = 12,787<br>$\chi^2 = 1,493.5$<br>R <sup>2</sup> = 0.368 | N = 11,025<br>$\chi^2 = 1,321.7$<br>R <sup>2</sup> = 0.394 | N = 6,946<br>$\chi^2 = 747.4$<br>R <sup>2</sup> = 0.410 |

Table 10.7. *Effects of structural class position on dyadic conflict – time-series cross-sectional analysis of politically relevant dyads*

| Independent variable                | MID initiation <sup>a</sup>                                  |                                                             |                                                             | War outbreak <sup>b</sup>                                  |                                                            |                                                          |
|-------------------------------------|--------------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------|------------------------------------------------------------|------------------------------------------------------------|----------------------------------------------------------|
|                                     | Role eq. 816                                                 | Role eq. 870                                                | Role eq. 950                                                | Sruct. eq. 1816                                            | Sruct. eq. 1870                                            | Sruct. eq. 1950                                          |
| Min. regime score                   | -0.001**<br>(4.21e-04)                                       | -0.005**<br>(4.77e-04)                                      | -0.006**<br>(0.001)                                         | -0.005**<br>(0.001)                                        | -0.010**<br>(0.001)                                        | -0.018**<br>(0.002)                                      |
| Capability ratio (A/B) <sup>c</sup> | -9.82e-07<br>(4.43e-06)                                      | 1.50e-06<br>(4.20e-06)                                      | 1.01e-05<br>(3.66e-06)                                      | -0.009**<br>(0.001)                                        | -0.009**<br>(0.001)                                        | -0.009**<br>(0.002)                                      |
| SRG members                         | 0.795**<br>(0.077)                                           | 1.348**<br>(0.072)                                          | 1.652**<br>(0.092)                                          | 2.208**<br>(0.169)                                         | 2.263**<br>(0.191)                                         | 2.504**<br>(0.387)                                       |
| Distance                            | -1.87e-04**<br>(9.89e-06)                                    | -2.30e-04**<br>(1.17e-05)                                   | -2.51e-04**<br>(1.71e-05)                                   | 4.32e-06**<br>(2.37e-05)                                   | 4.52e-05**<br>(2.35e-05)                                   | 1.13e-04**<br>(4.82e-05)                                 |
| Class position state A              | 0.083**<br>(0.026)                                           | 0.320**<br>(0.041)                                          | 0.012<br>(0.045)                                            | 0.339**<br>(0.069)                                         | 0.151*<br>(0.078)                                          | 0.144<br>(0.157)                                         |
| Class position state B              | -0.102**<br>(0.029)                                          | 0.258**<br>(0.042)                                          | 0.176**<br>(0.043)                                          | 0.214**<br>(0.077)                                         | 0.117<br>(0.089)                                           | 0.616**<br>(0.152)                                       |
| Min. pct. years in class            | -0.172**<br>(0.044)                                          | -0.317**<br>(0.060)                                         | 0.330**<br>(0.071)                                          | -0.224**<br>(0.097)                                        | -0.110<br>(0.120)                                          | 0.187<br>(0.220)                                         |
| No conflict years                   | -0.481**<br>(0.016)                                          | -0.419**<br>(0.015)                                         | -0.372**<br>(0.018)                                         | -0.829**<br>(0.065)                                        | -0.887**<br>(0.073)                                        | -0.764**<br>(0.111)                                      |
| Constant                            | -1.610**<br>(0.098)                                          | -3.196**<br>(0.118)                                         | -3.733**<br>(0.122)                                         | -4.692**<br>(0.220)                                        | -4.402**<br>(0.248)                                        | -7.068**<br>(0.433)                                      |
| Model statistics                    | N = 174,280<br>$\chi^2 = 10,112.8$<br>R <sup>2</sup> = 0.234 | N = 153,827<br>$\chi^2 = 7,539.3$<br>R <sup>2</sup> = 0.239 | N = 105,502<br>$\chi^2 = 4,385.9$<br>R <sup>2</sup> = 0.264 | N = 87,238<br>$\chi^2 = 1,411.5$<br>R <sup>2</sup> = 0.318 | N = 76,792<br>$\chi^2 = 1,241.2$<br>R <sup>2</sup> = 0.347 | N = 52,801<br>$\chi^2 = 428.8$<br>R <sup>2</sup> = 0.358 |

Notes: Numbers in parentheses are robust standard errors.

<sup>a</sup> Directed dyads.

<sup>b</sup> Nondirected dyads.

<sup>c</sup> for directed dyads: CAPRAT = CAPA/CAPB; for nondirected dyads CAPRAT = CAP<sub>if</sub>/CAP<sub>i</sub>.

the best of my knowledge – the first systematic investigation of the effect of the social class position of states on their domestic political stability and on their international conflict behavior. The hypotheses linking states' position to their political stability and to their propensity to fight are an important extension of the world system model. However, the manner in which social position is expected to relate to international conflict according to the world system model is not as linear and as clear as one would expect. Clearly, more theorizing on these matters is needed.

This chapter carries several theoretical and practical implications: First, it suggests that SNA approaches offer extremely useful strategies to world system modeling, not only in the static sense suggested by previous studies, but also in a more dynamic time-varying fashion. This opens the door to a number of important analyses on the stability and instability of states' positions within the world system, and the factors that affect mobility or immobility of these positions. Second, it opens a new window to the study of the – possibly reciprocal – relationship among several seemingly independent processes such as external conflict, dependence, world system position, and economic growth. These investigations may offer new and surprising insights into the evolution of international relations and of the international political economy.

Third, if the findings of this study are replicated in future analyses, they suggest that the division of labor in the world system carries an explosive potential. The conflict that we observe between the core and the periphery, as well as frequent intra-periphery conflicts and war, need to be addressed more thoroughly by the international community because they seem to provide the foundation for new and significant fault lines in the future.

## Methodological Appendix to Chapter 10

*Spatial and temporal domain.* This study covers all states in the international system over the period of 1816–2001. I use three subsets of this period due to different temporal spans of certain datasets used to develop blockmodels.

### Data Sources

Data on conflict, regime type, distance, SRG, and on trade, alliances, and IGO networks are the same as those used in previous chapters (see appendix to [Chapters 3](#) and [4](#)). Arms-transfer data were discussed in the appendix to [Chapter 6](#). I have also used a number of new datasets for the present study.

*Economic growth data.* Angus Maddison's (2008) dataset provides absolute and per capita GDP data for most states in the system since 1820.

*Civil war.* (1) The Fearon et al. (2007) civil war dataset covers the 1959–2001 period. (2) The COW civil war dataset (COW, 2008) covers the entire 1816–2001 period, and (3) the PRIO Armed Conflict dataset (Harbom and Sundberg, 2008) covers the 1946–2001 period. The correspondence between these datasets is moderate.<sup>14</sup>

*Units of analysis.* First, the state-year unit of analysis is used to study the effect of social position of a state on its economic growth, political stability, and its conflict behavior over time. The dyad-year unit is employed in the study of the effect of social position dyadic conflict. Dyadic data are also used for social network construction because most relational data come in dyad-year form. The dyadic conflict analyses are restricted to politically relevant dyads.

### Measurement of Variables

*Economic growth.* Economic growth variables are measured in two ways. One is an annual change in per capita GDP ( $GDPCCH = PCGDP_t - PCGDP_{t-1}$ ), the other is percent annual change in per capita GDP ( $PCGDPCCH = (PCGDP_t - PCGDP_{t-1})/PCGDP_{t-1}$ ).

*International conflict.* The definition of the conflict variables at both the national and dyadic levels of analysis is given in previous chapters (appendix to Chapter 6).

*Civil war.* As a dependent variable it is defined as 1 if a civil war broke out, and zero otherwise. When used as a control variable in the analyses on international conflict involvement, this is the number of years a civil war was underway over the past five-year period.

*Block position.* The procedure for deriving blocks is somewhat complex. As noted, I use several networks to measure block positions of states. The specific set of networks used depends on data availability. Therefore, I construct multiple indicators of role and structural equivalence for different periods. Table A10.1 provides the details of these indices.

I demonstrate the measurement of block positions with a set of four networks: a general trade network, an arms transfer network, an alliance network, and an IGO network. Each network is represented by an

<sup>14</sup> The relevant Tau-b statistics are: COW-Fearon = 0.823; COW-PRIO = 0.489; Fearon-PRIO = 0.486 for civil war occurrence (where occurrence is defined as 1 if a civil war was underway for a given state year and zero otherwise). The lower correlations between COW, Fearon and PRIO are due to the fact that the latter dataset includes low-intensity civil conflicts, whereas the former two datasets focus on high-intensity conflict. When only high-intensity conflicts are included, convergence increases to  $\text{Tau-b} \cong 0.64$ .

Table A10.1. *Data for role and structural equivalence foundations of blockmodels and block positions*

| Period    | Alliance network | IGO network | Trade network | Arms Trade network | Role/structural equivalence |
|-----------|------------------|-------------|---------------|--------------------|-----------------------------|
| 1816–2001 | Yes              | Yes         | NA            | NA                 | Alliance-IGO                |
| 1870–2001 | Yes              | Yes         | Yes           | NA                 | Alliance-IGO-trade          |
| 1950–2001 | Yes              | Yes         | Yes           | Yes                | Alliance-IGO-Trade-arms     |

$n \times n$  matrix (where  $n$  is the number of states in the system) and is measured at each year. The entries in each network reflect the dependence of the column state on the row state (see [Chapter 9](#)). Figure A10.1 displays some of the networks.

Figure A10.1.1 presents two of the four networks used to derive block positions.<sup>15</sup> Each network forms a dyadic dependence matrix. The alliance network exhibits four principal clusters: the OAS cluster (lower-left side), the NATO cluster (center), the Communist cluster (the lower-right side), and the Arab League cluster (top right). These clusters are connected via several bridge states. The arms transfer network shows two large clusters – one centered on the United States, the UK, and France, and the other centered on the Soviet Union and Czechoslovakia. Both networks contain a number of isolates.

Using these four networks, I use two methods to generate blocks. The first is the role equivalence method (Burt, 1990; Van Rossem, 1996). The second is the structural equivalence method. Both methods are discussed in [Chapter 2](#).

It is useful to compare structural and role equivalence in terms of the advantages and drawbacks of each approach. The advantage of role equivalence over structural equivalence measures is primarily substantive. The position of states in a world system does not depend of the identity of states with which it has ties. Rather, it depends on the structure of ties that states have with all other states in the system. Two states are roughly role equivalent to the extent that the structure of their ties to other states is similar. This is so even if they have ties to different states (Van Rossem, 1996). The key problem – as noted in the chapter – is that in order to perform the triadic census on which role equivalence scores are based, we need to binarize the data, thus potentially biasing block positions.

<sup>15</sup> The trade and IGO networks are too complex to provide any meaningful graphic interpretation. Therefore they are not presented here.

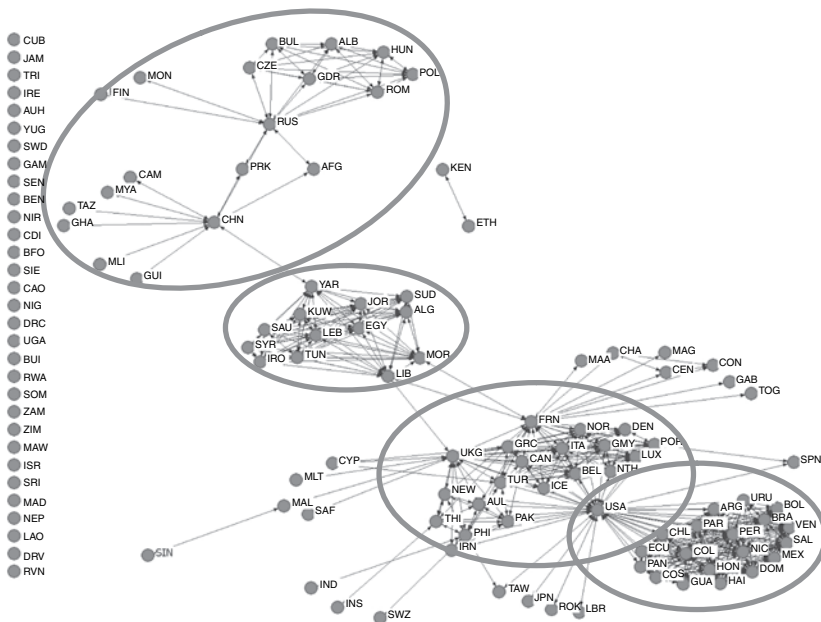


Figure A10.1.1. Alliances 1965.

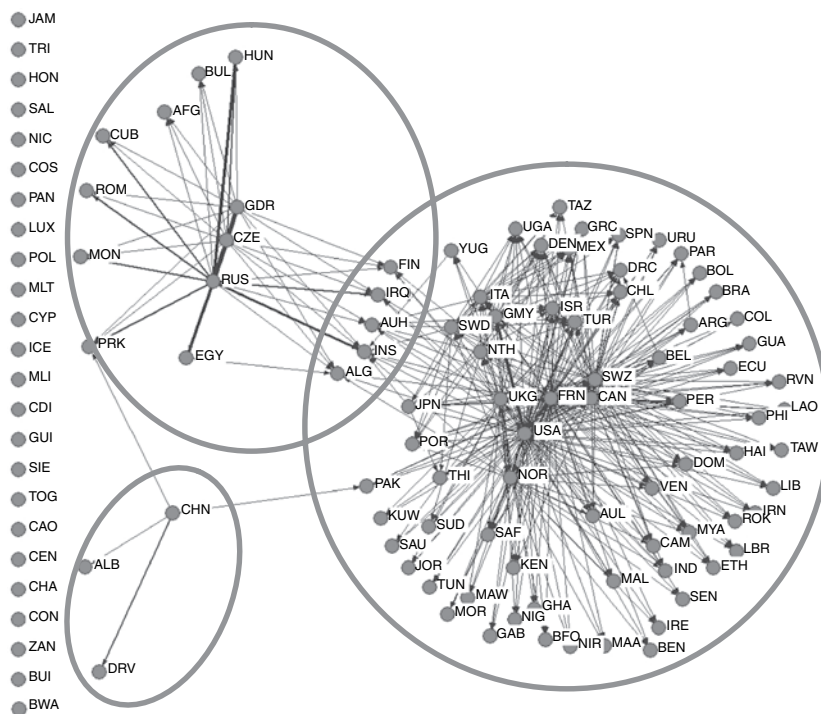


Figure A10.1.2. Arms trade 1965.

Figure A10.1. Networks and block positions of states, 1965.

Concomitantly, role equivalence cannot be integrated across multiple networks in a way that controls for intra-network dependencies. Role equivalence scores have to be computed for each network separately. This is not a problem generating the blockmodel based on role equivalence because the block generation method – CONCOR in our case – allows integration of multiple blocks through iterated multiple correlation analysis of all networks. However, if we wanted to conduct a dyadic analysis that relates role equivalence to behavior (e.g., Maoz et al., 2006), we could not create dyadically integrated role equivalence measures.

The properties of structural equivalence as the source of block positions are the opposites of those based on role equivalence. Structural equivalence scores depend on the identity of ties between nodes and all other nodes in the network. But they also reflect the actual magnitude of ties. Structural equivalence also allows integration of relations over multiple networks as part of its dyadic measures and certainly as part of its blockmodeling approach. On the other hand, structural equivalence does not adequately reflect positions based on structure of ties without regard to identity, which raises issues of interpretation.

Because neither approach of equivalence detection dominates the other, I use both role and structural methods to measure equivalence. I use the CONCOR method to generate block positions (see [Chapter 2](#)). The SE matrices already reflect a set of integrated structural equivalence scores.<sup>16</sup> Figure A10.1.2 shows the partitioning of the international system into role equivalent and structural equivalence blocks. As can be seen, the positioning of states differs significantly across methods.

The CONCOR algorithm positions states into distinct blocks. However, blocks are “blind”; they have no substantive meaning other than to represent some units that are clustered together into groups. We have no a priori way of knowing which block represents a given social class. Moreover, other world system studies using SNA were static; networks were frozen at a given point in time. In such cases, it was not crucial to designate specific blocks to the theory’s classification of core, semiperiphery, and periphery. In the present study, a block of states at one point in time may or may not be the same block number at another point. This requires setting identity markers on blocks.

In order not to conflate dependent and independent variables, I rely on centrality scores to assign substantive labels to blocks. For each year, I identify the state with the highest average centrality score (over the degree, betweenness, closeness, and eigenvector measures of centrality – see

<sup>16</sup> I restricted the CONCOR procedure to a depth of 2. This induces a relatively small number of blocks (ranging between two and five across the networks examined herein). The reason for this is that my goal is to establish three blocks that correspond to world system theories.



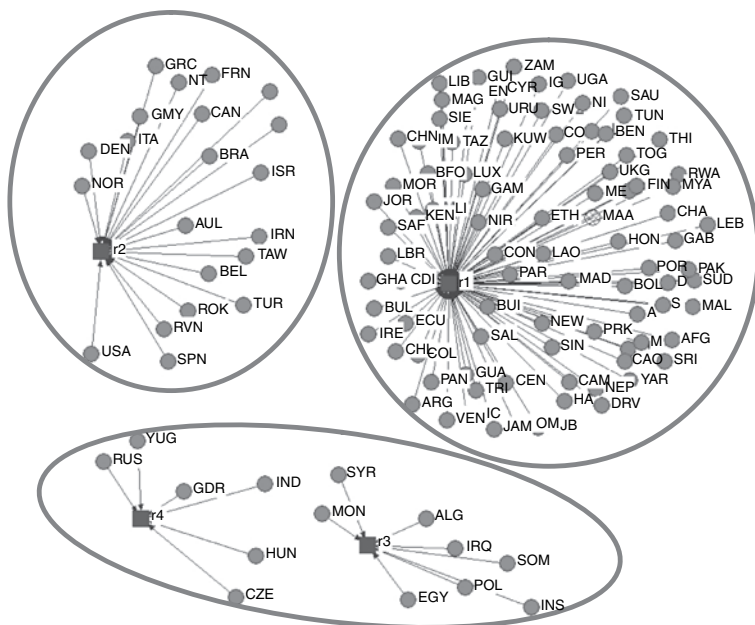


Figure A10.2.1. Structural equivalence blocks.

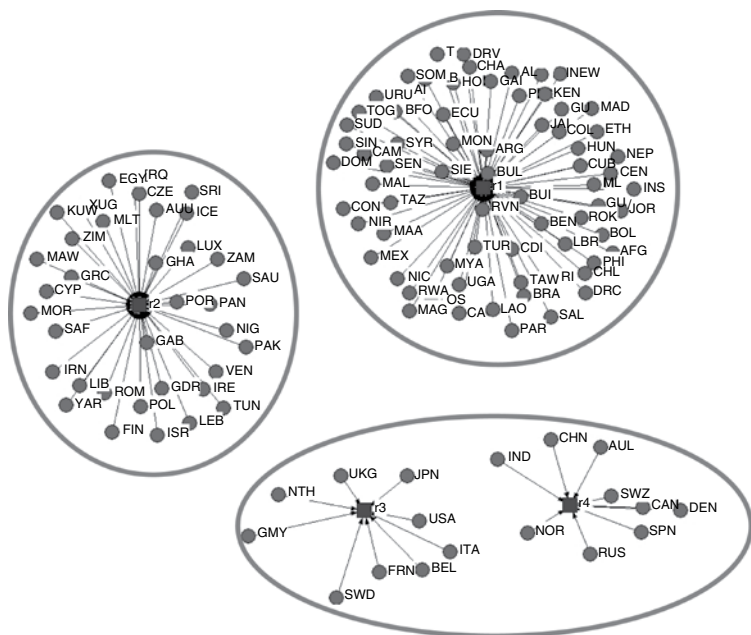


Figure A10.2.2 Role equivalence blocks.

Figure A10.2. Structural and role equivalence blocks, 1965.

Chapter 7).<sup>17</sup> The block to which this state belongs is designated as the “Core” block. All other states with the same block ID become part of the “Core” block. The block ID corresponding to the state with the lowest centrality score becomes the “Periphery.” All other blocks are designated as semiperiphery blocks.<sup>18</sup> The advantage of this method is that block assignments are based on the properties of states as measured on relational factors rather than on factors that serve to measure economic growth.

The multiple indicators (multiple networks used across different time periods), and the two methods of equivalence measurement require analyzing the extent to which block assignments correlate within method (across different sets of networks used to generate role and structural equivalence scores) and between methods (network assignments based on role equivalence versus role assignments based on structural equivalence). Table A10.2 provides the results of this analysis.

The results shown in Table A10.2 suggest that variation in terms of method and data produce dramatically different block assignments. With two networks (alliances and IGO memberships), we get a fairly good convergence between structural equivalence and role equivalence blocks. With one (trade) or two (trade and arms trade) networks added, we get a very low convergence between structural and role equivalence blocks. This suggests that the measurement of class position is not robust across methods, and thus we can expect considerable variation in the empirical results.

*Block stability.* Block stability defines the duration of a state’s position within a given structural block. It is measured as the number (or proportion) of the state’s years of independence in which it found itself in a given block.

*Control variables.* Most of the control variables had been defined in previous chapters.

*Cultural cohesion.* The religious similarity ( $R_t$ ) and linguistic similarity ( $L_t$ ) sociomatrices (see Chapter 4). The main diagonal of each of these matrices provides me with an index of state-level religious/linguistic diversity. The cultural cohesion measure is defined as  $cultcoh_{it} = 1 - 0.5(r_{iii} + l_{iii})$ . It ranges between zero (complete diversity – that is, the population is uniformly distributed among several cultural groups) and 1 (the population is composed of a single cultural group).

<sup>17</sup> Some scholars used GDP or GNP values to assign labels to blocks that had been derived via a variety of clustering or partitioning techniques. (See, e.g., Nemeth and Smith, 1985; Smith and White, 1992.)

<sup>18</sup> There were a few years where the block number of the state with the highest average centrality score and the state with the lowest score were identical. In this case, I went to the second-highest and/or second-lowest scores and designated the block number of the state with such a score as the “core” or “periphery.”

Table A10.2. *Correlations between block positions of states based on different block assignment methods and different sets of network relations*10.2.1. *Example of a contingency table analysis*

| Role equivalence blocks, 1816–2001 | Structural equivalence blocks 1816–2001 |               |        | Row total<br>row cell % |
|------------------------------------|-----------------------------------------|---------------|--------|-------------------------|
|                                    | Periphery                               | Semiperiphery | Core   |                         |
| Periphery                          | 5,389                                   | 807           | 453    | 6,649                   |
| Cell %                             | 41.39%                                  | 6.20%         | 3.48%  | 51.07%                  |
| Semiper                            | 536                                     | 1,690         | 535    | 2,761                   |
| Cell %                             | 4.12%                                   | 12.98%        | 4.11%  | 21.21%                  |
| Core                               | 15                                      | 1,583         | 2,011  | 3,609                   |
| Cell %                             | 0.12%                                   | 12.16%        | 15.45% | 27.72%                  |
| Column total                       | 5,940                                   | 4,080         | 2,999  | 13,019                  |
| Col. cell %                        | 45.63%                                  | 31.34%        | 23.04% |                         |

Note: Chi-Square = 8.1e+03; Gamma = 0.854; Tau-b = 0.670;  $p < 0.0001$ .

10.2.2. *General correlations (tau-b scores)*

|                         | RE<br>1816–2001     | SE<br>1816–2001     | RE<br>1870–2001     | SE<br>1870–2001    | RE<br>1950–2001    |
|-------------------------|---------------------|---------------------|---------------------|--------------------|--------------------|
| Struc. eq.<br>1816–2001 | 0.670**<br>(13,019) |                     |                     |                    |                    |
| Role eq.<br>1870–2001   | 0.198**<br>(11,210) | 0.164**<br>(11,210) |                     |                    |                    |
| Struc. eq.<br>1870–2001 | 0.127**<br>(11,210) | 0.070<br>(11,210)   | 0.203**<br>(11,210) |                    |                    |
| Role eq.<br>1950–2001   | 0.181**<br>(7,329)  | 0.177**<br>(7,392)  | 0.265**<br>(7,329)  | 0.298**<br>(7,392) |                    |
| Struc. eq.<br>1950–2001 | 0.079<br>(7,392)    | 0.090<br>(7,392)    | 0.204**<br>(7,392)  | 0.084<br>(7,392)   | 0.236**<br>(7,392) |

Notes: All correlations are Tau-b scores of block position contingency tables. Significance levels are based on one-tailed tests. Numbers in parentheses are Ns.

\*  $p < 0.05$ ; \*\*  $p < 0.01$ .

## Estimation

The state-year analyses estimate the following equation:

$$\begin{aligned}
 \text{GDPCH (PCTGDPCH)}_{i(t-1) \rightarrow t} &\Rightarrow \alpha_i + \beta_1 \text{REGIME}_{i(t-1)} - \\
 &\beta_2 \text{AVGGMID}_{i(t-3) \rightarrow (t-1)} - \beta_3 \text{DEFBUR}_{i(t-1)} \\
 &- \beta_4 \text{CIVWAR}_{i(t-1,t)} - \beta_5 \text{BLKTYPE}_{it} + \varepsilon
 \end{aligned} \quad [10.1]$$

where GDPCH is the change in per capita GDP from the previous to the current year, and PCTGDPCH is the percent change in per capita GDP. BLKTYPE is a rank going from 1 (periphery) to 3 (core). A dichotomous center/semiperiphery versus periphery variable was also tested with similar results. I use time-series cross-sectional GEE population-averaged models with (AR1) correction for autocorrelations and robust standard errors.

The analysis of political stability is based on the following equation:

$$\begin{aligned} \text{CIVWAR}_{it} = & \alpha_{it} - \beta_1 \text{CULTCOH}_{i(t-1)} - \beta_2 \text{REGIME}_{i(t-1)} \\ & + \beta_3 \text{REGPERST} + \beta_4 \text{AVGMID}_{i(t-3) \rightarrow (t-1)} \\ & - \beta_5 \text{PCGDP}_{i(t-1)} - \beta_6 \text{GDPCH}_{i(t-1)} \\ & - \beta_7 \text{BLKTYPE} + \varepsilon \end{aligned} \quad [10.2]$$

At the dyad-year level, I estimate the following equation:

$$\begin{aligned} \text{MID(WAR)}_{ijt} = & \alpha - \beta_1 \text{MINREG}_{ij(t-1)} \\ & - \beta_2 \text{CAPRAT}_{ij(t-1)} + \beta_3 \text{SRG}_{ij(t-1)} \\ & + \beta_4 \text{DISTANCE}_{ijt} - \beta_5 \text{BLKTYPE}_{jt} \\ & + \beta_6 \text{BLKTYPE}_{jt} + \varepsilon \end{aligned} \quad [10.3]$$

where MID/WAR/ESCALAT are the three conflict variables, and some of the class-location dummies (e.g., CENTSEMI, SEMISEMI) are dropped due to degree of freedom issues. SAMEBLK in Equation 3 is a binary variable that gets a score of 1 if the two states are in the same block and zero otherwise.

These equations are estimated via logit functions with years of peace and cubic spline variables. The latter are not shown in the tables in order to conserve space.

## *An International System of Networks: How Networks Interact*

### 1. Introduction

Most international relations scholars envision an international system as a set of state (and/or nonstate) actors that interact with each other according to a set of rules. These rules are derived from a structure, often defined in terms of the number of major powers and the distribution of capabilities among them (Kaplan, 1957; Waltz, 1979: 53). World system theories define structure in terms of a division of labor among state and nonstate units. The dominant mode of production at a given historical period determines the relative advantages of units and assigns states into “classes” or functional groups (Wallerstein, 1974). As we saw in Chapter 10, these two conceptions converge to some extent in the real world, but we do not have good theories of why this overlap should be observed.

One of interesting paradoxes in the study of global systems is that there is a voluminous literature on system effects, yet little theorizing exists about the causes of systemic structure. Most system theories do not contain clear and empirically testable explanations of structural change (Maoz, 1996: 1–28). Both approaches to the global system spend a great deal of time characterizing different structures. Both approaches have multiple explanations of how structures affect behavior or processes at various levels (Jervis, 1999). Neither approach provides a compelling explanation of when, why, and under what conditions structures change. The few attempts to theorize about structural changes (e.g., Gilpin, 1981; Wallerstein, 1989; Wendt, 1999) are framed in vague terms or involve circular reasoning. For example, Gilpin claims that an international system changes when one or more key actors are dissatisfied with the existing structure and act to change it. But one could always argue that when systems have changed, it was because enough actors had wanted change. Likewise, constructivists view changes in international culture as a result of ideational change in actors. But

ideational changes are due to experience gained via interactions that are due to behaviour that is consistent with ideational factors, which are due to interactions .... and so on.

Realists like Gilpin view general wars as one of the major agents of systemic change. But it is not clear whether such wars are a result of an explicit drive to change the system or are an unintended escalation of local conflicts. The debate on the origins of World War I (Tuchman, 1962; Christensen and Snyder, 1990; Levy, 1991; Jervis, 1999: 102) highlights this issue. Moreover, some of the most important transformations of international systems, for example, the shift from a bipolar to a hierarchical structure in the wake of the collapse of the Soviet Union, were peaceful. Without good theories of structure, it is difficult to construct meaningful, empirically testable propositions about system change (Jervis, 1999: 92–124).

In world system theories, the structure of the system changes when the dominant mode of production is altered. However, it is unclear what causes such changes. One can easily surmise that technology is a key trigger of change. Which technological innovations mark such changes is not immediately clear. Dramatic improvements in agricultural technology have taken place throughout human history. Nonetheless, the dominant mode of production has not been agricultural for a very long time. What exactly caused a shift from an industrial mode of production into a computerized and information-based mode is also not evident.

Another paradox in the study of international systems concerns a disconnect between qualitative and quantitative scholars. For a long time, the study of international systems was the bread and butter of theorists and empirical researchers. Yet, over the past twenty years or so, a growing gap seems to have emerged between theorists who use qualitative approaches to study world politics and scholars who study international politics using quantitative methods. The former keep theorizing and qualitatively analyzing global trends. They continue to hotly debate the effects of the changing structure of the international system on the nature of international relations, foreign policy, the rise and demise of actors, and – particularly – of war and peace (Mearsheimer, 1990, 2001; Huntington, 1996; Wendt, 1999; 2003; Keohane, 2001). Most quantitative scholars have pretty much given up on systematic studies of the international system.<sup>1</sup> This abandonment of system-level studies was largely a reaction to the failure to find any empirical generalizations about system effects (Bueno de Mesquita and Lalman, 1988; Bueno de Mesquita, 2002; Maoz, 2006b). At the same time, a wealth of generalizable results on a number of issues, for example, the democratic peace,

<sup>1</sup> A notable exception is Brecher (2008) which is a major study of the systemic effects of international crises using both quantitative and qualitative methods.

made the dyad a favorite unit of analysis among students of international relations (Ray, 1995).

It is possible that most of the arguments raised by the more qualitative scholars – especially the realists – about system effects are logically flawed (Bueno de Mesquita, 2002). Moreover, there is ample evidence that the propositions derived from such theories fail even the simplest empirical tests (Vasquez, 1997, 1998). At the same time, the alternative NIP perspective may well be both theoretically meaningful and empirically valid.

The NIP conception defines structure not in terms of the attributes of the units (e.g., national power), but rather in terms of the emergent properties of their interactions across different – conflictual and cooperative – networks. International structures are neither a simple sum, nor a linear transformation of such interactions. Nor is the structure of the system defined by a single type of interaction. Throughout this study we noted that there exist significant spillover effects: when, why, and with whom states interact in one network affects the interaction among states in other networks. Moreover, some of the collective characteristics of one network – for example, clique structures – correlate with the same structural characteristics of other networks. These effects, their magnitude and scope, are an important part of the structure of the system.

These cross-network interactions lead to the structural propositions of the NIP theory. Accordingly, this chapter focuses on three principal topics. First, it examines the determinants of system structure. Second, it analyzes the causes and consequences of internetwork dynamics. Specifically, I explore what determines the likelihood of internetwork convergence. Second, I analyze the ways in which the structure and evolution of one network affects the structure and evolution of other networks. Third, I assess the effects of network structure and of internetwork interaction on international stability.

## 2. Network Structure and Internetwork Interaction

I start with a theory of system structure as an emergent property. Suppose, for the sake of simplicity, that the structure of the international system is a function of one, and only one, type of interaction among states. Suppose, that this interaction involves security relations defined as security alliances of a certain type (e.g., defense or offense pacts). NIP is a microfoundational theory of networks. It starts out by discussing the factors that motivate states to seek allies and the criteria by which they select partners. Once these factors are spelled out, we can then derive propositions about the kind of systemic structures that emerge from the interaction of states on the basis of these principles.

But the structure of one network is also a function of the structure of other networks. The NIP theory suggests that one of the principal causes of alliance-seeking is the size and aggregate capabilities of the SRG of the focal state. If most states have a high alliance opportunity cost – that is, their capabilities are much lower than those of their respective SRGs – they will seek multiple allies. This means that the density of the alliance system should be related to the average degree of the SRG network. Likewise, states with similar SRGs are likely to consider each other as potential allies. The structural implication of the transitivity (or clusterability coefficient) of an alliance network is related to the transitivity of SRG networks.

The discussion of network-level indicators in [Chapter 2](#) suggests that SNA does not have a single best measure of network structure. Some theorists argue that a network can be characterized by two variables: the clustering coefficient – that is, transitivity – and average path length (Watts and Strogatz, 1998). However, these arguments are based on random networks that do not always match empirical ones. So a more complex characterization of structure is required. I offer the following five principal indicators of structure:

1. *Normalized number of components.* As the reader may recall, a component is a closed subset of a network composed of reachable nodes. This is a good measure of the direct and indirect connectivity of networks. The normalized number of components controls for the size of the network.
2. *Network polarization.* Polarization is a central concept in system theories of international relations (Wayman and Morgan, 1991). The NPI measure I have developed reflects the extent to which the structure of the international system is bipolarized. It captures the size of cliques, their cohesion, their attributes and their overlap.
3. *Density.* The density of the network measures first-order connectedness (as opposed to  $n - 1$  order connectedness measured by the number of components).
4. *Transitivity.* This measures the extent of relational consistency in the network, that is, the “cliquishness” of the network (Watts and Strogatz, 1998).
5. *Group eigenvalue centralization.* This is a measure of the extent to which the system is centralized in terms of Eigenvector centrality.<sup>2</sup>

I discuss now each of the characteristics of network structure as an emergent system property. The normalized number of components of a

<sup>2</sup> Maoz (2009b) discussed the mathematical relationships between NPI and these other measures.



system reflects the system's connectivity; the higher the number, the *less connected is the system*. States may choose allies based on how much they need specific partners. However, at a system level, the choice of allies involves – at least to some extent – a choice of the allies of one's allies, the allies of the allies of one's allies, and so forth. This induces complexity – chain ganging – that some scholars consider a major cause of war (e.g., Christensen and Snyder, 1990). A large number of trade components suggest that the system is economically disconnected, and the number of IGO components indicates the connectivity of institutional system.

The network polarization index (NPI) implies that state choices are connected to the emergent structure only at the end points of polarization. When all states choose to have direct ties with all other states, the system becomes totally unpolarized ( $NPI = 0$ , with one component). Likewise, when half of the states – which together account for 50 percent of the system's military capabilities – form an alliance against the other half of the system (and the other half does the same), we get a strictly bipolar structure (and the number of components is two). However, between these extremes, there is no simple or linear relationship between how states choose and the consequent level of NPI. This implies that theory is an important guide to the relationship between agents and structure.

Density is also related to the other network characteristics, but in a different way. The density of a network increases when more states have a large number of direct ties with other states. A system can have a large number of dyadic alliances and result in low density but very high connectedness in terms of the number of components. A chain network (one where  $i \leftrightarrow j \leftrightarrow k \leftrightarrow l \dots \leftrightarrow n$ ) contains only one component – hence, it is fully connected. But the density of the system is such that the two extreme states  $i$  and  $n$  have one tie each, and all other states have two ties each. This yields a density of  $\Delta = \frac{2 + 2(n-2)}{n(n-1)} = \frac{2(n-1)}{n(n-1)} = \frac{2}{n}$ , which becomes progressively smaller as  $n$  increases.

My colleagues and I discussed transitivity problems in international relations elsewhere (Maoz et al., 2007a). Transitivity increases with the consistency of ties but not in a linear manner. If the system were neatly split into friends and foes, it is easy to show that transitivity is given

by:  $t = \frac{2(n-2)^2}{n[(n-2)^2 - 2n]}$  which, again, declines with increasing network

size. When the system is fully connected, transitivity is maximal. Thus, even if the choices of allies lead to a perfectly bipolar world, the system contains a significant proportion of intransitive ties.

Finally, group centralization measures the degree of deviation of the network from a wheel structure. Bipolar systems have the same group centralization score – zero – as empty networks. If half the states choose

to form a collective security alliance against the other half, the centralization of the system would be identical to one wherein nobody has an alliance.

All this might seem odd to traditional system theorists who see everything in terms of the attributes of the actors (power, wealth) or in terms of exogenously defined conceptions of great powers. Yet such a complexity of indicators is natural if we think about the international system as an emergent structure that is defined by relational webs. Seen in such terms, the question becomes how we can account for this emergence. How do choices of allies, trading partners, affiliations with IGO transform into such structures?

The NIP conception is a bottom-up theory of structure (Maoz, 1990b: 547–564). Its ideas about the emergence of network structures derive from the general principles that guide states to form cooperative ties. In this chapter, I generalize the story of the NIP theory that was discussed in [Chapter 5](#) to account for the emergence of network structure.

The emergence of network structure builds upon the basic assumptions of NIP theory.<sup>3</sup> Accordingly, the principal network that defines how states choose to cooperate in security affairs is the security egonet of each state – its SRG. In a more general sense, these SRGs can be generalized into a strategic reference network (SRN). This is what we discussed in [Chapter 8](#) as a foundation for the democratic networks theory. Relations in strategic reference networks are defined by the rule “state *j* is strategically relevant (poses a potential or actual security challenge) to state *i* (and vice versa).” Consequently, a SRN reflects the structure of security challenges that states face in the international system. We have seen that the size and structure of SRGs have a powerful effect on the cooperative choices of individual states. These characteristics also affect the probability that states would cooperate in the security and economic realms. It follows that the structure of strategic reference networks has a powerful effect on the structure of cooperative networks. Let us see how this may work.

Strategic reference networks require switching our ideas about network ties. Such networks are so-called security-webs, or complexes (Buzan, 1983; Rosh, 1988). Various groupings of such networks – for example, the strategic reference cliques that were the center of attention in [Chapter 8](#) – reflect subsets of the network composed of states that treat each other as potential enemies. This kind of structure stands in

<sup>3</sup> These assumptions are: (1) Security as primary national goal; (2) Power maximization; (3) Suspicion of others; (4) National identity affects behavior; and (5) Modifiers of anarchy (common interests, common identity, and beneficial past experience). See [Chapter 5](#) for an elaborate discussion of these assumptions.

stark contrast to the notion of alliance, trade, or IGO cliques – groupings that reflect cooperative clusters.

*Effects of SRN structures.* The structure of SRNs affects the way states choose cooperative security ties. We found that states seek multiple and powerful allies when (a) they have large SRGs and (b) when they experience large gaps between their own capabilities and those of their SRGs. Yet, the need for security alliances diminishes when (a) SRGs exhibit increased democratization, (b) when states' trade with members of their SRGs increases, and (c) when they share high cultural traits with members of their SRGs. At the dyadic level, we saw that (a) democracies, (b) states with common enemies, and (c) culturally similar states attract one another into security cooperation. We also noted meaningful spillover effects from a history of beneficial economic and institutional cooperation into security cooperation. These results suggest several ideas about the factors that affect the network structure of the international system.

- SYS1. As the size of national SRGs rise and as average levels of alliance opportunity costs increase,
  - a. the normalized number of components in alliance networks decreases;
  - b. the polarization of alliance networks increases;
  - c. the density of alliance networks increases;
  - d. the transitivity of alliance networks increases; and
  - e. the group centralization of alliance networks declines.
- SYS2. As the average proportion of democracies in national SRGs increases,
  - a. the normalized number of components in, and the group centralization of, alliance networks increases; and
  - b. the polarization, density, and transitivity of alliance networks declines.
- SYS3. As the average cultural similarity between states and their SRGs increases,
  - a. the normalized number of components in, and the group centralization of alliance networks increases; and
  - b. the polarization, density, and transitivity of alliance networks declines.

The average size of SRGs and the average level of alliance opportunity cost at a given point in time are indicators of the average level of tension in the system. Large SRGs and high alliance opportunity costs tend to induce strong incentives to form alliances. The resulting networks become dense and the number of components decreases accordingly. Under such conditions, strategic considerations drive alliance choices. States that share common enemies tend to form security ties with each other. Consequently, system polarization increases. Since more states

form alliances, group centralization declines; states tend to display more uniform levels of alliance centrality.

We noted that political identities and cultural affinities are modifiers of threat perceptions. Consequently, as the democratization of SRGs increases, and as states become more culturally similar to their SRGs, their tendency to form alliances is expected to decline. The structural consequences of democratization and cultural affinities modify those of large and powerful SRGs. Specifically, security networks are composed of a larger number of components. They become less polarized, less dense, and less transitive (i.e., the level of alliance indirectness – the ally of my ally is my ally – declines). At the same time, states that are on the margins of the democratization distribution – either democracies or autocracies surrounded by predominantly authoritarian SRGs – form small clusters of alliances and their relative centrality increases. This causes a general increase in group centralization of the network.

*Spillover effects.* What do we mean by system-level spillover effects? Spillover effects go well beyond the simplistic notion that allies tend to trade strategic commodities or share multiple IGO ties. At the systemic level, spillover effects imply convergence of structural characteristics across different networks. The following propositions reflect these effects.

- SYS4. Trade and IGO networks consistently affect the structure of alliance networks. However, these effects vary across indicators of network structure.
  - a. The normalized number of components, polarization, transitivity, and group centralization of trade and IGO networks have a positive effect on the parallel indicators of alliance networks.
  - b. Trade and IGO density have a negative impact on the density of alliance networks.

As the proportion of trade and institutional components grows, the system becomes characterized by an increasingly large number of trading clusters, or institutional blocks. Such clusters may be either regional or functional. Spillover effects occur within these clusters but not across clusters. Consequently, and controlling for the other factors that determine the number of security components, the NIP theory expects a relatively large number of security components as well.

Trade and institutional polarization reflect increasingly polarized structures of economic interests and normative or functional concerns of states. These suggest existing economic or normative fault lines, which affect levels of threat perception. Consequently, economic and institutional polarization will ultimately induce polarized patterns of security cooperation. Another interpretation of this form of spillover is that

economic and institutional polarization exacerbate the already underlying tension among groups of states and pushes states belonging to different economic or institutional components to increase their security cooperation vis-à-vis members of “opposing” components.

When trade networks are increasingly transitive, indirect spillover effects – due to the economic ties between one’s trading partners – compound the direct spillover effect between direct trading partners. Increased levels of institutional transitivity imply a growing number of shared IGO memberships. Quite a few of such joint memberships are shared collective security structures (e.g., NATO, the World Trade Organization [WTO]) or collective security communities (e.g., Organization for Security and Co-operation in Europe [OSCE], ASEAN, OAU, OAS). This again spills over to greater level of alliance transitivity among these members.

Centralization of trade and institutional networks means that a few states become important economic or institutional hubs. This indicates a pattern of preferential attachment in such networks. These hubs tend to attract allies for several reasons. One is that hubs become a center of interests for other states. This is typically the case with states that export a low-elasticity commodity (e.g., oil). States that are dependent on imports are interested in safeguarding the security of their exporters, thus trying to induce exporters into security cooperation. Another pattern of preferential attachment concerns states that have a widespread span of interests and a high reach capacity. Those states tend to have high stakes in both trade and security, thus forming economic and security hubs.

Institutional group centralization also increases when a few states with global spans of interests use various institutions for security purposes (e.g., collective security arrangements across regions) or for economic purposes. This spills over into security cooperation.

What is different about the effect of the density of economic or institutional networks on the density of security networks? Dense economic or institutional networks imply a greater proportion of direct trading partners, or a larger number of states that share normative values. As the NIP theory hypothesized for the national and dyadic levels of analysis, these tend to reduce the threat perception of states, and therefore the need for large number of allies. Consequently, the overall density of security networks declines.

Before I discuss the effects of security cooperation networks on economic and trade structures, I need to sound a note of caution. NIP theory focuses on the emergence of security structures, not on the emergence of economic or institutional networks. The factors that affect the structure of economic and institutional networks are far more complex than can be covered herein. We study the structural determinants of such networks only in the context of spillover effects. The following propositions

offer a preliminary account focusing on spillover effects from security networks to other cooperative networks:<sup>4</sup>

- SYS5. Alliance network structures have a consistent effect on trade and IGO networks.
  - a. The normalized number of alliance components, alliance polarization, transitivity, and group centralization positively affect parallel measures of economic and institutional network structures.
  - b. Alliance density has a negative impact on the density of trade network structures but a positive impact on the density of institutional networks.
- SYS6. Trade network structures positively affect the structure of institutional networks.

The connections between security cooperation networks and economic and institutional structures are similar to those spelled out in SYS4. A diversified structure of security networks (more components, lower polarization, lower transitivity, and lower group centralization), indicates that states feel secure to cooperate with each other on economic and institutional matters. Consequently, trade and institutional networks becomes more diversified. However, high density of alliance structures tends to cause reduction in economic cooperation, resulting in reduced trade density. On the other hand, high density of alliances means that more states become members of security communities. This leads to a higher density of IGO networks.

*Network structures and international stability.* Throughout the book I have examined the effects of different aspects of network structure on international conflict. These analyses – conducted mostly at the state or dyad levels of analysis – revealed that the structure of security egonets (SRGs), clustering of dyadic ties (e.g., joint clique memberships), and characteristics of endogenous groups derived from security networks (e.g., the proportion of democratic states in SRG cliques) have a consistent effect on national, dyadic, and international patterns of conflict and peace. These corroborate other results in the literature on international networks (e.g., Hafner-Burton and Montgomery, 2006; Maoz et al., 2006, 2007b; Dorussen and Ward, 2008). I also showed that economic and integrative interdependence have a dampening effect on the level of systemic conflict. Here we explore additional effects of network structure on international conflict at the systemic level.

The basic message is straightforward.<sup>5</sup> The polarization of cooperative networks (i.e., democratic, economic, and institutional networks)

<sup>4</sup> I use a number of seemingly important variables as controls in these analyses, but these too should be regarded as rather tentative.

<sup>5</sup> See Maoz (2006b) for a more elaborate argument.

has an inverse effect on systemic levels of international conflict. In contrast, the polarization of conflictual networks (e.g., strategically relevant networks) and security networks (alliances) increases the level of instability in the international system. The logic behind these arguments follows the ideas in previous chapters that analyzed the systemic effects of democratic networks or interdependence. As the complexity of peaceful interactions increases, more and more nations coordinate their activity through international organization, the incentives to resolve conflicts peacefully increase. The spillover effects from cooperative networks to strategic ones reduce the probability of conflict outbreak and constrain states from expanding conflict.

On the other hand, increased complexity of SRG and alliance networks suggests that states are increasingly concerned about their security. Complexity of SRG networks – defined in terms of polarization – implies that states perceive themselves to be threatened by an increasingly large number of would-be enemies. All of these increase the prospect of conflict in the international system. These factors also increase the probability that low-level conflict would escalate into all-out wars. Thus,

SYS7. The polarization of trade and institutional networks has a negative impact on the level of systemic conflict; and

SYS8. SRG and security network polarization have a positive impact on the level of systemic conflict.

Beyond the effect of various characteristics of different networks, there exists a spillover effect. The level of international cooperation can fluctuate not only in terms of a single dimension of interaction; it can vary in terms of the extent to which states cooperate across different types of interaction. We can think of network effects in terms of the degree to which states forge multiple cooperative ties – they have both security and economic ties, or security and institutional ties, or security, economic, and institutional ties. In other words, we can think of structure as the composite density of multiple networks (or multiplexes). Extending the spillover effect to multiplexes suggests the following proposition:

SYS9. As the density of composite cooperative networks increases, the level of systemic conflict declines.

High density of composite cooperative networks implies that a larger proportion of states are tied across multiple networks. The constraints on states' self-help behavior increase substantially. Consequently, levels of international conflict are expected to decline.

These propositions accumulate into an overall complexity logic: The structural characteristics of cooperative networks are affected by the anticipation or prevalence of international conflict. Some of these structures tend to increase the prevalence of subsequent conflict, while others

Table 11.1. *Correlations among measures of network structure*

|                                  | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|----------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|
| 1 Prop. alliance components      | 1.000  |        |        |        |        |        |        |        |
| 2 Prop trade components          | -0.527 | 1.000  |        |        |        |        |        |        |
| 3 Prop. IGO comps.               | 0.186  | -0.394 | 1.000  |        |        |        |        |        |
| 4 Prop. SRG comps.               | 0.115  | 0.098  | 0.124  | 1.000  |        |        |        |        |
| 5 Alliance NPI                   | 0.091  | -0.704 | 0.755  | 0.036  | 1.000  |        |        |        |
| 6 Trade NPI                      | -0.509 | 0.164  | 0.053  | -0.418 | 0.096  | 1.000  |        |        |
| 7 IGO NPI                        | 0.433  | -0.430 | -0.073 | 0.004  | 0.142  | -0.169 | 1.000  |        |
| 8 SRG NPI                        | 0.379  | -0.561 | 0.620  | -0.179 | 0.787  | -0.058 | 0.221  | 1.000  |
| 9 Alliance density               | -0.398 | 0.065  | 0.482  | -0.067 | 0.687  | 0.493  | -0.102 | 0.392  |
| 10 Trade density                 | 0.555  | -0.636 | 0.039  | 0.030  | 0.451  | -0.473 | 0.397  | 0.378  |
| 11 IGO density                   | -0.286 | 0.457  | -0.962 | -0.143 | -0.727 | 0.037  | -0.098 | -0.618 |
| 12 SRG density                   | -0.133 | -0.168 | 0.273  | -0.514 | 0.504  | 0.483  | -0.011 | 0.527  |
| 13 Alliance transitivity         | -0.508 | 0.502  | 0.265  | -0.009 | 0.135  | 0.279  | -0.372 | -0.057 |
| 14 Trade transitivity            | 0.329  | -0.077 | -0.419 | 0.226  | -0.191 | -0.718 | 0.027  | -0.080 |
| 15 IGO transitivity              | -0.397 | 0.429  | -0.465 | -0.083 | -0.183 | 0.207  | -0.212 | -0.266 |
| 16 SRG transitivity              | -0.233 | 0.426  | -0.214 | -0.179 | -0.161 | 0.004  | -0.224 | 0.049  |
| 17 Alliance group centralization | -0.111 | -0.367 | 0.795  | 0.042  | 0.908  | 0.355  | -0.026 | 0.637  |
| 18 Trade group centralization    | 0.449  | -0.430 | 0.725  | -0.092 | 0.620  | 0.218  | 0.381  | 0.631  |
| 19 IGO eig. group cent.          | 0.310  | -0.452 | 0.819  | 0.194  | 0.730  | -0.031 | 0.166  | 0.628  |
| 20 SRG eig. group cent.          | 0.490  | -0.634 | 0.655  | 0.371  | 0.703  | -0.351 | 0.342  | 0.589  |
| 21 Composite network density     | -0.641 | -0.304 | -0.341 | -0.514 | 0.598  | -0.212 | -0.165 | -0.100 |

Note: Ns vary from 186 (correlations not involving trade indicators) to 132 (when a trade indicator is present). Correlations above 0.175 are statistically significant at the .05 level.

modify the need to resort to force. The level of cross-network or composite cooperation, however, is expected to have pacifying effects. Let us now see how these ideas perform in the real world.

### 3. Empirical Results

I start with a display of the correlations among the major networks characteristics (Table 11.1).

Interpreting the correlations between the various indices of network structure displayed in Table 11.1 requires some caution. Most of the network characteristics display secular trends, as we will see below.





with the comparable indicators of other cooperative networks. The only exceptions are the correlations among the group centralizations of the cooperative networks.

Finally, correlations between the density of the composite cooperative networks and the density of the other cooperative networks are not as high as one might suspect. In some cases (e.g., the correlation between composite network and trade network density), these are even negative. This is more a function of the definition of ties in the composite network (see appendix) than an empirical puzzle. It turns out that the structure of composite networks reflect are different from the structure of any individual type of cooperative interaction. The general, yet tentative, point we take out of this analysis is that no generalizable connections exist between the structural indicators of different cooperative networks. This may seem to contradict some of the results of previous chapters, but this is hardly the case, as we shall see in the material that follows.

Table 11.2 displays an analysis of factors affecting the structure of alliance networks. Alliance networks form the foundation of cooperative structures in world politics. The principal ideas of the NIP theory center on the dynamics of security cooperation. Here, we examine the structural consequences of these dynamics.

A number of results stand out in Table 11.2. First, the indicators of SRG-related security challenges affect the structure of alliance networks in ways that are consistent with the propositions of the theory. As the size of national SRGs and alliance opportunity costs increase, alliance networks become more polarized, more connected (fewer components, higher density), and increasingly transitive. On the other hand, group centralization declines. Second, as the level of systemic instability – the moving average of the number of MIDs in the international system as a whole – increases, the number of alliance components and the group centralization of alliance networks also rise. At the same time, the polarization, density, and transitivity of alliance networks declines.

This result may seem puzzling because it runs contrary to what we might intuitively expect. When states are faced by a volatile international system, they tend to join forces to meet what they might see as broader systemic challenges to their security. Under such circumstances, security cooperation networks should become more connected. What seems to happen is just the opposite. On second thought, however, this system effect seems quite reasonable. A volatile international system increases the suspicion of others. States are not sure about who is a credible ally and who might drag them into unwanted conflicts. The size of alliances tends to be more limited, and alliances tend to be based less on strategic needs and more on political or cultural affinities, resulting in relatively disconnected alliance networks.

Identity and cultural factors tend to induce sparse alliance networks. This is also consistent with the expectations of the NIP theory.

Table 11.2. *Factors affecting alliance network structures, 1870–2001: three-stage least squares with correction for autoregressive disturbances*

|                                     | Alliances             |                    |                     |                    |                      |
|-------------------------------------|-----------------------|--------------------|---------------------|--------------------|----------------------|
|                                     | Normalized components | NPI                | Density             | Transitivity       | Group centralization |
| Trade system indicator <sup>1</sup> | 0.721*<br>(0.391)     | -0.369*<br>(0.221) | -0.192**<br>(0.068) | 0.073*<br>(0.421)  | 0.006**<br>(0.002)   |
| IGO system indicator <sup>1</sup>   | 0.161*<br>(0.078)     | 0.155*<br>(0.177)  | 0.132**<br>(0.031)  | -1.736<br>(1.105)  | 0.088**<br>(0.026)   |
| Prop. major powers                  | -0.282*<br>(0.64)     | 0.158*<br>(0.119)  | 0.100**<br>(0.038)  | 2.679*<br>(0.965)  | -0.025<br>(0.028)    |
| Capability concentration            | -1.724*<br>(0.601)    | 0.296*<br>(0.186)  | 0.128**<br>(0.042)  | 3.009*<br>(1.044)  | -0.146**<br>(0.026)  |
| Prop. democ in SRG                  | 0.814*<br>(0.126)     | -0.128*<br>(0.057) | -0.049**<br>(0.009) | -0.381*<br>(0.266) | 0.038**<br>(0.010)   |
| Cultural similarity in SRG          | 0.361*<br>(0.351)     | -0.203*<br>(0.152) | -0.690**<br>(0.044) | -0.94*<br>(0.612)  | 0.050*<br>(0.020)    |
| Alliance opportunity cost           | -0.872*<br>(0.217)    | 0.143*<br>(0.065)  | 0.021*<br>(0.011)   | 0.774*<br>(0.216)  | -0.014<br>(0.009)    |
| Average prop. of MIDs               | 0.067*<br>(0.023)     | -0.006*<br>(0.006) | -0.007*<br>(0.003)  | -0.118*<br>(0.04)  | 0.002*<br>(0.001)    |
| Constant                            | 1.672*<br>(0.406)     | 0.085*<br>(0.094)  | -0.145*<br>(0.037)  | 0.579*<br>(1.022)  | 0.796**<br>(0.13)    |
| N                                   | 131                   | 131                | 184                 | 131                | 130                  |
| Adj. R-squared                      | 0.893                 | 0.442              | 0.493               | 0.492              | 0.959                |
| Chi square                          | 1,116.45**            | 178.85**           | 171.02**            | 124.26**           | 3,080.16**           |

Notes: <sup>1</sup> Endogenous variable. Equivalent trade and IGO system characteristics are used as the alliances system characteristic. Full system of equations is given in the book's Web site.

\*  $p < 0.05$ ; \*\*  $p < 0.01$ .

The democratization of national SRGs and increased cultural affinity between states and their respective SRGs increase the number of components and the group centralization of alliance networks. At the same time, the polarization, density, and transitivity of such networks declines. Growing political and cultural identities between states and their strategically relevant egonets makes states feel less threatened. Consequently, security cooperation declines. This results in reduced polarization and more dispersed security structures.

Two control variables – capability concentration and the proportion of major or regional powers – reflect the characteristics of system structure in international relations. These variables affect security network structures

in much the same way as the SRG-related indicators do. High levels of capability concentration and a relatively large number of major powers are associated with increasingly connected and bipolarized networks.

The central results in [Table 11.2](#) concern spillover effects. With some notable exceptions, these are generally consistent with the theory's expectations. As trade networks become increasingly connected (fewer components, less polarized, more dense and increasingly transitive), the complexity and connectedness of security networks declines. Alliance networks become less dense, less polarized, more uniform in terms of centrality, and less transitive. The spillover effects from institutional to security networks are more complex. The normalized number of components and the group centralization of IGO networks positively affect the parallel indicators of security networks. This is consistent with the expectations of the NIP theory. However, the polarization and density of institutional networks have a positive effect on the parallel indicators of alliance networks. This is the inverse of what the NIP theory predicts. This might be due to the fact that some IGOs – for example, NATO, the Warsaw Pact, OAS, the Arab League – are collective security arrangements. Thus, when they polarize, so does the alliance network as a whole.

Overall, however, we see consistently significant spillover effects from economic and institutional networks to security networks. These corroborate the results we obtained at other levels of analysis, and generally conform with NIP theory. To provide some sense of the performance of these propositions, [Figure 11.1](#) shows the relationships between the actual characteristics of security networks and the expected values of these characteristics based on the equations estimated in [Table 11.2](#). This figure also provides us a visual sense of the evolution of security networks over time.

The figure shows a fairly clear image of the evolution of security networks. Some characteristics of these networks show a declining secular trend – the normalized number of components and the group centralization of alliance networks decline over time. Alliance density does not display a similar trend and seems to be relatively stable over time. Alliance polarization fluctuates considerably and suggests some cyclical patterns.<sup>6</sup> The fit between the models and the actual data is relatively good, but there are no discernible temporal patterns of deviations between predicted and actual values. We now turn to discuss the spillover effects of security networks on economic and institutional networks ([Table 11.3](#)).

<sup>6</sup> It must be noted that the alliance NPI version I use in this chapter is different from that used in [Chapter 3](#). In [Chapter 3](#) I used a limited information NPI measure that did not include the capabilities of alliance cliques. The current version utilizes the complete NPI that uses both clique cohesion and clique size (capabilities) to measure polarization. See [Chapter 2](#) and Maoz (2009b) for a more elaborate discussion of this index.

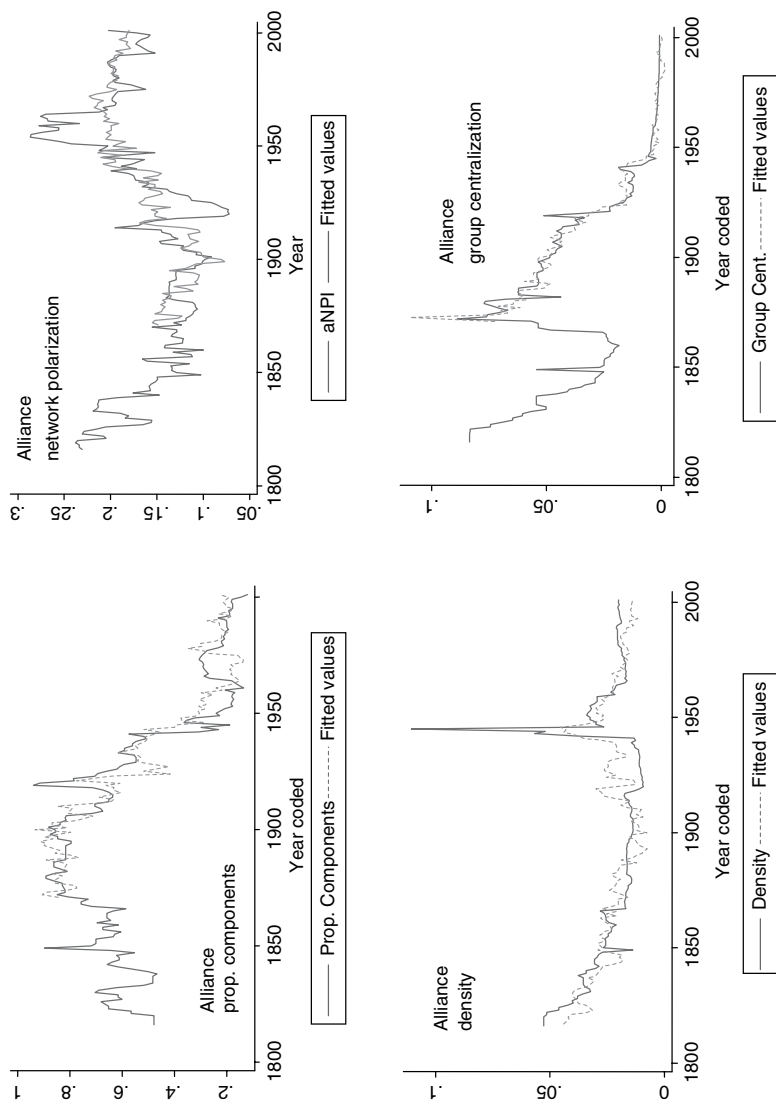


Figure 11.1. Structural characteristics of alliance networks, (1816) 1870–2001: Fitted and actual values.

Table 11.3. *Effects of security networks on economic and institutional networks – factors affecting alliance network structures, 1870–2001: three-stage least squares with correction for autoregressive disturbances*

| Independent variable      | Prop. components   |                   | Polarization      |                    | Density             |                    | Transitivity     |                   | Group centralization |     |
|---------------------------|--------------------|-------------------|-------------------|--------------------|---------------------|--------------------|------------------|-------------------|----------------------|-----|
|                           | Trade              | IGO               | Trade             | IGO                | Trade               | IGO                | Trade            | IGO               | Trade                | IGO |
| Prop. alliance components | 0.249*<br>(0.07)   | 0.625*<br>(0.148) | -                 | -                  | -                   | -                  | -                | -                 | -                    | -   |
| Prop. trade components    | -                  | -0.139<br>(0.073) | -                 | -                  | -                   | -                  | -                | -                 | -                    | -   |
| Prop. IGO components      | -0.601*<br>(0.182) | -                 | -                 | -                  | -                   | -                  | -                | -                 | -                    | -   |
| Alliance NPI              | -                  | -                 | 1.561*<br>(0.624) | 6.103**<br>(2.239) | -                   | -                  | -                | -                 | -                    | -   |
| Trade NPI                 | -                  | -                 | -                 | 0.970<br>(0.585)   | -                   | -                  | -                | -                 | -                    | -   |
| IGO NPI                   | -                  | -                 | -0.037<br>(0.038) | -                  | -                   | -                  | -                | -                 | -                    | -   |
| Alliance density          | -                  | -                 | -                 | -                  | -0.894**<br>(0.188) | 6.226**<br>(1.993) | -                | -                 | -                    | -   |
| Trade density             | -                  | -                 | -                 | -                  | -                   | 2.455**<br>(0.506) | -                | -                 | -                    | -   |
| IGO density               | -                  | -                 | -                 | -                  | 0.094**<br>(0.022)  | -                  | -                | -                 | -                    | -   |
| Alliance transitivity     | -                  | -                 | -                 | -                  | -                   | -                  | 0.015<br>(0.025) | -0.026<br>(0.019) | -                    | -   |

|                               |          |           |            |            |            |            |            |            |            |            |         |
|-------------------------------|----------|-----------|------------|------------|------------|------------|------------|------------|------------|------------|---------|
| Trade transitivity            | -        | -         | -          | -          | -          | -          | -          | -          | 0.286**    | -          | -       |
|                               | -        | -         | -          | -          | -          | -          | -          | -          | (0.044)    | -          | -       |
| IGO transitivity              | -        | -         | -          | -          | -          | -          | -          | 0.717**    | -          | -          | -       |
|                               | -        | -         | -          | -          | -          | -          | -          | (0.226)    | -          | -          | -       |
| Alliance group centralization | -        | -         | -          | -          | -          | -          | -          | -          | 0.375**    | 0.005      | 0.014   |
|                               | -        | -         | -          | -          | -          | -          | -          | -          | (0.087)    | (0.014)    | 0.115** |
| Trade group centralization    | -        | -         | -          | -          | -          | -          | -          | -          | -          | -          | (0.028) |
| IGO group centralization      | -        | -         | -          | -          | -          | -          | -          | -          | -1.633     | -          | -       |
|                               | -        | -         | -          | -          | -          | -          | -          | -          | (0.984)    | -          | -       |
| Avg. per capita GDP           | 2.32e-05 | -2.63e-05 | -1.23e-05  | -1.01e-05  | -8.97e-07  | 2.27e-05*  | 1.36e-05*  | 4.78e-06*  | -1.05e-04* | -5.42e-06  | -       |
|                               | 1.69e-05 | 1.30e-05  | (1.35e-05) | (1.45e-05) | (2.26e-06) | (8.49e-06) | (6.37e-06) | (2.65e-06) | (3.73e-05) | (5.39e-06) | -       |
| GDP concentration index       | 0.019    | 0.124     | -0.178     | -1.177     | 0.451**    | -1.649**   | -0.335*    | 0.144*     | 4.652**    | -0.278     | -       |
|                               | (0.29)   | (0.439)   | (0.307)    | (1.012)    | (0.074)    | (0.544)    | (0.179)    | (0.066)    | (0.997)    | (0.206)    | -       |
| Avg. SRG democratization      | -0.95*   | -0.368*   | -0.085**   | 0.532**    | 0.121**    | -0.273**   | -0.151**   | 1.61e-04   | -1.039**   | 0.049      | -       |
|                               | (0.188)  | (0.147)   | (0.039)    | (0.122)    | (0.020)    | (0.086)    | (0.024)    | (4.55e-04) | (0.316)    | (0.048)    | -       |
| Avg. cultural similarity SRG  | 0.154    | -0.401*   | -0.083     | 0.166      | -0.068*    | 0.369**    | -0.053     | 0.061      | -0.038     | -0.013     | -       |
|                               | (0.125)  | (0.168)   | (0.065)    | (0.213)    | (0.034)    | (0.125)    | (0.098)    | (0.035)    | (0.468)    | (0.066)    | -       |
| Constant                      | -0.729*  | 2.784*    | -0.116     | 0.094      | 0.303**    | 0.489**    | 0.275**    | 0.908*     | -0.015**   | 0.017**    | -       |
|                               | (0.319)  | (1.152)   | (0.088)    | (0.157)    | (0.038)    | (0.063)    | (0.107)    | (0.059)    | (0.005)    | (0.006)    | -       |
| N                             | 130      | 130       | 131        | 130        | 131        | 130        | 131        | 130        | 131        | 130        | -       |
| Chi-square                    | 259.73** | 101.24**  | 79.55**    | 148.03**   | 140.21**   | 381.53**   | 92.77**    | 115.97**   | 1,294.45** | 289.57**   | -       |
| R <sup>2</sup>                | 0.668    | 0.298     | 0.136      | 0.524      | 0.469      | 0.805      | 0.451      | 0.438      | 0.918      | 0.670      | -       |

\*  $p < 0.05$ ; \*\*  $p < 0.01$

As noted above, this is not a study of the formation, evolution, and change of economic and institutional networks. We are interested in the question of whether international security cooperation affects the structure of economic and institutional interactions. The discussion of the Table 11.3 results is limited to this issue.

The structure of security cooperation networks has a fairly consistent effect on trade and institutional networks. Most of these effects are in line with the expectations of the NIP theory. Specifically, the number of components, the polarization, and group centralization of alliance networks have a significant positive effect on the same structural characteristics of trade networks. Likewise, consistent with the theory, the density of alliance networks has a negative effect on trade networks. The indicators of alliance network structure affect parallel indicators of institutional networks. These effects are similar to the effect of alliance networks on trade networks. Yet, the results in Table 11.3 are less robust than in Table 11.2. Alliance network transitivity is not significantly related to the transitivity of trade or of IGO networks. Nor does alliance group centralization affect IGO group centralization. Finally, alliance density has a positive impact on the density of IGO networks.

Although they are not a central aspect of the present study, note that there are spillover effects between economic and institutional networks. However, these effects are not robust, nor are they consistent across indicators of network structure. Yet, the presence of such spillover effects suggests consistent relationships between economic and institutional networks, worthy of future, more focused investigations.

Finally, the only control variable having a consistent robust effect on the structure of economic and institutional networks is the level of democratization in states' SRGs. Yet, these effects are not robust across measures of structure. This, too, deserves a more detailed analysis. Figure 11.2 provides a graphic characterization of the fit between the actual network characteristics of economic and institutional networks (defined in terms of group centralization) and the predicted values of these network indicators.

The most interesting feature of the data presented in Figure 11.2 is the declining trend in group centralization of both the trade and IGO networks. This trend seems to characterize some – but clearly not – all of the other indicators of these networks.<sup>7</sup> Again, the fit of the model is high for trade but moderate for IGOs.

We now assess the effect of network structure on international stability. This is done in two stages. The first stage focuses on the effect of the individual characteristics of different networks on indicators of systemic

<sup>7</sup> For example, IGO density shows an increasing trend; IGO and trade transitivity show large fluctuations but the trend line is flat.



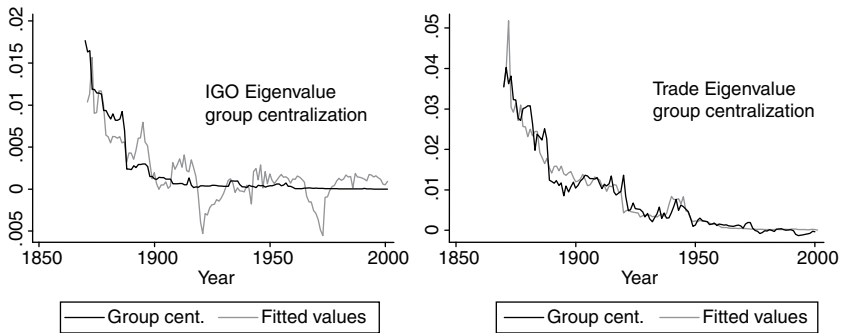


Figure 11.2. Group Centralization of IGO and Trade Networks, 1870–2001 – Fitted and Actual Values

conflict. The second stage examines the compound effects of network structure on international stability.

The results in Table 11.4 are fairly straightforward. For the entire period, as well as for the twentieth century, alliance network polarization has a consistent positive effect on the level of systemic conflict. It does not, however, affect the probability of MID escalation to war. In the nineteenth century, alliance polarization tends to have a negative effect on the proportion of war dyads and on the probability of MID escalation. By and large, these results are consistent with the expectations of the theory, but they challenge the arguments of structural realists who consistently argue for a negative effect of polarization on conflict (Waltz, 1964, 1979; Mearsheimer, 1990). The negative effect of alliance polarization on conflict in the nineteenth century also poses a challenge to structural realists because the structure of the system during this period is often characterized as multipolar (Kaplan, 1957).

On the other hand, trade polarization seems to have a pacifying effect. As trade networks become increasingly polarized, the level of conflict in the system declines. This seems to contradict the theory's expectations. IGO polarization also seems to have a positive effect on conflict in the twentieth century, but it has a negative effect on nineteenth-century conflicts. Finally, SRG polarization does not seem to have a consistent effect on conflict in the entire period, but it does increase the probability, frequency, and severity of twentieth-century conflicts.

As an extension of the democratic networks model, the proportion of SRG cliques having a majority of democratic states has a dampening effect on systemic conflict. As a larger number of SRG cliques become dominated by democratic states, the level of conflict in the entire period, as well as in the twentieth century, declines significantly. It is important to note that other characteristics of network structure do not seem to have a consistent effect on the frequency and severity of conflict. Some of

Table 11.4. *Network polarization and international conflict, 1870–2001*

|                           | 1816–2001           |                     |                     | 19th Century        |                     |                     | 20th Century        |                    |                     |
|---------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|--------------------|---------------------|
|                           | Pr. MID<br>dyads    | Pr. war<br>dyads    | Pr. escalation      | Pr. MID<br>dyads    | Pr. war<br>dyads    | Pr. escalation      | Pr. mid<br>dyads    | Pr. war<br>dyads   | Pr. escalation      |
| Capability concentration  | –0.022<br>(0.025)   | –0.012<br>(0.011)   | 0.010<br>(0.007)    | –0.243*<br>(0.122)  | –0.021<br>(0.072)   | 0.919<br>(2.807)    | –0.128*<br>(0.032)  | –0.069*<br>(0.015) | –0.009<br>(0.009)   |
| Alliance NPI <sup>a</sup> | 0.047**<br>(0.018)  | 0.020**<br>(0.008)  | 0.004<br>(0.005)    | –0.071<br>(0.047)   | –0.081**<br>(0.025) | –3.800**<br>(1.046) | 0.062**<br>(0.021)  | 0.025**<br>(0.010) | 0.006<br>(0.005)    |
| Trade NPI <sup>a</sup>    | –0.077**<br>(0.023) | –0.029**<br>(0.011) | –0.017*<br>(0.007)  |                     |                     |                     | –0.093**<br>(0.034) | –0.032*<br>(0.016) | –0.007*<br>(0.003)  |
| IGO NPI <sup>a</sup>      | 0.006<br>(0.012)    | 0.007<br>(0.005)    | 0.001<br>(0.003)    | –0.063**<br>(0.024) | –0.022<br>(0.015)   | –0.387<br>(0.583)   | 0.136**<br>(0.026)  | 0.076**<br>(0.011) | 0.016**<br>(0.006)  |
| SRG NPI                   | 0.060<br>(0.033)    | 0.021<br>(0.013)    | 0.009<br>(0.008)    | 0.020<br>(0.055)    | 0.043<br>(0.028)    | 1.304<br>(1.086)    | 0.096**<br>(0.038)  | 0.045**<br>(0.016) | 0.021**<br>(0.007)  |
| Democratic cliques        | –0.017*<br>(0.008)  | –0.006**<br>(0.000) | –0.003**<br>(0.002) | –0.002<br>(0.005)   | –0.003<br>(0.002)   | –0.020<br>(0.011)   | –0.023*<br>(0.011)  | –0.004*<br>(0.002) | –0.005**<br>(0.002) |
| Rho                       | 0.885**<br>(0.063)  | 0.879**<br>(0.061)  | 0.548**<br>(0.077)  | 0.002<br>(0.117)    | 0.113<br>(0.109)    | 0.399**<br>(0.104)  | 0.968**<br>(0.071)  | 0.934**<br>(0.066) | 0.577**<br>(0.083)  |
| Constant                  | 0.021*<br>(0.008)   | 0.008*<br>(0.003)   | 0.003<br>(0.002)    | 0.112*<br>(0.045)   | 0.019<br>(0.027)    | 0.300<br>(1.056)    | 0.027*<br>(0.01)    | 0.009*<br>(0.004)  | 0.000<br>(0.002)    |
| N                         | 130                 | 130                 | 130                 | 83                  | 83                  | 83                  | 101                 | 101                | 101                 |
| R-squared                 | 0.794               | 0.737               | 0.436               | 0.00                | 0.0411              | 0.366               | 0.685               | 0.547              | 0.491               |
| Chi-square                | 540.03**            | 399.72**            | 118.20**            | 20.11               | 27.88               | 81.02**             | 536.06**            | 380.86**           | 137.08**            |

<sup>a</sup> Endogenized. Full model presented on book's Website\*  $p < 0.05$ ; \*\*  $p < 0.01$ .

Table 11.5. *The effect of cooperative network density on systemic conflict, 1870–2001*

|                             | Proportion of<br>MID dyads | Proportion of<br>war dyads | Proportion of<br>MID escalation |
|-----------------------------|----------------------------|----------------------------|---------------------------------|
| Cooperative network density | –0.007**<br>(0.002)        | –0.002*<br>(0.001)         | –0.001<br>(0.0004)              |
| Capability concentration    | –0.036*<br>(0.019)         | –0.014<br>(0.009)          | 0.003<br>(0.005)                |
| Prop. major powers          | 0.055**<br>(0.012)         | 0.017**<br>(0.006)         | 0.011**<br>(0.004)              |
| Democratic cliques          | –0.033**<br>(0.009)        | –0.011**<br>(0.004)        | –0.006**<br>(0.002)             |
| Rho                         | 0.745**<br>(0.061)         | 0.775**<br>(0.061)         | 0.496**<br>(0.079)              |
| Constant                    | 0.027**<br>(0.006)         | 0.008**<br>(0.003)         | 0.001<br>(0.002)                |
| N                           | 130                        | 130                        | 130                             |
| R-squared                   | 0.819                      | 0.744                      | 0.467                           |
| Chi-square                  | 610.87**                   | 388.01**                   | 119.13**                        |

the other characteristics also have an effect that is the opposite of what is expected. Apparently, polarization is the most visible characteristic of network structure (other than interdependence, which we have already analyzed in [Chapter 9](#)) that affects levels of systemic conflict.

The final stage examines how the composite structure of cooperative networks affects systemic conflict. A cooperative network is the composite of security, economic, and institutional cooperation. Any pair of cooperative ties (alliance–trade, alliance–IGO, trade–IGO) has a higher network value than any single cooperative tie. A triple cooperative tie (alliance–trade–IGO) has the highest value. The composite network is an ordinal network, but its density can be calculated in meaningful terms. Consequently, [Table 11.5](#) examines the effect of composite cooperation density on systemic conflict.

The results shown in [Table 11.5](#) suggest that the density of cooperative networks has a significant dampening effect on the frequency and severity of systemic conflict. This is true not only for this particular index of the composite network but also for most other network characteristics. As cooperative networks become increasingly connected, the system becomes increasingly peaceful. Another aspect of the analysis not displayed in [Table 11.5](#) is that the effects are particularly higher in

the twentieth century, and even more so in the post–War World II era.<sup>8</sup> We do not have enough data to test the effects of internetwork interaction in the post–Cold War era, but there is reason to believe that these effects become increasingly pronounced in the last decade of the twentieth century.

Figure 11.3 shows the distribution of conflict indices over time, as well as the fitted values based on the models estimated in Table 11.5. The models provide a fairly good fit to the actual level of conflict and the probability of escalation. The lower part of Figure 11.3 focuses on the post–WWII era. The predictive success of the model in terms of the probability of MID escalation is far lower than the ability of the model to predict the proportion of MID and war dyads. Nevertheless, the data highlight the impact of cooperative network structures on international stability. This result constitutes important evidence in support of the NIP theory: It is the overlap across and the interaction among networks – not only the specific attributes of a single network – that affects conflict. We can tentatively conclude that cross-network spillover has important effects on international stability.

#### 4. Conclusion

This chapter examined the factors that affect the structure of international cooperative networks. It ended with a more traditional analysis of the effects of network structure on international stability. The results provide fairly consistent support to the proposition derived from the NIP theory with respect to the determinants of network structure and with respect to the effect of networks on international stability.

These findings provide for a new way of thinking about (a) how international structures emerge, (b) how they change, and (c) how they affect stability and instability in world politics. The story that the NIP theory tells us about structure can be summarized by the following key ideas: First, structure is an emergent property of the interaction among national choices. The decisions of some states to form security ties begin this process of emergence. These decisions are motivated partly by challenges that such states face from their external environment and partly by the political and cultural characteristics of their SRGs. The choice of allies is based on both strategic and identity factors. Common enemies, joint democracies, culturally similar states, and states that share a history of positive economic cooperation tend to flock together. This process of security cooperation results in networks that fluctuate quite significantly

<sup>8</sup> Full analysis with all the cooperative network structure indicators is shown in the book's Web site.

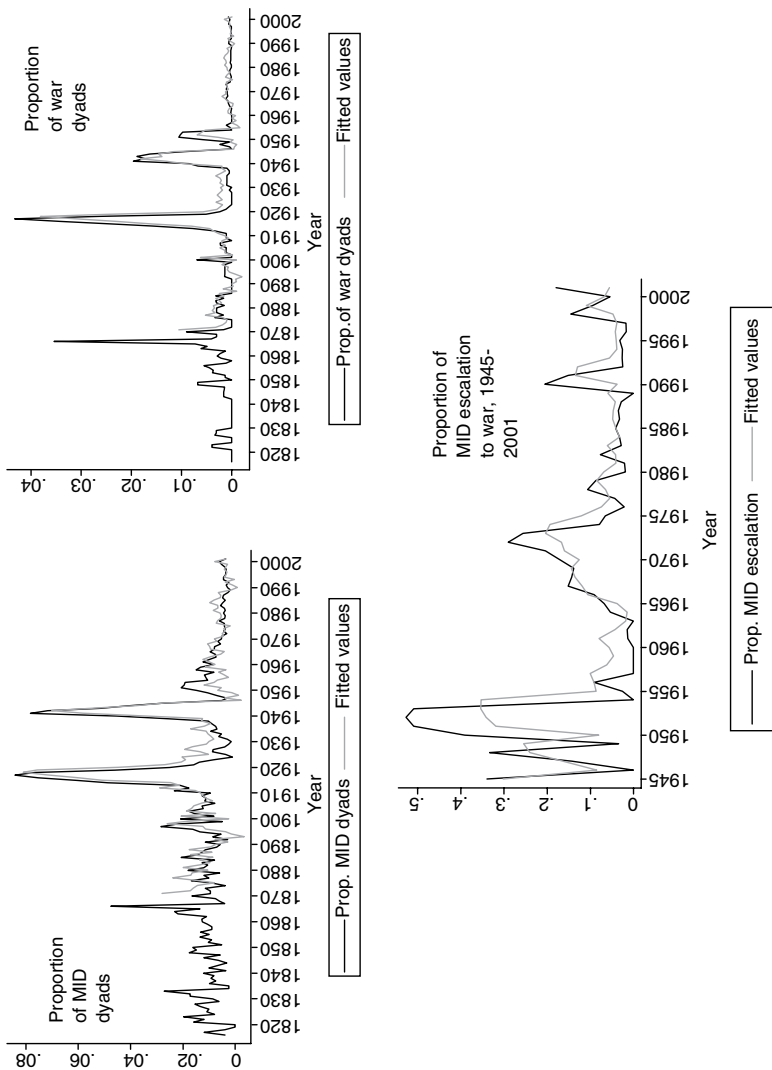


Figure 11.3. The Effect of cooperative network density on systemic conflict, 1870–2001.

in terms of their structural attributes over time. These fluctuations are due to changes in the sizes, composition, and attributes of national SRGs; they are also due to changes and fluctuations in the structure of economic and – to a lesser extent – institutional networks. And the converse seems also to be true: the structural characteristics of security networks affect the structure of economic and institutional networks. This spillover effect is due to the fact that states use past interaction experience in one realm as an indicator of the trustworthiness and credibility of potential partners in other realms. This creates an internetwork connectedness that crosses levels of analysis.

Finally, cooperative networks – in particular the level of cross-network connectedness – have a significant dampening impact on the frequency and intensity of systemic conflict. So does the democratization of SRGs. This suggests important system effects of networks and offers new avenues for research on the evolution of international politics.

Several insights into the study of international systems follow. First, these findings shed new light on the factors that affect international structures. Second, we can and should study international structure as a dependent variable because it emerges from states' choices to form economic, institutional, and security ties, or to fight other states. These emergent structures stand in stark contrast to more "conventional" system attributes that are (a) determined exogenously and – sometimes – quite arbitrarily (i.e., who is a major power); (b) fairly constant over time (i.e., the factors that determine national capabilities are fairly fixed); and (c) not a result of conscious choices (i.e., all states may choose to become major powers, but only few succeed; no major power wants to decline, but quite a few do). Third, structure is conceived in terms of the interaction among different types of relationships.

The central message of these analyses is that spillover effects exist across networks and that they go both ways: The structure of conflictual networks affects the structure of cooperative networks, and the structure of cooperative networks affects subsequent levels of stability. The microfoundations of cooperative international interactions can be found in the concerns of political leaders about the prospects of security and survival in an anarchic international system. These concerns are not, however, the sole determinants of decisions to form ties of various sorts with other states: political and cultural factors are at work as well. The present analyses highlight the fact that seemingly different networks are logically and empirically connected.

The implications of these spillover effects are far-reaching. The evolution and complexity of cooperative networks has important effects on international stability. Understanding this result takes us far away from simplistic theories about polarity and conflict, and allows us to revive the systemic study of international systems. It provides a new angle

on what structure is, how it emerges and changes, and how it affects behavior.

## Methodological Appendix to Chapter 11

### Data and Empirical Domain

All the data for the analyses of this chapter have been discussed in previous chapters. The unit of analysis is the system-year. Because trade data cover only the 1870–2001 period, most empirical analyses are limited to this period. In cases where the estimates of trade networks are statistically insignificant, the trade network characteristics were dropped. This increased the temporal domain to the 1816–2001 period.

### Measures of the Variables

The measures of general network structure have been discussed extensively in [Chapter 2](#). Other measures of system-level variables (e.g., democratic cliques) were discussed in [Chapters 8](#) and [9](#). Here, I focus primarily on the operationalization of system-level variables that were not discussed in the previous chapters.

I generated network characteristic from four networks: alliances, trade, IGOs, and SRGs. A discussion of composite network structure is provided separately.

*Alliance networks.* I used alliance commitment scores which induce valued alliance networks. For the purpose of NPI calculation, any type of alliance (except a consultation pact; Leeds, 2005) was considered a tie between members. The capabilities of cliques were aggregated such that the size of each alliance clique was defined as the total capabilities of its members. This allows generation of a fully defined NPI for each year (Maoz, 2009b).

*Trade networks.* Trade networks were binarized such that,

$$trd_{(ij)t} = \begin{cases} 1 & \text{if } \frac{EXP_{(ij)t}}{GDP_{(i)t}} \geq 0.001 \\ 0 & \text{otherwise} \end{cases}$$

For the purpose of NPI generation, the size of trade cliques was set as the share of the clique members' GDP of the total system's GDP for that year.

*IGO networks.* IGO networks were defined as in [Chapter 2](#) as diagonally standardized IGO sociomatrices. These are valued networks. Recall that each entry in this matrix  $igo_{ij}$  reflects the proportion of  $i$ 's IGO membership shared with  $j$ . Such networks had to be binarized

because – as of 1920 – virtually all states were members of at least one IGO. Hence, the standardized IGO matrices starting in 1920 are all fully connected. Consequently, I differentiated between highly connected and low-connection dyads, dichotomizing the IGO network for each year such that,

$$bigo_{(ij)t} = \begin{cases} 1 & \text{if } igo_{(ij)t} > \overline{igo}_t \\ 0 & \text{otherwise} \end{cases}$$

Where  $bigo_{(ij)t}$  is the binarized value of IGO relations between states  $i$  and  $j$  at year  $t$ , and  $igo_t$  is the average tie value at year  $t$ . The valued network was used to calculate clique cohesion for the computation of the IGO NPI (Maoz, 2009b).

*SRG networks.* As discussed in [Chapter 8](#), SRG networks are binary and symmetric. The NPI of SRG networks was calculated in the simplest manner, ignoring the size of such networks and their cohesion. Since SRG networks are conflictual networks, each SRG clique represents a security complex, sort of a “state of nature” grouping of states. For that reason, the size or cohesion of such networks does not matter. The polarization of an SRG network, however, can be interpreted in the same manner as the cooperative networks. Namely, a bipolar SRG network implies that all states in one clique are – actual or potential – enemies of each other, and therefore are potential allies of all members in the other clique. When multiple SRG cliques exist, then members of one clique tend to consider members of another clique with which they do not overlap as potential allies.

I start with brief operational definitions of the indicators of network structure.

*Normalized number of (alliance, trade, IGO, SRG) components.* The number of components of each network for each year is divided by the number of states. This variable ranges from  $1/n$  to  $n$ .

*Network polarization index (NPI).* Defined as in [Chapter 2](#) above. For alliances and trade, the NPI indices reflect both the size and cohesion of networks, as mentioned above. The IGO NPI is defined in terms of the cohesion of IGO cliques but not their size. (Implicitly size is the number of states in a given IGO clique.) Likewise, SRG networks are defined in terms of the simplest form of this measure.

*Density.* The density of a network is the proportion of actual ties to the maximum possible number of ties. For valued networks this index takes into account the largest value of a relationship.

*Transitivity.* The proportion of transitive ( $i \leftrightarrow j$ ,  $i \leftrightarrow k$ ,  $j \leftrightarrow k$ ) triples to the total number of possible triples in a network of size  $n$  [ $n(n-1)(n-2)/6$ ]. For directional networks, we symmetrize the network by the minimum tie ( $s_{ij} = 1$ , if  $i \rightarrow j$  or  $i \leftarrow j$ ).



*Group centralization.* I use the eigenvalue group centralization index for each network, as discussed in [Chapter 2](#). Alliance group centralization is based on the actual structure of the network. Trade, IGO, and SRG networks are binarized so the group centralization indices for these networks are also based on binary relations.

*Composite network structure.* A composite network is a compound network or multiplex (Wasserman and Faust 1997) composed of multiple networks. I use the three cooperative networks – alliances (A), trade (T), IGOs – as elements of the multiplex. The elements of the composite cooperative network ( $ccn_{ij}$ ) are defined as follows:

$$ccn_{ij} = \begin{cases} 1 & \text{if } a_{ij} = 0 \text{ \& } t_{ij} = igo_{ij} = 1 \\ 2 & \text{if } a_{ij} \leq 0.5 \text{ \& } igo_{ij} = 1 \\ 3 & \text{if } a_{ij} \leq 0.5 \text{ \& } t_{ij} = 1 \\ 4 & \text{if } a_{ij} > 0.5 \text{ \& } igo_{ij} = 1 \\ 5 & \text{if } a_{ij} > 0.5 \text{ \& } t_{ij} = 1 \\ 6 & \text{if } a_{ij} \leq 0.5 \text{ \& } t_{ij} = igo_{ij} = 1 \\ 7 & \text{if } a_{ij} > 0.5 \text{ \& } t_{ij} = igo_{ij} = 1 \\ 0 & \text{otherwise} \end{cases}$$

The network characteristics of the composite cooperation are measured based on the ordinal matrix values. The NPI of this network, however, is measured by the simplest possible algorithm (ignoring clique attributes but including clique cohesion). Table A11.1 provides the descriptive statistics of the structural characteristics of these networks.

### Measures of Conflict

I employ four measures of systemic conflict; one measure is used as a control variable in the analysis of network structures ([Tables 11.2–11.3](#)), and the remaining three are used as dependent variables in analyses of system effects ([Tables 11.4–11.5](#)).

*Moving average of proportion of MIDs.* A three-year moving average of the number of MIDs divided by the number of states measures the relative conflictivness of the system in the previous three years. This is an indicator of the level of instability in the international system.

*Proportion of MID dyads.* The number of dyadic MIDs divided by the number of dyads. This indicates the probability of a dyad getting involved in a MID.

*Proportion of war dyads.* The number of dyadic wars divided by the number of dyads.

*MID escalation.* The number of dyadic wars divided by the number of dyadic MIDs. This indicates the probability of a MID escalating into an all-out war.

Table A11.1. *Descriptive statistics of variables used in this chapter*

| Variable                        | N   | Mean  | Std. Dev. | Min   | Max   | Defined in           |
|---------------------------------|-----|-------|-----------|-------|-------|----------------------|
| Prop. trade components          | 132 | 0.167 | 0.084     | 0.034 | 0.378 | Ch. 2, appendix A11. |
| Prop. alliance comps.           | 186 | 0.538 | 0.243     | 0.120 | 0.939 | Ch. 2, appendix A11. |
| Prop. IGO comps.                | 186 | 0.390 | 0.377     | 0.012 | 1.013 | Ch. 2, appendix A11. |
| Prop. SRG comps.                | 186 | 0.333 | 0.138     | 0.043 | 0.783 | Ch. 2, appendix A11. |
| Trade NPI                       | 132 | 0.362 | 0.046     | 0.270 | 0.472 | Ch. 2, appendix A11. |
| Alliance NPI                    | 186 | 0.165 | 0.048     | 0.072 | 0.287 | Ch. 2, appendix A11. |
| IGO NPI                         | 186 | 0.197 | 0.082     | 0.034 | 0.417 | Ch. 2, appendix A11. |
| SRG NPI                         | 186 | 0.166 | 0.041     | 0.085 | 0.265 | Ch. 2, appendix A11. |
| Trade density                   | 132 | 0.105 | 0.026     | 0.059 | 0.149 | Ch. 2, appendix A11. |
| Alliance density                | 186 | 0.023 | 0.012     | 0.009 | 0.111 | Ch. 2, appendix A11. |
| IGO density                     | 186 | 0.292 | 0.166     | 0.032 | 0.488 | Ch. 2, appendix A11. |
| SRG density                     | 186 | 0.042 | 0.039     | 0.009 | 0.257 | Ch. 2, appendix A11. |
| Trade transitivity              | 132 | 0.569 | 0.062     | 0.334 | 0.664 | Ch. 2, appendix A11. |
| Alliance transitivity           | 186 | 0.768 | 0.197     | 0.000 | 1.000 | Ch. 2, appendix A11. |
| IGO transitivity                | 186 | 0.968 | 0.042     | 0.762 | 1.000 | Ch. 2, appendix A11. |
| SRG transitivity                | 186 | 0.319 | 0.115     | 0.000 | 0.624 | Ch. 2, appendix A11. |
| Trade eig. group centralization | 132 | 0.008 | 0.010     | 0.000 | 0.052 | Ch. 2, appendix A11. |
| Alliance eig. group cent.       | 186 | 0.030 | 0.026     | 0.001 | 0.089 | Ch. 2, appendix A11. |
| IGO eig. group cent.            | 186 | 0.014 | 0.025     | 0.000 | 0.097 | Ch. 2, appendix A11. |
| SRG eig. group cent.            | 186 | 0.029 | 0.034     | 0.001 | 0.264 | Ch. 2, appendix A11. |
| Composite network density       | 132 | 0.068 | 0.018     | 0.041 | 0.191 | Appendix A11.        |

### SRG Characteristics

I use a number of characteristics of SRG networks as independent variables in [Tables 11.2](#) and [11.3](#) as indicators of threat/assurance levels of states.

*Average number of SRG members.* Average number of members across all national SRGs per year (see the appendix to [Chapter 4](#)).

*Average alliance opportunity cost.* The average alliance opportunity cost across all states in the system for a given year.

*Average proportion democracies in SRG.* The average, over all states in the system at a given year, of the proportion of democratic states in national SRGs. See the appendix to [Chapter 8](#).

*Average cultural similarity state/SRG.* This is the average, over all states in the system at a given year, of the religious/linguistic similarity between a given state and its SRG.

*Capability concentration (CAPCON).* Measured as in [Chapter 7](#) as the relative concentration of military capabilities across all states in the international system.

*Proportion of major/regional powers.* The number of states designated as major or regional powers divided by the number of states in the system. This measures a relative proportion of system members designated as major powers.

*Average per capita GDP.* I rely on the Maddison (2008) dataset and calculate the average per capita GDP across all system members at a given year. This is used as a control variable in the analysis of trade and IGO networks.

*GDP concentration index.* Measured the same way as CAPCON using raw GDP data. This variable measures wealth inequality in the system.

*Proportion of democratic cliques.* This measure is discussed in the appendix to [Chapter 8](#). It measures the rate of SRG clique democratization.

### Methods

All analyses in this chapter assume cross-network spillover effects. Therefore, some of the right-hand variables are endogenized. However, since all analyses are based on time-series data, we need to control for serial correlations. This complicates the use of instrumental-variable or three-stage least square methods. To deal with this problem, I estimated the autoregressive coefficient  $\rho$ . For a given equation, this modification is given by:

$$\begin{aligned}\hat{Y}_t &= bX_{t-1} + r_t \\ r_t &= \rho(r_{t-1}) + u_t \\ \hat{Y}_t^* &= bX_{t-1} + \rho Y_{t-1} + u_t\end{aligned}\tag{11.1}$$

Where  $r_t = Y_t - bX_{t-1}$  and  $\rho$  is the autocorrelation coefficient. The first equation is a simple OLS equation. It does not include endogenized variables on the right-hand side. The final equation is the fully specified three-stage least squares regression with the  $\rho$ -corrected lagged dependent variable included. The full results of the three-stage least squares equations are displayed in the book's Web site at: <http://psfaculty.ucdavis.edu/zmaoz/books/networksofnations.html>.

## *The Network Analysis of International Politics: Insights and Evidence*

### 1. Introduction

A few years ago, I published a study that examined the relationship between political leaders' perceptions of historical processes and the historical record (Maoz, 2004). I content-analyzed the speeches of all the heads of state who participated in the September 2000 UN Millennium Summit. I was struck that nearly every leader talked about the interconnectedness and interdependence of international relations. Most emphasized that it was impossible for a state to live in complete or even relative isolation. No state is an island, even if it resides on one.

This book documents the extent to which this belief is rooted in fact. The connectedness of international relations is not surprising. Nor is it new. To some extent, the world has exhibited at least partial connectedness since the dawn of human history. What is striking, however, is just how such connectedness manifests itself in different ways and how it became more extensive and complex over time. We have many names for this connectedness – globalization, small world, or global village. There are also many different aspects of connectedness – among people across political borders, between firms, or among social organizations, and there are the complex relations among nations. Understanding the causes of the rapidly changing and co-evolving patterns of connectedness may well become the central focus of what Duncan Watts called “the science of the Twenty-First Century” (Watts, 2007: 489). Even if network science does nothing more than add to our understanding of collective human and social behavior, it will be a great leap forward.

The aim of the present study is much more modest. This book seeks to contribute to our understanding of international relations as a *network of international networks*. It aims to show that this perspective offers a new way of explaining the evolution of international politics over time.

It seeks to expand our understanding of how simple processes, such as formation of security alliances, the forging of trade ties, or the forming or joining of international organizations, can have important implications. And it seeks to analyze both the processes leading to the formation of networks and the implications of these networks for individual states, groups of states, and the international system as a whole. Finally, it aims at increasing the appreciation among students and scholars of the value of networks analysis for international relations research.

This chapter recapitulates the principal themes of the book. It ends with a discussion of some of the most pressing and important issues in the networks analysis of international relations and the implications of the current results for policy making.

## 2. Key Puzzles and Principal Findings

We started this journey by asking several questions about international networks.

1. How, why, and when do different international networks form?
2. How do they change over time?
3. How do different networks affect each other?
4. How do the structure and characteristics of international networks affect levels of international stability, the degree of economic inequality, and transformations in the structure of the international system?
5. What is the relationship between *nondiscretionary* networks (e.g., geographic or cultural networks) and *discretionary* ones (e.g., alliances, trade, international organizations)?

The theory of networked international politics sought to address these and several other questions by integrating the ideas of the three central paradigms of international relations: realist, liberal, and constructivist/cultural. The fundamental assumption of NIP theory is that networks are emergent structures. To understand how they form, change, affect each other, and affect stability and change in the global system, we need to start with the microfoundations of such networks. This explanation should account for the processes by which individual states decide whether, when, and with whom to form cooperative ties. The theory sets out to generate such an explanation and to derive implications from individual states' motivations and calculations with respect to the structural characteristic of various networks. The tests of the principal propositions of the NIP theory yield several conclusions.

1. The decision of states to form security ties with each other rests on a combination of strategic considerations and affinity-related factors. Specifically, it is affected by the size and characteristics of the strategic reference group (SRG) of each state.
2. Each state defines its security challenges based on the size and composition of its SRG, defined as a set of actors that are perceived to challenge the focal state's security. The SRG of each state consists typically of its past enemies, its strategic rivals, and the allies of its enemies. This concept was shown to have powerful effects on the security policy and strategic behavior of states.
  - a. The size and strategic structure (capabilities) of SRGs create a powerful motivation to form security alliances. States confronting large and hostile environments composed of many and/or powerful states are prompted to cooperate with each other, pooling their resources in order to balance the capabilities of their respective SRGs.
  - b. However, democracies that face highly democratic SRGs are less inclined to look for allies than (a) nondemocracies facing either democratic or nondemocratic SRGs, or (b) democracies facing nondemocratic SRGs.
  - c. States feel less threatened by their SRGs – and are therefore less inclined to seek allies – to the extent that they have a history of extensive trade relations with members of their SRGs.
  - d. Likewise, states who share cultural affinities with members of their SRGs tend to feel less threatened than states that are culturally different from members of their SRGs.
3. The probability of two states forming a security alliance is a function of both strategic and affinity-related factors, including the following:
  - a. The states have common enemies.
  - b. Both states have a high opportunity cost for alliance formation (both face large and powerful SRGs).
  - c. Both states are democracies.
  - d. Both have a history of trade and institutional ties.
  - e. Both are culturally similar.
4. States that have security relations – a security alliance – are far more likely to sell and buy weapons and strategically important goods from each other than are states that do not have such alliances.
5. Security alliance cliques tend to overlap with strategic trade cliques.

6. The degree of overlap between alliance and strategic trade cliques is affected by the same factors that determine the probability of direct ties between states: shared enemies, joint democracy, and cultural affinity.
7. Networks evolve in ways that are not always consistent with the NIP theory's expectations. Analyses of network evolution reveal that:
  - a. Strategic factors (alliance opportunity costs, common enemies) and cultural similarity have a stronger effect on alliance networks during periods of network transformation than during periods of relative stability. This is consistent with the NIP theory.
  - b. Contrary to the NIP theory's expectations, however, trade clique membership overlap and institutional clique overlap also tend to have a stronger effect on alliance networks during periods of network transformation than under stable networks.
  - c. Results about the differential effects of various factors on network structure are not robust across different types of networks.
  - d. At the dyadic level, the strength of network ties between states – defined in terms of alliance trade and IGO clique overlap – tends to significantly dampen the probability of conflict between them.
8. These results carry important theoretical implications, the most important of which is that cooperation is induced by the reality of conflict or states' anticipation of conflict. States are reluctant to cooperate with each other. Yet, they are pushed into security cooperation by a perception of a threatening international environment. This supports the conception of the realist paradigm. The NIP theory claims that cooperation may also emerge from shared ties or shared affinities. This combination of strategic and affinity-related motivation for cooperation has two important effects: First, it induces cross-network spillover effects. Second, as these spillover effects become more manifest and intensive, the propensity for conflict is reduced.
9. These processes operate at several levels of analysis. The analyses in [Chapter 6](#) provided fairly robust evidence for the operation of these dynamics at the levels of dyads and cliques. In [Chapter 9](#), we offered another dimension of this process by examining the cross-levels effects of strategic and economic interdependence on international conflict. Finally, in [Chapter 11](#), we showed both the



presence and the results of spillover effects at the system level of analysis.

10. In [Chapter 7](#), we noted that spillover effects can be viewed in terms of the prestige of states – defined in terms of various indicators of incoming centrality – across different networks.
  - a. The trade and IGO centrality scores of states have a fairly consistent effect on a given state's alliance centrality.
  - b. Likewise, alliance centrality has a significant effect on a state's trade centrality standing.
  - c. Surprisingly, network centrality is not a powerful predictor of whether a state is defined as a major, regional, or minor power according to the conventional labeling of states by international relations scholars.
11. The prestige of states – defined in terms of their network centrality – does not have a consistent effect on their ability to exert influence in international organizations.
12. Interestingly, status inconsistency can be both a cause of peace and a cause of war. This result holds across levels of analysis.
  - a. States whose power-related status exceeds their prestige tend to be far more hostile than status-balanced states. Likewise, states whose prestige tends to exceed their power-related status are likely to be more pacific than the “average” state.
  - b. The level of status inconsistency – discrepancies between a power-based ranking of states and network centrality-based ranking – affect the magnitude of international conflict at the systemic level.
13. One of the important processes by which networks can affect behavior is through changes to their internal structure. This can occur in several ways. In [Chapter 8](#), we explored the pacifying effects of democratization in strategic reference networks. The puzzle that motivates this part of the NIP theory is the democratic peace paradox – the fact that the relationship between democracy and peace displays severe inconsistencies across levels of analysis. The democratic networks model focuses on the relationship between democracies and their strategic reference groups.
  - a. As the SRGs of democratic states undergo a process of democratization, the focal state tends to reduce substantially its level of conflict involvement. Surprisingly, the level of conflict involvement of nondemocratic states also

drops significantly as a result of a democratization process in their SRGs.

- b. We corroborate the famous democratic peace result at the dyadic level but supplement it with an idea derived from the democratic networks model: Democratization in the SRG of dyad members reduces the probability of dyadic conflict.
- c. Increased democratization in highly conflict-prone environments – strategic reference cliques composed of potential or actual enemies – causes substantial reduction of conflict within those cliques.
- d. This is another expression of spillover effects at a new level of analysis – endogenous groups. Democratization within volatile and unstable environments has an effect on the entire environments, not only on those states that democratize. This result extends and strengthens the democratic peace result.
- e. At the system level, the proportion of cliques that are dominated by democracies, as well as the average proportion of democratic states in strategic reference cliques, have a significant dampening effect on systemic conflict. This is a very important result. It suggests that the characteristics of units – modified by their strategic network ties – have system-level effects.

14. The relationship between economic interdependence and international conflict has been at the center of debate in the international relations literature for quite some time. [Chapter 9](#) offered a new approach to this issue, arguing that interdependence should be seen as encompassing other relationships, not just economics. Political theorists who talked about interdependence in world politics focused primarily on strategic interdependence due to anarchy and to the resulting insecurity of states. Using the measures of dependence and interdependence discussed in [Chapter 2](#) (c.f., Maoz, 2009a), the analyses in this chapter revealed several results.

- a. Strategic interdependence does not have a consistent effect on international conflict, and when it does, its actual effects are different from what the realist paradigm expects. First, as the level of strategic interdependence of states increases, they tend to lower their participation in international conflicts. Although this result contrasts with the expectations of the realist paradigm, it is consistent with the expectations of the liberal paradigm. Second,

the higher the level of strategic interdependence of dyad members, the less likely they are to engage in all-out wars and to escalate ongoing MIDs to the war level. Finally, the level of strategic interdependence in the international system dampens the level of systemic conflict. This contrasts with the expectations of the realist paradigm, but is in line with those of the liberal paradigm.

- b. Economic interdependence displays a consistently dampening effect on national, dyadic, and systemic conflict.
- c. Integrative interdependence – a juxtaposed measure of strategic and economic interdependence – has also a consistently dampening effect on international conflict across levels of analysis. This is also very much in line with the ideas of the liberal paradigm.

Taken together, these results establish a strong connection between an important network property and international conflict. They also show how SNA can help us resolve the level-of-analysis puzzle in international relations.

15. The puzzle that motivated [Chapter 10](#) derives from a line of studies that attempted to test the propositions of the world systems theory. The key questions in this chapter concern the extent to which the global division of labor in the world system induces significant differences in rates and levels of economic growth. These questions were at the center of a debate among sociologists who had applied SNA approaches to test the world system theory. I critiqued these studies on both theoretical and methodological grounds. I offered an alternative approach that rests on the network analytic concepts of dependence and interdependence. I also argued that one could draw important propositions from the world system theory with respect to patterns of domestic and international conflict. Analyzing these issues leads to several novel and quite interesting results.
  - a. There is a fairly consistent relationship between the social class position of states – their block position derived from their pattern of dependence relations across networks – and their reputational ranking. Major and regional powers tend to be in core blocks; minor powers tend to populate the semiperipheral and peripheral blocks.
  - b. Also in line with the expectations of the world system theory, the tendency of states to stay in the same social class over time is higher for peripheral states than for semiperipheral or core states. Concomitantly, block stability increases across the board in the post-World War II

- era compared to previous periods. This is because of the greater stability in the dominant mode of production of the post-WWII world system compared to previous epochs.
- c. The division of labor in the world system has a consistent and robust effect on absolute levels of economic growth: states in the core and semiperiphery grow at substantially higher rates than states in the periphery. However, rates of economic growth are faster in the core than in other social classes only in the post-WWII era.
  - d. The global division of labor has interesting – though not terribly robust – effects on the political stability of states. The likelihood of civil war (based on two of the three civil war datasets) is significantly lower in core states than in periphery states. At the same time, class stability has a consistent dampening effect on the probability of civil war: States that have recently moved from one class to another are more likely to experience civil wars than states that have been in the same class for some time.
  - e. Core states are more likely to intervene on the government's side in states experiencing civil war; periphery states tend to intervene on the side of the rebels.
  - f. The association between class position and the probability of international conflict does not yield clear and consistent patterns. There is some evidence to suggest that core states are more conflict-prone than peripheral states and that the probability of conflict in a dyad composed of core states is higher than in dyads composed of peripheral states.
16. **Chapter 11** focuses on the network consequences of the processes and issues discussed in previous chapters. It offers an array of novel findings about the determinants of network structure and about the effects of the structural characteristics of networks on international stability.
- a. The structure of alliance networks is consistently affected by microlevel decisions to form security ties. The factors that motivate such decisions have an effect on the structural characteristics of alliance networks. Specifically, the average size and the average alliance opportunity costs of national SRGs increase the polarization, density, and transitivity and reduce the number of components and the group centralizations of alliance networks.
  - b. SRG democratization and the average level of cultural similarity of SRG members tend to reduce the polarization, density, and transitivity of alliance networks, and to

- positively affect the number of alliance components and their group centralization.
- c. Most prominently, cross-network effects are significant. The indicators of trade and IGO network structure have a positive effect on parallel indicators of alliance network structure. Some exceptions exist, though. Trade polarization has a negative impact on alliance polarization. This is inconsistent with the expectations of the NIP theory. On the other hand – and consistent with the expectations of the theory – trade density has an inverse effect on alliance network density.
  - d. Spillover effects work both ways. The indicators of alliance network structure have, by and large, a positive impact on the parallel indicators of trade network structure. The exception – consistent with the NIP theory's expectations – is that alliance density has a negative impact on trade density.
  - e. IGO networks have a spillover effect on both alliance and trade networks in ways that are typically consistent with the NIP theory's expectations.
17. Cooperative networks and the regime structure of SRG cliques have important effects on peace and war in world politics.
- a. Alliance polarization has a positive effect on the frequency and severity of conflict in the international system. This effect is not robust over time and over indicators. However, it is common enough to suggest that it is meaningful.
  - b. Trade polarization tends to have a dampening effect on the frequency and severity of international conflict. This effect is quite robust (although there are not enough observations to test it for the nineteenth century).
  - c. IGO network polarization as well as the polarization of SRG networks tends to have positive effects on the frequency and intensity of twentieth-century conflict. But these effects do not apply for the entire 1816–2001 period, nor do they apply to international conflict in the nineteenth century.
  - d. When we juxtapose the individual cooperative networks into one multiplex, we find that the density of the joint network has a dampening effect on the frequency of conflict but not on its propensity to escalate from low levels to war.
  - e. Finally, and consistent with the democratic networks model, the proportion of democratic cliques – SRG

cliques dominated by democracies – as well as the average proportion of democracies in national SRGs have a consistent dampening effect on the frequency and severity of systemic conflict.

18. The traditional measures of system structure commonly invoked by international relations scholars do not seem to exhibit consistent effects either on the structure of cooperative networks or on the frequency and severity of systemic conflict.

These results accumulate into a novel and quite general body of knowledge about the origins, evolution, and impact of international networks. Taken together, they suggest a number of important points about the theory and practice of international relations.

We started our journey with the idea that we can understand the evolution of international relations over the past two centuries as a network of – cooperative and conflictual – networks. I argued that these networks are interrelated, that they co-evolve, and that their characteristics and structure have important effects. The theory of networked international politics sought to put these ideas into a systematic framework. This framework did not seek to reinvent the wheel; the major paradigms in the field had a lot of useful ideas about networks, even though they were not expressed in strictly network-theoretic terms. The current theory builds on and integrates the principal assumptions and some of the central propositions of the realist, liberal, and constructivist/cultural theories. However, as far as any integration of existing knowledge goes, the selective combination of assumptions and stories derived from partly complementary but mostly competing paradigms leads to new insights, novel stories, and new propositions.

On the whole, the results of the empirical analyses conducted herein vindicate the principal conception embedded in the theory. The support for specific propositions is not uniform across the board, but quite a few of the propositions derived from the NIP theory received substantial corroboration in the analyses. Clearly, this is only a first step in the analysis of the formation, evolution, and impact of international networks. Replication of these analyses is essential for increasing the confidence in the theory. But there are a lot of other things that network analytic studies of international politics should and can do.

### 3. Challenges for the Future

Many people talk and write about the networked nature of international relations. Yet, we did not have a systematic theory of what this means.

This book sought to answer some central aspects of this question. It is a first step toward a network-theoretic conception of international relations. Much more can be done. I outline herein some ideas that may help guide future research on international networks. These ideas are subjective; there may be many others. Nonetheless, it is useful to lay out some of the key challenges that lie ahead for those who may use this approach to advance our knowledge about international politics in general, and about international networks, in particular.

First, quite a few of the ideas and analyses herein need further extension and replication. More nuanced understanding of the conditions under which the propositions of the NIP theory are supported or refuted needs to emerge from further studies on the topics covered by the theory.

Second, criticisms of the theory's ideas, concepts, and the methodology used herein will undoubtedly emerge. This is the nature of science in general, and the discourses among international relations scholars are no different. The combination of replication and extension of existing theories, with their critical review and alternative ideas would help advance our knowledge on international networks.

Beyond these things, several important processes need to take place to promote the study of international networks. These seem to me the principal challenges that scholars using SNA in international relations will be facing in the future.

1. *Breaking up the black box of states.* We need more theories and analyses of the relationships between intrastate networks and international networks. This calls for models of nested networks. A nested network is one in which a node in the external network is a network in the internal one. States' decisions result from interactions in internal networks. Such networks may consist of bureaucracies, individual decision makers, legislatures, public opinion, interest groups, and so forth. Paul Thurner's work (Thurner and Pappi, 2008; Thurner and Binder, 2009) is an excellent model of this kind of work.
2. *Examining state–nonstate actor networks.* Several datasets have explored ties between states and insurgency/guerrilla/terrorist groups. Interesting network implications of these ties follow. Who chooses to support whom, who is the target, and why? What are the effects of state–nonstate networks on interstate networks? What are the effects of interstate networks on state–nonstate networks? We need more systematic networked datasets on the operation of NGOs and the networks they establish within states. More work is needed on transnational corporation networks and their relation to interstate networks. The point is that

contemporary international politics involves both interstate networks as well as state–nonstate networks. Modern international relations are also possibly affected by nongovernment-mediated ties between or among nonstate actors across national boundaries. If interstate networks proved to be important – as this book argues – then it is likely that these other networks would shed a great deal of light on different patterns of cooperation in world politics.

3. *Collecting more data on international and domestic networks.* Currently data collection is underway to improve the quality of the cultural data that have been used in this study. There are additional datasets available on various aspects of cooperative international relations, including diplomatic representation, telecommunication, tourism, scientific collaboration, or internet chat groups. These data may capture important aspects of international relations at the “low politics” level. There are also different datasets on conflictual interactions – various event-datasets, terrorist activity datasets, and the like. These datasets are scattered. The first and most important thing is to generate a comprehensive depository of relational and affiliational data, formatted in ways that are amenable to network analyses (e.g., matrix format, dyadic format). We also need additional data on interstate interactions such as cooperation on crime, terrorism, or a more refined breakup of IGOs into specific types (e.g., security, economic, administrative, human rights, etc.). Legal interactions among states are also extremely important if we wish to understand the evolution and impact of international law on international politics writ large. The more people get interested in these issues, the more likely data collection projects will receive the kind of funding that would make such a dataset happen.
4. *More integration of network analyses with other forms of analyses.* There are a number of projects that begin to conceptualize the merging of network data with GIS data. This offers a very interesting way of both generating data and gaining understanding of the interrelations between geography and politics. We need more efforts of this sort.
5. *Combining network models with formal models of politics.* This is the trend in economics, where some major advances have been made in this regard (Jackson and Wolinsky, 1996; Bala and Goyal, 2000; Jackson, 2008). We need to both apply existing models and develop more suitable models that capture the unique character of international relations. Likewise, there is a growing tendency in political science – especially in the literature



on collective behavior – to use agent-based models to study complex processes. The merging of such models with network data would offer interesting insights that are difficult to capture in highly complex networks.

The need to make inroads for network analysis in world politics as a legitimate approach is still very much pertinent. This book offers a small step toward this end, but much more effort is required.



## Glossary

| Concept                                   | Abbreviation/<br>(notation) | Definition                                                                                                                                                                          |
|-------------------------------------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Affiliation (two-mode) networks           |                             | A network composed of units affiliated with events, organizations, institutions, and so forth – Chapter 1                                                                           |
| Affiliation matrix                        | A                           | A matrix of order $n$ (nodes) $\times$ $k$ (events) representing an affiliation network, with entries $a_{ij}$ representing the affiliation of node $i$ with clique $j$ – Chapter 2 |
| Affiliation to sociomatrix transformation |                             | Conversion of an affiliation matrix to a sociomatrix (different methods) – Chapter 2                                                                                                |
| Alliance dataset                          |                             | Source: Leeds (2005). Dataset containing information of all formal alliance commitments of states over the 1816–2001 period, by type of alliance – Chapter 2                        |
| Alliance onset                            |                             | The formation year of an alliance – Chapter 6                                                                                                                                       |
| Alliance opportunity cost                 | AOC                         | The opportunity cost of failing to form an alliance – the difference between the capabilities of the focal state and the cumulative capabilities of its SRG members – Chapter 4     |
| Allies-SRG cap difference                 |                             | Same as AOC – Chapter 6                                                                                                                                                             |
| Ally of My Enemy                          | AOE                         | The ally of a state that is an enemy of the focal state – Chapter 4                                                                                                                 |
| Arms trade clique                         |                             | A closed subset of the arms trade network – states that trade arms with each other – Chapters 5 and 6                                                                               |

(continued)

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| Concept                                | Abbreviation/<br>(notation) | Definition                                                                                                                                                                                                                                                                                                        |
|----------------------------------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Average capability ratio in SR cliques |                             | Average ratio of capability scores of all dyads in a given strategic reference clique – Chapter 6                                                                                                                                                                                                                 |
| Average IGO co-membership, state-SRG   |                             | Average number of normalized IGO co-membership of all dyads in a given strategic reference clique – Chapter 6                                                                                                                                                                                                     |
| Average nodal degree                   | AvD                         | Average number of ties of nodes in a network ( $1/n\Sigma D_i$ ) – Chapter 2                                                                                                                                                                                                                                      |
| Average percent clique overlap         |                             | Average percentage of states that overlap across cliques in a network – Chapter 8                                                                                                                                                                                                                                 |
| Average regime in clique               |                             | Average regime score of states in a given clique – Chapter 6                                                                                                                                                                                                                                                      |
| Betweenness centrality                 | C <sub>B</sub>              | The centrality of a node as a broker. Proportion of times a node bridges between two other nodes – Chapter 2                                                                                                                                                                                                      |
| Block affiliation matrix               | BA                          | A matrix of order $n$ (nodes) $\times k$ (blocks) in which entries $ba_{ij}$ denote the affiliation of state $i$ with block $j$ – Chapter 2                                                                                                                                                                       |
| Block characteristics                  |                             | A matrix that assigns various attributes of nodes to blocks (e.g., average regime score of block, relative power of block, etc.) – Chapter 2                                                                                                                                                                      |
| Block membership overlap               | BMO                         | A $n \times n$ binary matrix with entries $bmo_{ij} = 1$ if nodes $i$ and $j$ are in the same block, and zero otherwise – Chapter 2                                                                                                                                                                               |
| Blockmodeling                          |                             | A method for partitioning a network into discrete groups of roughly equivalent nodes and using this partition to test hypotheses about network structure – Chapter 2                                                                                                                                              |
| Blocks                                 |                             | A set of discrete endogenous groups composed of equivalent nodes.                                                                                                                                                                                                                                                 |
| Bridge                                 |                             | A node connecting two or more other nodes.                                                                                                                                                                                                                                                                        |
| Capability concentration               | CAPCON                      | Sources: Singer, Bremer, and Stuckey (1972), Ray and Singer (1973). A measure of the degree of concentration of capabilities in the international system. Varies from zero when the distribution of capabilities over states is uniform to one when one state controls all capabilities in the system – Chapter 7 |
| Change in CINC                         |                             | Change in the CINC from one year to another – Chapter 4                                                                                                                                                                                                                                                           |

*(continued)*

| Concept                          | Abbreviation/<br>(notation) | Definition                                                                                                                                                                                                                                            |
|----------------------------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Claim presence                   |                             | Source: ICOW (Hensel, Mitchell, and Sowers, 2006). Territorial, river, or maritime claims by one state against another – Chapter 4                                                                                                                    |
| Claim severity                   |                             | Source: ICOW. Severity of the claim on a scale of 1–12 – Chapter 4                                                                                                                                                                                    |
| Clique                           |                             | A closed subset of a network. A group of nodes, all of which are directly tied to each other. No clique can be a proper subset of another clique – Chapter 2                                                                                          |
| Clique affiliation matrix        | CA                          | A matrix of order $n$ (nodes) $\times k$ (cliques) with entries $ca_{ij}$ denoting the affiliation (1) or nonaffiliation (0) of state $i$ with clique $j$ – Chapter 2                                                                                 |
| Clique characteristics           |                             | A matrix that defines the attributes of cliques (e.g., the average regime score of clique members, the total capabilities of clique members, etc.) – Chapter 2                                                                                        |
| Clique cohesion                  | $c_i$                       | A score that denotes the extent to which members of clique $i$ are equivalent or similar on an exogenous attribute (e.g., ideological similarity between political parties). Used as an element in measuring CPOL – Chapter 2                         |
| Clique-level MID                 |                             | The proportion of dyads in a given strategic reference clique that had a MID at a given year – Chapter 8                                                                                                                                              |
| Clique membership overlap matrix | CMO                         | A square matrix of order $n$ that reflects the extent to which nodes overlap in terms of clique membership. Entry $cmo_{ij}$ is the number of cliques that nodes $i$ and $j$ share in common – Chapter 2                                              |
| Clique overlap index             | COI                         | An index that measures the extent to which cliques overlap in terms of membership. Used as an element in the measurement of NPI – Chapter 2                                                                                                           |
| Clique polarization              | CPOL                        | A measure that reflects the extent of polarization between members of a given clique and nonmembers, as a proportion of the maximum possible overlap in a network of size $n$ that is divided into $k$ cliques. Used as an element of NPI – Chapter 2 |
| Clique size                      | $s_i$                       | Number of nodes in clique $i$ – Chapter 2                                                                                                                                                                                                             |

*(continued)*

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| Concept                                  | Abbreviation/<br>(notation) | Definition                                                                                                                                                                                                                  |
|------------------------------------------|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Clique-by-clique overlap                 | COC                         | A matrix of order $k \times k$ that measures the number of nodes that overlap across cliques. Entry $coc_{ij}$ measures the number of nodes that are common to cliques $i$ and $j$ – Chapter 2                              |
| Closeness centrality                     | $C_c$                       | The centrality of a node as an inverse function of the distance to all other nodes – Chapter 2                                                                                                                              |
| Cognitive algebra                        |                             | A set of Boolean algebraic operations used to manipulate signed graphs (Axelrod, 1976).                                                                                                                                     |
| Cognitive maps                           |                             | A method used to measure and analyze structures of beliefs or argumentations. A map is a set of concepts and signs that denote causal connections between them (Axelrod, 1976) – Chapter 1                                  |
| Components                               | CM                          | A closed subset of reachable nodes. All nodes in a component are reachable from all other nodes within the component. No node in the component is reachable from a node outside the component – Chapter 2                   |
| Composite index of national capabilities | CINC                        | Sources: Singer (1990); COW (2003). An index measuring the national capabilities of a state as an average of the state's system share of six variables measuring economic, demographic, and military attributes – Chapter 4 |
| Constructivism                           |                             | An approach to the study of international relations that focuses on the interactions between ideas, identities, and behavior – Chapter 1                                                                                    |
| Contiguity                               |                             | Geographic proximity via a shared land border, a colonial border, a river, or a short maritime distance between two states' territories – Chapter 4                                                                         |
| Convergence of iterated correlations     | CONCOR                      | A method used to generate blocks on the basis of repeated iteration of a matrix of equivalence scores – Chapter 2                                                                                                           |
| Correlates of war                        | COW                         | A project that is devoted to the collection, dissemination, and analysis of quantitative data on a wide variety of aspects in world politics, primarily militarized interstate disputes and wars – Chapter 1                |

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| Concept                                     | Abbreviation/<br>(notation) | Definition                                                                                                                                                                                                           |
|---------------------------------------------|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Correlation structural equivalence          | SEQ <sub>c</sub>            | A measure of the extent to which two nodes have similar profiles of relations with all other nodes in the network. Uses Pearson bivariate or multivariate correlation coefficient to measure equivalence – Chapter 2 |
| COW status                                  |                             | Source: Singer and Small (1972), COW, 2003a. A code that establishes the reputational status of states as major or minor powers. Based on the “consensus of diplomatic historians” – Chapter 7                       |
| Cultural cohesion                           |                             | The average degree of cultural affinity between dyads making up a given clique – Chapter 8                                                                                                                           |
| Cultural similarity                         |                             | The average linguistic and religious similarity between states – Chapter 6                                                                                                                                           |
| Cultural similarity state-SRG               |                             | The average degree of religious and linguistic similarity between a focal state and the members of its SRG – Chapter 6                                                                                               |
| Cyclical interdependence                    |                             | The interdependence of a state on itself due to a cycle of relations with other states – Chapter 9                                                                                                                   |
| Data development in international relations |                             | A NSF-funded project in the 1980s that supported the updating and collecting of multiple datasets on various aspects of international relations – Chapter 1                                                          |
| Defense/offense–SRG cap differences         |                             | The difference between states that had an offensive or defensive alliance with a focal state and the capabilities of members of the focal state’s SRG – Chapter 6                                                    |
| Degree centrality                           | C <sub>D</sub>              | The centrality of a node defined as a proportion of the number of direct ties it has to the number of possible ties it can have ( $n-1$ ) – Chapter 2                                                                |
| Democ × prop. democs in SRG                 |                             | An interactive variable that measures the relationship between a state’s democracy status and the democratization of its SRG – Chapter 6                                                                             |
| Democratic networks                         |                             | A theory that attempts to account for the relationship between democracy and peace across levels of analysis (Maoz, 2001) – Chapter 8                                                                                |

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| Concept                               | Abbreviation/<br>(notation) | Definition                                                                                                                                                                                                                                         |
|---------------------------------------|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Diagonally standardized sociomatrices |                             | A matrix whose entries are divided by the column diagonal. Typically applies to CMO or COC matrices in order to normalize by differential levels of clique memberships or the sizes of cliques – Chapter 2                                         |
| Discretionary networks                |                             | Network in which the rule that defines relations or affiliations is based on choices made by nodes – Chapter 1                                                                                                                                     |
| Dyadic dependence                     | $d_{ij}$                    | Level of dependence of one state on another, reflecting both direct and indirect relations (and also reflects opportunity costs of breaking up relations) – Chapter 2                                                                              |
| Dyadic dependence balance             | $db_{ij}$                   | The level of dependence of one state on another. The dependence balance between $i$ and $j$ is the difference between $j$ 's dependence on $i$ and the dependence of $i$ on $j$ , as a proportion that includes $i$ 's self-dependence – Chapter 2 |
| Dyadic interdependence                |                             | The average dependence of two state on each other – Chapter 2                                                                                                                                                                                      |
| Dynamic network analysis              |                             | Analysis of changes in networks over time – Chapter 5                                                                                                                                                                                              |
| Ego networks                          |                             | A network viewed from the vantage point of a specific node – Chapter 2                                                                                                                                                                             |
| Egonet characteristics                |                             | The attributes (e.g., size, capabilities, regime) of the egonet of a given state – Chapter 2                                                                                                                                                       |
| Egonet size                           |                             | The number of nodes attached to a focal node – Chapter 2                                                                                                                                                                                           |
| Eigenvector centrality                | $C_E$                       | The centrality of a node measured by the number of ties it has and the centrality of the nodes with which it is tied; the more nodes one is tied to and the more central these nodes, the higher the Eigenvector Centrality score – Chapter 2      |
| Endogenous groups                     |                             | Subsets of a network derived by some method or rule that does not require information beyond that contained in the network (presence, direction, or magnitude of ties between nodes) – Chapter 1                                                   |



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| Concept                                                    | Abbreviation/<br>(notation) | Definition                                                                                                                                                                                                                        |
|------------------------------------------------------------|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Enemy of my enemy                                          | EOE                         | A member of the SRG of one's enemies (SRG members) – Chapter 4                                                                                                                                                                    |
| Euclidean distance structural equivalence                  | SEQ <sub>ED</sub>           | A measure of similarity of relational profiles between two nodes in the network based on the Euclidean distances between these profiles – Chapter 2                                                                               |
| Event-based transformation of affiliation to sociomatrices |                             | A conversion of an affiliation matrix into a Sociomatrix where the event is used as the basis for transformation – Chapter 2                                                                                                      |
| Exponential random graphs                                  |                             | An approach to modeling the properties of actual networks based on random networks with certain dependence structure – Chapter 1                                                                                                  |
| General Agreement on Tariffs and Trade                     | GATT                        | Established in 1947 as an outgrowth of the Bretton Woods Conference (1944). An agreement to regulate international trade. Replaced in 1995 by the World Trade Organization – Chapter 1                                            |
| Giant component                                            |                             | The largest component in the network – Chapter 2                                                                                                                                                                                  |
| Group centralization                                       |                             | A measure of the degree to which different nodes represent radically different levels of centrality – Chapter 2                                                                                                                   |
| Group degree centralization                                | GC <sub>D</sub>             | The difference between the node with the highest degree centrality score and the degree centrality of all other nodes, as a proportion of the maximum possible distances in a network of size $n$ ( $n-1$ ) ( $n-2$ ) – Chapter 2 |
| Homophily                                                  |                             | A process of attachment where nodes connect to nodes that are similar to themselves on some attribute – Chapter 2                                                                                                                 |
| Hub                                                        |                             | A node that connects between multiple other nodes – Chapter 1                                                                                                                                                                     |
| Hubbell influence index                                    |                             | Source: Hubbell (1965). A measure of influence that describes the structure of ties between a node and other nodes in the network – Chapter 9                                                                                     |
| Hypergraph                                                 |                             | A graph that connects several networks – Chapter 2                                                                                                                                                                                |
| Hypermatrix                                                |                             | A matrix that contains several matrices, each reflecting a different network – Chapter 2                                                                                                                                          |

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| Concept                                 | Abbreviation/<br>(notation) | Definition                                                                                                                                                                                                |
|-----------------------------------------|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IGO affiliation network                 |                             | Source: Pevehouse et al., 2004b, Nordstrom and Wranke (2004). An affiliation network that details the membership of states in IGOs over the 1815–2001 period – Chapter 2                                  |
| IGO co-membership network               |                             | The IGO affiliation network converted into a (diagonally standardized) sociomatrix that reflects the degree to which any two states share IGO memberships – Chapter 2                                     |
| Image matrix                            |                             | A matrix of the characteristics of Blocks – Chapter 2                                                                                                                                                     |
| Indegree centrality                     |                             | Centrality based on incoming ties – Chapter 2                                                                                                                                                             |
| Indirect dependence                     |                             | Dependence due to indirect relations between states – Chapter 2                                                                                                                                           |
| Indirect relations                      |                             | Relations between nodes that are mediated by other nodes – Chapter 2                                                                                                                                      |
| International Crisis Behavior Project   | ICB                         | Sources: Brecher et al., 1988; Wilkenfeld and Brecher (1989). A project that collected data on the characteristics of international crises and foreign policy crises – Chapter 1                          |
| International governmental organization | IGO                         | An organization that has the following characteristics: at least three member states; a secretariat and a plenary that meet at least one year; members are official representatives of states – Chapter 1 |
| Isolates                                |                             | Nodes that have no ties to other nodes – Chapter 1                                                                                                                                                        |
| Issue correlates of war                 | ICOW                        | A dataset of territorial, river, and maritime claims of states over the 1816–2007 period – Chapter 4                                                                                                      |
| Joint democracy                         | JD                          | A measure that reflects the fact that two states are democratic (1), or not (0)                                                                                                                           |
| Katz influence index                    |                             | Source: Katz (1953). A measure of network influence.                                                                                                                                                      |
| Level of alliance commitment            | ALLYCOMM                    | A measure ranging between zero and 1 reflecting the number and level of commitments between two states – Chapter 2                                                                                        |

*(continued)*

| Concept                         | Abbreviation/<br>(notation) | Definition                                                                                                                                                                                                                                                                        |
|---------------------------------|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Level-of-analysis problem       |                             | A problem that refers to difficulty to generalize empirical findings from the monadic level to the dyadic and/or system level – Chapter 1                                                                                                                                         |
| Liberal paradigm                |                             | An approach to the study of international relations that focuses on the relationships between domestic and international politics and on the effects of international institutions on state behavior and on systemic outcomes – Chapter 1                                         |
| Log World Trade                 |                             | Log of total trade in the international system – Chapter 2                                                                                                                                                                                                                        |
| Major power                     |                             | A reputational status of state that reflects its power and influence – Chapter 7                                                                                                                                                                                                  |
| Maritime claims                 |                             | Claims that include contested oceanic waterways between states – Chapter 4                                                                                                                                                                                                        |
| Maximum flow                    | MAXFLOW                     | A measure of the degree of information transfer among nodes – Chapter 1                                                                                                                                                                                                           |
| MID escalation                  |                             | The escalation (1) or nonescalation (0) of a MID to an all-out war – Chapter 7                                                                                                                                                                                                    |
| MID initiation                  |                             | Source: Maoz (1982). The initial act of threat, display, or use of force by a state, thus starting a MID – Chapter 4                                                                                                                                                              |
| MID involvement                 |                             | The participation of a state in a MID as an initiator, target, or joiner – Chapter 4                                                                                                                                                                                              |
| Militarized interstate disputes | MID                         | Source: Gocham and Maoz (1984). A set of interactions between or among states involving the threat, display, or use of force in “short temporal intervals” To be included, these actions must be overt, nonaccidental, government-sanctioned, and government-directed – Chapter 2 |
| Minimum AOC                     |                             | The smallest AOC in a dyad – Chapter 6                                                                                                                                                                                                                                            |
| Minimum regime score            | MINREG                      | The lowest regime score in a dyad – Chapter 6                                                                                                                                                                                                                                     |
| Minor power                     |                             | Source: Singer and Small (1972). A state with relatively few capabilities and limited span of interests – Chapter 7                                                                                                                                                               |
| Modified CPOL                   |                             | CPOL modified by cohesion and/or size – Chapter 2                                                                                                                                                                                                                                 |

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| Concept                                       | Abbreviation/<br>(notation) | Definition                                                                                                                                           |
|-----------------------------------------------|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| Monadic dependence                            |                             | The total dependence of a state on the network – Chapter 2                                                                                           |
| Monadic dependence balance                    |                             | The difference between the dependence of other states on the focal state and the state's dependence on other states – Chapter 2                      |
| Monadic interdependence                       |                             | The aggregated level of Out and On Dependence of a given state – Chapter 2                                                                           |
| Multiple network clique affiliation matrix    | MCA                         | A clique affiliation matrix that reflects clique structure across two or more networks – Chapter 2                                                   |
| Multiplex dyadic dependence                   |                             | Dyadic dependence across several networks – Chapter 2                                                                                                |
| Network attributes                            |                             | A set of measures that describe entire networks – Chapter 2                                                                                          |
| Network density                               | $\Delta$                    | The proportion of the tied nodes in a network to the number of possible ties $n(n-1)$ – Chapter 2                                                    |
| Network polarization index                    | NPI                         | An index that measures the extent to which a network tends towards bipolarity (Maoz, 2006b, 2009b) – Chapter 2.                                      |
| Network transitivity (clustering coefficient) | T                           | The extent to which ties in a network are transitive, or the proportion of closed triads to the number of possible triads $(n-1)(n-2)/6$ – Chapter 2 |
| No. MIDs in system                            |                             | Number of MIDs underway at a given year – Chapter 7                                                                                                  |
| No. wars in system                            |                             | Number of wars underway at a given year – Chapter 7                                                                                                  |
| Nodal degree                                  | ND                          | The number of direct ties of a given node – Chapter 2                                                                                                |
| Nodes                                         |                             | Elements of a network – Chapter 1                                                                                                                    |
| Nondiscretionary networks                     |                             | A network in which ties are defined by a rule over which nodes have no control – Chapter 1                                                           |
| Normalized number of components               | C/N                         | The number of components divided by the number of nodes – Chapter 11                                                                                 |
| Normalized clique-by-clique overlap           | COC                         | COC matrix in which each entry is divided by the row diagonal – Chapter 2                                                                            |
| Normalized CMO matrix                         | CMO                         | CMO matrix in which each entry is divided by the row diagonal – Chapter 2                                                                            |
| Number of defense/offense pacts               |                             | Number of allies who signed an offense or defense pact with the focal state at a given year – Chapter 6                                              |

*(continued)*

| Concept                                     | Abbreviation/<br>(notation) | Definition                                                                                                                                                    |
|---------------------------------------------|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| On dependence                               | ONDEP                       | The degree of dependence of a given state on other states in the network – Chapter 2                                                                          |
| Organization of American States             | OAS                         | Established in 1890 as an organization (that also represents a collective security institution) of security and cooperation among American states – Chapter 1 |
| Out dependence                              | OUTDEP                      | The degree of dependence of other states on the focal state – Chapter 2                                                                                       |
| Percent improvement in fit                  | PIF                         | The improvement in fit of a model compared to a modal prediction of a distribution – Chapter 4                                                                |
| Positivism                                  |                             | An approach to testing hypothesis via logical or empirical tests – Chapter 5                                                                                  |
| Prestige                                    |                             | The degree to which other nodes choose to have ties with the focal node                                                                                       |
| Prop. allies in strategic reference cliques |                             | The proportion of dyads in a strategic reference clique that have formal alliances with each other – Chapter 8                                                |
| Prop. democracies in SRG                    |                             | The proportion of democratic states in the SRG of a given state – Chapter 2                                                                                   |
| Prop. dyads in MIDs                         |                             | The proportion of the dyads in the system that have MIDs at a given year – Chapter 7                                                                          |
| Prop. dyads in wars                         |                             | The proportion of dyads in the system that have a war at a given year – Chapter 7                                                                             |
| Prop. of democratic cliques                 |                             | Proportion of Strategic Reference Cliques with a majority of democratic states                                                                                |
| Proportion of clique dyads in MIDs          |                             | Proportion of dyads in a clique that have a MID at a given year                                                                                               |
| Reachability matrix                         | R                           | A matrix that reflects the extent to which nodes are reachable from other nodes, either via direct or indirect ties – Chapter 2                               |
| Realist paradigm                            |                             | An approach to the study of international relations that focuses on states' pursuit of security and power – Chapter 1                                         |
| Regime persistence                          |                             | The extent to which a regime maintains its structure over time – Chapter 7                                                                                    |

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| Concept                        | Abbreviation/<br>(notation) | Definition                                                                                                                                 |
|--------------------------------|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Regime score                   |                             | Source: Maoz and Russett (1993). The democracy-autocracy scale ranging from -100 (perfect autocracy) to +100 (ideal democracy) – Chapter 2 |
| Regional power                 |                             | Source: Maoz (1996). A state that has a regional reach capacity – Chapter 7                                                                |
| Relational (one-mode) networks |                             | A network in which the rule that defines ties reflects a specific relationship between nodes – Chapter 1                                   |
| Relational algebra             |                             | A set of mathematical operations dealing with multiplexes                                                                                  |
| Reputational status            |                             | A status of a state by virtue of its capabilities and influence – Chapter 7                                                                |
| River claims                   |                             | Claims involving navigation or water sharing on a river – Chapter 4                                                                        |
| Role equivalence               |                             | Source: Burt (1990). The degree of similarity in the structure of ties between two states – Chapter 2                                      |
| Second-order egonets           |                             | Egonets involving the ties of members of one's egonet – Chapter 2                                                                          |
| Sensitivity interdependence    |                             | The effect of a change in one node on another node – Chapter 9                                                                             |
| Signed graphs                  |                             | Graphs where relations are positive or negative – Chapter 1                                                                                |
| Small world phenomenon         |                             | A set of random ties between nodes that are not adjacent geographically. Leads to high degree of connectivity – Chapter 1                  |
| Social networks analysis       | SNA                         | A framework for the scientific analysis of interactions in social and political networks – Chapter 1                                       |
| Sociomatrix                    |                             | A square matrix of size $n$ in which entries establish the existence, magnitude, or direction of relations between nodes – Chapter 1       |
| Spillover proposition          |                             | A process whereby relations or structures in one network affect relations or structures in other networks – Chapter 5                      |
| SRG capabilities               |                             | The sum of the capabilities of one's SRG members – Chapter 4                                                                               |
| SRG size                       |                             | The number of states in a state's SRG – Chapter 4                                                                                          |

*(continued)*

| Concept                                    | Abbreviation/<br>(notation) | Definition                                                                                                                                                          |
|--------------------------------------------|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SRN polarization                           |                             | The NPI of a strategic reference network – Chapter 11                                                                                                               |
| Status inconsistency                       |                             | Discrepancy between power-based status and network centrality – Chapter 7                                                                                           |
| Strategic interdependence                  |                             | Interdependence based on alliance commitments and capability pools – Chapter 9                                                                                      |
| Strategic reference clique                 |                             | A clique that consists of states all of which are in the SRG of each other – Chapter 8                                                                              |
| Strategic reference group (egonet)         | SRG                         | A set of states that is perceived to pose challenges to the security of a focal state. Consists of past enemies, strategic rivals and allies of enemies – Chapter 4 |
| Strategic reference network                | SRN                         | A network in which relations are defined by the rule $j$ is in the SRG of $i$ – Chapter 8                                                                           |
| Strategic rivalry                          |                             | Source: Thompson (2001) A dyadic relationship characterized by competition and mutual threat perceptions – Chapter 4                                                |
| Strategic trade cliques                    |                             | Cliques composed of states that trade with each other commodities with military potential – Chapter 5                                                               |
| Structural equivalence                     | SEQ                         | A measure that reflects similar profiles of relationships – Chapter 2                                                                                               |
| Systemic interdependence                   |                             | The level of interdependence in the network as a whole – Chapter 2                                                                                                  |
| Systemwide democratic network score        |                             | A measure of the average level of democratization of strategic reference cliques – Chapter 8                                                                        |
| Territorial claims                         |                             | Claims regarding contested land between two states – Chapter 4                                                                                                      |
| Theory of networked international politics | NIP                         | A theory that attempts to account for the evolution of international relations as a system of networks – Chapter 5                                                  |
| Ties (edges)                               |                             | Arrows reflecting relations between nodes                                                                                                                           |
| Top trade partners                         |                             | The state that has the highest overall level of trade (imports and exports) with the focal state – Chapter 1                                                        |
| Trade with SRG                             |                             | Average level of trade between a state and members of its SRG – Chapter 6                                                                                           |

*(continued)*

*(continued)*

| Concept                                            | Abbreviation/<br>(notation) | Definition                                                                                                              |
|----------------------------------------------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------|
| Unit of analysis                                   |                             | The level of generalization of a given observation                                                                      |
| Vulnerability interdependence                      |                             | The opportunity cost of breaking a relationship—one of the meanings of interdependence – Chapter 9                      |
| Weighted <b>CMO</b> matrices for multiple networks | WCMO                        | CMO matrices reflecting membership overlap across cliques when cliques are extracted from multiple networks – Chapter 2 |
| Weighted <b>CO</b> matrices for multiple networks  | WCOC                        | COC matrices reflecting overlap among cliques when cliques are extracted from multiple networks – Chapter 2             |



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