Social Network Conceptualizations of International System Structure and National Power: A Social Network Perspective on International Relations

Hyung Min Kim

A dissertation submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Department of Political Science.

Chapel Hill
2007

Approved by

Advisor: Professor Timothy J. McKeown
Reader: Professor Mark J. C. Crescenzi
Reader: Professor Thomas Oatley
Reader: Professor Marco R. Steenbergen
Reader: Professor Stephen E. Gent

ABSTRACT

Hyung Min Kim
Social Network Conceptualizations of International System Structure and National Power:
A Social Network Perspective on International Relations
(Under the direction of Timothy J. McKeown)

The central focus of this project is on the new social network conceptualizations of international system structure and national power. This project examines two traditional questions using the social network conceptualizations: (1) how do we conceive a state's national power, and (2) how does the distribution of national powers define international system structure? The project also answers the following question by applying the above questions to the empirical phenomena of international relations: how does redefining "power" and "system" in this way contribute to a better understanding of international politics? This project argues that international system structure is more accurately depicted by considering different interaction networks participated in by all system members, and that a state's power is more accurately conceptualized by considering how it interacts with all other states in the international system of different networks. The social network conception of national power, derived from the social network conception of international system structure, is applied to two empirical phenomena, focusing on their power explanations. The empirical analyses of militarized conflicts find that: (1) at the system level, the results do not reveal any clear support for either of power theories, but (2) at the dyadic level, the results strongly support power preponderance theory over balance of power theory. The analyses of economic sanctions find that sanction cases with disproportional network power balance between sender and target are far less likely to be successful, while cases with the target possessing high network power are far more likely to be successful. The evidence from nonparametric model discrimination statistics and information criteria measures shows that the conflict and sanctions models with new structural network power measures have greater explanatory power than or statistically outperform those with old attributional power measures, such as COW index and GNP. Finally, this project provides graphical

representations of international system structure and national power to show how network conceptions give a radically different view of international relations than the older scalar representations do. The graphical representations of international conflict and sanction networks also reveal that the significant majority of conflicts and sanctions are indeed regional, “connected,” and “recurrent.”

DEDICATION

To my parents, Deuk Lin and Sun Kim, without whose love, support, and encouragement none of this would have been possible.

ACKNOWLEDGEMENTS

I owe a significant debt of gratitude to Timothy J. McKeown, the chair of my committee, for his continuous help, guidance, and insightful comments throughout this research. He was generous with his time and expertise, and this dissertation has benefited from his enthusiasm and careful mentoring. He has been an outstanding advisor and a true mentor to me. For that, I am deeply grateful.

I extend my appreciation to the remaining members of my committee, Mark J. C. Crescenzi, Thomas Oatley, Marco R. Steenbergen, and Stephen E. Gent, for their valuable comments and crucial suggestions for improvement.

I wish to thank David L. Rousseau, who has contributed so much to my intellectual development, and to my education in international relations. I also want to thank Gary Marks, from whom I learned so much.

My greatest debt of all is to my parents, Sun and Deuk Lin Kim, for their love, support, and encouragement throughout graduate school and my life. I could not have done this without them. It is to them that I dedicate this dissertation.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AR1	First Order Autoregressive
CHINCOM	China Committee of the Paris Consultative Group
CINC	Composite Index of National Capability
COCOM	Coordinating Committee on Export Controls
COMECON	Council for Mutual Economic Assistance
COW	Correlates of War
EUGene	Expected Utility Generation and Data Management
GEE	Generalized Estimating Equation
GNP	Gross National Product
ICB	International Crisis Behavior
IGO	Intergovernmental Organization
IOM	International Organization for Migration
ITU	International Telecommunication Union
MID	Militarized Interstate Dispute
NAM	Non-Aligned Movement
NBREG	Negative Binomial Regression
OAS	Organization of American States
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary Least Squares
ReLogit	Rare Events Logistic Regression
SIPRI	Stockholm International Peace Research Institute
SNPI	Structural Network Power Index
UNESCO	United Nations Educational, Scientific, and Cultural Organization
UPU	Universal Postal Union
WSEV	Window Subsampling Empirical Variances
WTO	World Tourism Organization

CHAPTER 1. INTRODUCTION

A state in the international system always interacts with other states in different issue areas. Each state's power comes from interactions with other states in different networks of the international system, and the structure of the international system is shaped or defined by how the system members in those different social networks interact. When I conceptualize international system structure, I focus on these different interaction networks and how states are positioned in them. This project is the application of the social network perspective to the study of international relations. One of its main claims is that the international system is composed of different social networks (e.g., of arms transfers, international trade, international assistance, diplomatic exchanges, foreign student exchanges, and international telecommunication) among sovereign but interdependent states. By considering all these different social networks, we can more correctly depict how the structures of the international system affect each state's behaviors. The project takes existing theories, applies them in network settings, and tests them using my network conceptions of the international system. I treat the international system as a collection of networks and explore how this idea leads us to recast a great deal of existing empirical work. Does a structurally centralized or concentrated international system induce a more peaceful world, or just the opposite? How is the structural network power balance between states related to their conflict behaviors? How are the structural network powers of sanction senders and their targets, and the structural power balance between the two related to the onset and success of economic sanctions? What are some distinctive characteristics of militarized dispute networks and economic sanctions networks? These are some of the research questions examined in this project. This project also explores the graphical representations of states' interactions with other members of the international system, as well as how well the sociograms of international networks depict and highlight the distinctive characteristics of international system structure and the different interaction relations among system members.

I apply social network analysis to different types of interaction relations among international system members. This study posits that the interactions of states are played out in the web of different social networks, and that the structure of different networks and the structural network power of each state (measured by their interactions with other states in the networks) play important parts in state behavior in the international system. This new conception of international system structure and of each state's power as arising from its position in a network is different from previous studies in the field of international relations, where system structure is focused on one or a few of the most powerful (in the material-capability sense) states in the system, and where a state's power in the system is defined solely based on its attributional power (especially, material-based capability). This project argues that international system structure is more accurately depicted by considering different types of interaction networks participated in by all the member states in the international system, and that the power of each state is more accurately conceptualized by considering how it interacts with all other states in the international system of different networks. This produces a richer way of depicting international system structure and of conceptualizing each state's national power in the international system. By focusing on the network characteristics of interaction patterns of states, we can present a more complete picture of the structure of the international system, each state's structural power in the system, the distribution of the structural power in the system, and the changes of both a state's structural power and its distribution.

The Motivation of this Dissertation

Tellis et al. (2000, 30–31) point out,

> Since the late 1970s, no new attempts at developing aggregate power measures of the kinds [during the 1960s and the 1970s] have materialized (or at least none have received widespread visibility), in part because such aggregate measures have been perceived as having reached the limits of their success. Scholarship since then seems to have focused on using the preexisting measures of power to answer other questions...or to refine the preexisting measures through better quantitative techniques.

My project posits that we have to go back to our old efforts and examine whether we have truly reached the limits of our power studies. The answer from my study is obviously "no;" we need better conceptualizations of national power and international system structure based on a relational (rather than an attributional) power concept using interactive behaviors of all (rather than a few important) system members in a web of network relations.

We need these new social network concepts because the old power concept is limited and rather inappropriate. If we think that an individual state's power comes from its attributes, and if we think that international system structure is defined by the attributional power distribution among a handful of major states in the system, the new social network concepts of system structure and national power will add little to the study of international relations. However, if we think that an individual state's power comes instead from its interactions with all other system members in different social networks of international relations, and if we think that the international system is a set of networks, the attribute-based theories will be neither empirically accurate nor theoretically fruitful. This study also provides graphical representations (using sociograms in the social network analyses) of networks of the international system. These sociograms give a radically different view of the international system than the older scalar representations do.

The social network perspective is not just applying a new measurement technology to international phenomena, but is a different conceptualization of how to understand international politics and a different way of perceiving international relations. Unlike previous theories, the notion of structure in this project is multidimensional, rather than one-dimensional ordering from strong to weak or rich to poor, and it focuses on interactions rather than on attributes. I apply the network power concept to two old but still unresolved empirical phenomena in world politics (on militarized conflicts and on economic sanctions): the contributions of this project are not only the introduction of this new social network power concept (focused on relational rather than attributional power) but also how this new power concept is applied to the two old power theories in the field (balance of power theory and power preponderance theory) to understand militarized conflicts and economic sanctions. The key concept of social network power is a tool to examine the existing theories in the field; the project uses social network power to address/examine the empirical puzzles that are raised by previous research and theories.

The Outline of this Dissertation

This project proceeds in the following manner. In Chapter 2, the first section reviews the major theories of international relations of international system structure (focusing on polarity theory) and previous attempts to measure individual states' national power (focusing on the COW material capability index), emphasizing what is missing from those previous conceptualizations of system structure and national power, as well as how social network conceptualizations improve our understanding of the two concepts. The next section reviews research on the two international phenomena examined in the later empirical chapters of this study, namely militarized conflict studied at systemic and dyadic levels, and the study of the onset and outcomes of economic sanctions, focusing on how social network conceptualizations of world politics can answer the empirical questions of the old material-based power theories and improve our understanding of the two phenomena.

In Chapter 3, the first section introduces the social network conceptualization of the structure of the international system, and the second section introduces its conceptualization of an individual state's national power. The two sections also introduce the data sets for the two dimensions of the international system, focusing on the justifications for their use in the project, the substantive importance of each measurement concept, and the implications of these measures. The third section introduces the operational indicators of each of five different network power measures. The five different centrality measures used in this project, which have been developed by social network theorists, emphasize different aspects of structural network power (e.g., Boje and Whetten 1981; Lincoln and Miller 1979; Blau and Alba 1982; Brass 1984, 1992; Brass and Burkhardt 1992, 1993; Burkhardt and Brass 1990; Knoke and Burt 1983; Krackhardt 1990; Sparrowe and Liden 2005). The section also introduces two different sets of system-level power measures using the above five state-level structural network power concepts: (1) the set of systemic power centralization (measuring the degree of how power is centralized within the whole system [Freeman 1978/1979; Freeman, Borgatti, and White 1991]); and (2) the set of systemic power concentration, change, and movement (measuring different aspects of the power distribution within the whole system) by Singer, Bremer, and Stuckey (1972) and Mansfield (1994). The fourth section compares the social network measures of national power to the previous measures of power, focusing on the COW material capability index. A comparison of the two sets of measures is performed by two sets of analyses: confirmatory factor analyses and correlation analyses (Pearson and Spearman). The fifth section presents an example of graphical representation of the two new conceptualizations using the sociograms of international arms transfer networks. This graphically shows us how the two new social network conceptualizations give a radically different view of the international system than the older scalar representations do. The final section introduces four central principles of applying the social network perspective to international relations, and explains how the two new conceptualizations are applied to the two empirical phenomena of militarized conflicts and economic sanctions, which are examined in the later empirical chapters.

In Chapters 4 and 5, I provide the results from the empirical analyses, applying the social network perspective of international system structure and national power to militarized conflicts and economic sanctions. I also identify the theoretical and substantive meanings of the empirical findings. These empirical analyses focus on how my social network conceptions of international system structure and national power lead to more accurate and powerful empirical models of militarized conflicts and economic sanctions than previous ones rooted in attribute logic, and on how my models applying the social network perspective perform better than the previous models of these phenomena. In Chapter 4, covering militarized conflicts, the first section argues for the importance of graphical representation of dyadic conflict (militarized dispute and crisis) onsets from the social network perspective, focusing on describing what information each set of figures from the social network perspective provides in the study of militarized conflicts. The second section is devoted to the systemic study of international conflict. I present ordinary least squares (OLS) and negative binomial regression (NBREG) analyses of militarized disputes and international crises, and empirical analyses test how the structure of the international system—more specifically, the structural network power concentration, changes, and movement in the system, derived from changes in network relationships among system members—affects the number and proportion of disputes and crises. The third section is devoted to the study of conflict in dyads that are nested in larger networks. Using the four different estimation methods of logistic estimation clustered on dyads, Window Subsampling Empirical Variances (WSEV) estimation, Rare Events Logistic Regression (ReLogit) estimation, and generalized estimating equation (GEE) estimation controlling for the first order autoregressive (AR1) process, I focus on testing the power-based dyadic hypotheses in the study of interstate disputes; that is, the hypotheses from balance of power theory and power preponderance theory using a structural network power conception. In the final section, the performance of conflict models at both systemic and dyadic levels using structural network power measures will be compared against those using attribution-based power measures, through nonparametric model discrimination statistics and information criteria measures.

In Chapter 5, the empirical analysis of economic sanctions, the first section presents their graphical representations. The next two sections are devoted to empirical analyses of economic sanctions, using the sample selection method (censored probit estimation). In the second section, I argue that even though there have been many recent efforts to identify the determinants of economic sanctions success, we lack empirical analyses of the factors affecting the onset of economic sanctions; when do states initiate their use? Although we now know quite a lot about the determinants of the onset of militarized interstate disputes, we know far less about the determinants of the onset of economic sanctions. This section addresses the gap in empirical analysis of sanction onset. In the third section, regarding the second stage of sample selection analyses, I argue that even though many different attributes of the sender or target state and of the relationship between the two have been hypothesized to affect the success of economic sanctions, two important factors have been neglected or tested inadequately in the previous empirical studies: the relative structural network power difference between sanctioning and target states, and the target's structural network power. In the final section, the performance of sanction models on both onset and success using structural network power measures will be compared against those using attribution-based power measures, through nonparametric model discrimination statistics and information criteria measures. In Chapter 6, I summarize the major findings from this project and address directions for future studies.

CHAPTER 2. PREVIOUS RESEARCH

This review chapter consists of two sections. The first section reviews major theories of international system structure, focusing on polarity theories and previous attempts to measure individual states' national power, focusing on the COW material capability index. It discusses what is missing from previous conceptualizations of system structure and national power, and how social network conceptualizations improve our understanding of the two concepts. The next section reviews the previous research on the two international phenomena examined in the later empirical chapters. It considers how the new social network conceptualization of world politics can answer the empirical questions of the old material-based power theories and improve our understanding of the two phenomena in international relations.

2.1. Previous Research on International System Structure and National Power

2.1.1. On International System Structure

In this section I compare and contrast the neorealist conceptualization of system structure, focusing on polarity theories, to the social network conceptualization. Table 2.1 summarizes the main differences between the two.

Table 2.1 Neorealist and Social Network Approaches to International System Structure

	Neorealist Approach	Social Network Approach
Main aspect of system structure	The number of poles	Systemic centralization
Focus on the units	Focus on a few polar powers	Focus on all system members
System characterization	In discrete terms	In continuous terms
Power concept	Material capabilities (focusing on what it possesses)	Social network power (focusing on how it interacts with other system members)

As the systemic reformulation of political realism, neorealism (or structural realism) has been the most influential systemic theory of world politics (Glaser 2003; Maoz et al. 2005). Operating at the system level, neorealism identifies the basic structure of the international system in terms of the number of major powers and the distribution of power among these states (Waltz 1979). Different aspects of system structure have been studied by neorealists: for example, as in Bueno de Mesquita (1975), the number of the system's poles (Deutsch and Singer 1964, Snyder and Diesing 1977, Waltz 1979, Morgenthau and Thomson 1985, Gaddis 1986, 1987, Midlarsky 1988, Wohlforth 1999), the tightness or looseness of poles (Kaplan 1957; Deutsch and Singer 1964; Singer and Small 1968; Hass 1970; Brody 1963), and the degree of inequality in the distribution of power among poles (Gulick 1955; Morgenthau 1962; Organski 1968; Bueno de Mesquita and Singer 1973; Lucier 1974). The focus of structural aspects in neorealism has been on the number of the system's poles distinguishing the international system as being led by a single preponderant state (hegemonic or unipolar), two dominant states (bipolar), or more than two dominant states (multipolar). Polarity has been defined in terms of either the number of major alliance blocs in the system (Singer and Small 1968; Hass 1970; Wallace 1973; Bueno de Mesquita 1975; Stoll and Champion 1985) or the number of preponderant states in the system (Nogee 1975; Rapkin, Thompson, and Christopherson 1979; Waltz 1979; Wayman 1984 Levy 1985; Wayman and Morgan 1990). However, Waltz (1979) and his followers have concentrated on the latter:

> The polarity of the international system is defined by the number of great powers in the world. To determine polarity in a particular era, one counts states of great and roughly

> equivalent capabilities….If there are three or more powerful states, the system is multipolar. If there are two such states, it is bipolar. If there is one state with unrivaled power, the system is unipolar (Waltz 1979, 92, 194–195).

Conceptualizing international system structure as a network responds to three criticisms of polarity theories (Mansfield 1994; Maoz et al. 2005): its focus on only a few polar powers, its characterization of states of the system in strictly discrete terms, and its conception of power in material terms. First, treating the structure of the international system as merely defined as the distribution of power between a few great powers does not tell us how to distinguish polar powers from other system members. As a result, there have been considerable disagreements over the definition, measurement, and operationalization of the number of poles in the system (Mansfield 1994). It also arbitrarily assumes that the vast majority of international system members are irrelevant. As Maoz et al. (2005) point out, as the world becomes increasingly heterogeneous, we lose much by ignoring relations among non-polar powers. Neorealism might be parsimonious by using the information on a few major powers and focusing on wars only involving those major powers (Singer, Bremer, and Stuckey 1972; Bueno de Mesquita 1981; Bueno de Mesquita and Lalman 1988; Mansfield 1994, 1995), but it fails to address the vast majority of international relations among non-major powers. For example, non-major powers are 82% of interstate war participants (for 1950–1997 COW Interstate War Data), 81% of international crisis participants (for 1950–2001 ICB Crisis Data), and 80% of interstate dispute participants (for 1950–2001 COW Interstate Dispute Data). By using information on all system members, the social network approach discards the "zero influence" assumption implicit in the way that polarity theories treat the vast majority of nation-states.

Second, polarity theories characterize international system structure in strictly discrete terms. As a consequence, in the empirical research of polarity theories, the polarity variable has been defined as a dummy variable, taking on a value of one if the system is multipolar and zero if it is bipolar (or vise versa) (in Snyder and Diesing 1977, Waltz 1979, and Levy 1985, the international system is considered multipolar until 1945, and bipolar thereafter). This categorical and time-invariant treatment of system structure by neorealism is partly due to the lack of system transformation theory (i.e., no theoretical mechanism to account for the transitions from one structure to another). Instead, it finesses this weakness by treating major wars as ending old configurations and inaugurating new ones. However, as Maoz et al. (2005) point out, there are varying degrees of unipolarity, bipolarity, and multipolarity. Polarity theories' depiction of international system structure in strictly discrete terms precludes a theoretical treatment of intermediate or disequilibrium situations. The social network approach allows for a more complicated conception of the international system structure than the simple notion of poles such as the bipolar Cold War era and the unipolar/multipolar system since the Soviet demise. With the multiple networks approach, we can treat system structure as continuous and multidimensional. Finally, polarity theories conceive individual states' national power as an attribute of the state, but not of its relations with other states. This is another "zero influence" assumption—this time, about the relevance of day-to-day international interaction patterns.

In this project, the international system structure is conceived as a set of networks. Following Maoz (2001a), a network is defined as a system that consists of units (states) and a set of relationships among these units—defined as ties on a given relationship. Since states in the international system have ties with other system members in many different types of relationships, we observe multiple networks in the international system (Maoz et al. 2005). This project uses six types of international networks along two dimensions (communication flow networks and resource flow networks) of the international system. Network thinking is, however, not new in the field of international relations. There have been several studies that treat (or at least consider) multiple networks of international relations as characterizing international system structure (Deutsch 1954; Singer and Small 1966; Brams 1966, 1968; Snyder and Kick 1979), and that apply the network thinking to specific subject matters in the field of international relations (e.g., international conflict in Maoz 2001a, 2006a, 2006b, Maoz et al. 2005, 2006, and Hafner-Burton and Montgomery 2006; sanctions in Martin 1992). For example, Brams (1966, 1968) identifies clusters of nations within the international system, using three different types of international networks (the diplomatic exchanges network, the international trade network, and the intergovernmental organizations network). Maoz (2006b) develops a democratic networks model embedded in a social network perspective to address the democratic peace puzzle. Martin's (1992) sanctions study approaches a limited form of network thinking in the sense that it considers how a multilateral organization has different effects than simple bilateral interventions.

In contrast to the treatment of international system structure in polarity theories (i.e., its focus on a few polar powers, its system characterization in strictly discrete terms, and its power conception in material terms), social network approaches use a concept of network centralization[1] to depict international system structure[2] (Freeman 1978/1979; Freeman, Borgatti, and White 1991). Unlike the polarity conception, this conception uses the information on interaction relations among all system members and enables us to quantify the characteristics of international system structure in terms of continuous variables. A network centralization concept measures the extent to which the whole network has a centralized structure (its overall "compactness") or the extent to which the cohesion of the network is organized around a particular focal point[3] (Scott 2000; Alderson and Beckfield 2004; Hanneman and Riddle 2001). The Freeman system centralization measures also express the degree of variability (or of inequality or variation) in our observed network as a percentage of that in a baseline "star" network of the same size. When all states hold exactly the same amount of structural network power[4] in the whole network (often depicted as a "circle" or "wheel" figure), the systemic centralization score equals 0 (corresponding to the most extreme case of multipolarity). When one state holds all the network structural power (often depicted as a "star" or "hub-and-spokes" figure), the systemic centralization score equals 1 (corresponding to the

[1] Social network theorists use the term "network centralization" (or "group centralization") differently from "point centrality" (or "node centrality") (see Scott 2000, 82). The first term refers to the level of centralization of the network as a whole (or the distribution of point/node centralities within the network); the second term refers to an individual node's relative centrality or prominence (compared to other nodes in the network). These concepts from the social network perspective can be compared to the concentration of powers among states in the international system (for the former) and an individual state's power (for the latter) in the studies of international relations.

[2] In this project, "structure" means more than an ordering of states based on some attributes possessed by each state (as in the scalar representations); it refers to elements of the international system that cannot be observed merely by observing each state in isolation from others.

[3] The formal definition of the measure is provided in Chapter 3.

[4] I define a state's "structural network power" as the power of an individual state at its location within the networks of international relations—how each state is structurally positioned in different types of social networks of international relations. This concept will be discussed in more detail in the following section.

most extreme case of unipolarity). For example, in Figure 2.1, the "star" network depicts the system where RUS (Soviet Union/Russia) monopolizes the arms transfers among the remaining system members; the "wheel" network depicts the system where the control of arms transfers are equally shared among the system members. The actual centralization scores are usually greater than 0 and less than 1. A high centralization score is consistent with the network being controlled by a few powerful states (e.g., arms transfers are dominated by a few large suppliers). A low centralization score is consistent with the network control being shared by many other states (e.g., arms transfers are controlled by relatively many different suppliers).

Another aspect of system structure studied by social network theorists is network density. It describes the extent to which states are tied (either directly or indirectly) to each other in the network, and is measured by the total number of ties, divided by the total number of possible ties in the network. As in Figure 2.1, when the system members have ties to all the other system members, the systemic density equals 1 (corresponding to the extreme case of tight system in polarity approaches). When none of the system members has ties to the other system members, the systemic density is 0 (corresponding to an extremely loose system). Actual density scores are usually greater than 0 and less than 1. A highly dense system is one in which every state in the system has some relationship with nearly every other state. A low-density system is one in which states have few relationships to other states in the system.

2.1.2. On National Power

In this section I compare and contrast the attribute conceptualization of national power (as exemplified by the COW material capability index) to the social network conceptualization.[5] Table 2.2 summarizes the main differences between the two.

[5] In the next chapter, the comparison of the two measures (the COW index and the new social network index) is performed by the two sets of analyses: confirmatory factor analyses and correlation analyses (Pearson and Spearman).

Table 2.2 Attribute and Social Network Approaches to National Power

	Attributional power concept (focusing on the COW index)	Social network power concept
Focus	What a state possesses (i.e., its attributes)	How a state interacts with other states (i.e., its relations)
Aspects of power	Demographic, industrial, and military capabilities	Five different aspects of network power
Independent of other system members	Yes A state's power is not affected by power of the other system members	No A state's power is affected by power of the other system members
Independent of international system structure	Yes A state's power is not affected by system structure	No A state's power is affected by system structure (how a state is positioned in the structure defines its power)

As the most widely used power index in the field, the COW capability index (Composite Index of National Capability, CINC) focuses on material attributes to conceptualize national power. The index is composed of three aspects of what a state possesses: (1) demographic capabilities (total population and urban population), (2) industrial capabilities (energy consumption and iron/steel production), and (3) military capabilities (total military expenditures and size of the armed forces). How much total or urban population does a state hold? How much energy or iron/steel does a state consume? How much does a state spend on its military and how many military personnel does a state possess? Power in the COW index is operationalized by treating a state as a "resource container" (Tellis et al. 2000, 32) possessing six such capability components.[6]

The social network approach to national power is responsive to the criticism that the concept of an individual state's national power such as the COW index is an isolated concept, isolated both from other system members and from international system structure. First, because it conceptualizes a state's national power based on what it possesses, it is isolated from other states in the system: what state A

[6] Of course, the COW index is not the only measure of national power that has been used to study international relations. Details on other efforts of measuring national power are given in Appendix 2.1 (see also Stoll and Ward 1989, Tellis et al. 2000, Sweeney 2003a).

possesses does not take an account of what any of other system members possesses. The perspective that power is by definition a relative concept is not new. Many scholars have emphasized that power is essentially defined based upon relations, and should be conceptualized as relational. For example, Dahl (1961, 1966) defines power as the ability to get others to do what they otherwise would not do; Morgenthau's classical realism posits that power should be understood as "control" over actors (Morgenthau, 1948: 29–36, 124–65). Baldwin (1985, 18–24; see also Baldwin 1971a, 1971b, 1980) identifies several principles of power analysis and emphasizes that "power is a relational concept" and that "it refers to a relationship between two or more people, not to a property of any one of them." Lasswell and Kaplan (1950) define power relationally, not as a simple property. Pruitt (1964) posits that international theorists have placed too much emphasis on the resources of nations as the basis of their power. As Baldwin (1985) and others correctly point out, international theorists have long been criticized for their failure to define power in relational terms (Holsti 1964; Pruitt 1964; McCllelland 1966; Sprout and Sprout 1962; Sullivan 1963). For example, during the Cold War era, some viewed power as a zero-sum concept, so that any power increase by the Soviet Union translated to a power decrease of the United States. However, this relative power concept by realists has been treated only as a measurement issue rather than a conceptual one (e.g., the power-balance variable in dyadic conflict studies, measured by the state A's power/state B's power). Even worse, this approach used in dyadic studies ignored information from outside the dyad: behavior in a dyad is studied as if it were a closed system, when we all know that each dyad is embedded in a network of other international relations. If power is an inherently relational concept, we should conceptualize power in relational terms. A social network view of power is closer to the relational power concept of "the ability to get people to do what I want" (as in Dahl, Morgenthau, or others) than to the previous one that is based on a state's attributes.

Second, the previous conception of national power is also disconnected from international system structure. Neorealists such as Waltz (1979) posit that the international system is affected by the distribution of power among major powers. However, the causal arrows could go in both directions: units (or characteristics of units such as their power) affecting international system structure and international structure affecting units (and their characteristics). Waltz (1979, 2003) himself emphasizes that causation runs not only from international structure to interacting units, but also from units to structure. However, the previous way of conceptualizing national power has been unable to incorporate how international system structure and its characteristics affect the power of its member states. A network view of power implies that an individual state's power comes not simply from what it possesses, but rather from how it is connected or interacts with other system members in the networks of relations. Cartwright (1965, 4) posits, "When an agent, O, performs an act resulting in some change in another agent, P, we say that O influences P. If O has the capacity of influencing P, we say that O has power over P." In other words, he argues that power is specific to each dyadic relationship. The main difference between the concepts is in how to conceptualize this influencing capacity. In the attribute power concept, the capacity comes from the properties of a state's own resources (i.e., its control over internal, domestic resources). In the network power concept, this capacity comes from how a state interacts with other system members (i.e., its control over external interactions). Oppenheim (1981) addresses power as property versus power as relation. Hart (1976) and Schmidt (2005) discuss power as control over resources versus power as control over actors. In other words, the main difference comes from two different ways of looking at the influencing capacity and, as a result, the two power measures tap two different aspects of national power. As noted above, this understanding of the "relational" aspect of national power, focused on the controls over actors, is not new in the field of international relations.

Adopting the social network concept, this project focuses on two broad dimensions of the international system to depict national power (in channels of communication exchanges and of resource transfers): (1) how a state is connected or interacts with other states through diplomatic channels (how diplomatic missions are exchanged/transferred between states), academic channels (how foreign students are exchanged/transferred between states), and telecommunication channels (how international telephone messages are exchanged/transferred between states), and (2) how a state is connected or interacts with other states in arms channels (how arms are transferred or exchanged between states), trade channels (how foreign goods and services are transferred or exchanged between states), and monetary channels (how international monetary assistance is transferred or exchanged between states).

A state does not have power in isolation from others (without considering its linked interactions to others) nor from system structure (without considering its structural positions in the system); rather, it has power as a consequence of its interactive relations with other states in the system and its structural positions in the networks of relations (Hanneman and Riddle 2001). The proposed power concept from the social network perspective is called "structural network power," defined as the power of an individual state arising from its location within the networks of international relations. A structural network power concept views an individual state's power as arising from its positions in different interaction networks of international relations: if it is well-positioned, or occupies relatively advantageous positions in networks, then it will be influential. This way of conceptualizing a state's power accords with social network theorists who believe that the characteristics of social units arise out of structural or relational processes played out among all the units within the network (Hanneman and Riddle 2001; Degenne and Frosé 1999; Wasserman and Faust 1994; Scott 2000; Knoke and Kuklinski 1982; Freeman 1978/1979; Borgatti and Everett 1999; Freeman, Borgatti, and White 1991; Borgatti, Everett, and Freeman 2002; Wellman 1988).

This project assesses five different aspects of such structural network power of states in the system. They are based on five different measures of point centralities from network analyses of interaction data (i.e., degree, betweenness, flow-betweenness, coreness, and ego network brokerage). The details on the substantive meanings of each of the power aspects are discussed in Chapter 3. Here, I will illustrate the degree and betweenness aspects of structural network power using the hypothetical arms transfers "star" network in Figure 2.1, where RUS (Soviet Union/Russia) is the most powerful among the system members.

In the "star" network of Figure 2.1, the structural position of the Soviet Union/Russia enables it to hold a more powerful position compared to all other system members. For example, its position in the arms transfer network enables it to: (1) be less dependent on other states for its export and import needs since it has many alternative ways of arms transfers, (2) have more access to the arms resources available within the network since it has more ties to other system members, and (3) benefit from an advantageous third-party position (or "deal maker" position) in the exchanges of arms since it has many ties to other system members (Hanneman and Riddle 2001). If one of the system members, say BUL (Bulgaria), decides not to import arms from the Soviet Union, the Soviet Union has many other places to export their arms. However, if the Soviet Union decides not to export arms to Bulgaria, Bulgaria (with its limited number of arms sources) might be unable to find other alternatives to import their arms. Since the Soviet Union has more opportunities and alternatives than Bulgaria, it has more structural network power (in terms of degree aspect of network power). It is the most visible actor in the network, and therefore it is "where the action is" in the network (Wasserman and Faust 1994).

The Soviet Union is also standing on the geodesic paths (i.e., minimal length paths) connecting the pairs of system members (i.e., other states depend on it to make connections to other system members) and there is no direct connection between one of the system members, say Bulgaria, and the other system members. Thus, if the Soviet Union wants to interact with, say, ALB (Albania), it simply is able to do so. However, if Bulgaria wants to interact with Albania, it could do so only by way of the Soviet Union.[7] Since the Soviet Union holds a more advantageous position (by way of being between the system members) than Bulgaria, it has, in the social network perspective, more structural network power (in terms of betweenness aspect of network power). This betweenness aspect of network power conceptualizes the degree to which a state plays the role of a "broker" or "gatekeeper" with a potential for control over other states in the network (Scott 2000). It is also interpreted as the extent to which a state controls the communication between other pairs of states in the system (Brandes and Erlebach 2005, 30).

2.2. Previous Research on Militarized Conflicts and Economic Sanctions

This section briefly reviews the previous research on two international phenomena examined in the later empirical chapters (militarized conflict study at systemic and dyadic levels, and economic sanction study regarding outcome and onset) focusing on the major studies that will be compared to my applications. This is followed by a discussion of how we can improve our understanding of the two phenomena by using social network conceptualizations.

[7] In a real situation, this might have worked in two ways: first, Bulgaria and Albania might have had no interest in creating a bilateral arms sales agreement; second, the Soviet Union (as a leader of COMECON) might have discouraged such a bilateral agreement between Bulgaria and Albania with the purpose of dictating their relationship.

2.2.1. On Militarized Conflicts

Previous research on militarized conflicts has been conducted at both systemic and dyadic levels (the latter much more frequently than the former). At the systemic level, the focus has been on three aspects of structural characteristics in the system: (1) the number of poles, (2) the degree of polarization, and (3) the concentration of power in the system. At the dyadic level, the focus has been on the two widely contested debates: (1) that of the so-called "liberal peace" theory, and (2) that between balance of power theory and power preponderance theory.

At the systemic level, polarity theory posits that how the system is shaped (the number of poles) is the main determinant of individual states' behaviors and system stability. Polarization refers to the degree of tightness and separation of poles. It has been argued that a high level of polarization (e.g., high levels of tightness and discreteness of alliances) is associated with war. At the dyadic level, the so-called liberal peace theory posits that democratic states, economically interdependent states, or states that share intergovernmental organization (IGO) memberships are less likely to have conflicts with each other. The theory has its origins in classical literature. Immanuel Kant argued in *Perpetual Peace* ([1797] 1970) that "peace can be built on a tripod of complementary influences: republican constitutions (i.e., representative democracy), international law and organization, and 'cosmopolitan law' (economic interdependence)" (Oneal and Russett 1997, 268).

However, the focus of my study of militarized conflicts is on the debate between balance of power theory (Wright 1965; Kissinger 1964; Ferris 1973; Claude 1962; Morgenthau 1948; Waltz 1979) and power preponderance theory (or power transition theory) (Blainey 1988; Organski 1958; Organski and Kugler 1980). The balance of power theory posits that under a relatively equal power balance encompassing two or more states, the states in question will be less likely to go to war (or militarized conflict) with one another. In contrast, when one state is substantially more powerful than another, it may go to war (or militarized conflict) to enhance its power position further. The power-balance thesis rests on the logic that victory becomes problematic under a condition of relative power parity, and that the resulting uncertainty enhances deterrence and discourages aggression. A power imbalance (i.e., power preponderance) will tend to support aggression and weaken deterrence by increasing the probability of success for the stronger state's use of force. Mansfield (1994, 75–76) also posits that "the more uniform the distribution of power among the leading states, the greater the number of potential blocking coalitions that exist. And the more potential blocking coalitions that exist, the greater the expected cost of initiating war relative to the expected benefits of doing so, all other things being equal. As the distribution of power becomes increasingly skewed, fewer blocking coalitions exist, thus tempting aggression on the part of a stronger state" (see also Gulick 1955; Herz 1959; Claude 1962; Wolfers 1962). Wright (1965, 254) also posits that "the balance of power is a system designed to maintain a continuous conviction in every state that if it attempted aggression it would encounter an invincible combination of the others."

On the other hand, the power preponderance theory posits that when power is roughly equal among the states involved, they may perceive a reasonable chance of winning (i.e., be overconfident about their ability to secure their interests through the use of force). This makes them more willing to take firm stances or escalate tensions, leading to an increased probability of disputes and actual war. In contrast, when one side enjoys a preponderance of power, the outcomes of potential conflicts are clear, and states will settle disputes before they escalate to war. This power-preponderance thesis holds that the probability of war (or militarized conflict) increases under a condition of relative parity. The logic is that the likelihood of war (or conflict) is greatest when both sides see a prospect for victory and this condition is met when parity characterizes the power balance. Under power preponderance, the weaker side cannot afford to fight and the stronger side rarely has to go to war in order to achieve its goals (Blainey 1988). Mansfield (1994, 75–76) also posits that "a highly skewed distribution of power deters the onset of certain types of war. Aggression against preponderant states is likely to be fruitless, and preponderant states can achieve political goals vis-à-vis smaller states though means other than war. When inequalities of power are less pronounced, states are likely to engage in wars for (among other reasons) the purposes of bolstering their positions in the system" (see also Wagner 1986; Niou, Ordeshook, and Rose 1989; Niou and Ordeshook 1990).

At the systemic level, as noted above, the advocates of balance of power theory posit that a highly centralized system is dangerous because states with preponderant power will use it to improve their position, and therefore that the balance (or parity) of power in the system will promote stability. On the other hand, the advocates of power preponderance theory posit that a highly centralized system is more stable because the state with preponderant power will use that power to coordinate the other states' actions, provide leadership, and manage conflict responsibly; and that the system becomes unstable when the dissatisfied challenger approaches the power of the dominant state and tries to change the system. The research on this debate at the systemic level has been focused on the relationship among the concentration, change, and movement of capabilities in the system and the war among major powers (see Singer, Bremer, and Stuckey 1972; Mansfield 1994; see also Cannizzo 1978; Bueno de Mesquita 1981; Thompson 1983; Bueno de Mesquita and Lalman 1988, 1992).

For example, Singer, Bremer, and Stuckey (1972) and Mansfield (1994) test the propositions from the debate among the advocates of balance of power vs. those of power preponderance theory at the systemic level. Using the material capability concentration, change, and movement to measure international system structure, Singer, Bremer, and Stuckey (1972)'s empirical analysis suggests a weak empirical finding in favor of the power preponderance theory at the systemic level (when the data were split, the balance of power theory was supported during the nineteenth century, whereas the power preponderance theory was supported during the twentieth century); however, Mansfield (1994) finds that there is no clear support of either theory, but that there is a strong evidence of an inverted U-shaped relationship between capability concentration and wars involving major powers.

I accept the argument by Mansfield (1994) and Singer, Bremer, and Stuckey (1972) that the structure of the international system (measured by the power concentration, change, and movement in the system) affects the onset of systemic conflicts. However, my study posits that the effect of the international systemic structure goes beyond the major power wars they studied. Most international disputes do not escalate into crises in which one or both parties threaten or use military force, and, by the same logic, most international crises do not escalate into wars in which one or both parties use large military forces to resolve the crisis. Therefore, the previous empirical studies that have focused on crises or wars capture only a small subset of the population of international conflicts, and, perhaps more importantly, they do not depict a multistep process of conflict escalation or de-escalation (Rousseau 2005). In my study, I analyze the effect of international system structure on the number and proportion of disputes and crises in the system.

At the dyadic level, as noted above, balance of power theorists argue that if a state enjoys a power advantage over its adversary in a dyad, it will be more likely to use military force because it is more likely to succeed, and the cost of using force is likely to be low. Weaker states will view the initiation of violence as a very risky strategy that is likely to result in substantial costs. Two states of equal power will be deterred from conflict with each other because there will be no guarantee of winning and the conflict will be long and hard-fought. On the other hand, power preponderance theorists argue that when the two states in a dyad share disproportional power, they are less likely to go to war (on be involved in conflicts) with each other. The weaker state will not try to fight with the stronger state because it will certainly lose, and therefore the stronger state does not have to initiate conflict to get what it wants.

Most empirical studies on testing the two power theories at the dyadic level are basically focused on using the COW material capability index. One of the advantages of using the social network power concept instead of the COW index used by all the previous dyadic empirical studies is that we utilize the information embedded in relations among all other states in the international system. The most widely used power-balance variable in dyadic conflict studies is the dyadic capability ratio variable, usually measured by state *a*'s power/state *b*'s power (with power usually measured by the attributional capability). This variable only takes into account two nodes (in a dyad) and one link (connecting the two nodes in a dyad). It implicitly assumes that behavior in a dyad can be studied as if it were a closed system (unless it aggregates allies' capabilities onto each side of the dispute), when we all know that each dyad is embedded in a network of other international relations. I argue that what happens in a dyad is a function not just of attributes of the members of the dyad, but also of the relations with other states that are linked to one or both members of the dyad under study. I use six different measures of extra-dyadic interaction on the two dimensions of international relations (communication and resource flows) to test dyadic hypotheses in conflicts. The testing of hypotheses in the dyadic conflict analyses is focused on whether my newer conceptions of “power” and “system” lead to more accurate and powerful empirical models than previous ones rooted in attribute logic.

2.2.2. On Economic Sanctions

The previous research on economic sanctions has been conducted focusing on both sanction outcomes and sanction onsets (the former much more frequently than the latter). First, regarding the study of sanction outcomes, Hufbauer, Schott, and Elliott (hereafter HSE, 1990) find that, among their 18 hypothesized determinants of sanction success, only 5 were empirically supported based on the results from their analysis—which includes variables for World Wars I and II, “international assistance to target,” “target conditions,” “time trend” and “pre-sanction relations between sender and target.” Bergeijk (1989) reanalyzes their data and finds that three of the HSE variables (“pre-sanction relations between sender and target,” “sanction length,” and “target conditions”) and his “sender reputation” variable reached statistical significance. Dashti-Gibson, Davis, and Radcliff (1997) argue that the factors affecting the success of economic sanctions are dependent on the goals of the sender country. Running different logit models with the sender’s different goals, they find the following: that when the sender’s goal is simply destabilization, the main determinant of success is the target conditions; and that for all other goals, the use of financial sanctions are most effective, and that there is a modest downward trend over time in the effectiveness of sanctions in this category.

Bonetti (1998) finds that third-party assistance to the target and relatively small pre-sanction trade between target and sender makes sanctions less successful, but that “modest” objectives and a cordial/neutral pre-sanction relationship between sender and target make sanctions more successful. Reanalyzing the HSE data using the ordered logit estimation, Drury (1998) finds that most of their bivariate variables are insignificant; the exceptions are the positive effect of target gross national product (GNP) cost, the negative effect of international cooperation with the sender, and the positive effect of institutional cooperation. Using the ordered probit analysis, Hart (2000) finds that sanctions by democracies on average are more successful due to the signaling properties of sanctions, and that there is a positive effect of pre-sanction trade level and a negative effect of international cooperation with the sender on sanction success. Using only U.S. sanctions in a censored probit analysis, Nooruddin (2002) finds that sanctions are less likely to be successful if there was cooperation with the sender, the two had a militarized interstate dispute (MID), or the two are aligned; and more likely to be successful if the target is a democracy and has a high sanction cost. Martin's (1992) sanction study approaches a limited form of network thinking in the sense that it considers how a multilateral organization sanction has different effects than simple bilateral interventions. He argues that "the leading sender has to demonstrate a credible commitment to the threats [for the success of its sanction]" and that one of the important mechanisms that accompanies the credible commitments is the use of international institutions (413). By making the cooperation among other possible sanctioners easier and the free ride among those countries more difficult, sanctions by international institutions have the higher probability of success.

Unlike the rather voluminous empirical research on sanction outcomes, there has been little research on sanction initiation. Drezner (1998) rightly points out that "most of the (sanction) literature has focused on the outcome of coercive attempts; there has been little research explaining when senders (the sanctioning county) will initiate threats or act on economic sanction" (710). Studying the U.S. use of economic sanctions, Drury (2000) finds that a U.S. president considers both domestic factors (such as job approval rating, election proximity, inflation rate, and unemployment levels) and the relationship with the target county (tension level, increase/decrease of that tension level, and provocative statements/actions by target) before making a decision to initiate sanctions. When presidents decide to maintain or alter sanctions after they are in place, they only consider the factors relating to the relationship with the target. Drury's later work (2003) finds that democracies more frequently and autocracies less frequently use economic sanctions, and that sanctions between democracies are rare (the joint democratic peace in terms of economic sanctions). Nooruddin (2002) finds that sanctions are (1) more likely to be imposed on targets in the Western hemisphere by a major power with high pre-sanction trade, and (2) less likely on those with the MID onset. Lektzian and Souva (2003) argue and find with their statistical analysis that democracies (compared to non-democracies) are more likely to initiate economic sanctions since they encompass a greater variety of interest groups, and that democracies prefer sanctioning non-democracies rather than democracies. Applying the liberal peace theory, mostly argued in the militarized conflicts study, to the economic relations among states, Goenner (forthcoming) finds that democratic states are less likely to engage in the onset of economic sanctions compared to non-democratic ones, but that economic interdependence between states does not have any effect on the sanction onset.

I argue that my analyses of economic sanctions will provide a better understanding of sanction onsets and outcomes in the following three ways. First, the previous research on the success of economic sanctions does not take into account the selection effects that take place; states involved in economic sanctions select or are selected into the sanction phase by a strategic process. Ignoring the selection bias (in the previous empirical studies of economic sanctions) might yield the erroneous findings regarding the sanction outcomes and onset; I use instead the censored probit estimation, controlling for statistical linkages of the two dependent variables of sanction outcomes and sanction onset. Second, to test balance of power theory and power preponderance theory on sanction outcomes, Hufbauer et al (1999) use the measure on the GNP ratio of sender to target. As I pointed out earlier in the above section of dyadic conflict studies, the use of material capabilities to test the two theories is limited since they are unable to utilize the extra-dyadic information where we all know that each dyad is embedded in a network of other international relations.

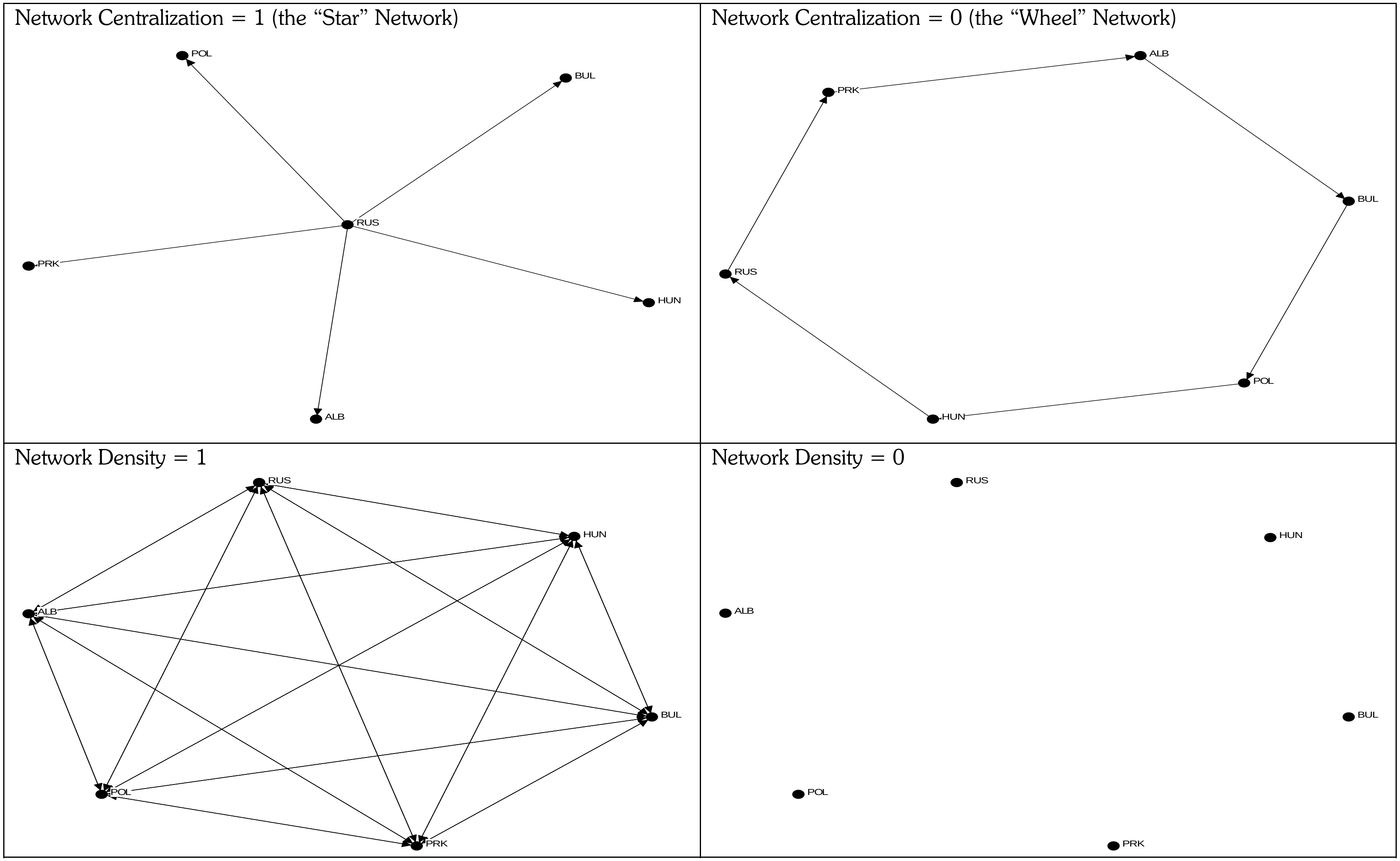
Third, my analyses of sanction outcomes also posit that even though many different attributes of the sender or target state (as well as the relationship between the two) have been hypothesized to affect the success of economic sanctions, one important factor has been neglected or tested inadequately: the target's national power. As Lam (1990) points out, the sender usually is less likely to put much importance on foreign policy goals (of economic sanctions) toward a less powerful target (245), and this low resolve or low commitment of the sender toward a less powerful target eventually leads to sanction failure. As I will present in detail in the next chapter, the structural network power of each state also represents how well it is globalized (communication globalization from the first dimension of communication patterns; economic globalization from the second dimension of resource flows) in the international system. In other words, structural network power also represents each state's level of globalization in the system; how centrally each state is positioned in the network of relations shows how well each state is globalized in the web of network relations. Based on this conceptualization, the additional hypothesis on a target's power will test the argument that a highly globalized target (i.e., a target with relatively high structural network power) will be more severely hurt by the economic sanction, and therefore more likely to concede to the sender's demands, because the sender usually makes its best effort to disconnect the target's globalization web (i.e., isolate the target from its interactive relations with other states), especially in the economic arena (e.g., target's access to international trade or investment market). The well-globalized target will be more seriously hurt by the sanction, and the high price that is paid by the target ultimately leads to concessions.

2.3. Conclusion

I reviewed the theoretical developments on international system structure (focusing on polarity theory) and the previous research of national power in the study of international phenomena, focusing on the COW material capability index. In previous studies of international system structure, the defining structural characteristics are how capabilities are distributed among the system members (often among only a few major powers). In the previous studies, each state's power is operationalized by attributes such as economic capability (measured by its GNP or total population), military capability (measured by its military expenditures or military personnel), or some combination of the two. However, this study posits that: (1) an attribute conception of national power is inadequate because it offers no method for investigating influences outside of a dyad, and (2) a depiction of international system structure based solely on the distribution of national attributes is too coarse-grained to provide a satisfactory description of the international system. It neglects both the regularities in how the components interact with each other and how these interaction patterns are shaped or defined by the structure. This study provides social network conceptualizations of international system structure and individual states' national power. Power in a social network perspective is focused on individual states' relational power: unlike the attributional power concept in the previous studies, a state's power in a social network perspective is focused on its interactive behaviors with all other states in a network of relations. International system structure in a social network perspective is conceived by considering social network powers of all system members focusing on the different types of interaction networks played in among those member states in the system, unlike the previous studies where only a handful of the most powerful actors in the system were considered.

The central focus of my study is on this national power concept and its contribution to national and systemic attributes in international relations. This study examines the following two traditional questions: (1) how do we conceive individual states' national power, and (2) how does the distribution of national power define the structure of international system? This study attempts to show how redefining "power" and "system" in this way contributes to a better theoretical understanding of international politics and more accurate empirical work. This study applies the social network perspective of world politics and the application of this new solution (social network concepts of international system structure and national power) to address the old power theories on the subjects. The focus of the two empirical chapters is on how social network conceptions of international system structure and national power lead to more accurate and powerful empirical models than previous ones, which are (1) mainly rooted in attribute logic, and (2) assume behavior in a dyad can be studied as if it were a closed system. The next chapter introduces the network perspectives on depicting international system structure focusing on different international interaction networks played by all system members, and of conceptualizing national power focusing on a state's structural network power derived from its structural positioning in those different social networks of international relations. It also introduces four central principles of applying the social network perspective to international relations, and explains how the two new conceptualizations are applied to the two empirical phenomena (militarized conflicts and economic sanctions) to be examined in the later empirical chapters.

Figure 2.1 Hypothetical Arms Transfer Networks



CHAPTER 3. NETWORK CONCEPTUALIZATIONS OF INTERNATIONAL SYSTEM STRUCTURE AND NATIONAL POWER

This project is focused on two closely related conceptualizations in the study of world politics, the first regarding international system structure and the second regarding individual states' national power. First, it introduces an alternative to polarity theories of the structure of the international system, based on the different types of interaction networks potentially involving all member states in the system. The project is primarily focused on two broad sets of such international interaction networks: first, a set of communication flow networks such as diplomatic exchange networks, foreign student exchange networks, and international telecommunication networks; second, a set of resource flow networks such as arms transfer networks, international trade networks, and international assistance networks. Next, I argue that the previous research studying individual states' national power should be modified by the new power concept called "structural network power," which is based on social network views of international relations. Instead of conceptualizing individual states' power focused on attributional (and material-based) aspects such as military capability (using military expenditure or military personnel) or economic capability (using GDP or total population), the project asserts that a state's power should be conceptualized by its structural network power, which comes from its interactive relations with all other member states in the international system. This project will contribute to the studies of international relations by introducing such a social network perspective of world politics and applying this new solution (social network conceptualizations of international system structure and national power) to examine old but still unresolved empirical phenomena in the field of international relations.

This chapter consists of five sections. The first section introduces the social network conceptualization of the structure of the international system, and the second section introduces the social network conceptualization of individual state's national power. The two sections also introduce the data sets for the two dimensions of the international system, focusing on the justifications for their use in the project, and the operational indicators of each of five different network power measures. Third, I compare the social network measures of national power to the previous measures of power (focusing on the COW material capability index). A comparison of the two sets of measures is performed by the two sets of analyses: confirmatory factor analyses and correlation analyses (Pearson and Spearman). Fourth, I present an example of this approach using the sociograms of arms transfer networks. This section shows how social network conceptualizations give a radically different view of the international system than the older scalar representations do. Finally, I introduce four central principles of applying the social network perspective to international relations, and present how the two new conceptualizations are applied to two empirical phenomena (militarized conflicts and economic sanctions) that are examined in the later empirical chapters. The final section also presents the groundwork for the later two empirical chapters, focusing on three questions, two of which are old questions from the power studies of world politics: (1) how do we conceive an individual state's national power (from the social network perspective), (2) how is the structure of the international system shaped or defined not only by the distribution of national powers, but also interaction patterns among states (from the social network perspective), and (3) how does redefining "power" and "system" from the social network perspective contribute to a better understanding of international politics? The project recasts existing theories and tests them using my new network conceptions of the international system.

3.1. Depicting International System Structure

The international system is indeed composed of many different international networks. How do we define the "network" of international relations, and what is the relationship between "network" and "(international) system"? I use Maoz's (2001a) research to answer these two questions (see also Maoz et al. 2005). According to Maoz (2001a), a network is defined as a system that consists of units (states) and a set of relationships among these units—defined as ties[8] on a given relationship; since states in the international system do have ties with other system members in many different types of relationships, we observe multiple networks[9] in the international system. Regarding the network-international system relationship, Maoz (2001a, 150) correctly notes that there is considerable overlap between the two concepts. The key difference between them, adopted from Maoz (2001a), is the nature of the bonds that make units members of a network or of a system.[10] In this project, states become a part of a network only if they have an actual and voluntary contact with other network member(s); this is different from the situation where states become a part of a system (here, international system), as long as they are part of a common structure that regulates their behaviors. Also, as in Maoz (2001a) and Maoz et al. (2005), the project posits that the international system is composed of different types of interaction networks, based on different types of connections among states in the system.

The decision rules that I adopt for choosing international networks to depict the international system structure are based on the following three theoretical and empirical considerations. First, international networks used in this project are primarily focused on the dynamic behaviors of interactive relations among states in the system, and therefore this decision rule excludes the international networks that are static, such as a state's affiliation (Maoz et al. 2005), its attribute(s), its involuntary decision(s)[11]

---

[8] A difference from Maoz's research (Maoz 2001a; Maoz et al. 2005) is that this project only focuses on the directional ties among states. The definitions of directional and non-directional ties and the reasons for only using directional ties are explained in a later section.

[9] The use of multiple networks is not new in the field of international relations. There have been several studies that examine (or at least consider) multiple networks of international relations to characterize international system structure (Deutsch 1954; Singer and Small 1966, 1973; Brams 1966, 1968; Snyder and Kick 1979).

[10] The definition of a "network" and the use of multiple networks can also be found in Knoke and Kuklinski (1982): "Relations are the building blocks of network analysis. A network is generally defined as a specific type of relation linking a defined set of persons, objects, or events (see Mitchell 1969). Different types of relations identify different networks, even when imposed on the identical set of elements" (12). They suggest one such example of using multiple networks: studying the relationship among employees at a workplace focusing on the advice-giving network, the friendship network, and the formal authority network.

[11] This project uses "discretion networks" rather than "nondiscretion networks" (Maoz 2001a). According to Maoz (2001a, 148), the former focuses on the connections by "a result of a choice and a joint activity of members" (e.g., the European Union members decide whether to accept Turkey, or the United

(Maoz 2001a), or other static relationships between states (Singer and Small 1966). This decision rule excludes, among the possible candidates, the international networks (1) that are primarily based on a state's affiliation or attribute such as ethnic, linguistic, religious, or democratic networks (e.g., international networks composed of English-speaking states or of democratic states); and (2) that are primarily based on a static relationship between states such as contiguity or distance (e.g., international networks composed of contiguous states). The theoretical reasoning behind this decision rule is that (1) this project is focused on states' dynamic interactions with other system members rather than their "natural" or static bonds with them, and (2) the power concept derived from the new social network depiction of international system structure is focused on the relational aspect rather than attributional aspect of national power. States continuously interact with other system members in different international networks, and this project focuses on such interactive networks of international relations. This project focuses on the international networks where states interact with other system members by continuous choices that are updated and revised on a regular basis, rather than on international networks to which states belong based on their attribute or affiliation in isolation from other states, or where states hold static relationships with other system members. One cannot say much about network effects unless the network varies.

The international networks used in this project are solely constructed from the directional behaviors of interactive relations among states in the system, and thus this decision rule excludes international networks that are not focused on the directional characteristics of relationships among states. Here, following the consensus among social network theorists, I distinguish directed (or asymmetric) international networks from nondirected (or symmetric) international networks based on whether we can differentiate between "choices made" and "choices received" (Wasserman and Faust 1994, 198). For example, the arms transfer network used in this project is a directed (or asymmetric) international network,

---

Kingdom can decide whether to join the Euro regime), and the latter focuses on connections by "an involuntary association formed by some external authority or by circumstances and structural conditions not under the discretion of units" (e.g., a neighborhood of states makes up a network, a so-called politically relevant international environment or PRIE, Maoz 1996). In other words, the discretionary networks are formed as a result of states' choices; members in the discretionary network can opt into the network. The nondiscretionary networks are formed by factors that are not under the control of a state; membership in the nondiscretionary network is defined by factors that are outside the realm of states' choices.

because we can distinguish "choices made" (state *a* transfers arms to state *b*) and "choices received" (state *b* receives arms from state *a*). By contrast, the IGO joint membership network, used in some network studies of international relations but not here, is a nondirected (symmetric) network because we cannot define direction within it.[12] The theoretical reasoning behind this decision rule of excluding the nondirected international network is that without the true directional characteristics of interaction relationships, it is difficult to depict who is influencing or influenced by whom when we consider the social network power derived from the international system structure. Compare, for example, the arms transfer network (a directional network) used in this project and the IGO membership network (a nondirectional network) not used. If we see the direction of arms transfers from state *a* (e.g., the Soviet Union during the Cold War era) to state *b* (e.g., East Germany), we can argue that the sender exerts influence on the receiver by way of transferring arms (by the same logic, if we see the direction of international assistance from state *a*, say the United States, toward state *b*, say the Philippines, we should be able to differentiate the "influencing" and "influenced" parties in this relationship). However, suppose the two states shared the IGO membership (say, the Soviet Union and the United States in the UN during the Cold War era); can we pinpoint who influences and influenced whom by way of the joint membership within this nondirected network, or can we operationalize a social network power from this international network? The answer is probably no in this case, and that is why I focus on directional (or asymmetric) networks of international relations in this project (by the same logic, from the nondirectional tie of state *a* and state *b* being territorially contiguous, we should be unable to distinguish the parties of "influencing" and of "being influenced"). Third, some of the international networks identified in previous research are not used in this project for practical reasons (e.g., insufficient data). Some of the international networks that satisfy the above two theoretical decision rules had to be excluded due to the lack of consistent data available for the time period of this project, for all the system member states, or for the directional ties identifying the origins and destinations of relationships. They include international networks of mail correspondence,

---

[12] Define *X* as the matrix of social network data. If the *i*th row of the sociomatrix is identical to the *i*th column, we call it a nondirectional (symmetric) network. If the two are non-identical, we refer to it as a directional (asymmetric) network (Wasserman and Faust 1994, 177, 199).

migration, Internet correspondence, and tourism.[13] Following the three theoretical and empirical decision rules outlined above, six types of international networks[14] along two dimensions (communication flow networks and resource flow networks) of international systems are used in this project.

3.1.1. Dimension of Communication Flows

The first dimension used to define the international system structure[15] is that of communication flows among states in the system (the communication aspect of interactions in international relations). This dimension is focused on the exchanges or flows of people among states, or the communication exchanges among people across states. This project argues that states in the system are connected with each other in many different social networks of international relations, and one of the dimensions we should focus on when we define international system structure is how states interact with each other in international communication networks. As Barnett (1999) correctly points out, the communication networks of international relations have always been one important part of global interactions as the exchanges of and among "people" have expanded in response to the globalization process (see also Robinson 1991).

---

[13] I have personally contacted the relevant international institute or agency for the availability of such data (e.g., Universal Postal Union [UPU] for international mail correspondence; International Organization for Migration [IOM] for international migration; International Telecommunication Union [ITU] for international Internet correspondence; World Tourism Organization [WTO] for international tourism; and some other international and research institutes). According to the representatives of each institute or agency, their data are only available either for a short time period, or for limited numbers of states, or for an aggregation of states (rather than for the countries of origins and destinations used in this project).

[14] I have decided to use this set of six international networks not only because they satisfy the three decision rules outlined above, but also because they have been used in previous research in international relations consistent with the two new conceptualizations of this project (i.e., to identify the international system structure and an individual state's national power). For example, diplomatic, academic, and telecommunication exchanges or flows have all been used to identify the international system structure; arms, international trade, and monetary flows or exchanges have all been used to identify the relational power among states in the system. Of course, we can surely identify and use more than two dimensions of international system structure and, by the same logic, find more than three networks for each of the two dimensions. My project, however, will focus on six such international networks along the two broad dimensions of international system structure, based on the theoretical/empirical decision rules outlined above.

[15] In this project, "structure" means more than an ordering of states based on some attributes possessed by each state (as in the scalar representations noted by Chapter 2); it refers to elements of the international system that cannot be observed merely by observing each state in isolation from others.

Deutsch (1954) also argues that, in the mapping and measuring political community at the international level, the most important aspect of international transaction is international communication and the level of mutual communication among different groups and regions. Communication flows are operationalized by three measures: diplomatic exchanges, foreign student exchanges, and international telephone exchanges. In this first set of communication networks, interactive relational ties (linkages) between sovereign but interdependent states are channels of communication exchanges that show how states are connected or interact with each other in diplomatic channels (how diplomatic missions are exchanged/transferred between states), in academic channels (how foreign students are exchanged/transferred between states), and in telecommunication channels (how international telephone messages are exchanged/transferred between states).

The first international communication network used here is diplomatic exchanges. These exchange networks have been examined to classify international system members based on their attributed status (e.g., Singer and Small 1966, Small and Singer 1973), or to identify clusters of nations within the international system (e.g., Brams 1966, 1968; Snyder and Kick 1979). Small and Singer (1973) claim that the decision to locate, maintain, and abolish a diplomatic mission reflects a wide variety of considerations between states, and that the sum total of such diplomatic missions to a given capital represents some consensus as to how important the recipient state is to all other states in the system (also in Singer and Small 1966). Snyder and Kick (1979) use the network of diplomatic exchanges as one of their four types of international networks to define international system structure. They all argue that diplomatic exchanges are an important part of how states are connected with each other in the web of relationships.

Two widely used data sets of diplomatic exchanges among states are used in this project to identify this aspect of international communication flows (the diplomatic channels of international communication exchanges): Singer and Small's (1991) "Diplomatic Missions Received by Each International System Member (ICPSR 5025)" and "Diplomatic Exchange Data (ICPSR 5026)." The two data sets record the presence or absence of a diplomatic mission and, if present, the number and rank of missions sent or received (at five-year intervals) among states in the international system. I will use states' interaction with other system members in terms of their diplomatic exchanges (i.e., in the diplomatic channels of international relations) as one of the communication flows to depict the international system structure. States interact with other states in different networks of international relations, and this diplomatic exchange network identifies one aspect of international system structure focused on the importance of diplomatic channels in such international communication interactions.

The second international communication network used here is based on foreign student enrollments. As Chen and Barnett (2000) correctly point out, as scientific and technological knowledge and information are being regarded as vital in the process of globalization, higher education has become a key international linkage among states in the international system. Chen and Barnett (2000) also argue that foreign student enrollments have become another important form of communication, determining how states interact and communicate with each other. Much recent research in the field of communications studies has argued that foreign student exchanges are one of the key communication linkages connecting states in the system, and that this exchange of overseas students among states is also related to other aspects of international relations such as political or economic relations. The flow of knowledge resources among states (in the form of overseas study) is closely interconnected with the global political, economic, and cultural relationships among states in the system (McMahon 1992). Global expansion in overseas study is sensitive to changes in the world economy (Sutton 1993). Cummings (1993) argues that the increase in overseas education is related to the emergence of a new international economic order. Arguing that the exchange of students is an important part of how states are connected with each other in the web of relationships, Barnett and Wu (1995) study international student exchange networks in 1970 and 1989; Chen and Barnett (2000) study international student exchange networks in 1986, 1989, and 1996.

This project uses data from the United Nations Educational, Scientific and Cultural Organization (UNESCO)'s *Statistical Yearbook* (various years) to identify this aspect of international communication flows. The source recodes the yearly number of foreign students exchanged by their countries of origin. I use this information about how states interact with other system members in terms of their foreign student exchanges (i.e., in the academic channels of international relations) as one of the communication flows to depict international system structure. States interact with other states in different networks of international relations, and this foreign student exchange network identifies one aspect of international system structure focused on the importance of academic channels of such international communication interactions.

Finally, the third international communication network used here is international telecommunication exchanges. These networks have been examined mainly in the discipline of communications studies. The use of telecommunication networks is important because, as Barnett et al. (1996) correctly point out, telephones until very recently provided the basic connection for social interactions and the linkages within or among states, producing what Deutsch (1953) called "a web of nations." For example, Barnett and his colleagues have examined the structure of telecommunications networks, arguing that it provides one of the important linkages connecting states in the system: Barnett and Choi (1995) for 1986 telecommunication networks; Barnett et al. (1996) for 1982, 1986, and 1989 networks; and Barnett and Salisbury (1996) for 1992 networks. This project uses two widely-used data sets of telecommunication exchanges to identify this aspect of international communication flows: the international telecommunication data from ITU's *Yearbook of Statistics* (various years) and *Direction of Traffic* (various years). These sources recode the yearly incoming/outgoing international telephone traffic in minutes by country of origin. I use state interaction with other system members in terms of their international telephone exchanges (i.e., in the telecommunication channels of international relations) as one of the communication flows to depict international system structure. States interact with other states in different networks of international relations, and this international telephone exchange network identifies one aspect of international system structure focused on the importance of telecommunication channels of such international communication interactions.

All the data for each type of communication dimension are first transformed from the typical dyadic interaction data (state A, state B, year, dyadic data variable) to the n*n (n=number of states in the international system) square matrices of each year.[16] These valued directional square matrices are then

[16] The example for international trade (bilateral export) data set is below.

transformed to the binary directional[17] square matrices to be used in the social network analyses (using the procedures in Ucinet Version 6.87 by Borgatti, Everett, and Freeman 2002). Appendix 1.1 is included to illustrate these procedures, the original and binary matrices of diplomatic exchanges and foreign student exchanges in 1960 (for the European continent only, to save space). So for example, for the diplomatic exchanges matrix in 1960, UKG (United Kingdom) received diplomatic missions from all other 23 states in Europe except ALB (Albania) and BUL (Bulgaria); but it sent diplomatic missions to all other 23 states in Europe except ALB (Albania) (thus the *directional* square matrix where the raw and column of the data entries can be different). For the foreign student exchange matrix, we can see how many foreign students from each state in Europe were received by the United Kingdom in 1960 by taking a look at the raw entries for UKG in Appendix 1.1. How many students the United Kingdom sent to other states in Europe can be revealed by taking a look at the column for UKG in Appendix 1.1. These valued matrices of foreign student exchange are then binalized to be used in the social network analyses by using the average value of cells in the whole matrix as a cutoff point (e.g., the cutoff point in a foreign student exchange matrix in 1960 is 14.492; if the cell is greater than or equal to 14.492, it is coded as 1, otherwise it is coded as 0).

State A	State B	Year	Dyadic Data
United Kingdom	France	1990	$155mil
United Kingdom	U.S.	1990	$357mil
France	United Kingdom	1990	$282mil
France	U.S.	1990	$126mil
U.S.	United Kingdom	1990	$536mil
U.S.	France	1990	$465mil
...			

==>

1990	United Kingdom	France	U.S.	...
United Kingdom	.	$155mil	$357mil	
France	$282mil	.	$126mil	
U.S.	$536mil	$465mil	.	
...				

[17] Define *X* as the matrix of social network data. If the *i*th row of the sociomatrix is identical to the *i*th column, we call it a nondirectional (symmetric) network. If the two are non-identical to each other, we refer it as a directional (asymmetric) network (Wasserman and Faust 1994, 177 and 199). Or, let's refer x_{ij} to the matrix entities that recode the value υ_k associated with the line or arc l_k between n_i and n_j. If the matrix entity of x_{ij} is identical to that of x_{ji}, we refer to the matrix as a nondirectional matrix. If the matrix entity of x_{ij} is different from that of x_{ji}, we refer to the matrix as a directional matrix. Furthermore, if the value υ_k associated with x_{ij} is restricted to zeros and ones, we refer to the matrix as a binary matrix. On the other hands, if the value υ_k associated with x_{ij} is not restricted to zeros and ones (i.e., it carries a value), we refer to the matrix as a valued matrix.

3.1.2. Dimension of Resource Flows

The second dimension used to define international system structure is that of resource flows among states in the system (the resource aspect of interactions in the international relations). This dimension is focused on the transfers or flows of goods and services among states in the system. States in the system are connected with each other in many different social networks of international relations, and one of the dimensions that we should consider when we define international system structure is how states interact with each other in the international resource flow networks. Resource flows are operationalized by three measures: arms transfers, international trade (exports), and international economic assistance. In this second set of resource networks, interactive relational ties (linkages) between sovereign and interdependent states are channels of resource transfers that show how states are connected or interact with each other in the arms channels (how arms are transferred or exchanged between states), in the trade channels (how foreign goods and services are transferred or exchanged between states), and in the monetary channels (how international monetary assistance is transferred or exchanged between states).

The arms transfer networks have been examined in many studies of international relations, such as arms transfer relationships used as a tool of statecraft, especially during the Cold War era (Krause 1991; Sanjian 1989; Blanton 2000; Maniruzzaman 1992; Cutler, Despres, and Karp 1987). Recently, Kinsella (2003, 2004, 2006) examined the structure of arms transfer networks using the social network perspective. Kinsella (2003, 1) argues that "the global arms trade should be understood not as a market but as a network, one that shares some important properties with networked forms of organization studied by sociologists." I use data from the Stockholm International Peace Research Institute (SIPRI) to identify this aspect of international resource flows.[18] The SIPRI *Arms Transfers Database* contains information on all transfers of seven categories of major conventional weapons. The source covers both the sales of weapons (including manufacturing licenses) and other forms of weapon supplies such as gifts and aid.

[18] For providing arms transfer data used in this project, my thanks go to Nicholas Chipperfield and Natasza Nazet of the SIPRI Arms Transfers Project.

The second international resource network used here is the flows of goods and services. The international trade (of goods and services) networks have been examined, for example, in the empirical analyses of world-system theory to depict the structure of the world economy (Snyder and Kick 1979, Nemith and Smith 1985, Smith and Nemith 1988, Smith and White 1992). As Smith and White (1992) correctly point out, world-system theorists have long argued the importance of commodity trade ("unprocessed raw materials" for periphery trade and "highly processed exports" for core trade) in determining stratum membership and in promoting unequal exchange in the world economy (also in Emmanuel 1972, Frank 1969, Galtung 1971, Firebaugh and Bullock 1987, and Steiber 1979). For example, Nemith and Smith (1985), exclusively focusing on flows of international commodity trade to formulate international system structure, emphasize that the world-system theory stresses the world economy as the basic unit of analysis, and therefore international trade should be subjected to analysis in its own right. I use data from Gleditsch (2002, 2004) to identify this aspect of international resource flows. The *Expanded Trade and GDP Data* version 4.1 by Gleditsch (2002, 2004) covers total exports and imports among states in the system in millions of current U.S. dollars.

The third international resource network used here is the flows of monetary assistance. The international assistance networks have been suggested by Singer and Small (1966, 1973) as one of the possible candidates to characterize international system structure. The use of economic assistance networks also has been studied to examine the consequences of the recipient's aid dependence on the sender and, as a result, the sender's power over the recipient in such areas as human rights (e.g., Roeder 1985, Regan 1995, Cingranelli and Pasquarello 1985, Carleton and Stohl 1987). The international assistance data from the Organization for Economic Cooperation and Development (OECD)'s *International Development Statistics: Geographical Distribution of Financial Flows to Aid Recipients* provides the volume, origin, and types of aid and other resource flows for more than 180 countries in the system. The same procedures used to derive the binary directional matrix for the data sets of communication dimension are also applied to derive the matrix for the resource dimension data sets (Appendix 3.1 illustrates the procedures, using the examples of arms transfer and international trade data sets).

3.2. Conceptualizing National Power

I define a state's "structural network power" as the power of an individual state at its location within the networks of international relations—how each state is structurally positioned in different types of social networks of international relations. In this project, I focus on several different dimensions of structural network power that arise from a state's structural positioning in different types of interaction networks of the international system. These dimensions are based on five different conceptualizations of point centralities[19] from network analyses of different types of interaction data (i.e., degree, betweenness, flow-betweenness, coreness, and ego network brokerage) (Hanneman 2001; Degenne and Frosé 1999; Wasserman and Faust 1994; Scott 2000; Knoke and Kuklinski 1982; Freeman 1978/1979; Borgatti and Everett 1999; Freeman, Borgatti, and White 1991; Borgatti, Everett, and Freeman 2002). The substantive meanings of each of the network power measures are provided in this section; the technical details of how to derive each measure (or formal definitions of each measure) are presented in the next section.

As most social network theorists emphasize, there is a consensus among social network analysts that there is a positive relationship between an actor's centrality and its power within a network. Actors occupying central positions are essentially viewed as powerful due to their greater access to and possible control over the relevant resources (Boje and Whetten 1981; Lincoln and Miller 1979; Blau and Alba 1982; Brass 1984, 1992; Brass and Burkhardt 1992, 1993; Burkhardt and Brass 1990; Knoke and Burt 1983; Krackhardt 1990; Sparrowe and Liden 2005). Each of the five different centralities that have been developed by social network theorists emphasizes different aspects of structural network power, and I argue that we should consider all five when we conceptualize a state's national power. The five centrality concepts can be divided into two groups based on the emphasis of each centrality concept. We can place

[19] Social network theorists use the term "point centrality" (or "node centrality") differently from that of "network centralization" (or "graph centralization") (see Scott 2000, 82). The first term refers to an individual node's relative centrality or prominence (compared to other nodes in the network); the second term refers to the level of centralization of the network as a whole (or the distribution of point/node centralities within the network). These concepts from the social network perspective can be compared to an individual state's power (for the former), and the concentration of powers among states in the international system (for the latter) in the studies of international relations.

degree and ego network centralities in one group, and betweenness, flow-betweenness, and core centralities in the other. The first group focuses on the nodes to which a particular node is adjacent (called "local centrality" [Scott 2000, 82–89]), and the second group focuses on the distances among the various nodes (called "global centrality"). We might also categorize the five power measures as follows: first, degree centrality focuses on the node's direct involvement with other network members; second, betweenness, flow-betweenness, and ego network centralities focus on the node's third-party broker opportunities within the network; and finally, core centrality focuses on the node's overall core-peripheral structural positioning within the network. Grouping some of the power measures together or choosing one or a few of the measures over the others all depends on which aspect of structural network power concepts we are interested in (or which aspect of the power concept is more or less appropriate for examining the research question at hand). For example, in the field of international relations, if we are interested in examining the interdependence-conflict relationship, we might want to focus on the degree aspect of structural network power. If we are interested in studying the third-party involvement-conflict relationship, we might want to focus on the betweenness and flow-betweenness aspects of network power (or the ego network brokerage aspect if the focus is more regional). If we are interested in testing the arguments of the world-system theory, we might want to focus on the coreness aspect of structural network power. Better yet, we might want to use all five different aspects of structural network power to examine the empirical phenomenon at hand and see how each aspect of structural network power (in isolation from other aspects) is related, or how structural network power as a whole (considering all five aspects of power) is related.

3.2.1. Structural Network Power Based on Degree Centrality

Viewing a state's structural network power as arising from its degree centrality treats each node's (state's) structural power based on its total number of direct connections to other nodes (states) in the network. A state with a high degree centrality (i.e., many direct ties to other states) holds a powerful (influential), prestigious (prominent), or advantaged position in the network (Hanneman 2001; Degenne and Frosé 1999; Wasserman and Faust 1994; Scott 2000; Knoke and Kuklinski 1982; Freeman 1978/1979; Borgatti and Everett 1999; Freeman, Borgatti, and White 1991; Borgatti, Everett, and Freeman 2002). It is the most visible actor in the network, and therefore it is "where the action is" in the network (Wasserman and Faust 1994). Compared to the state that holds a less powerful or prestigious position in the network (with its limited number of direct ties to other network members), a highly degree-central state: (1) is less dependent on other states because it has many alternative ways to get what it needs, (2) has more access to the resources of the network since it has more ties to other states, and (3) usually holds and benefits from a third-party position (or a deal-maker position) in exchanges among other states in the network because it has many ties to other states[20] (Hanneman 2001). For example, the Cold War matrices of arms transfers show that the Soviet Union had a higher degree centrality in the arms transfer network than Bulgaria. The structural position of the Soviet Union enabled it to: (1) be less dependent on other states for its export and imports needs, (2) have more access to the arms resources available within the network, and (3) benefit from advantageous third-party positions in the exchanges of arms. For example, if Bulgaria decided not to import arms from the Soviet Union, the Soviet Union had many other places (especially in Eastern Europe) to export their arms. However, if the Soviet Union decided not to export arms to Bulgaria, Bulgaria (with its limited number of arms sources) might be unable to find other alternatives places to import their arms to. Since the Soviet Union had more opportunities and alternatives than Bulgaria, it had more structural social network power (in terms of degree centrality) in the arms networks. The Soviet Union could also influence the behavior of other suppliers such as East Germany.

[20] The long-debated relationship between economic interdependence and national power in the field of international relations has some merit here (especially in terms of "sensitivity interdependence" and the vulnerability interdependence regarding the "mutual effects" or "the opportunity costs of disrupting the relationship;" refer to the summary of the debate in Baldwin 1980).

3.2.2. Structural Network Power Based on Betweenness Centrality

An approach to structural network power focused on betweenness centrality treats each node's structural power as arising from its position on the geodesics (minimal length paths) that connect two other nodes in the network. A state with a high betweenness centrality (standing on many geodesics) holds a powerful or prestigious (prominent) position in the network (Bavelas 1948, Shaw 1954, Shimbel 1953, Cohn and Marriott 1958; see also Hanneman 2001; Degenne and Frosé 1999; Wasserman and Faust 1994; Scott 2000; Knoke and Kuklinski 1982; Freeman 1978/1979; Borgatti and Everett 1999; Freeman, Borgatti, and White 1991; Borgatti, Everett, and Freeman 2002). Many other states depend on it to make connections to other states in the system. The betweenness centrality conceptualizes the degree to which a state plays the role of a "broker" or "gatekeeper," with a potential for control over other states in the network (Scott 2000). This centrality is also interpreted as the extent to which a state controls the communication between other pairs of states in the system (Brandes and Erlebach 2005, 30). This broker or gatekeeper role played by a state with high betweenness centrality is more clearly understood by viewing Figure 3.6, which maps international arms transfers among states in 1950. In this situation, Italy (ITA) played an important intermediary role among the three sets (or blocs) of states centered around the Soviet Union, the U.S., and the United Kingdom.; the same role was played by Indonesia (INS) in the international arms transfer network of 1960. During the Cold War, the data show that the Soviet Union had a higher betweenness centrality in the arms transfer network than Bulgaria. The Soviet Union was standing on the geodesic paths connecting many pairs of communist states (as a leader of the Council for Mutual Economic Assistance [COMECON]), while there were no direct connections between Bulgaria and many other communist states. Thus, if the Soviet Union wanted to interact with, say, Albania, it was able to do so. However, if Bulgaria wanted to interact with Albania, it could do so only by way of the Soviet Union.[21] Since the Soviet Union held a more advantageous position (by way of being between the states of COMECON) than Bulgaria, it had, in the social network perspective, more structural social network power (in terms of betweenness centrality).

[21] This works in two ways: first, Bulgaria and Albania might have had no interest in creating a bilateral arms sales agreement; second, the Soviet Union (as a leader of COMECON) might have discouraged such a bilateral agreement between Bulgaria and Albania with the purpose of dictating their relationship.

3.2.3. Structural Network Power Based on Flow-Betweenness Centrality

Treating structural network power as arising from flow-betweenness centrality implies measuring each node's structural power based on its position on both the direct and indirect paths that connect two other nodes (states) in the network (Hanneman 2001; Degenne and Frosé 1999; Wasserman and Faust 1994; Scott 2000; Knoke and Kuklinski 1982; Freeman 1978/1979; Borgatti and Everett 1999; Freeman, Borgatti, and White 1991; Borgatti, Everett, and Freeman 2002). As a modification of Freeman's original conceptualization of betweenness, flow-betweenness is focused on the notion that the actors will use all paths to be connected to other actors (not only the shortest geodesic paths); as Stephenson and Zelen (1989) point out, there is no reason to believe that interactions between a pair of states occur only on the shortest path. This approach assumes that states use each pathway that connects them in proportion to the length of that pathway, and that states that are "between" other states are able to translate their broker roles to power (Hanneman 2001). A state with high flow-betweenness centrality (standing on many direct and indirect paths) holds a powerful or prestigious position in the network because it can affect so many interaction channels.

Flow-betweenness centrality enriches the conceptualization of betweenness centrality. Suppose, for example, that two states, South Korea and North Korea, want to exchange arms transfers, and that the direct geodesic path between them is blocked by China (say, to maximize its arms transfers by its separate connections to South Korea and to North Korea by blocking the direct connection between the two Koreas). If there is another pathway to connect them, such as Russia, they will be likely to use it, in spite of the fact that it is longer and also subject to disruption. States interact with other network members using both direct and indirect pathways, and, from a social network perspective, a state that holds a more advantageous position (standing on many direct and indirect paths among network members) holds more structural social network power (in terms of flow-betweenness centrality).

3.2.4. Structural Network Power Based on Core Centrality

Viewing a state's structural network power as arising from its core centrality treats each node's (state's) structural power based on its degree of coreness compared to the other nodes (states) in the network (Borgatti and Everett 1999; see also Mintz and Schwartz 1981, Mullins et al. 1977, Doreian 1985, and Corradino 1990). Based on the concepts of a core/periphery structure (i.e., a dense and cohesive core and a sparse and unconnected periphery), and of a core/periphery relationship (the former exploiting the latter), this conceptualization of core centrality is an extension of Wallerstein's (1974, 1979) dichotomous (core-periphery) or trichotomous (core-semiperiphery-periphery) typology that has been used in many studies of world-system theory. It measures "coreness" as a continuous variable (a high score on coreness represents a highly core state; a low score on coreness represents a highly peripheral state). World-system theorists claim that a state's degree of coreness is highly related to its power. With this approach, we can now not only partition states into different groups (core, semiperiphery, and periphery), but also differentiate the within-group members (who is the mostly/least powerful within each group).

3.2.5. Structural Network Power Based on Ego Network Brokerage Centrality

Defining structural network power in terms of ego network (or egonet) brokerage centrality involves measuring each node's (state's) structural power based on its possibilities for brokerage among the nodes (states) within its own ego network. This treatment involves two separate network concepts. First, the concept of brokerage has been defined as a process "by which intermediary actors facilitate transactions between other actors lacking access to or trust in one another" (Marsden 1982, 202). Burt (1976) and Galaskiewicz and Krohn (1984) define brokers as "actors who simultaneously send and receive resources from different parts of the network in which they are embedded" (Gould and Fernandez 1989, 18). This concept of brokerage has been studied in both theoretical and empirical social network research (Blok 1974, Boissevain 1974, Knoke and Laumann 1982; Pruitt 1964); this research emphasizes linking the ability to broker negotiation or resource flows to perceived power or influence (see also Galaskiewicz 1979, Galaskiewicz and Krohn 1984, Gould 1989, Gould and Fernandez 1989). Gould and

Fernandez (1989) identify five qualitatively different roles of the broker: (1) as a local broker or coordinator (e.g., the Federal Reserve Bank as a clearinghouse for all the private banks in a major city), (2) as a cosmopolitan or itinerant broker (e.g., a stockbroker as a mediator among clients, buyers and sellers), (3) as a gatekeeper or representative (e.g., the broker as a gatekeeper for his or her political party can decide whether to grant other party members access to an outsider in a rival party, (4) as a representative for other party members who can decide whether to establish contact with an outsider in a rival party [Rogers and Rogers 1976]), and (5) as a liaison to link distinct groups (e.g., agents in the publishing or entertainment industries). Second, the ego network (or egonet) consists of a focal node (called "ego"), the nodes to which ego is directly connected (called "alters"), and the ties among the alters. The ego network (also called the neighborhood network or the first order neighborhoods of ego) is a set of states to which a given state is directly connected, and therefore focuses on a limited set of interactive relationships compared to the other structural network power conceptualizations previously outlined.

To illustrate the brokerage concept, suppose that South Korea has a tie to the U.S., and that the U.S. has a tie to Afghanistan, but that South Korea has no direct tie to Afghanistan. In this triad of relationships (the U.S., South Korea, and Afghanistan), the U.S. (as a local broker or coordinator, as a cosmopolitan or itinerant broker, as a gatekeeper, as a representative, or as a liaison in the relationship between South Korea and Afghanistan) can play a brokerage role in case South Korea needs to reach Afghanistan. If we extend this brokerage role of the U.S. to all the member states within the U.S. ego network, we can depict U.S. structural network power in terms of egonet brokerage centrality. The data matrices of arms transfers, for example, show that the size of the U.S. ego network increased from 29 in 1950 to 35 in 2000. Assume that, during the Cold War era, there were two large ego networks (one led by the United States and the other by the Soviet Union) and a small number of groups whose members did not belong to either. The ego in each of the two ego networks might have played a number of roles as a broker: coordinating and mediating transactions among states within the egonet (e.g., the U.S. coordinating or mediating the foreign policies among the Organization of American States [OAS] members); deciding, as a gatekeeper, whom to invite as its egonet member(s) or whether to grant its member state(s) access to an outsider (e.g., during the Cold War era, the U.S. deciding who can belong to

OAS or granting its egonet member(s) permission, in an implicit or explicit way, to interact with the Soviet egonet member[s]); establishing, as a representative, relationship with an outsider (e.g., the U.S. establishing, as a representative of its egonet members, a relationship with outside states such as China); working as an agent to mediate transactions between two outside groups (e.g., the U.S. mediating among the members of different non-aligned groups, such as Non-Aligned Movement [NAM] groups during the Cold War era). We measure it by first constructing the ego network for each node within the whole network, and then by computing each node's brokerage centrality within its own ego network. From the social network perspective, this egonet brokerage represents a more localized structural network power compared to other types of structure network power that use all the interactions within the whole network.

3.3. Measuring Structural Network Power

3.3.1. State-Level Measures of Structural Network Power

Each of the five measures of structural network power is constructed using yearly n*n binary directional matrices of interaction data (diplomatic exchanges, foreign student exchanges, and international telecommunications for the communication dimension; arms transfers, international exports, and international assistance for the resource dimension) using the procedures stated below.

1. The degree aspect of structural network power

The degree aspect of structural network power, measured by degree centrality, calculates each node's structural network power according to its total number of connections to other nodes in the network (Hanneman 2001; Degenne and Frosé 1999; Wasserman and Faust 1994; Scott 2000; Borgatti, Everett, and Freeman 2002). For directed graphs, it measures both indegree centrality (the number of ties received by the node) and outdegree centrality (the number of ties initiated by the node). The indegree and outdegree C_D of each state n_i are:

$$C_D(n_i) = x_{+i} = \sum_j x_{ji} \text{ (indegree)}$$

$$C_D(n_i) = x_{i+} = \sum_j x_{ij} \text{ (outdegree)}$$

Since the measures depend on the actual network size g (i.e., the number of states in the system), I use the normalized version of these measures, independent of the network size g, to facilitate comparisons across networks of different sizes (i.e., to accommodate changes in the number of international system members over time). The normalized indegree and outdegree centralities C'_D of each state n_i are

$$C'_D(n_i) = \frac{C_D(n_i)}{(g-1)}$$

If g is the number of nodes in the network, then (g – 1) is the maximum possible number of connections linking j to i (indegree) or i to j (outdegree). Dividing by (g – 1) allows us to compare each state's centrality to that of the most central state in an ideal star network.[22] The normalized degree centralities range from 0 (when a given node n_i has connections to none of the nodes in the network) to 1 (when a given node n_i has connections to all the nodes in the network).

To illustrate how countries fare when evaluated by the degree aspect of structural network power, Appendix 1.3 displays the degree centralities of foreign student exchanges for the dimension of communication patterns and arms transfers for the dimension of resources flows.[23] Those figures are accompanied by the table ranking each state's raw degree centrality scores in Appendix 1.2. The figures in the Appendix portray the extent to which each state is degree-centralized compared to all other states in the network. For example, from the foreign student exchange network of 1960, we see the U.S. is the most centralized state, followed closely by France, West Germany, and the United Kingdom, in that order. We also see that there is another set of about 13 states that are less central than the first set of states but far more central than a third set of states; and that the other remaining states (the majority of system members, 90 out of 107 in the system) have relatively minimal centrality scores (i.e., minimally powerful

[22] Appendix 3.2 describes in detail how to calculate an individual state's degree centrality by using one of the resource flow data sets (arms transfer data sets in 1960 and 2000) and one of the communication flow data sets (foreign student data sets in 1960 and 2000).

[23] The figures in the appendix use the Concentric Layout Algorithm, with the options of threshold value and grid of 10 in Netminer 2.5.0a.

in the degree aspect) compared to the first two groups of states. In 2000, however, we see that the first set of states (the U.S., France, Germany, and the United Kingdom) still hold strongly central positions in the network; but the second set of states, which is less central than the first set of states but far more central than the remaining states in the network, has expanded to approximately 25 states. The top destinations of overseas study have not changed much in fifty years, but more countries now host a sizable number of foreign students. We might describe this change of pattern as a rough graphical representation of the systemic changes argued by world-system theorists (no change of the major powers or of the core grouping, and the expansion of middle powers or of the semi-periphery grouping).

2. The betweenness aspect of structural network power

The betweenness aspect of structural network power is measured by a betweenness centrality that calculates each node's structural network power according to its capacity of standing on the geodesic paths that connect two other nodes in the network (Hanneman 2001; Degenne and Frosé 1999; Wasserman and Faust 1994; Scott 2000; Borgatti, Everett, and Freeman 2002). The betweenness C_B of each state n_i is

$$C_B(n_i) = \sum_{j<k} g_{jk}(n_i) / g_{jk}, \ i \neq j \neq k$$

Since the measure depends on the actual network size g (i.e., the number of states in the system), I use the normalized version of the measure, independent of the network size g, to facilitate the comparisons across networks of different sizes (i.e., to accommodate changes in the number of international system members over time). The normalized betweenness centrality C'_B of each state n_i is

$$C'_B(n_i) = C_B(n_i) / \left[(g-1)(g-2)\right]$$

where (g – 1)(g – 2) is the maximum possible betweenness score. This enables us to compare each state's centrality to that of the most central state in an ideal star network. The normalized betweenness centrality ranges from 0 (when a given node n_i falls on no geodesic paths in the network) to 1 (when a given node n_i falls on all geodesic paths in the network).

To illustrate how countries fare in the betweenness aspect of structural network power, Appendix 1.3 depicts the betweenness centralities of foreign student exchanges for the dimension of communication patterns, and arms transfers for the dimension of resource flows. The figures in the Appendix portray the extent to which each state is betweenness-centralized compared to other states in the network. Those figures are accompanied by the table ranking each state's betweenness centrality scores in Appendix 1.2. In the 1950 network of arms transfers, the U.S. held the most centralized position, closely followed by the USSR and Italy, and the United Kingdom, in that order. The 2000 network of arms transfers shows the U.S. in the strongest position, with four other suppliers becoming a distant secondary supply group. Comparing these two networks shows that the arms transfer network has become more centralized. This graphical representation is also confirmed by the systemic centralization index change from 0.007 (in 1950) to 0.015 (in 2000). Briefly, what the centralization index measures is how centralized each system is compared to the star system, where one state holds all the powers obtainable in the network (the centralization index of star network equals 1).

3. The flow-betweenness aspect of structural network power

The flow-betweenness aspect of structural network power is measured by a flow-between centrality. It calculates each node's structural network power according to its capacity for standing on both the direct and indirect paths that connect two other nodes in the network (Hanneman 2001; Degenne and Frosé 1999; Wasserman and Faust 1994; Scott 2000; Borgatti, Everett, and Freeman 2002). Flow-betweenness centrality C_{FB} of each state n_i is

$$C_{FB}(n_i) = \sum_{j}^{n}\sum_{k}^{n} f_{jk}(i), \quad i \neq j \neq k \text{ and } j < k$$

where $f_{jk}(i)$ is the amount of flow-between node j and node k that must pass through i for any maximum flow. This normalization enables us to compare each state's centrality to that of the most central state in an ideal star network. Therefore, the flow-betweenness of node i is the sum of all $f_{jk}(i)$ where i, j, and k are distinct, and j < k. Since the measure depends on the actual network size g (i.e., the number of states in the system), I use the normalized version of the measure, independent of the network size g, to ensure the accuracy of comparisons across networks of different sizes (i.e., to accommodate changes in the number of international system members over time). The normalized flow-betweenness centrality C'_{FB} of each state n_i is

$$C'_{FB}(n_i) = \frac{C_{FB}(n_i)}{\sum_{j}^{n}\sum_{k}^{n} f_{jk}}, \; i \neq j \neq k \text{ and } j < k$$

The normalized flow-betweenness centrality of state i is the flow-betweenness of i divided by the total flow through all pairs of points where i is not a source or sink and ranges from 0 (minimum flow-betweenness centrality) to 1 (maximum flow-betweenness centrality).

To illustrate how countries fare in the flow-betweenness aspect of structural network power, Appendix 1.3 depicts the flow-betweenness centralities of foreign student exchanges for the dimension of communication patterns, and arms transfers for the dimension of resource flows. These figures in the Appendix portray the extent to which each state is flow-betweenness centralized compared to other states in the network. These figures are then accompanied by a table ranking each state's flow-betweenness centrality scores in Appendix 1.2. In the 1950 network of arms transfers, the U.S. held the most centralized position, closely followed by Italy, the United Kingdom, the USSR, and Czechoslovakia, in that order. The 2000 network of arms transfers still shows a strong position for the U.S. with other suppliers (around nine states) becoming a distant second supply group. Comparing these two networks show that the foreign student exchange network has become more centralized.

4. The coreness aspect of structural network power

The coreness aspect of structural network power is measured by a core centrality that indicates each node's structural network power according to its degree of coreness to the other nodes in the network (Hanneman 2001; Degenne and Frosé 1999; Wasserman and Faust 1994; Scott 2000; Borgatti, Everett, and Freeman 2002). Based on the concept of a core/periphery structure (i.e., a dense and cohesive core and a sparse and unconnected periphery), the index of core centrality is a development of

Wallerstein's (1974) dichotomous (core-periphery) or trichotomous (core-semiperiphery-periphery) conception that is used in many studies of world-system theory. The strength of this continuous measure (over its previous categorical measure) can be easily understood with the notion of the differentiation among states within the core and within periphery groups in the old study of world-system theory.

The procedure for core centrality fits a core/periphery model to the data network by finding a vector C such that the product of C and C transposed is as close as possible to the original data matrix; "In a Euclidean representation, this would correspond to distance from the centroid of a single point cloud" (Borgatti and Everett 1999, 387). More specifically, the algorithm to derive the core centrality starts with the nodes with the highest coreness score and places them in the core; all other actors are placed in the periphery. The core is then successively increased by moving the node with the highest coreness score from the periphery into the core. This is continued until the periphery consists of a single node (Borgatti, Everett, and Freeman 2002). The coreness of each node is normalized so that the total sum of squares is 1; the normalized coreness measure ranges from 0 (minimum core centrality) to 1 (maximum core centrality). More details on each state's coreness centrality scores can be found in the Appendix 1.2. For example, in 1950, the U.S. held the most centralized position (i.e., the most powerful in the core aspect of structural network power) with a coreness score of 0.502; United Kingdom was a distant second at 0.262; Canada was 0.205; and France was 0.205. The scores for all the other states in the system were below 0.200. In 2000, the U.S. still held the highest coreness position, but with a much lower score of 0.347; several other states (such as the United Kingdom, Canada, France, and Switzerland) had scores around 0.200; and many other states had scores between 0.100 and 0.200. The pattern is rather clear in the terms of coreness centrality: the network has become less centralized.

5. The ego network brokerage aspect of structural network power

The ego network brokerage aspect of structural network power is measured by an ego network brokerage centrality that indicates each node's structural network power according to its level of brokerage among the nodes within its own ego network (Hanneman 2001; Degenne and Frosé 1999; Wasserman and Faust 1994; Scott 2000; Borgatti, Everett, and Freeman 2002). This measure involves two different measures in social network analysis: ego network and brokerage. To measure ego network brokerage centrality, we first construct the ego network for each node within the whole network (consisting of a focal node, called "ego," the nodes to which ego is directly connected, called "alters," and the ties among the alters); and then we compute each node's brokerage centrality within its own ego network (by calculating the number of ordered actor pairs not directly connected to each other divided by the total number of ordered pairs in each ego network). From a social network perspective, this measure of ego network brokerage represents a more localized network power index compared to other measures that use the interactions in the whole network. Since the measure depends on the actual network size g (i.e., the number of states in the system), I use the normalized version of the measure, independent of the network size g, to facilitate the comparisons across networks of different sizes. This measure ranges from 0 (minimum ego network brokerage centrality) to 1 (maximum ego network brokerage centrality). More details on each state's ego network brokerage centrality scores can be found in Appendix 1.2. For example, in 1950, the U.S. held the most centralized position (i.e., the most powerful in the ego network brokerage aspect of structural network power) with an ego network brokerage score of 0.892, with many states closely following. The 2000 figures do not differ much. But the U.S., the most powerful, became slightly less powerful and many other states held more powerful positions (compared to the 1950 figures) in terms of ego network brokerage. In other words, the system is less centralized in 2000 than in 1950.

3.3.2. System-Level Measures of Structural Network Power

Two different sets of systemic measures of structural network power are used in this project; first, the set of system-level measures developed by Freeman (1978/1979) and Freeman, Borgatti, and White (1991) that accompanies their state-level centrality measures of degree, betweenness, and flow-betweenness; second, the set of system-level measures using the formulas developed by Singer, Bremer, and Stuckey (1972) and Mansfield (1994).

1. System-level measures from Freeman (1978/1979); structural network power centralizations

The following three sets of system-level structural network power measures are based on Freeman (1978/1979) and Freeman, Borgatti, and White (1991). Each of the three system characteristics is measured based upon different aspects of social network power (i.e., degree, betweenness, and flow-betweenness). Each type of systemic centralization measures the level of centralization in the whole network, compared to the ideal "star" network, where a node is connected to all the other N-1 nodes. They measure the extent to which the whole network has a centralized structure (or an overall "compactness" of a network), or the extent to which the cohesion of the network is organized around a particular focal point (Scott 2000). Freeman network centralization scores range from 0 to 1. When all states hold exactly the same amount of structural network power in the whole network (which looks similar to the "circle" or "wheel" figure), the systemic centralization score equals 0. When one state holds all the network structural power in the whole network (which looks similar to the "star" figure), the systemic centralization score equals 1. When the centralization score is high, the network is controlled by a few powerful states. When the centralization score is low, the control of network is shared by many other states. The actual centralization scores are usually greater than 0 and less than 1. Following Freeman (1978/1979), this general formula for network centralization is used:

$$C = \frac{\sum_{i=1}^{g} \left[C(n^*) - C(n_i) \right]}{\max \sum_{i=1}^{g} \left[C(n^*) - C(n_i) \right]}$$

where $C(n_i)$ is the actor i's centrality value and $C(n^*)$ is the largest observed centrality value in the whole network.

Each type of centralization (degree centralization, betweenness centralization, and flow-betweenness centralization) is measured by applying the following formulas:

$$C_D = \frac{\sum_{i=1}^{g} \left[C_D(n^*) - C_D(n_i) \right]}{\left[(g-1)(g-1) \right]} \quad \text{(degree centralization)}$$

$$C_B = \frac{\sum_{i=1}^{g}\left[C_B(n^*) - C_B(n_i)\right]}{\left[(g-1)^2(g-2)\right]} \text{ (betweenness centralization)}$$

$$C_{FB} = \frac{\sum_{i=1}^{g}\left[C_{FB}(n^*) - C_{FB}(n_i)\right]}{\left[(g-1)^2(g-2)\right]} \text{ (flow-betweenness centralization)}$$

2. System-level measures from Singer, Bremer, and Stuckey (1972) and Mansfield (1994); structural network power concentration, change, and movement

The following sets of system-level structural network power measures are based on Singer, Bremer, and Stuckey (1972) and Mansfield (1994) in their study of systemic power concentration and systemic war. Each of the three different system characteristics is measured based upon five different aspects of structural network power (degree, betweenness, flow-betweenness, coreness, ego network brokerage, and their composite index); they will measure different aspects of structural network power distribution among states in the international system, using the formula from Singer, Bremer, and Stuckey (1972) and Mansfield (1994).

1) Systemic Network Power Concentration
2) Systemic Network Power Chance (five-year Moving Average)
3) Systemic Network Power Movement (five-year Moving Average)

The formulas for each of the measures are as follows:

$$CON_t^{ALL} = \sqrt{\frac{\sum_{i=1}^{N_t}(S_{it})^2 - 1/N_t}{1 - 1/N_t}}$$

where N_t is the total number of states in the system in year t and S_{it} is the proportion of state i's control of the aggregated structural network power possessed by all states in year t. The variable CON_t^{ALL} varies from 0, where each state possesses the equal proportion of aggregated structural network power possessed by all states, to 1, where one state possesses all aggregated structural network power possessed by all states in the system.

$$CHANGE5_t^{ALL} = \frac{CON_t^{ALL} - CON^{ALL}{}_{(t-5)}}{t-(t-5)}$$

where $CON^{ALL}{}_t$ is the level of structural network power concentration at the beginning of five-year period (year t), and $CON^{ALL}{}_{(t-5)}$ is the level of structural network power concentration at the beginning of the previous period (year t-5).

$$MOVE5_t^{ALL} = \frac{\sum_{i=1}^{N_t} \left| S_{it} - S_{i(t-5)} \right|}{2(1-S_{mt})}$$

where m is the state that possesses the smallest proportion of structural network power in the system.

3.4. Comparing Measures of National Power

This section compares and contrasts our new measure of national power (SNPI) to the previous measures of national power (focusing on the COW material capability index, CINC). A comparison of the two measures is performed by two sets of analyses: confirmatory factor analyses and correlation analyses (Pearson and Spearman). The first part of this section provides the results and discussion on the confirmatory factor analysis (CFA) of the measurement models of CINC and SNPI. The CFA evaluates the performance of a particular factor structure through a measurement model that assesses the fit of the structure with the data. In other words, the analysis is used to examine the structure of each national power index (CINC and SNPI) by comparing its models to the data, allowing for measurement errors in the indicator variables. The analysis provides insight into which index of national power provides the better fit in its measurement model. The second part of this section provides the results and discussion on the Pearson and Spearman correlation analyses for the two power measures. The analyses indicate the strength and direction of a relationship between the two measures over time.

3.4.1. Confirmatory Factor Analysis (CFA) Measurement Models

Figure 3.1 represents the CFA measurement model[24] of the Composite Index of National Capability (CINC), the most widely used measure of national power in the field of international relations. The index utilizes the following six variables along three dimensions (demographic, industrial, and military): (1) total population (TPOP), (2) urban population (UPOP), (3) energy consumption (ENERGY), (4) iron and steel consumption (IRST), (5) military expenditure (MILEX), and (6) military personnel (MILPER). The single-headed arrow from the construct toward each of the six indicators represents the direct causal effect (also called factor loading or pattern coefficient) of the latent variable on the observed measures; the single-headed arrow from the indicator to its measurement error term represents all variance not explained by the indictor's underlying factor (such as random or systemic error). Figure 3.2 represents the CFA measurement model of the Structural Network Power Index (SNPI), the newly proposed measure of national power. The index utilizes the following six variables along two dimensions (communication and resource flows): (1) diplomatic exchange (DEX), (2) foreign student exchange (FSEX), (3) international telecommunication (TELE), (4) arms transfers (ARMS), (5) international trade (TRADE), and (6) international assistance (ASSIST). Table 3.1 presents the estimates of coefficients and model fit indices for the CFA measurement model for CINC. Table 3.2 presents the estimates of coefficients and model fit indices for the CFA measurement model[25] for SNPI.

[24] Following the conventions of standard CFA models (see Kline 2005, 165-169), two assumptions are held. First, each indicator (X_i, per notation conventions of Jöreskog 1978, or Y_i, per conventions of Bollen 1980) is a continuous variable represented as having two causes: a single underlying factor (ξ_i or η_i) that the indicator is supposed to measure, and all other unique sources of causation that are represented by the error term (δ_i or ε_i). Second, the measurement errors are independent of each other and of the factor.

[25] All of the CFA measurement models examined in this section pass the two necessary conditions (the number of free parameters less than or equal to the number of observations and every latent variable with a scale) and one sufficient condition (at least three indicators for a single-factor model) for model identification (Kline 2005, 169-175).

1. Comparing the standardized coefficients of indicators

The standardized estimates for the six indicators for the CINC measurement model range from .453 to .943 (all statistically significant at p=.001), with the expected positive signs; the estimates represent how much each indicator changes per one-unit change of the construct. For example, the coefficient of .453 for TPOP indicates that for a one-unit change in the factor POWER (CINC), TPOP changes .453 units. The results show that in general, the set of indicators representing a state's population, such as TPOP, UPOP, and MILPER, show the relatively low factor loadings of .453, .728, and .775 (respectively) on CNIC (i.e., relatively low direct causal effects of CNIC on the indicators), compared to the remaining indicators representing a state's consumption or spending (ENERGY, IRST, and MILEX), which have relatively high factor loadings of .970, .935, and .943 (respectively) on CINC. The standardized estimates for the six indicators in the SNPI measurement model range from .490 to .851 (all statistically significant at p=.001), with the expected positive signs; one of the indicators (DEX) shows low factor loading (.490), whereas the other five indicators show relatively high and comparable factor loadings (FSEX with .839, TELE with .753, ARMS with .794, TRADE with .851, and ASSIST with .832).

2. Comparing the reliability coefficients of indicators

The reliability coefficient of each indicator shows how well the construct explains the variance in the indicator. The reliability coefficients of the six indicators for the CINC measurement model range from .205 to .940, showing that the indicator TPOP is the least reliable (only 20.5% of its variance is explained by the latent variable) and the indicator ENERGE is the most reliable (94.0% of its variance is explained by the latent variable). The reliability coefficients of the six indicators for the SNPI measurement model range from .240 to .724, showing that the indicator DEX is the least reliable (only 24.0% of its variance is explained by the latent variable) and that the other five indicators show comparable reliability coefficients (ranging from .567 to .724). The correlations among the six indicators in each measurement model also show a similar pattern. For the indicators of the CINC model, the correlations of TPOP (the least reliable indicator) with the other five indicators are quite low (ranging from .329 to .439) and the remaining correlations between indicators all exceed .564. For the indicators of the SNPI model, the correlations of

DEX (the least reliable indicator in the model) with the other five indicators are quite low (ranging from .369 to .417) and the remaining correlations between indicators all exceed .598.

3. Comparing the model fits

Researchers have used different model fit indices to examine how well the implied model (set by the researchers) portrays the data. Following suggestions by Kline (1998, 2005), Hoyle and Panter (1995), and Hu and Bentler (1999), I use five standard indices to evaluate the overall fit of proposed measurement models (of CINC and SNPI): (1) Bentler's (1990) Comparative Fit Index (CFI), (2) Bentler and Bonett's (1980) Normed Fit Index (NFI), (3) Bollen's (1989) Incremental Fit Index (IFI), (4) the Standardized Root Mean Square Residual (SRMR), and (5) the Akaike Information Criterion (AIC) and its parsimony-adjusted index (ECVI, Browne and Cudeck, 1992).[26] The first three indices (CFI, NFI, and IFI) are called comparative or incremental fit indices, which are the most widely used indices in the structural equation model literature (Kline 2005, 140). The indices assess the relative fit improvement of the implied model (set by the researchers) compared to the null model (or so-called baseline model or independence model), which assumes zero variance among the observed variables. Values for the CFI, NFI, and IFI range from 0 to 1, and any fit of .95 or better is considered to be excellent, while .90 or better is deemed acceptable (Kline 1998, 2005; Hu and Bentler 1999). The fourth index (SRMR) is based on covariance residuals – the differences between observed and predicted covariances. It has been suggested that a value greater than .10 indicates that the model does not explain the associated correlations very well;

[26] The formal definitions of each of the fit indices used are as follows: (1) CFI = 1 – d (Proposed Model) / d (Null Model) where d = $X^2 - df$ where *df* indicates the degrees of freedom of the model, (2) NFI = 1 – X^2 (Proposed Model) / X^2 (Null Model), (3) IFI = (1 – X^2 (Proposed Model) / X^2 (Null Model)) – (*df* / (N – 1)), (4) SRMR is the standardized difference between the observed covariance and predicted covariance, and (5) AIC = X^2 (Proposed Model) + k(k – 1) – 2*df* where k is the number of variables in the model and ECVI = (X^2 (Proposed Model) + k(k – 1) – 2*df*) / (N – 1) where N is the sample size in the model. I have also examined other overall model fit indices and the results are in line with those presented in the section. However, I decided not to use one of the other most widely used fit indices, the X^2 index, because, as Kline (1998, 128) correctly points out, the index is very sensitive to sample size; if the sample size is large (as is the case for all the models examined in this section), the statistic is usually significant even though differences between observed and model-implied covariances are slight. Bollen and Long (1993) and Tanaka (1993) also show that large sample size can supply sufficient statistical power to reject the null hypothesis (indicating the model is significantly different from the data), regardless of the adequacy of model fit.

conversely, a value less than .10 is considered to indicate a "good" model (Kline 2005, 131; Browne and Cudeck 1992, 239). The last two indices (AIC and ECVI) are called predictive fit indices, which assess the model fit in hypothetical replication samples of the same size and randomly drawn from the same population as the researcher's original sample (Kline 2005, 142). The model with the smallest AIC and ECVI is preferred since it represents the best fit (Baron and Kenny 1986).

Table 3.1 shows the different fit indices of the CINC measurement model. Overall, the model fits are far from acceptable range. The first three incremental fit indices are .629 (far from the conventional threshold of .90) and the SRMR is .593 (far from the conventional threshold of .10). Sub-sampling the whole population into five decades (the 1950s, 60s, 70s, 80s, and 90s) reveals that the overall model fits get worse over time (e.g., CFI of .659 for the 1950s to .559 for the 1990s; SRMR of .624 for the 1950s to .641 for the 1990s). Table 3.2 shows the different fit indices of the SNPI measurement model. Overall, the model fits are far better than those of the CINC measurement model and are acceptable. The first three incremental fit indices are .974 (better than the conventional threshold of .90) and the SRMR is .099 (better than the conventional threshold of .10). In contrast to the results from the CNIC measurement model, sub-sampling the whole population into five decades reveals that the model fits improve over time (e.g., CFI of .935 for the 1950s to .972 for the 1990s, SRMR of .181 for the 1950s to .100 for the 1990s). Finally, the predictive fit index (ECVI) for the CINC measurement models is 3.175 for the whole period, worsening over time (3.556 for the 1950s to 3.717 for the 1990s). The SNPI measurement model shows a much better model fit than the CNIC measurement model; the fit index is .094 for the whole period, improving over time (.350 for the 1950s to .112 for the 1990s). Three overall patterns are clearly revealed from the comparison of the fit indices of the CINC and SNPI measurement models. First, the fit indices from the CINC measurement model are far from the acceptable range of a "good" model. In contrast, all the fit indices from the SNPI measurement model are within the range of a "good" model. Second, all the fit indices from SNPI model are far better than those from CINC model, providing the rationale to prefer the SNPI model over the CINC model. Finally, the gap of fit indices between the two models widens over time (i.e., the SNPI model gets better and the CINC model gets worse); in other words, the performance difference between the SNPI model and the CINC model is more apparent over time. Figure 3.3, comparing the overall model fit indices between the CINC and SNPI measurement models based on yearly statistics (instead of the decade statistics in Tables 3.1–3.2) for 1950–2000, also confirms the above three patterns.

4. Sensitivity analyses

I have conducted two sensitivity checks on the CFA measurement models of CINC and SNPI.[27] First, I ran a two-factor measurement model of SNPI (for the two dimensions of the SNPI index) and compared the results with those from the proposed single-factor model of SNPI. The overall results indicate that a two-factor model poorly fits the data and that a single-factor model is superior.[28] The various overall fit indices show little difference between the two; for example, the CFI, NFI, IFI, SRMR, and ECVI for the two-factor model are .975, .975, .975, .101, and .088 (respectively), whereas for the single-factor model they are .974, .973, .974, .099, and .094 (respectively). However, the $X^2_{\text{difference}}$ statistic (45.791 with one degree of freedom, which is significant at the 0.001 level) of the two hierarchical (nested) models[29] indicates that the fit of the single-factor model is significantly better than that of the two-factor model. Second, I performed the CFA measurement models for CINC and SNPI, putting all twelve indicators together. The results show that the six indicators for CINC load on one factor (with the factor loadings ranging from .683 to .921), whereas the six indicators for SNPI load on the other factor (with the factor loadings ranging from .851 to .943).

---

[27] In addition to the two main sets, several additional sets of sensitivity checks on the CFA measurement models were performed, and support the main findings.

[28] Similar results were found with a three-factor measurement model of CINC (for the three dimensions of the CINC index) compared to the results with those from the proposed single-factor model of CINC.

[29] As Kline (1998, 215) points out, the two models are nested because the single-factor model is a constrained version of the two-factor model. If the correlation between the two factors in the two-factor model is fixed at 1.0, then the two factors are identical, which is the same as replacing the two factors with just one factor (as in a single-factor model).

3.4.2. Pearson and Spearman Correlation Analyses

Table 3.3 shows the correlations of CINC with SNPI (different aspects of SNPI and GDP are also compared). Pearson correlations between measures are below the main diagonal and Spearman correlations between measures are above the diagonal. I also split the whole sample into two groups: one of developed states and one of less-developed states, using the yearly medians of GDP.[30] The purpose of the sub-sample correlations is to examine the argument that “the commonly used power capability indices do not adequately tap the underlying concept because they work well only among more developed countries (MDCs) but fail among the less developed countries (LDCs)” (Taber 1989, 29; see also Tellis et al. 2000 and Organski and Kugler 1980).[31] Several overall patterns are clear from the correlation tables. First, the correlation of CINC with SNPI is modest (.551). Second, the Spearman correlation of CINC with SNPI is higher (.718) than the Pearson correlations. This indicates that even though the face validity among the measures is acceptable (as evidenced from the Spearman correlations), the two measures do not completely overlap (as evidenced from the Pearson correlations). Third, providing indirect evidence for the findings by Taber (1989), Tellis et al. (2000), and Organski and Kugler (1980), the Pearson correlations are higher among developed states (.512) than less-developed states (.304), whereas the Spearman correlations are compatible for the two groups (.508 for developed states and .503 for less-developed states). The yearly correlation graphs of Figure 3.4 also confirm the above findings and reveal that the yearly correlations of CINC with SNPI show a similar pattern to that of CINC with GDP.[32]

[30] Using the yearly medians of GDPs as the cutoff points (e.g., 3.724 million dollars in 1950 and 23.309 million dollars in 2000), the countries of the sample in each year were split into two groups. The countries above the yearly median point were categorized as developed and those below as less-developed.

[31] Tellis et al. (2000, 3) argues that most power measures such as GNP and the COW index adequately measure national power for the developed world but fail to do so for developing world, largely due to “analysts’ greater interest in and familiarity with the great power as opposed to the underdeveloped countries.” Organski and Kugler (1980) argue that “although [power measures such as GNP and the COW index] in the case of developed countries can generate some fairly reliable estimates of national capabilities, the same measures, applied to other systems, lead to substantial errors” (66) and, as a result, “such measures fail mainly in cases in which a developing and a developed nation, or two developing nations, go to war with each other” (68).

[32] The congruence between the two measures is also assessed by OLS. Regressing CINC on SNPI, the results show that (1) the SNPI only accounts for 30.3% of the variance in CINC, (2) the variance in CINC explained by SNPI is larger for developed states (26.2%) than for less-developed states (9.2%) and

3.5. Social Network Visualizations of International System Structure and National Power

3.5.1. Social Network Visualization of International System Structure

The sociograms in Figure 3.5 represent one of the international interaction networks used in this project, an arms transfer network of the post-World War II period (1950–2000). These sociograms show how each nation-state node interacts with other nodes in each of the networks in different time periods; they provide a picture of a specific international network and its evolution (for 1950–2000). These sociograms provide the following information: (1) the direction of ties/linkages between nodes represented by the arrowhead of the tie (an arrowhead shows the origin and destination of exchange/transfer), (2) the absolute/relative structural network power of each node represented by the size of the node (a bigger node size means larger raw structural network power score), (3) the major power status, defined by the COW project, represented by the shape of the node (diamond for a major power; a circle for all other states), and (4) the regions of each node represented by the color of the node (the five regions in the international system defined by the COW project)

If I borrow the conception of blocs or poles from polarity theory, in the networks of arms transfers, the sociograms in Figure 3.5 show that: (1) the United Kingdom bloc or pole (in addition to the U.S. and the Soviet Union/Russia blocs) clearly existed until 1960, (2) the bloc led by France emerged in 1960 and persisted through 2000, (3) the Soviet Union/Russia bloc grew beginning in 1970 and persisted through 2000, (4) the size of the U.S. bloc was far larger than the other existing blocs, and (5) a considerable amount of interactions among the bloc-followers occurred, especially since 1970, and the blocs led by each bloc leader[33] were much more intertwined, especially since 1960 (several states in each bloc received arms transfers from members of other blocs). This is quite different from polarity theory's depiction of

declines over time (43.1% for the 1950s to 29.8% for the 1990s), and (3) similar patterns are also found for the regressions of CINC on GDP.

[33] The term bloc leader (or pole leader) refers to the most powerful state within the bloc (or pole). The term bloc follower (or pole follower) refers to all the other states within the bloc (or pole) that are constrained by the regular rules of interactions established and maintained by the bloc leader (or pole leader).

international system structure, which depicted the system during the Cold War era as a bipolar system (the U.S. and the Soviet Union blocs), and, after the demise of the Soviet Union, as a unipolar system (with the U.S. the only bloc). The sociograms also highlight the differences between polarity theory and my social network perspective of international system structure. In polarity theory: (1) the pole leader and pole followers are connected mainly by their alliance formation (or some other foreign policy similarity), (2) the interactions among the pole followers are assumed to be nonexistent or unimportant, (3) the interactions between the members of different poles are assumed to be nonexistent (or minimal), and (4) the pole leaders are the only powerful members in the system. On the other hand, my social network perspective of international system structure during the post-World War II period shows that: (1) the pole leaders and pole followers are connected by different types of interactions (different communication interactions, different resource interactions), (2) the interactions among the followers of one pole and with the members of different poles are significant, and (3) almost all system members (not just the pole leaders) play roles to depict international system structure. One other advantage of my social network approach over polarity theory is that it allows us to express several different characteristics of international system structure as a continuous variable; this permits us to observe transitions much more easily. As mentioned in Chapter 2, polarity theory treats polarity as a categorical, and provides no way to characterize mixed or transitional systems.

Arms transfer networks provide another view of how social network representations differ from the scalar representations of polarity theory. The sociogram in Figure 3.5 of the 1950 arms transfer network shows that the international system is composed of three subnetworks led by the United States, the United Kingdom, and the Soviet Union. The three subnetworks in 1950 show several distinctive structural characteristics that are not revealed by polarity theory. First, each is composed of the subnetwork leader, its exclusive members, and some joint members of different subnetworks (belonging to two or three different subnetworks). Polarity theory has never provided for the possibility of these joint-bloc members. Second, the size of the three subnetworks is quite different; the U.S. subnetwork is the largest with around 30 members, followed by the United Kingdom subnetwork with around 20 members, and the Soviet subnetwork with around 10 members; polarity theory does not describe the relative size of such blocs. Third, the U.S. and the United Kingdom subnetworks are closely linked with each other by the interaction between their subnetwork leaders (the U.S. and the United Kingdom) and the interactions between many of their joint subnetwork members (e.g., ITA, EGY, NTH, BEL, PAK, ISR, NOR, GRC, and DEN). Polarity theory cannot assume such a configuration of connected subnetworks (it can be either a bipolar system with the U.S. bloc vs. the Soviet Union bloc, or a multipolar system with the U.S., the United Kingdom [the connection with the two is ignored], and the Soviet Union blocs). Fourth, polarity theory does not directly capture the interactions among the bloc members other than those interactions from bloc leader toward bloc followers (it only implicitly argues for within-bloc and between-bloc interaction patterns with the claims of "tight" or "loose" blocs), but the sociogram of the 1950 arms network clearly shows several noticeable interaction patterns among the subnetwork followers (e.g., those of CAN, NTH, and ITA in the U.S. bloc; those of SWD, EGY, and ITA in the U.K. bloc; and, those of CZE in the Soviet bloc). Fifth, we also see the important intermediary roles of ITA and CZE (polarity theory does not consider such an intermediary role). ITA plays a role in connecting the U.S./United Kingdom subnetworks to the Soviet Union subnetwork by its direct connection to the Soviet Union; CZE plays a role in connecting the Soviet subnetwork to the United Kingdom subnetwork by its direct connection to SWZ, which is a United Kingdom subnetwork member. These five distinctive characteristics that are revealed by the sociograms of arms transfer networks clearly show that the social network approach of depicting international system structure provides a richer picture of how the system components are connected or interact with each other than the simple poles conception from polarity theory. In addition, the changes of the structure of each type of network and across different types of networks (say, the arms network in 1950 and foreign student network in 1950) clearly reveal that the structure of the international system is more accurately depicted when we consider all the different interaction networks present in the international system.[34]

[34] One other advantage of using the social network approach to depict international system structure is that it can also show the subsystem (or regional) structure on which many previous studies of international relations (also in the regional studies of comparative politics field) have focused (e.g., Lemke 2002). The arms transfer networks in Appendix 3.3 show that the network approach of international system structure can also provide a means of analyzing such regional subsystems (sociograms in Appendices 3.3 and 3.4 are based on states' affiliation in their relevant regions, defined by Bueno de Mesquita 1981, 95–98 and

3.5.2. Social Network Visualization of National Power

In this project, a state's power is based on its structural network power that is derived from its position in different types of international interaction networks. As described above in detail, an individual state's structural power is different depending on the type of network (communication or resource) and on the specific structural network power characteristics (degree-based, betweenness-based, flow-betweenness-based, coreness-based, and ego network brokerage-based structural power). Some states, for example, will be powerful in communication networks but not in resource flows networks; other states will be powerful in the degree-based structural dimension but not in the betweenness-based structural dimension. By considering all these different characteristics of an individual state's structural network power, a social network approach of conceptualizing the state's national power will provide a more sophisticated and richer conception of a state's national power in the international system, compared to the simple material-capability based dominance/submission, the top dogs/underdogs, the core/periphery, the strong/weak, and the top/bottom power arguments in the previous theories in the field.

Figure 3.6 (the arms transfer network in 1950) shows how each state's structural relational power can vary, depending on its different structural dimensions of network power. The main focus of the sociograms in Figure 3.6 is the absolute or relative size of a node within the network, which represents the raw scores of different dimensions of structural network power. For example, the analysis of the arms transfer network in 1950 shows that the structural network power of each state differs, depending on the different conceptualizations of structural network power adopted. In the degree aspect of structural

---

adapted by the COW project). From the sociograms, we can see how each subsystem is configured (i.e., how regional members are connected with each other in their regional settings) and how the structural characteristics of subsystems are similar to or different from those of the whole international system. Several distinctive structural features in the Asian arms transfer networks from Appendix 3.3. stand out (as compared to the whole system structure). First, the region is mainly divided into two subregions during the Cold War era (one led by the U.S. and the other led by the Soviet Union), comprising multiple subregions during the post Cold War era. Second, the U.S.-led subregion outnumbers by a great deal the Russian-led subregion; third, the United Kingdom and France play less active roles (the former less than the latter) in the U.S.-led subregion, while China plays an important role in the Russian-led subregion since 1980. Finally, the network becomes much more intertwined over time (in terms of interactions among members within and across the two subregions).

network power that focuses on each node's (state's) centrality according to its total number of connections to other nodes (states) in the network, the U.S. and the United Kingdom held the two most powerful positions in the network, and the Soviet Union held a comparable but less powerful one. The U.S. and the United Kingdom are the most visible actors in the network, and therefore they are "where the action is" in the network of the 1950 arms transfer network (Wasserman and Faust 1994).

Regarding the betweenness aspect of structural network power that focuses on each node's (state's) centrality according to its capacity of standing on the paths or geodesics (i.e., minimal length paths) that connect two other nodes (states) in the network, we see the following in 1950: (1) the United Kingdom held a relatively less powerful position, (2) the Soviet Union held a powerful position compared to the most powerful state, the U.S., and (3) Italy, due to its structural position, connecting the three blocs of the U.S., the United Kingdom, and the Soviet Union, held a powerful position that is comparable to the two most powerful states, the U.S. and Soviet Union. Those states that held positions in the between aspect of structural network power played the role of a "broker" or "gatekeeper" with a potential for control over other states in the network (Scott 2000). In the flow-betweenness aspect of structural network power that focuses on each node's (state's) centrality according to its capacity of standing on both the direct and indirect paths that connect two other nodes (states) in the network, Canada became one of the two most powerful states in the network because it transferred arms to the state (the U.S.) that held the other most powerful position within the network by transferring arms to some 30 states. In the coreness aspect of structural network power that focuses on each node's (state's) centrality according to its degree of coreness to the other nodes (states) in the network, the U.S. is shown to hold the most powerful position in the network. In the egonet brokerage aspect of structural network power that focuses on each state's centrality based on its level of brokerage within its own ego network, the U.S., the United Kingdom, Soviet Union, Italy, Canada, Netherlands, and Czechoslovakia all show levels of brokerage that are the highest within their own ego networks.[35]

[35] As in Appendix 3.3, the social network approach can be used to analyze national powers among regional subsystem members. For example, Appendix 3.4 (of the Asian arms transfer network in 1950) shows that: (1) overall, the U.S. held the most powerful position in the Asian arms transfer network, (2) the United Kingdom and the Netherlands held quite powerful structural positions due to their roles of

3.6. Central Principles and Hypotheses: A Social Network Perspective

3.6.1. Four Central Principles

Wasserman and Faust (1994, 4) provide the four central principles underlying the network perspective in general. First, actors and their actions are regarded as interdependent rather than autonomous, independent units. Second, relational linkages (ties) between actors are channels for the transfer or "flow" of resources (either material or nonmaterial). Third, network models focusing on an individual actor view the network structural environment as providing opportunities for or constraints on individual action. Fourth, network models conceptualize structure (social, economic, political, and so forth) as relatively persistent multilink patterns of relations among actors.

This set of four central principles will be applied to the study of international relations in the following ways. First, sovereign states in the international system and their behaviors are viewed as interdependent rather than independent. Sovereign states conduct their foreign policies in multiple social networks of international relations. I primarily focus on two broad sets of such social networks: the set of communication networks (composed of diplomatic exchange, foreign student exchange, and international telecommunication networks) and the set of resource networks (composed of arms transfer, international trade, and international assistance networks). The assumption of interdependent units (rather than autonomous and independent units) argues that the main interests of the social network perspective on international relations are the interdependence of states (1) within each type of social network (say, arms transfer networks) and (2) across different types of social networks (say, three different resource networks) and how states' behaviors in a particular network are affected by their behaviors in other interaction networks. For example, South Korea's actions in one social network (for example, arms transfers) are being affected by and affecting another state's (for example, the United States') actions in the same

---

connecting the two most viable blocs (the U.S. and the United Kingdom blocs) in the network, and the Soviet Union did so with their arms transfers to China and North Korea, and (3) the U.S., the United Kingdom, the Soviet Union, and the Netherlands all showed that their levels of brokerage were the highest within their own ego networks of the 1950 Asian arms transfer network.

network and in a different network (such as the international trade network). The first assumption posits that we will not be able to conceive the units in our social networks of international relations as truly isolated from other units (unless they are actually isolated) in the system.

Relational ties (linkages) between states in the international system are channels for the transfer or "flow" of resources (either material or nonmaterial). Relational linkages (ties) between states in the system are focused on two sets of social networks in the international system. In the first set of communication networks, relational ties between sovereign but interdependent states are channels of communication exchanges that show how states are connected or interact with each other through diplomatic channels (how diplomatic missions are exchanged/transferred between states), academic channels (how foreign students are exchanged/transferred between states), and telecommunication channels (how international telephone messages are exchanged/transferred between states). In the second set of resource networks, relational ties (linkages) between sovereign but interdependent states are channels of resource transfers that show how states are connected or interact with each other through arms channels (how arms are transferred/exchanged between states), trade channels (how foreign goods and services are transferred/exchanged between states), and monetary channels (how international monetary assistance is transferred/exchanged between states).

The network perspective presumes that the social networks of international relations provide the structural environment that constrains the foreign policy behaviors of their member states. The two-way processes of (1) interdependent states and their relational linkages creating the social networks and (2) the created social networks constraining each state's behaviors enable us to perceive (3) the structure of the international system and (4) the processes that create it. This third principle gives us a rationale for (1) the two-way processes of interdependent states and their relational linkages that define the main characteristics of the resultant social networks (e.g., using such measures as network centralization and network density) and (2) the created social networks defining the structural network power of individual states from their positions in the networks.

Finally, the network perspective of international relations conceptualizes the structure of the international system based on observed patterns of interaction among individual states in the system.

Even though interaction patterns are never perfectly stable (i.e., there is always some change from one time period to the next), the network perspective posits that interaction patterns persist long enough for there to be significant constraints on the structure of the international system. As the first principle above implies, not only are the social networks of international relations intertwined across different sets (e.g., across the three different communication/resource networks and across the two different types/sets of communication and resource networks), but each type of social network is evolving, and in such a way that is constrained by past and present interaction patterns.[36] For example, the structural characteristics of the arms transfer network in 1952 depend on those of the arms transfer network in 1951; the structural characteristics of the international assistance network in 1951 depend on those of the arms transfer networks in 1951 Based on this principle, I will use time-series analyses (1950–2000) based on the time-series data of different types of interaction networks in the international system. This persisting but co-evolving sense of system structure provides us with a better conception than previous approaches such as hegemonic stability and polarity theories. The latter are only able to provide us with a rough categorization of different system structures and rather time-invariant views of them.

3.6.2. Hypotheses To Be Tested in the Two Empirical Chapters

The social network conception of national power is applied to two empirical phenomena focused on their power explanations. This project is the application of the relatively new (at least in the field of international relations) network power concept to examine the old but still unresolved empirical phenomena in world politics. The contributions of this project are not only the introduction of this new social network power concept (focused on relational rather than attributional power) but also how this new power concept is applied to the two old power theories in the field (balance of power and power preponderance theories). In other words, the key concept of a social network power, conceptualized as acting within and derived from its position within a network of international relations, is a solution or a

[36] This, of course, is also at tension with the idea of a stable pattern of interactions that reproduces itself.

tool to attack the existing theories in the field; a social network power in this project intends to address/examine the puzzles that are raised by other previous research and theories.

The two empirical phenomena examined with the new social network conceptions of international system structure and national power are international militarized conflicts and economic sanctions. In the chapter on international conflicts, the new social network power concept is applied to balance of power and power preponderance theories at both systemic and dyadic levels. My main questions are the following: (1) does the increased level of systemic structural network power concentration, change, and movement lead to an increased or decreased level of systemic conflict onset, and (2) does the structural network power balance between the two states in a dyad increase or decrease the probability of dyad conflict onset? In the following chapter on international sanctions, the network power concept is applied to the power explanations. My main questions here are: (1) does the structural network power balance between sanctioning and target states in a dyad increase or decrease the probability of sanction success, and (2) does the structural network power of the target in a dyad increase or decrease the probability of sanction success?[37] The focus of hypothesis testing in the two empirical chapters is on how my new social network conceptions of international system structure and national power lead to more accurate and powerful empirical models than previous ones mainly rooted in attribute logic. In other words, I take existing theories and models as the starting point, and ask how they perform when they are modified by my newer social network conceptions of international system structure and national power. In both chapters, the focus will be on how the new social network power concept answers the empirical questions of the old material-based power theories regarding the power-balance between states in a dyad. The performance of empirical models using structural network power measures will be compared against those using attribution-based power measures, through nonparametric model discrimination statistics and information measures (AIC and BIC).

[37] To measure the structural network power balance between sanctioning and the target states, one would first have to measure the target's power, so these two hypotheses are not really two distinct ones—the second is contained within the first hypothesis.

1. Hypotheses on Militarized Conflict Onset

At the Systemic Level

Three hypotheses are tested in the section on systemic study of militarized conflicts. The first part of the military conflict empirical chapter focuses on testing the propositions from the debate among the advocates of balance of power vs. those of power preponderance theory at the systemic level, modified by my new social network conceptions of international system structure and national power. The three hypotheses on structural characteristics of the system and systemic conflicts are based on Singer, Bremer, and Stuckey (1972); Bueno de Mesquita (1981); Thomson (1983); Bueno de Mesquita and Lalman (1988); and Mansfield (1994). The details on the two power explanations on systemic conflicts can be found in Chapter 2, and the following three hypotheses are tested based on the balance of power theory at the systemic level (the hypotheses based on the power preponderance theory will have the opposite relationships).

Hypothesis 1. The greater the level of systemic structural network power concentration, the greater the level of systemic conflicts. However, there is an inverted U-shaped relationship between systemic power concentration and conflicts.

Hypothesis 2. The greater the rate of systemic structural network power change, the greater the level of systemic conflicts.

Hypothesis 3. The greater the rate of systemic structural network power movement, the lesser the level of systemic conflicts.

At the Dyadic Level

Two hypotheses are tested in the section on dyadic study of militarized conflicts. The second part of the military conflict empirical chapter focuses on testing the propositions from the debate among the advocates of balance of power vs. power preponderance theory at the dyadic level, modified by my new social network conceptions of international system structure and national power. The two hypotheses below test the effect of structural network power balance, using the network power analyzed at the dyadic level. This use of a new power concept is based on the core argument that a state's power should be conceptualized focusing on the social network perspective of international system structure (on different types of communication and resource networks) and measured by taking account of its interactions with all other states in those different types of social networks in international relations. The details on the two power explanations of dyadic conflicts can be found in Chapter 2. Basically "balance of force" theorists argue that if a state enjoys a power advantage over its adversary, it is more likely to be involved in a dispute because it is more likely to succeed, and the cost of dispute involvement is likely to be low. On the other hand, "power preponderance" theorists argue that a power preponderance between states will preserve peace, because it reduces the uncertainties of winners and losers in a dispute.

Hypothesis 1. The parity of structural network power decreases the probability of the onset of dispute.

Hypothesis 1'. The preponderance of structural network power decreases the probability of the onset of dispute.

2. Hypotheses on Economic Sanctions Success

The two hypotheses that are tested in the economic sanctions empirical chapter are on the power relationship between sanctioning and target states, modified by my new social network conceptions of international system structure and national power. The two main hypotheses in this study are based on (1) the results from those of previous empirical research (generally, the negative effect of sender/target power balance and, as a consequence, the positive effect of target power on sanction success. As I noted earlier, the two hypotheses are closely related to each other, as the second hypothesis is contained within the first), and (2) the use of the structural network power concept (based on the social network concept of international system structure) to measure the power balance between sender and target, and the target's power. Based on the previous empirical research regarding the powers of sender and target and the structural network power concept derived from this project, it will be hypothesized: (1) that the relative structural network power difference will have the expected negative effect (from Hypothesis 1, the lower structural network power balance of sender/target leads to the higher sanction success), and (2) that the structural network power of the target will have the opposite positive effect on sanction success (Hypothesis 2, the higher structural network power of the target leads to higher sanction success). As Lam (1990) points out, the sender usually is less likely to put much importance on foreign policy goals (of economic sanctions) toward a less powerful target (245), and this low resolve or low commitment of the sender toward a less powerful target eventually leads to sanction failure (Hypothesis 2). As Elliott and Uimonen (1993) point out, the larger the sender's power relative to the target's, the lower the stakes involved, and therefore the weaker the commitment of the sender (408–409). The low stakes of the sanction or the low commitment of the sender ultimately leads to the sanction failure (Hypothesis 1). Since the two hypotheses are complementary (in the sense that when the target's power is large, the relative power balance of sender/target is relatively small, and vise versa), the argument for either one of the hypotheses will be applied to support the other hypothesis.

As I pointed out in the measurement section, the structural network power of each state also represents how well it is globalized (communication globalization from the first dimension of communication patterns; economic globalization from the second dimension of resource flows) in the international system. Structural network power also represents each state's level of globalization in the system; how centrally each state is positioned in the network of relations shows how well each state is globalized in the web of network relations. Based on this conceptualization, Hypothesis 2 will also test the argument that a highly globalized target (i.e., a target with relatively high structural network power) will be more severely hurt by the economic sanction, and therefore more likely to concede to the sender's demands, because the sender usually makes its best effort to disconnect the target's globalization web (i.e., isolate the target from its interactive relations with other states) especially in the economic arena (e.g., target's access to international trade or investment market). The well-globalized target will be more seriously hurt by the sanction, and the high price that is paid by the target ultimately leads to concessions. The use of the structural network power concept (based on the social network concept of international system structure) in this study is based on the core argument of this project, positing that a state's power should be: (1) conceptualized focusing on the social network perspective of international system structure (on different types of communication and resource networks), and (2) measured by taking an account of its interactions with all other states in the system in those different types of social networks in international relations. Accordingly, the measures of these structural network powers (for the sender-target balance and for the target) are derived from using six types of international interaction data (on the dimensions of communication patterns and resource flows) using the social network analysis. In the sanction empirical chapter, I argue that the two hypotheses regarding the sender/target power balance and the target's power are more accurately examined with this new power concept, called "structural network power;" this concept captures more accurately the powers of two states in a sanction than all of the previous measures (in HSE 1990; Lam 1990; Elliottt and Uimonen 1993; Morgan and Schwebach 1997; Drezner 1998, 1999; Hart 2000; and Nooruddin 2002). The two hypotheses tested are as follows:

Hypothesis 1. The lower the difference in the levels of structural network power between sender and the target, the higher the probability of success.

Hypothesis 2. The higher the structural network power for the target, the higher the probability of success.

3.7. Conclusion

A state in the international system always interacts with other states in different issue areas. This project posits that each state's structural network power comes from its interactions with other states in different networks of the international system, and that the structure of the international system is shaped or defined by the interactions of the system members in those different social networks in the international system. This project argues that when we conceptualize the international system structure, we should focus on those different interaction networks and how states are structured in those different networks of the system (i.e., conceptualize international system structure and states' national power from the social network approach). This project is the application of social network perspective to the study of international relations. One of its main focuses is that the international system is composed of different social networks (e.g., networks of arms transfers, international trade, international assistance, diplomatic exchanges, foreign student exchanges, and international telecommunication) among sovereign but interdependent states in the system. This project argues that when we consider all those different social networks in the system, we will more correctly depict how the structures of the international system affect each state's behaviors, and how each state's structural position in the system affects its behaviors with other members of the system.[38] This project takes existing theories and tests them using my newer network conceptions of the international system; this project also focuses on the conception of the international system as networks, and is primarily interested in how this newer conception leads us to recast a great deal of existing empirical work. Does a structurally centralized or concentrated international system induce a more peaceful world, or just the opposite; and how is the structural network power balance between states related to their conflict behaviors? How are the structural network powers of the sanction sender and its target, and the structural power balance between the two related to the onset and success of economic sanctions? What are some distinctive characteristics of militarized disputes networks and economic sanctions networks? These are some of the research questions to be examined in this project of social network application to international relations. This project also emphasizes the graphical representations (in a global map) of states' interaction with other members of the international system (Gleditsch and Ward 2005); it also emphasizes how useful the sociograms (produced by the social network analysis) of different international networks are in depicting and highlighting the distinctive characteristics of international system structure and the different interaction relations among system members in the international system.

In this project, I apply the social network analysis to different types of interaction relations among international system members. It posits that the interactions of states are played out within the web of different social networks, and that the structure of different networks and the structural power of each state measured by their interactions with other states in the networks play important parts in their behaviors in the international system. This new conception of international system structure and of each state's network power based on the network perspective is different from other previous studies in the field of

[38] Social network theorists emphasize the same arguments. For example, Scott (2000, 14) argues that "The structure of relations among actors and the location of individual actors in the network have important behavioral, perceptual, and attributional consequences both for the individual units and for the system as a whole" (see also Mitchell 1969).

international relations, where system structure is focused on one of or a few of the most powerful (in the material-capability sense) states in the system and a state's power in the system has been defined solely focused on its attributional power (especially, material-based capability). This project argues that international system structure is more accurately depicted by considering different types of interaction networks participated in by all the member states in the international system, and that the power of each state is more accurately conceptualized by considering how it interacts with all other states in the international system of different networks. This project develops a more accurate way of depicting the international system structure and of conceptualizing each state's national power in the international system using a social network perspective. By focusing on the network characteristics of interaction patterns between states in the system, we can depict a more complete picture of the structure of the international system, each state's structural power in the system, the distribution of structural power in the system, and the changes of both a state's structural power and its distribution. Based on these two new conceptualizations of international system structure and of a state's structural national power, the next two chapters focus on: (1) the empirical analyses of the onset of international militarized disputes; and (2) the empirical analyses of the onset and success of economic sanctions.

Table 3.1 Evaluation of a Measurement Model of Composite Index of National Capability (CINC)

Correlations	TPOP	UPOP	ENERGY	IRST	MILEX	MILPER	R^2	Standardized Coefficient	
TPOP	1.000						0.205	0.453	
UPOP	0.329	1.000					0.529	0.728	
ENERGY	0.439	0.706	1.000				0.940	0.970	
IRST	0.423	0.680	0.906	1.000			0.874	0.935	
MILEX	0.427	0.686	0.914	0.881	1.000		0.889	0.943	
MILPER	0.351	0.564	0.752	0.725	0.731	1.000	0.601	0.775	
Goodness of Fit Summary									
	X^2	*df*	X^2/df	CFI	NFI	IFI	AIC	ECVI	SRMR
1950–2000	22626.208	9	2514.023	.629	.629	.629	22662.208	3.175	.593
1950s	2905.042	9	322.782	.659	.659	.659	2941.042	3.556	.624
1960s	4520.527	9	502.281	.642	.642	.642	4556.527	3.720	.640
1970s	5718.195	9	635.355	.575	.575	.575	5754.195	3.944	.659
1980s	5900.541	9	655.616	.570	.570	.570	5936.541	3.713	.640
1990s	7487.214	9	831.913	.559	.559	.559	7523.214	3.717	.641

Table 3.2 Evaluation of a Measurement Model of Structural Network Power Index (SNPI)

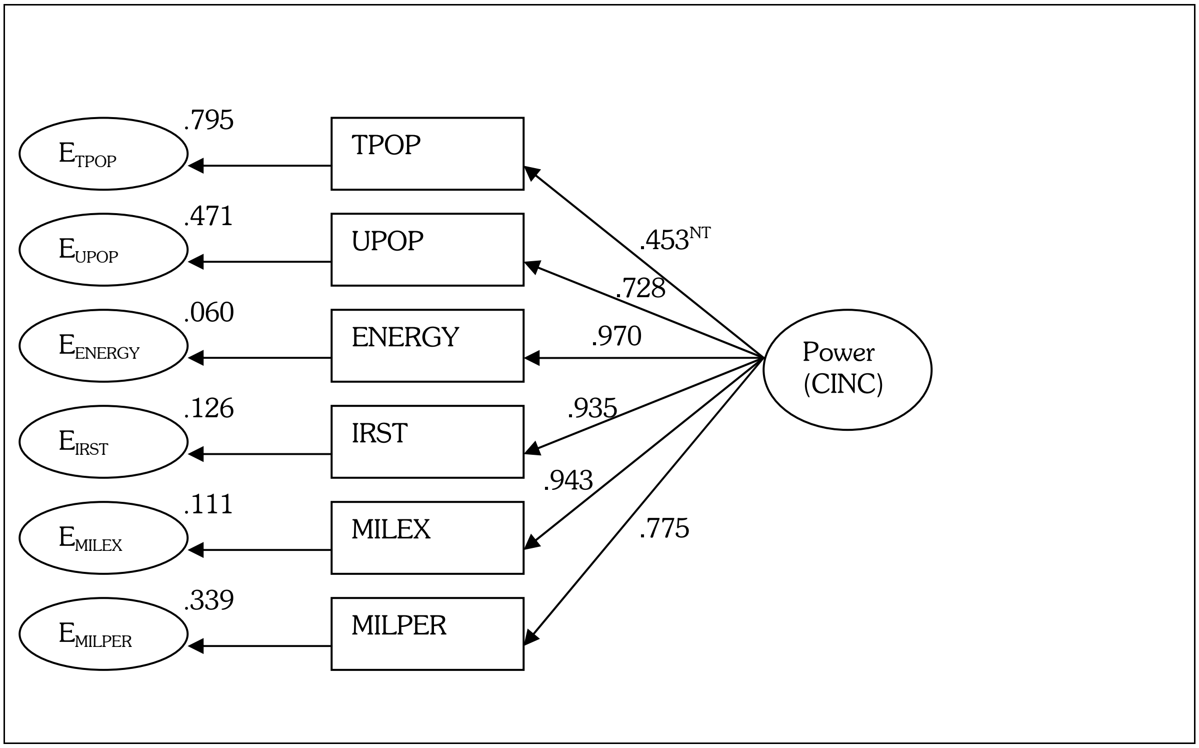
Correlations	DEX	FSEX	TELE	ARMS	TRADE	ASSIST	R^2	Standardized Coefficient	
DEX	1.000						0.240	0.490	
FSEX	0.411	1.000					0.704	0.839	
TELE	0.369	0.632	1.000				0.567	0.753	
ARMS	0.389	0.667	0.598	1.000			0.631	0.794	
TRADE	0.417	0.714	0.640	0.676	1.000		0.724	0.851	
ASSIST	0.407	0.698	0.626	0.661	0.708	1.000	0.692	0.832	
Goodness of Fit Summary									
	X^2	*df*	X^2/df	CFI	NFI	IFI	AIC	ECVI	SRMR
1950–2000	634.204	9	70.467	.974	.973	.974	670.204	.094	.099
1950s	253.162	9	28.129	.935	.932	.935	289.162	.350	.181
1960s	271.224	9	30.136	.947	.945	.947	307.224	.251	.154
1970s	100.784	9	11.198	.981	.980	.981	136.784	.094	.084
1980s	147.882	9	16.431	.975	.974	.975	183.882	.115	.098
1990s	190.560	9	21.173	.972	.970	.972	226.560	.112	.100

Table 3.3 Pearson and Spearman Correlations of CINC and GDP with SNPI

All	CINC	GDP	Degree	Betweenness	Flow-Betweenness	Coreness	Egonet Brokerage	SNPI
CINC		0.823	0.692	0.805	0.774	0.717	0.669	0.718
GDP	0.550		0.715	0.731	0.700	0.692	0.669	0.712
Degree	0.501	0.481		0.824	0.840	0.961	0.854	0.989
Betweenness	0.703	0.534	0.776		0.925	0.837	0.816	0.844
Flow-Betweenness	0.717	0.494	0.808	0.982		0.833	0.830	0.850
Coreness	0.537	0.492	0.960	0.809	0.827		0.829	0.990
Egonet Brokerage	0.464	0.422	0.896	0.656	0.706	0.874		0.852
SNPI	0.551	0.502	0.986	0.831	0.854	0.991	0.888	
Underdeveloped	CINC	GDP	Degree	Betweenness	Flow-Betweenness	Coreness	Egonet Brokerage	SNPI
CINC		0.535	0.484	0.525	0.536	0.489	0.379	0.503
GDP	0.200		0.439	0.270	0.341	0.359	0.320	0.401
Degree	0.285	0.347		0.694	0.798	0.930	0.828	0.971
Betweenness	0.795	0.043	0.334		0.858	0.672	0.657	0.694
Flow-Betweenness	0.658	0.129	0.490	0.768		0.749	0.732	0.784
Coreness	0.262	0.269	0.932	0.335	0.456		0.759	0.986
Egonet Brokerage	0.219	0.214	0.690	0.298	0.460	0.643		0.802
SNPI	0.304	0.316	0.985	0.369	0.509	0.979	0.684	
Developed	CINC	GDP	Degree	Betweenness	Flow-Betweenness	Coreness	Egonet Brokerage	SNPI
CINC		0.603	0.487	0.646	0.640	0.477	0.530	0.508
GDP	0.523		0.550	0.535	0.503	0.453	0.552	0.518
Degree	0.459	0.466		0.793	0.765	0.937	0.802	0.984
Betweenness	0.681	0.506	0.816		0.901	0.788	0.804	0.819
Flow-Betweenness	0.693	0.461	0.827	0.986		0.734	0.802	0.778
Coreness	0.493	0.467	0.954	0.832	0.832		0.780	0.981
Egonet Brokerage	0.407	0.387	0.882	0.655	0.687	0.850		0.811
SNPI	0.512	0.481	0.984	0.864	0.868	0.989	0.867	

NOTE: The upper, right sided quadrant represents Spearman correlations among measures. The lower, left-sided quadrant represents Pearson correlations.

Figure 3.1 Confirmatory Factor Analysis of Six Components of National Power (CINC)



NOTE: NT=not tested, the parameter is constrained to 1 for the scaling.

Figure 3.2 Confirmatory Factor Analysis of Six Components of National Power (SNPI)

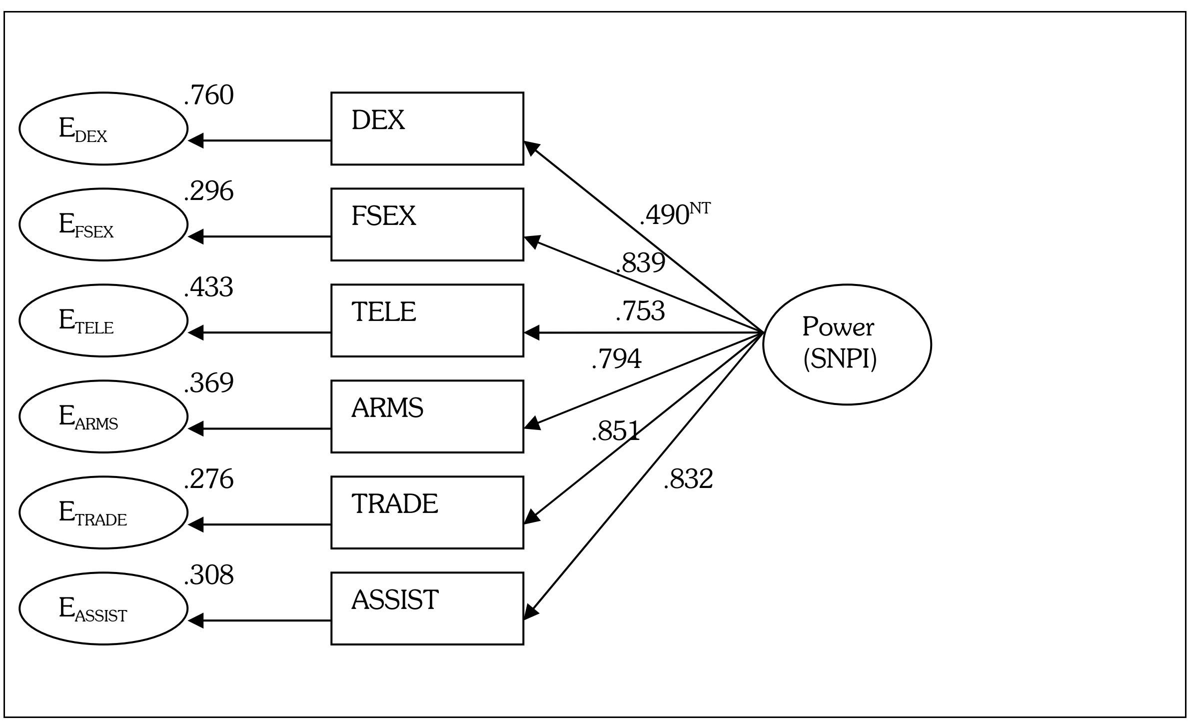
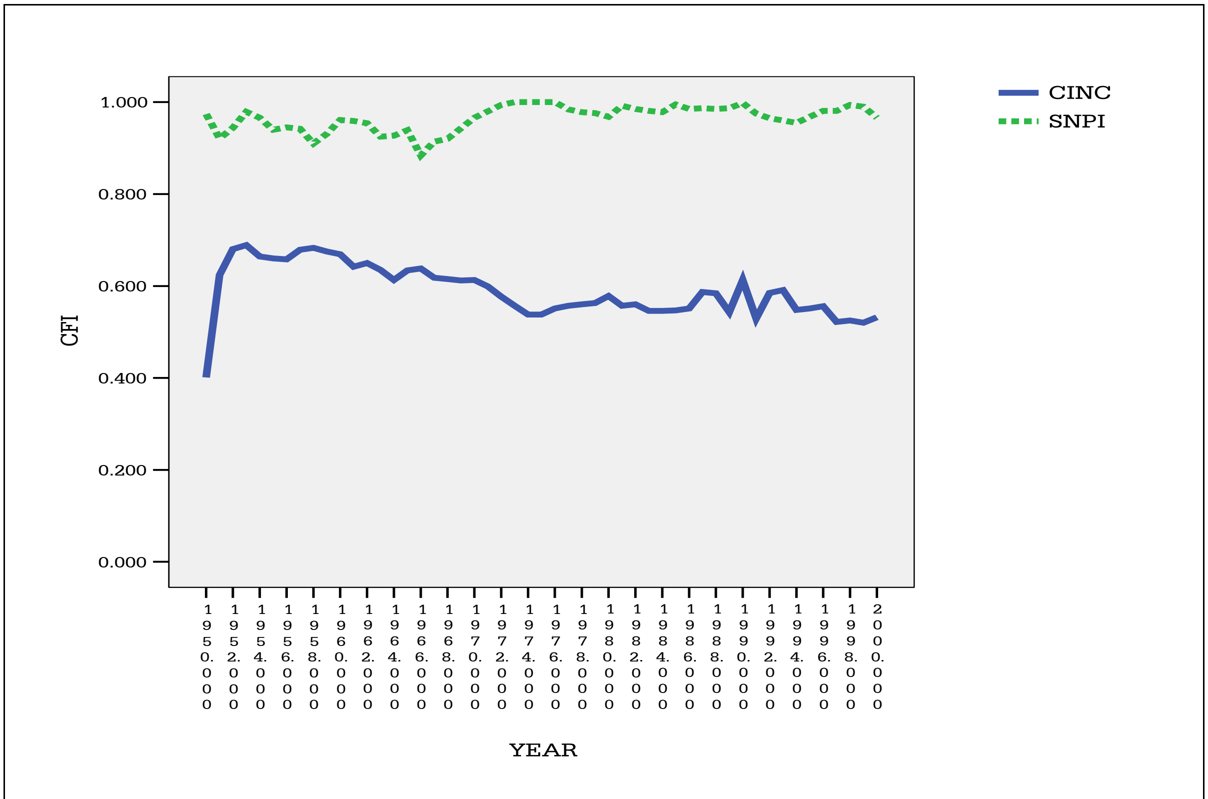


Figure 3.3 Fit Indices of CINC with SNPI



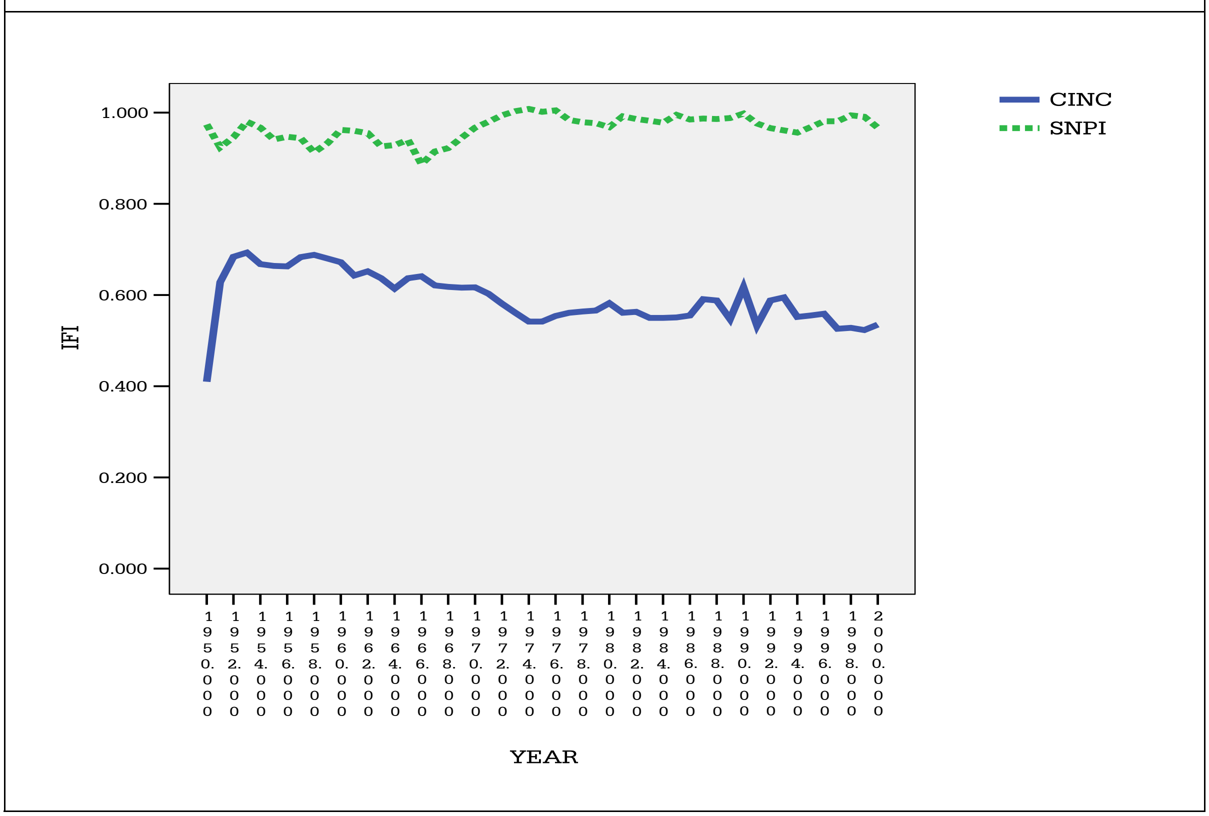


Figure 3.3 Fit Indices of CINC with SNPI (Continued)

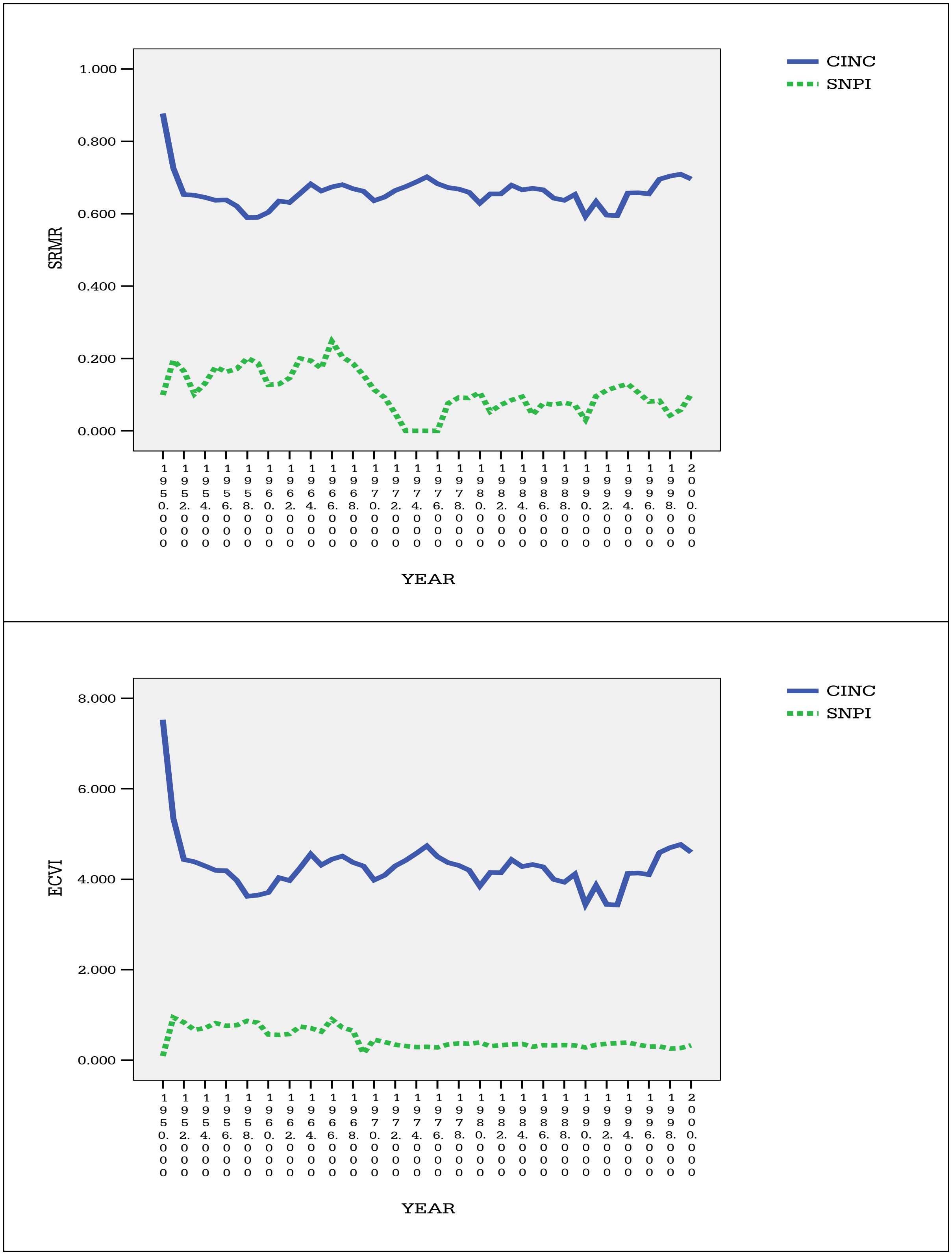
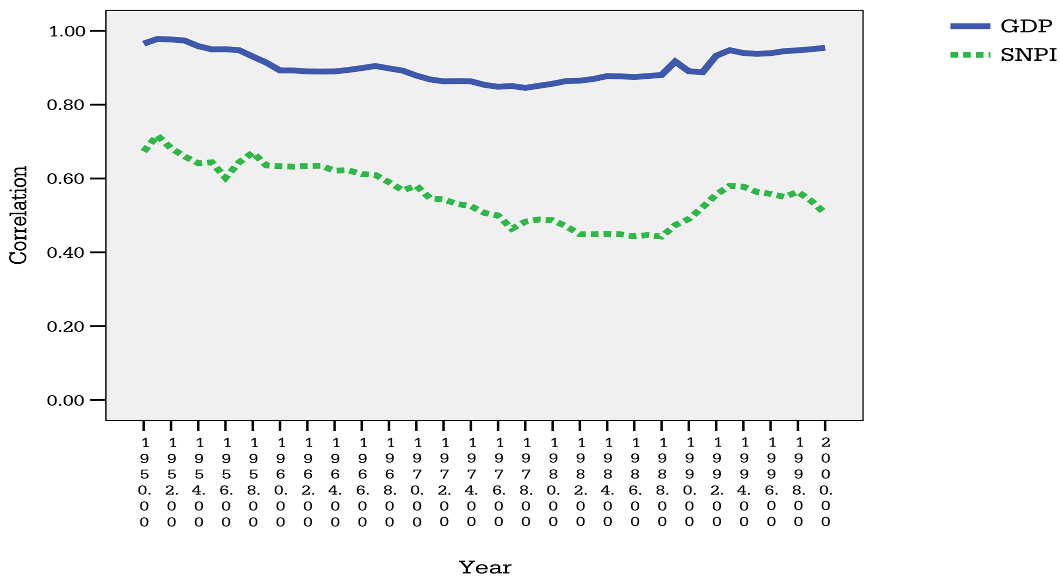


Figure 3.4 Pearson and Spearman Correlations of CINC and GDP with SNPI

Pearson (All)



Spearman (All)

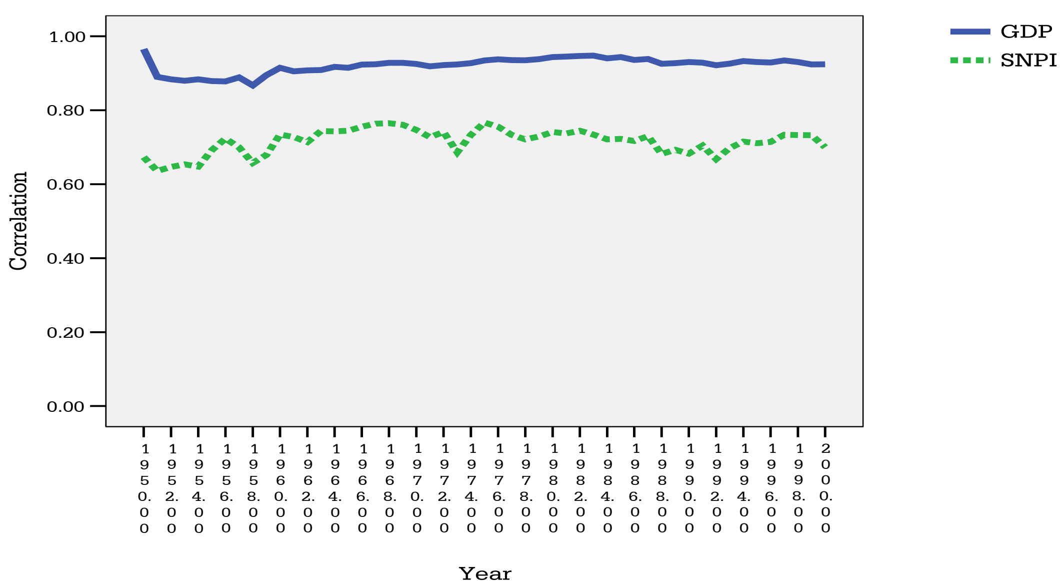
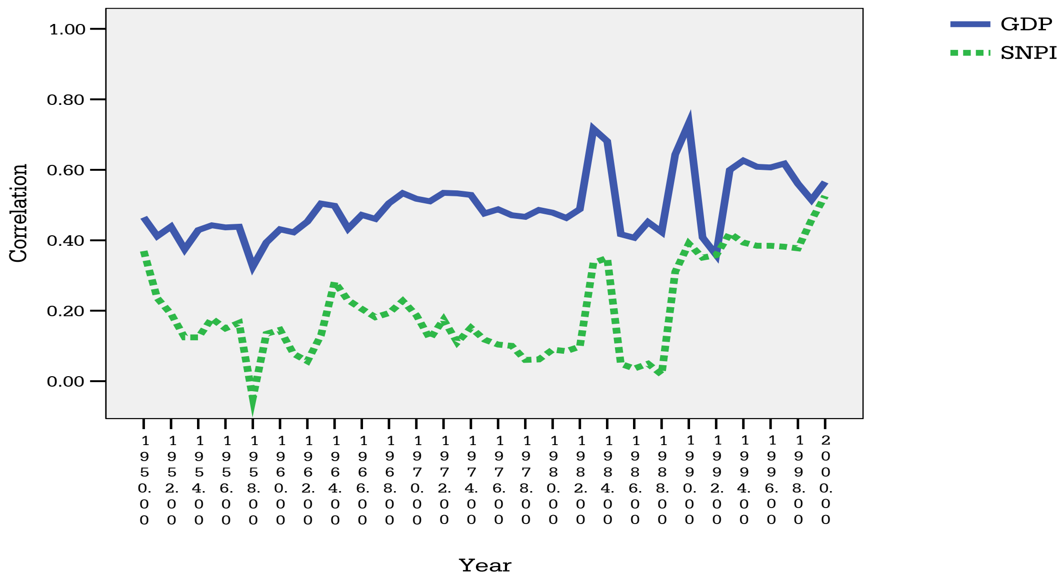


Figure 3.4 Pearson and Spearman Correlations of CINC and GDP with SNPI (Continued)

Pearson (Underdeveloped)



Spearman (Underdeveloped)

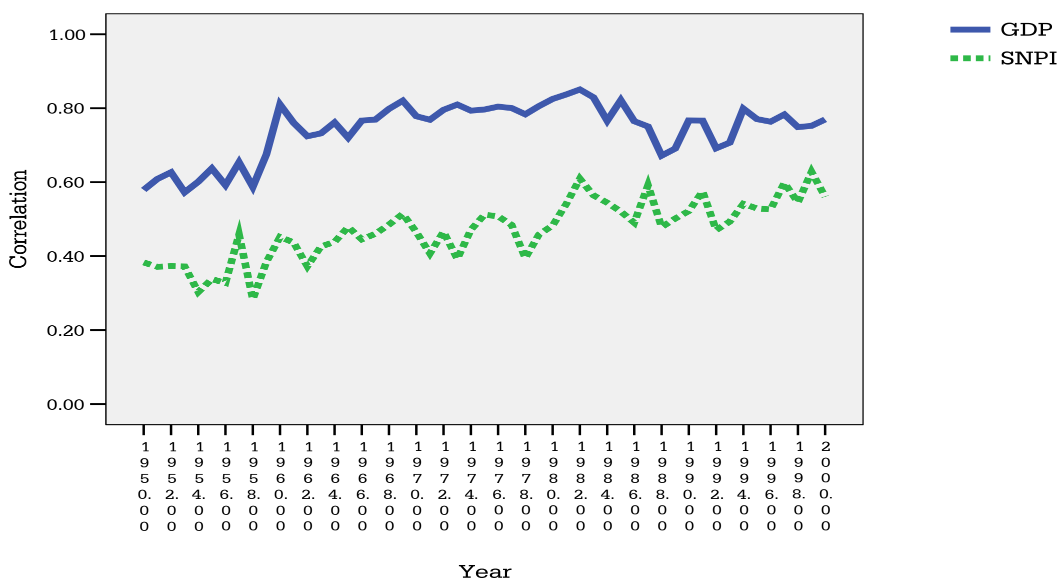
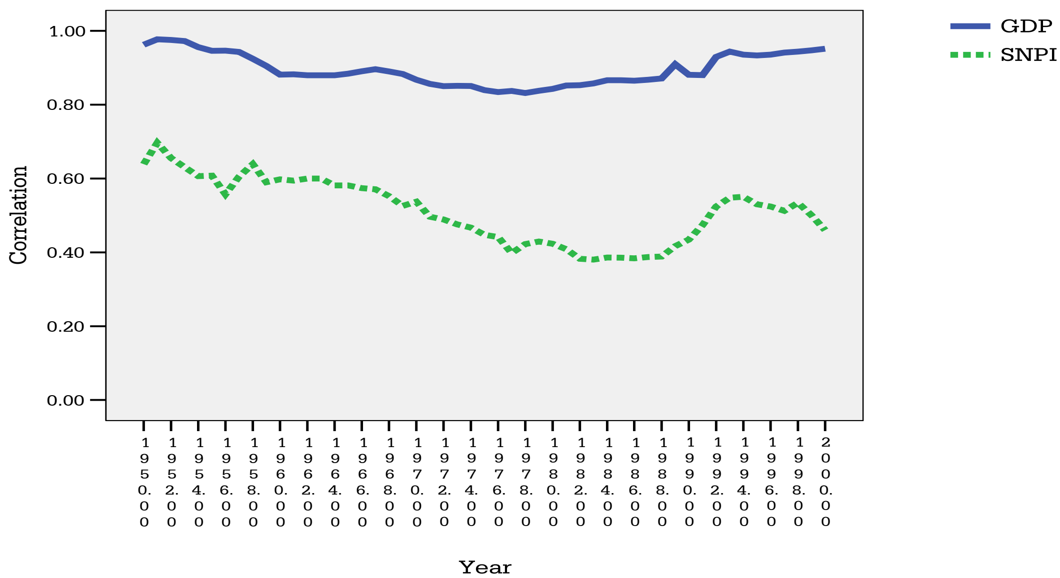


Figure 3.4 Pearson and Spearman Correlations of CINC and GDP with SNPI (Continued)

Pearson (Developed)



Spearman (Developed)

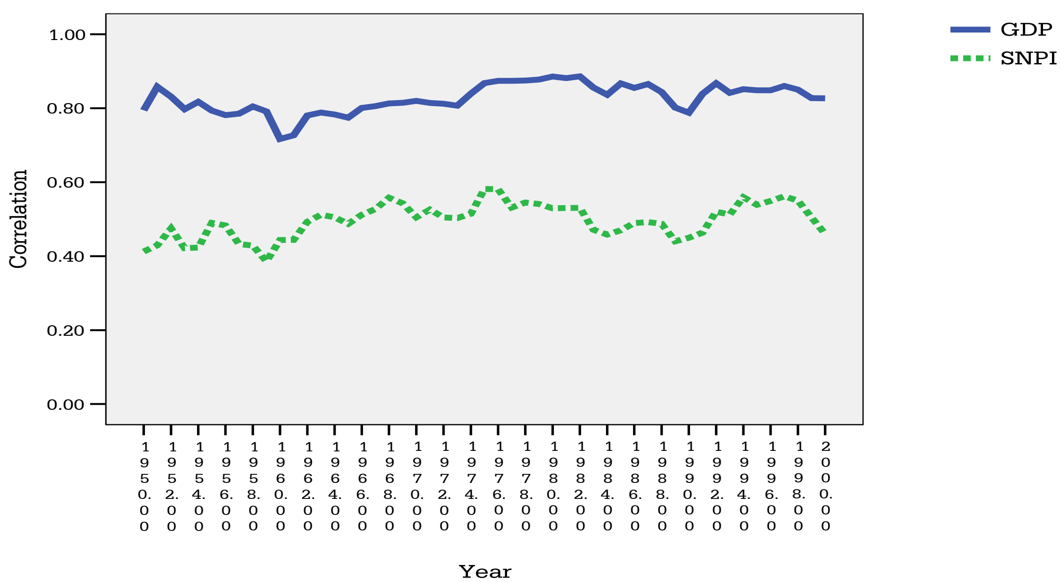


Figure 3.5 Arms Transfer Networks, 1950–2000: Social Network Perspective of International System Structure

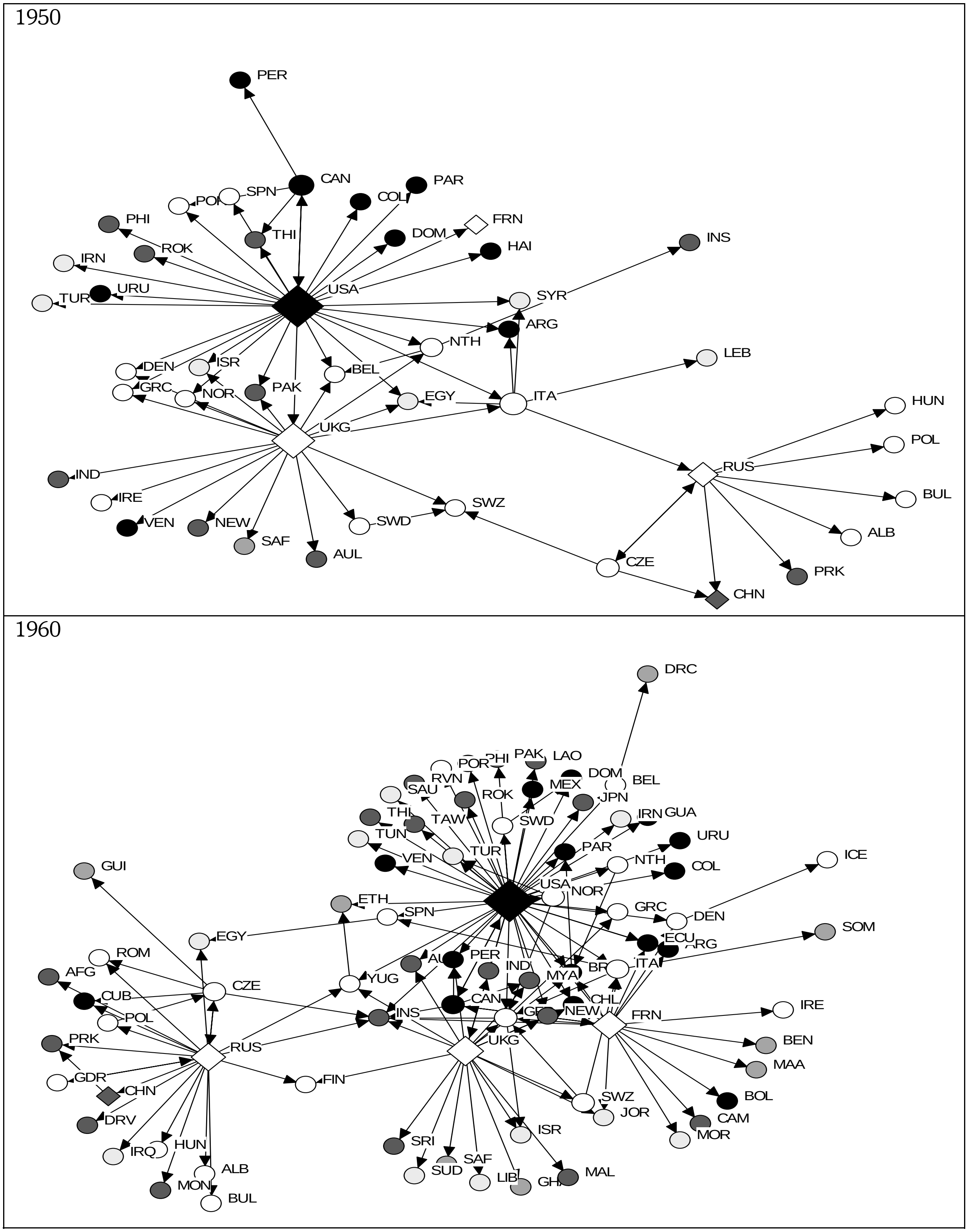


Figure 3.5 Arms Transfer Networks, 1950–2000: Social Network Perspective of International System Structure (Continued)

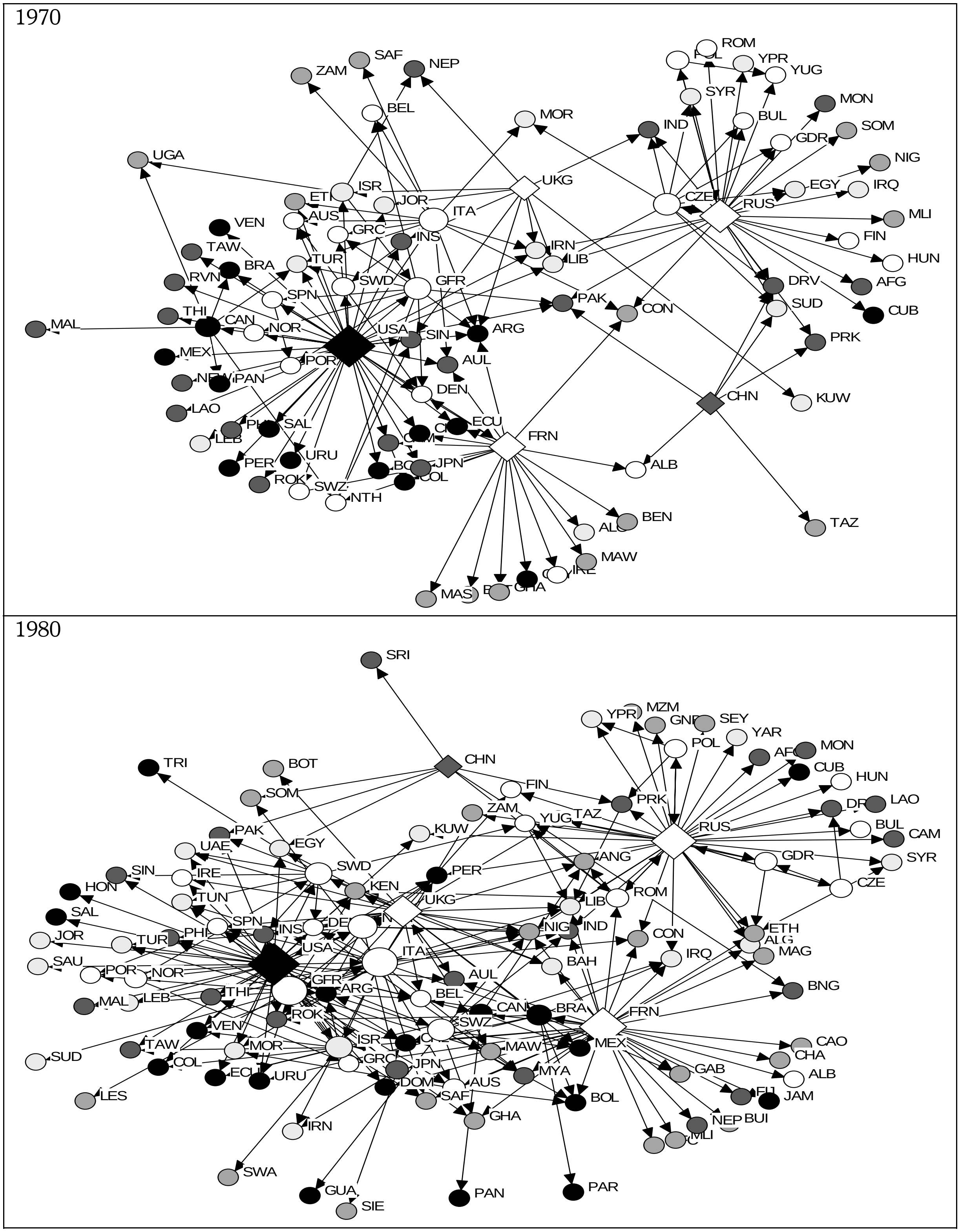


Figure 3.5 Arms Transfer Networks, 1950–2000: Social Network Perspective of International System Structure (Continued)

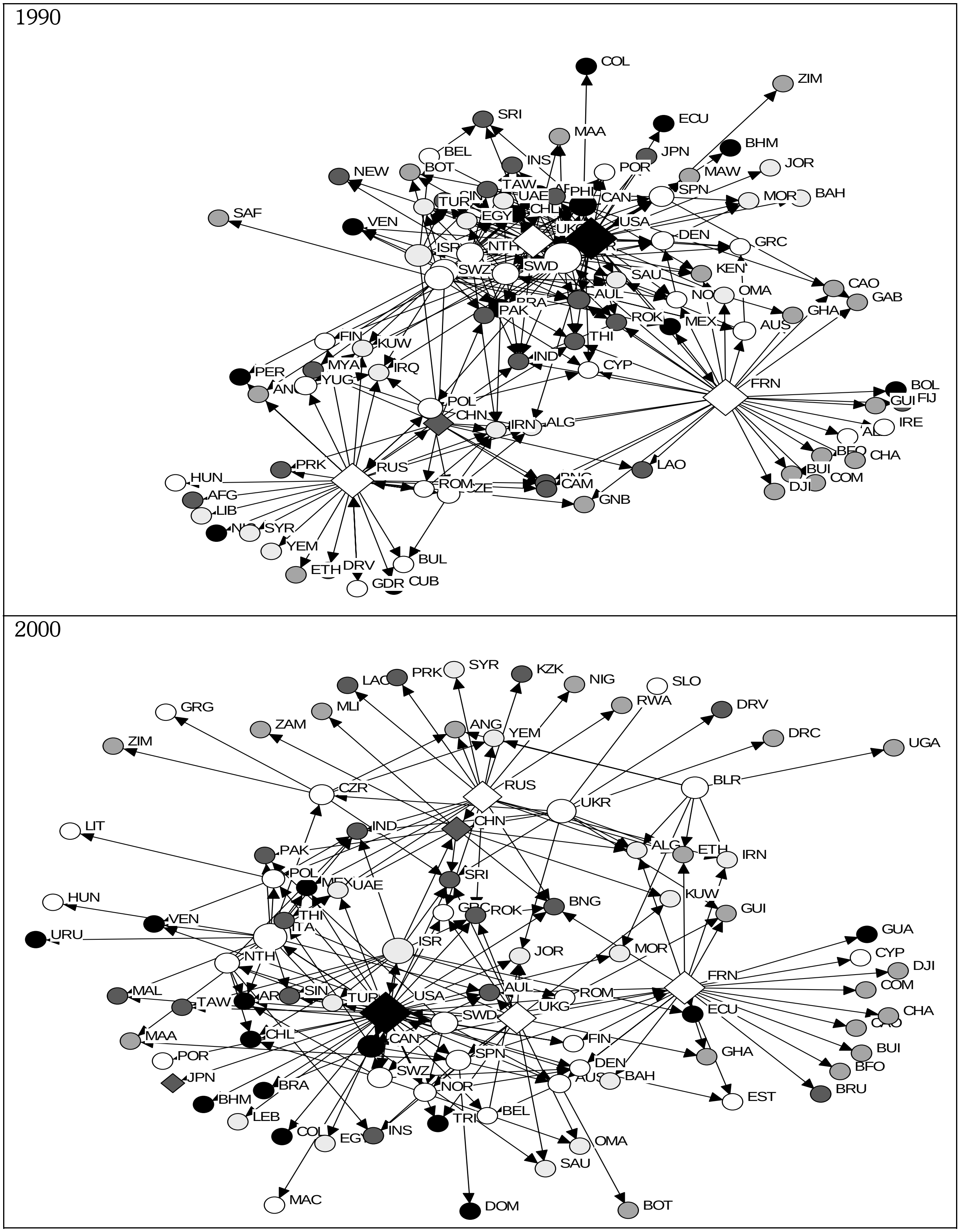


Figure 3.6 Arms Transfer Networks in 1950: Social Network Perspective of National Power

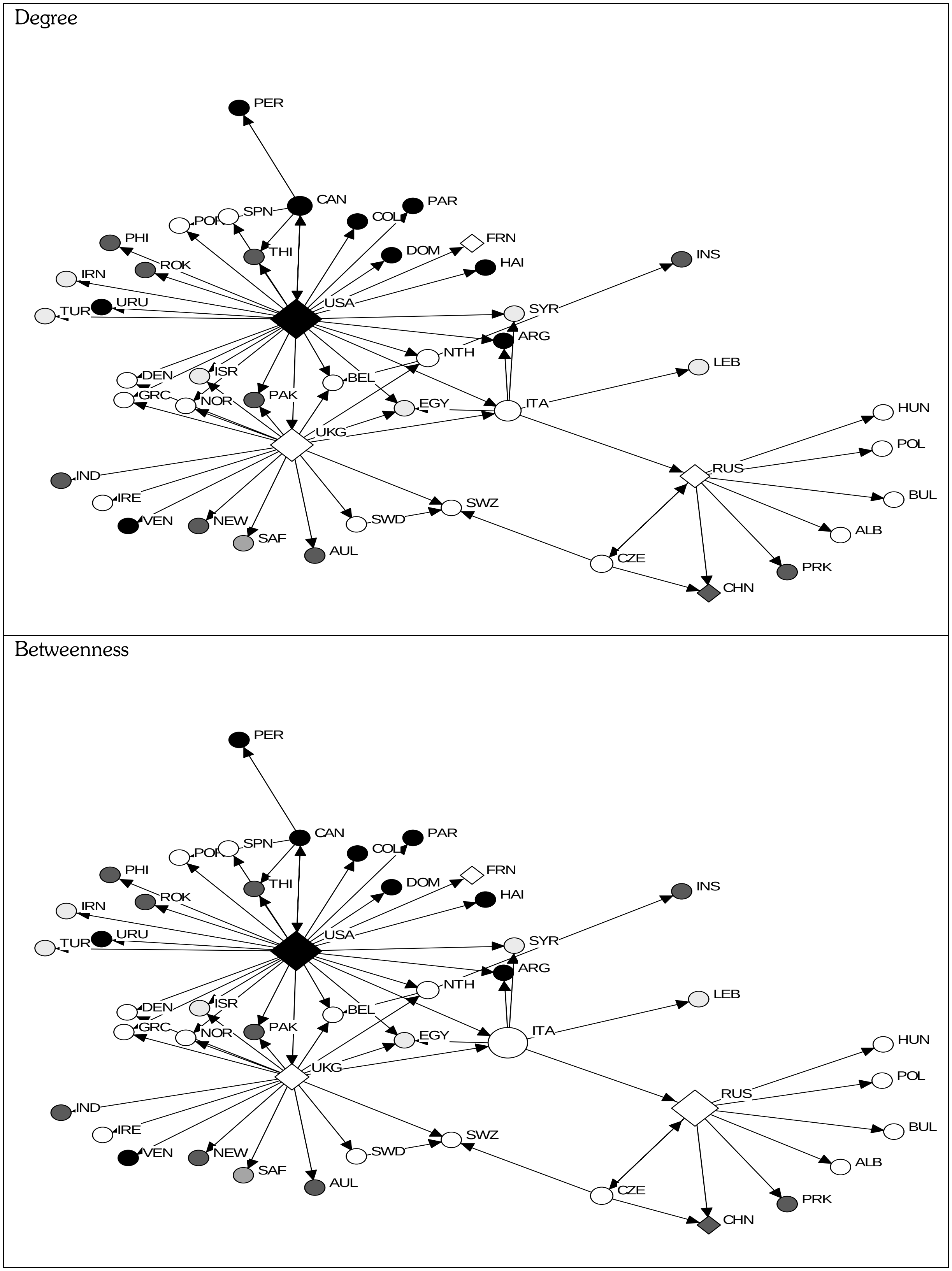


Figure 3.6 Arms Transfer Networks in 1950: Social Network Perspective of National Power (Continued)

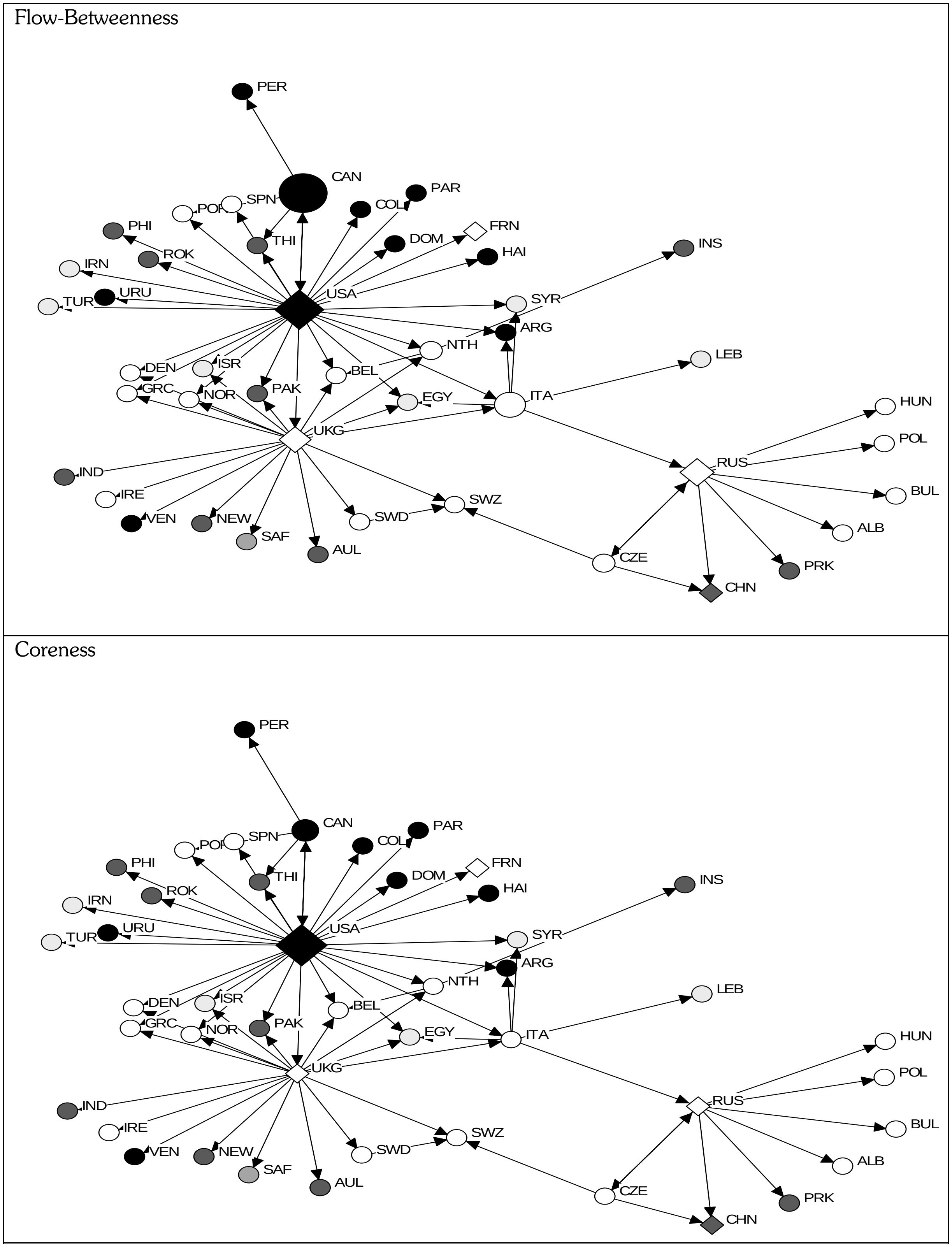
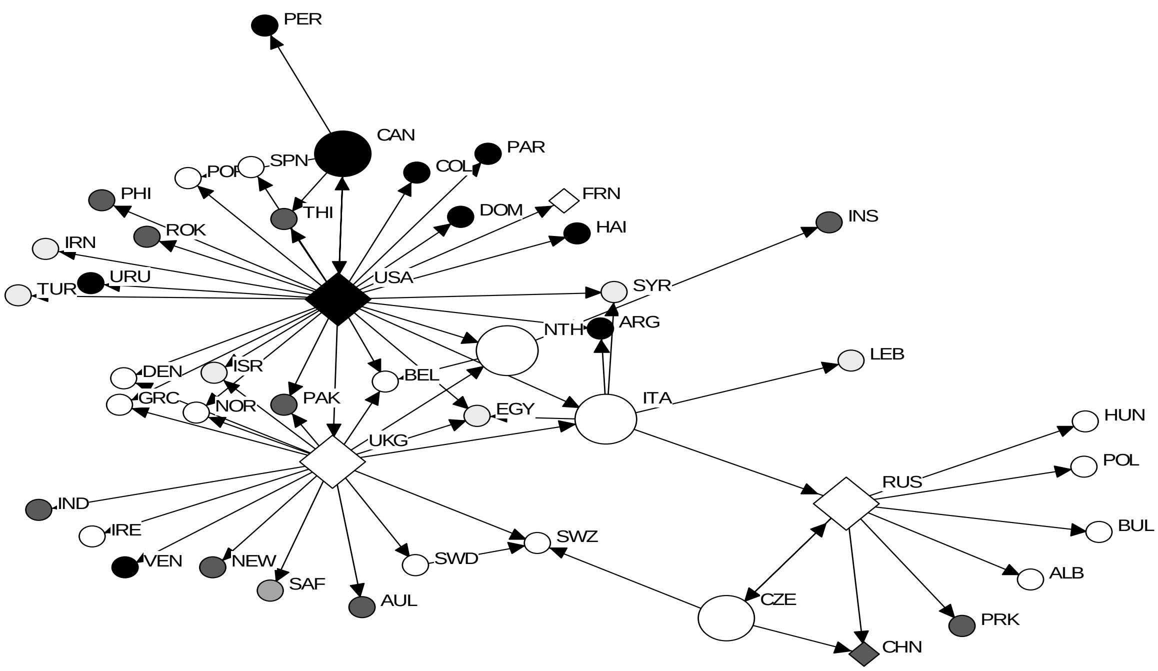
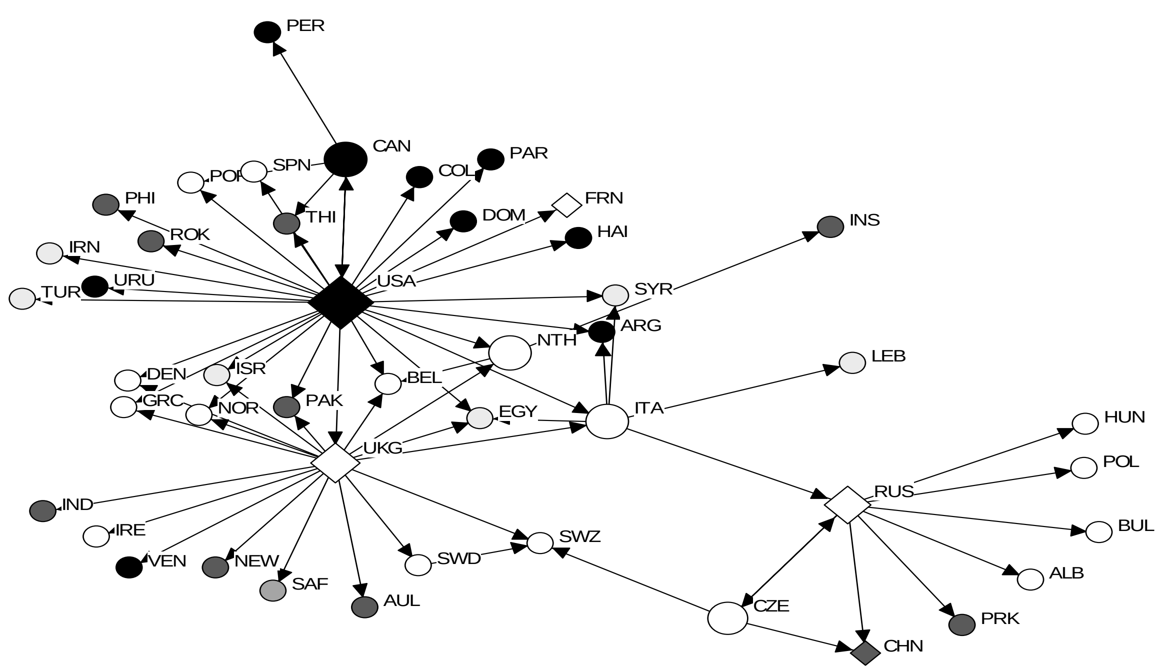


Figure 3.6 Arms Transfer Networks in 1950: Social Network Perspective of National Power (Continued)

Egonet Brokerage



SNPI



CHAPTER 4. DETERMINANTS OF THE ONSET OF MILITARIZED CONFLICTS

This study, which is an application of social network perspective to international conflicts, focuses on several important contributions to the study of militarized conflicts, using the measures of each state's structural network power (derived from using six types of international communication and resource interaction data with the social network analysis) and their distribution (especially concentration, movement, and change) in the international system. The first third of the chapter focuses on the graphical representations of international conflicts. This part argues for the importance of graphical representation of dyadic conflict (militarized dispute and crisis) onsets from the social network perspective; it uses figures to describe how the social network perspective represents the study of militarized conflicts.

The second third of the chapter is devoted to the systemic study of international conflict. Here, using both the OLS and NBREG analyses for both militarized disputes and international crises, this set of empirical analyses is conducted to test how the structure of the international system (more specifically, the structural network power concentration, change, and movement in the system, derived from the network relationships among system members) affects the number and proportion of disputes and crises in the system. The final third of the chapter is devoted to the dyadic study of international conflicts, focusing on hypotheses arising from balance of power and power preponderance theories (using a structural network power conception from the social network perspective). Using several different estimation methods such as: (1) logistic regression with errors clustered on dyads, (2) logistic regression with clustering on periods (sometimes called the WSEV estimation), (3) ReLogit estimation (the logistic regression of rare events), and (4) the pooled estimation of GEE controlling for the AR1 process, the main hypotheses are tested for dyadic militarized interstate disputes for the period of 1950–1992.

The use of the structural network power concept (based on the social network concept of international system structure) both at the systemic and dyadic levels in the last two subchapters is based on the core argument of this project, positing that a state's power should be conceptualized based on the social network perspective of international system structure (on different types of international communication and resource networks) and measured by taking an account of its interactions with all other states in the system in those different types of social networks in international relations. Accordingly, the measures of those structural network powers at both systemic and dyadic levels are derived by using six types of international interaction data sets (on the dimensions of communication patterns and of resource flows) using the social network analysis. In other words, the focus of hypothesis testing in the latter two parts of this empirical chapter is on how my new social network concepts (of international system structure and national power) lead to more accurate and powerful empirical models of militarized conflicts than previous ones mainly rooted in attribute logic. The performance of conflict models at both systemic and dyadic levels using structural network power measures is compared against those using attribution-based power measures, through nonparametric model discrimination statistics and information criteria measures.

4.1. Graphical Representations of Dyadic Militarized Dispute and Crisis Onsets

Figures 4.1–4.3 display the graphical representations of dyadic militarized conflict (dispute and crisis) onsets (please see Appendix 4.1 for (1) a discussion on graphical network data representation (especially sociograms) versus tables and (2) an exercise to compare the two methods). In each of the sociograms, the two states involved in the onset of conflicts are connected by two-way arrows representing the dyad's involvement of conflict onset. To account for the major power-conflict onset relationship, the five major powers as defined by the COW project (the U.S., the United Kingdom, France, the Soviet Union/Russia, and China) are represented by the circle-in-box shape rather than by the circle shape used for all other states. To account for the pattern of regional conflicts,[39] the region of each state as defined by the COW project is represented by a different color: yellow for the Middle East; pink for North and South

[39] The regional conflict is identified as a conflict where both states in a conflict belong to the same region. For example, the dispute between Iran and Iraq in the 1950s disputes network is identified as a regional dispute because both states belong to the same region, the Middle East.

America; green for Africa; blue for Asia; and red for Europe. To represent the pattern of recurrent conflicts[40], the frequency of conflict onset in a dyad is represented by the thickness of lines connecting the dyad. Figure 4.1 displays the networks of dyadic disputes in the 1950s, 1960s, 1970s, 1980s, 1990s, and throughout 1950–2000. The sociograms for five separate decades display all pairs of states that had more than one dispute in the respective decade; the sociogram for the whole study period (of 1950–2000) displays all pairs of states that had more than five disputes in the period (i.e., identifying the recurrent militarized dispute patterns in the system). Figure 4.2 displays the networks of dyadic crises in five separate decades and throughout 1950–2000. The sociograms for the five separate decades display all pairs of states that had at least one crisis in the respective decade; the sociogram for the whole study period (1950–2000) displays all pairs of states that had more than two crises in the period (i.e., identifying the recurrent militarized crisis patterns in the system).

We see several distinctive characteristics revealed from each set of sociograms in Figures 4.1–4.2. First, the sociograms of dispute onsets (of each decade from 1950–2000) in Figure 4.1 reveal the following: (1) the predominance of dispute onsets by major powers (e.g., the Soviet Union and China in 1950s; the U.S., the United Kingdom, USSR, and China in 1960s; the U.S. and USSR in the 1970s, 1980s, and 1990s), (2) the high connectedness[41] of regional dispute onsets (e.g., in Asia, Europe, and the Middle East in the 1950s; in Asia in the 1960s; in Asia, Africa, and the Middle East in the 1970s and 1980s; in Asia, Africa, Europe, and the Middle East in the 1990s), (3) the high connectedness of dyadic dispute involvement especially in the later decades, and (4) the predominance of a few large-scale dispute onsets in a few decades (e.g., the dispute onset of the Korean War involving 25 states; the dispute onset of the Gulf War involving 27 states; the dispute onset of the NATO-Yugoslavia War involving 20 states). The

[40] The recurrent conflict identifies a situation where the same dyad experiences more than one dispute case. For example, the dispute between France and Tunisia in the 1950s disputes network is identified as a recurrent dispute because both states experienced more than one dispute during the decade. Grieco (2001) identifies that a significant majority of conflicts are such recurrent conflicts (72% of dyadic-level disputes of 1816-1992, 49% of dyadic-level crises of 1918-1994, and 26% of dyadic-level wars of 1816-1992).

[41] The conflict onset case is defined as “connected” in the network if it has a connection to any other conflict onset cases in the network. The conflict onset case is defined as “isolated” or “disconnected” in the network if it does not have any connection with other conflict onset cases in the network.

sociograms of crisis onsets in Figure 4.2 show quite similar patterns to those of dispute onsets in Figure 4.1; however, because the definition of crisis is narrower than that of dispute (see below for the definitions of dispute and crisis used in this study), the sociograms of crisis onsets reveal rather intensified conflict patterns (i.e., fewer states are involved, but more conflict cases are connected to each other in the crisis networks) than those of dispute onsets.

Figure 4.3 shows us how the sociograms of militarized disputes reveal the general graphical patterns of monadic or dyadic factors affecting the onset of disputes (of regime type[42], economic development, major power status, alliance, contiguity, distance, economic interdependence, past conflict interaction levels, and alliance agreements). For each of the sociograms in Figure 4.3, the two nodes (states) involved in a dispute are connected by a two-way arrow. Each state's regime type is represented by the color of the node (blue for a democratic regime; red for a non-democratic regime); each state's economic development level, measured by its total trade size, is represented by the size of the node (bigger for more economically developed; smaller for less economically developed); and each state's major power status is represented by the shape of the node (circle-in-box shape for major, circle for all others). We can see that, among 27 total dyadic disputes in 1960, there were only 3 (or 11%) democratic-democratic disputes (United Kingdom-Iceland, United States-Austria, and Austria-Italy), supporting the argument that democratic states are less likely to be involved in conflict with other democracies, and that major powers were involved as much as non-major powers (14 dispute dyads or 52%). The remaining sociograms reveal that allied states were far less involved than non-allied states. Contiguous states were far less involved than non-distant states. Economically interdependent states, measured by bilateral trade, were somewhat less involved than economically non-interdependent states. Hostile states, measured by past conflict interaction level, were somewhat more involved than non-hostile states. States with alliance agreements, measured by Tau-b, were far less involved than states without alliance agreements.

Gleditsch and Ward (2005) emphasize the importance of global maps when displaying, identifying, or highlighting international relations data. Figures 4.4 and 4.5 provide such global maps of

[42] The measurements and data sources for all the variables in this section will be discussed later in detail.

international conflicts utilizing each state's monadic conflict[43] (dispute or crisis) onset distribution in the system.[44] Figure 4.4 displays the global map of monadic dispute onset distribution in 1950–2000; Figure 4.5 displays the global map of monadic crisis onset distribution in 1950–2000. From these maps we can see the zone of conflict or peace (groups of states that have relatively more or less amounts of conflicts). States are grouped into three sets: (1) those most actively involved in dyadic conflicts (involved in the top third of total dyadic conflicts in the period), (2) those least actively involved in dyadic conflicts (involved in the bottom third of total dyadic conflicts in the period), and (3) those between the two groups (involved in the middle third of total dyadic conflicts in the period). For example, the global map of militarized disputes for 1950–2000 (from Figure 4.4) reveals that 10 states (in the order of dispute involvement: the Soviet Union/Russia, the U.S., China, Iraq, Yugoslavia, United Kingdom, Iran, Israel, Turkey, and North Korea), which were colored black in the map, were involved in the top third (1,066 dyadic disputes, or 33.04%) of total dyadic disputes for the period (3,326 dyadic disputes, for 1950–2000); 29 states (including Thailand, Egypt, India, Japan, France, and others), which were colored as gray in the map, were involved in the next third (1,065 dyadic disputes, 33.02%) of total dyadic disputes; and the remaining 159 states (including Philippines, Venezuela, Canada, Somalia, Spain, and others), which were colored white in the map, were involved in the bottom third (1,095 dyadic disputes, or 33.94%) of total dyadic disputes (please also see Appendix 4.2 for the raw scores on the distribution of each state's dispute/crisis onsets for 1950–2000). The global map of militarized crisis for 1950–2000 (from Figure 4.5) reveals that only 7

[43] The monadic conflict onset represents a dispute onset of each state, in contrast to the dyadic conflict onset, which represents a dispute onset of each dyad. This distinction is from the level-of-analysis discussions in international relations where monadic analysis focuses on the state, dyadic analysis focuses on the dyad, and system analysis focuses on the system. This chapter tries to reveal the patterns of militarized conflicts at all three levels (monadic, dyadic, and systemic). The global maps in Figures 4.4–4.5 show monadic patterns of international conflicts (which state is more or less likely to be involved in international conflicts). The two following empirical sections focus on finding dyadic and systemic patterns of international conflict (the determinants of dyadic and systemic conflicts).

[44] There have been other efforts to identify global maps of international conflicts (i.e., the monadic patterns of international conflict). For example, the Nobel Foundation provides global maps of 20th wars (1899-2001, interstate, colonial and civil wars) and their casualties (http://nobelprize.org/educational_games/peace/conflictmap/). ViewConflicts (Software for Visualizing Spatiotemporal Data on Armed Conflicts) provides global maps of arms conflicts (1946-2004, internal and internationalized conflicts) (http://www.svt.ntnu.no/geo/forskning/konflikt/viewConflicts/).

states were involved in the top third (320 dyadic crises, or 32.13%) of total dyadic crises for the period (996 dyadic crises for 1950–2000); 24 states were involved in the next third (352 dyadic crises, or 35.34%) of total dyadic crises; and the remaining 167 states were involved in the bottom third (324 dyadic crises, or 32.53%) of total dyadic crises. The zone of crisis in the world for 1950–2000 was composed of a much smaller number of states compared to that of dispute (i.e., a smaller number of states was more actively involved in crises than in disputes), but the composition of each zone is mostly in line with each other (i.e., states actively involved in the crises were also actively involved in the disputes).

4.2. Systemic Analysis of Militarized Conflicts

4.2.1. General Approach

The third section of this chapter is devoted to the systemic study of international conflicts. As pointed out in Chapter 2, there have been only a handful of empirical analyses on systemic conflicts (see also Maoz et al. 2005; Sacko 2004).[45] The model setup of systemic analyses performed in this section is based on exemplary works by Singer, Bremer, and Stuckey (1972) and Mansfield (1994) that have been regarded as the benchmark for the systemic empirical study of international conflicts. I base my analysis on their systemic conflict model setups to facilitate comparison with previous research. However, I performed a set of sensitivity analyses to check the robustness of the results found in the chapter (e.g., varying the models by adding some of other control variables used in the literature[46]); the overall pattern from this sensitivity test confirms my findings. Equation (4-1) summarizes the set of hypotheses that will be tested for the systemic analysis of international conflict:

---

[45] Maoz et al. (2005, 35) notes that "in the last two decades, most students of international politics have abandoned the systemic level of analysis in favor of the dyadic level, which seemed to have been more promising in terms of meaningful findings." Sacko (2004, 116) notes that "although systemic studies of international politics were once the focus of the field, they no longer hold the attention of researchers. Advanced data collection and more properly specified theories have primarily led researchers to analyze dyadic levels of conflicts. Thus, there is little recent work on the analysis of system-level conflict."

[46] For example, see Rousseau and Kim (2005) for the systemic conflict analysis comparing explanations from the systemic, regional, dyadic, and monadic levels.

Systemic $Conflicts_t$ = ß0 + ß1*Systemic Structural Network Power $Concentration_t$ + ß2*Systemic Structural Network Power Concentration $Squared_t$ + ß3*Systemic Structural Network Power $Change_t$ + ß4*Systemic Structural Network Power $Movement_t$ + *e* (Equation 4-1)

The hypotheses to be tested in this section of systemic conflict analysis (hypotheses 1–3) are presented in detail in Chapter 3. These hypotheses are tested mainly in regard to the power explanations that use the new power measures in the systemic conflict models.

1. Data

I test the three hypotheses on balance of power theory versus power preponderance theory at the systemic level, using the onset of militarized interstate dispute data ("Militarized Interstate Dispute Data Set, Version 3.0") for 1950–2000 from the COW project modified by Maoz (2001b, DYMID1.1)[47] and the onset of international crisis data ("ICB Version 5.0") for 1950–2000 from the International Crisis Behavior (ICB) project. The COW data set is a collection of interstate disputes where a case of dispute is defined as "a set of interactions between or among states involving threats to use military force, displays of military force, or actual uses of force" (Gochman and Maoz 1984, 586). To be included in this dispute data set, acts must be explicit, overt, nonaccidental, and government-sanctioned (587). The ICB data set contains a population of international crises, with international crisis defined as "a situation change characterized by an increase in the intensity of disruptive interactions between two or more adversaries, with a high probability of military hostilities" (Brecher, Wilkenfeld, and James 1989, 5). A militarized interstate dispute (e.g., the COW data case) evolves into an international crisis (e.g., the ICB data case) when a system member on each side of the dispute indicates by its actions its willingness to go to war to defend its interests or to attain its objectives (i.e., a dangerously high probability of war, see also Brecher 1977;

[47] The use of Maoz's modified version instead of the COW original data is based on the finding (Maoz 2001b) that the COW data set contains dispute cases where states on one side of a multilateral contest may never have threatened, displayed, or used force against states on the opposing side (e.g., Bulgaria and Japan on the opposite sides in World War I). Maoz corrects this and other problems to produce more accurate militarized interstate dispute data (see also Oneal, Russett, and Berbaum, 2003, 376).

Snyder and Diesing 1977; Buchan 1964; Bell 1971). Maoz and Russett (1993) find that, due to different definitions and criteria, the two data sets are not strongly related (628).[48]

2. Measurements

I use four different dependent variables on the onset of systemic conflicts (Maoz et al. 2005):

Proportion of Dyads in Disputes. This is measured by dividing the total number of militarized dispute dyads by all possible dyads in the system in a given year.

Proportion of Dyads in Crises. This is measured by dividing the total number of crisis dyads by all possible dyads in the system in a given year.

Number of Dyadic Disputes in the System. This is measured by the total number of dyads engaged in interstate militarized disputes in a given year.

Number of Dyadic Crises in the System. This is measured by the total number of dyads engaged in international crises in a given year.

The measurements of the independent variables used (systemic structural network power measures) are presented in detail in Chapter 3. The first set of systemic measures is based on Freeman (1978/1979) and Freeman, Borgatti, and White (1991), and measures the level of systemic power centralization in the whole network, compared to the ideal "star" network, where a node is connected to all the other N-1 nodes, or the extent to which the whole network has a centralized structure (or an overall "compactness" of a network), or the extent to which the cohesion of the network is organized around a particular focal point (Scott 2000). The second set of systemic measures is based on Singer, Bremer, and Stuckey (1972) and Mansfield (1994), and measures the level of systemic power concentration and its dynamic features (change and movement). The two sets of systemic power measures identify how concentrated or

---

[48] Of course, the two data sets used in this chapter are not the only international conflict data available. There are other data sets that have been used to examine the causes of international conflicts (see Leng and Singer [1988] for a general discussion on the different types of interstate conflicts such as interstate dispute, militarized interstate dispute, militarized interstate crisis, and interstate war, as well as the relationships among them). For the descriptions and discussions on those other data collections, see the SIPRI website at http://www.sipri.org/contents/conflict/conflictdatasets.html and Rousseau (2005, esp., 100-105). The SIPRI website provides brief descriptions of 16 different data collection projects on international conflicts. Rousseau (2005) discusses some other data collection efforts on international conflicts such as Huth (1996) and Huth and Allee (2002) on territorial conflicts and Sherrman (1994, SHERFACS).

centralized each system is, based on the power distribution among the system members (see Ray and Singer 1973 for the summary review and discussion on different types of power concentration or unequal distribution measures such as the Herfindahl-Hirshman index and the Gini index; see Wasserman and Faust 1994 for a discussion on other social network measures of power concentration, such as the dispersion/heterogeneity index [Snijders 1981] and the hierarchization index [Coleman 1964]).

4.2.2. Estimation Methods

I use two different estimation methods for this part of study. For the two dependent variables of proportions of dyadic conflicts (disputes and crises) in the system, I use the OLS estimation, controlling the *Year* variable to capture the passage of time. Mansfield (1994) finds evidence of a secular trend in the onset of international conflicts and recommends the control of the *Year* variable to ensure that an observed relationship between the power distributions and conflicts is not due to the secular trends on both variables (85). For the two dependent variables of total numbers of dyadic conflicts (disputes and crises) in the system, I use the NBREG estimation, again controlling by year. Overdispersion (i.e., the variance is greater than the mean of the distribution) as revealed by the results of alpha (which is an estimate of the degree of overdispersion) in my analyses (see Table 4.6) recommend the use of NBREG over poisson regression. As Long and Freese (2005) point out, in the presence of overdispersion, the poisson regression model underfits the amount of dispersion in the outcome, and the NBREG model corrects this failure of the poisson model by adding ancillary parameter alpha that reflects unobserved heterogeneity among observations (372).

4.2.3. Results and Discussion

Here I present two analyses of the relationship between systemic structural network power and militarized conflicts: first, the correlation analysis, and second, the OLS and NBREG analyses.

Correlations Results

Tables 4.1–4.4 display the Pearson correlations between the sets of dependent variables (systemic conflicts) and independent variables (systemic structural network power). As noted earlier, I use four different types of dependent variables on systemic conflicts (proportions and numbers of dyadic disputes, and crises in the system), and two different sets of independent variables on systemic structural network power (Freeman's [1978/1979] systemic network power centralizations and Singer, Bremer, and Stuckey's [1972] systemic network power concentrations[49]). The results (Tables 4.1–4.4) reveal that there are clear positive relationships between the systemic structural network power measures and the proportions of dyadic disputes and crises, and between power measure and the number of dyadic crises in the system; they also show that there are negative relationship between the systemic structural network power measures and the number of dyadic disputes in the system. This set of results, in general, supports the hypothesis that the greater the level of systemic structural network power concentration, the greater the level of systemic conflicts, suggesting support for balance of power theory over power preponderance theory at the systemic level. Regarding the other two structural aspects, there is no clear evidence of either systemic structural network power change or systemic structural network power movement's relationships with the proportions and numbers of dyadic disputes or crises (some weak evidence of a negative relationship of systemic structural network power change and of a positive relationship of systemic structural network power movement are apparent, however). In general, the results from the correlation analysis in Tables 4.3–4.4 reject the hypotheses that: (1) the greater the level of systemic structural network power change, the greater the level of systemic conflicts; and (2) the greater the level of systemic structural network power movement, the lower the level of systemic conflicts. However, this set of null findings from the correlation analysis is in line with those from Mansfield (1994).

[49] For sensitivity purposes, I have also tried the structural network power concentration measures using only major powers instead of using all of the members and the power change and movement measures using a one-year instead of five-year interval (Singer, Bremer, and Stuckey 1972; Mansfield 1994). The overall pattern with this sensitivity test confirms my findings.

Regression Results

Table 4.5–4.6 display the OLS results of the systemic structural network power characteristics-conflicts (for the proportions of dyadic dispute and crisis dependent variables) and the NBREG results of the systemic structural network power characteristics-conflicts (for the number of dyadic disputes and crisis dependent variables). Regarding the ratio-level dependent variables (the proportions of dyadic conflicts in the system), the results differ depending on the type of conflict data used in the analyses. For the dispute dependent variable, there is clear evidence of a U-shaped relationship between systemic power concentration and systemic disputes (the support of power preponderance theory over balance of power theory at the system level). The coefficient on *SCON* is negative and statistically significant, and that on $SCON^2$ is positive and statistically significant. However, for the crisis dependent variable, no clear pattern is revealed. The results from this set of OLS regression analyses show that, in general, the greater the level of systemic network power concentration, the lower the level of dyadic disputes in the system. After the systemic concentration of structural network power reaches a certain level, the system is likely to have more dyadic disputes. Both the highest and lowest levels of systemic power concentrations give rise to the highest level of systemic conflicts, while the intermediate levels of systemic power concentration do so at the lowest level of systemic conflicts. However, this empirical pattern is not found when analyzing the dyadic crisis dependent variables. Regarding the other two systemic characteristics (the change and movement of structural network power concentration), there seems to be only weak evidence of the negative effects of the change and movement of structural network power concentration on dyadic disputes. All in all, from the OLS results on the systemic structural network power characteristics-conflicts, we do see the general support of power preponderance theory over balance of power theory at the system level.

Regarding the count dependent variables (the numbers of dyadic conflicts in the system), the results also differ depending on the type of conflict data used in the analyses. For the dispute dependent variable, there is evidence (rather weak compared to the results from its ratio-level dependent variable) of a U-shaped relationship between systemic power concentration and systemic disputes (and thus the support of power preponderance theory over balance of power theory at the system level). The coefficient on *SCON* is negative and statistically significant, and that on $SCON^2$ is positive and statistically significant. However, for the crisis dependent variable, there is clear evidence of an inverted U-shaped relationship between systemic power concentration and systemic crises as in Mansfield (1992) (the support of balance of power theory over power preponderance theory at the system level). The coefficient on *SCON* is positive and statistically significant, and that on $SCON^2$ is negative and statistically significant. The results show that the greater the level of systemic network power concentration, the greater the level of dyadic crises in the system. After the systemic concentration of structural network power reaches a certain level, the system is likely to have fewer dyadic crises. Both the highest and lowest levels of systemic power concentrations give rise to the lowest level of systemic conflicts, while the intermediate levels of systemic power concentration give rise to the highest level of systemic conflicts. Regarding the other two systemic characteristics (the change and movement of structural network power concentration), there seems to be no clear evidence for either a positive or negative relationship. All in all, from the NBREG results for the systemic structural network power characteristics-conflicts, we do see mixed support for power preponderance theory and balance of power theory at the system level (for the former with systemic disputes, and for the latter with systemic crises).

This section addresses the systemic study of militarized conflicts, and examines the hypotheses on balance of power theory and power preponderance theory at the system level. The overall results do not reveal any clear support for either theory. The balance of power theory, in general, does have support for the hypotheses on the systemic crises, and the power preponderance theory, in general, does have support for the hypotheses on the systemic disputes. These seemingly contradictory findings should be examined in future studies, but one possible explanation might be the omitted variable bias for the crisis models. The OLS results show that there are relatively high adjusted R^2 for the dispute models (ranging from .571 to .777), but relatively low adjusted R^2 for the crisis models (ranging from .215 to .489), suggesting that the results from the dispute models (and as a consequence, the support for the power preponderance theory at the system level) seem to be stronger than the support for the balance of power theory at the system level coming from the crisis models.[50] Perhaps the system-level crisis study should be distinguished from the system-level dispute studies (i.e., the process of getting involved in the dispute stage is different from that of escalating into the crisis stage). It can be argued that, in the lower level of systemic conflicts (militarized dispute), the higher level of systemic power concentration leads to the lower level of systemic conflicts; in the higher level of systemic conflicts (militarized crisis), the opposite is true (the higher level of systemic power concentration leads to the higher level of systemic conflicts). However, in both cases, we do find clear support for Mansfield's argument that the relationship between the systemic power concentration and systemic conflicts (or major power wars in the system) is (inverted) U-shaped rather than monotonic.

4.3. Dyadic Analysis of Militarized Conflicts

4.3.1. General Approach

The second section of this chapter is devoted to the dyadic study of international conflicts.[51] As pointed out in Chapter 2, there have been many empirical analyses on dyadic conflicts and Oneal, Russett, and their colleagues have been leading proponents of the dyadic study of international conflicts (e.g., Maoz and Russett 1993; Russett and Oneal 2001). Their model setup has been regarded as fully specified for dyadic interstate conflict. It has been adopted extensively and includes the views of (1) realists – that power (power balance and major-power status) and alliance are crucial determinants of conflict, (2) liberals – that the factors on state interests such as regime type (democracy) and trade ties (economic

[50] Another reason for my preference of accepting the results from the dispute models over those from the crisis models is that the sample of disputes captures a much larger subset of international conflicts than that of crises. As Rousseau (2005) point out, most international disputes do not escalate into crises in which one or both parties threaten or use military force and, by the same logic, most international crises do not escalate into wars in which one or both parties use large military forces to resolve the crisis. Therefore, the empirical studies that have focused on crises or wars (Mansfield 1994; Singer, Bremer, and Stuckey 1972) capture only a small subset of the population of international conflicts.

[51] The analyses in this section are focused on the causes of dyadic conflicts (i.e., what causes a state's conflict involvement with other states). This focus is different from the causes of monadic conflicts (i.e., what causes a state's conflict involvement in general). See Bennett and Stam (2004, 44-46) and Croco and Teo (2005) for general discussion on the dyadic analysis of militarized conflicts.

interdependence) influence a state's conflict behavior, and (3) political geographers (e.g., Mahan 1893; Mackinder 1919; Spykman 1944; Richardson 1960; Sprout and Sprout 1965; Most and Starr 1989) – that a county's region and proximity to other states (contiguity and distance) affect conflict.[52] My analysis is based on their dyadic conflict model setup, to facilitate comparisons with previous research. However, to check the robustness of the results found in the chapter, I performed a set of sensitivity analyses (e.g., varying the models by adding or dropping some of the control variables and using sub-samples such as politically relevant or politically active dyads); the overall pattern with this sensitivity test confirms my findings. Equation (4-2) will be tested for the dyadic analysis of international conflicts:

Onset of Dyadic Dispute$_t$ = ß0 + ß1*Balance of Structural Network Power$_t$ + ß2*Level of Economic Interdependence$_t$ + ß3*Level of Democracy$_t$ + ß4*Shared Alliance Ties$_t$ + ß5*Contiguity$_t$ + ß6*Distance$_t$ + ß7*Major Power$_t$ + ß8*Peace Year$_t$ + ß9*Spline1$_t$ + ß10*Spline2$_t$ + ß11*Spline3$_t$ + *e* (Equation 4-2)

1. Hypotheses

The main hypotheses to be tested (hypotheses 1 and 1', on balance of power and power preponderance theory at the dyadic level) are presented in detail in Chapter 3. All the other hypotheses to be tested in this section of dyadic conflict analysis (hypotheses 2–7) are in Appendix 4.3. The main purpose of testing the hypotheses in this section is to determine how the two main hypotheses on power explanations using the new power measures behave in the dyadic conflict models.

[52] For more detailed discussion on dyadic conflict model setups, see Vasquez (1993), Bremer (1992, 1993), and Gartzke, Nordstrom, Boehmer, and Hewitt (2006). Also see the following research for each of the factors in the conflict model setups: (1) for democracy and interdependence, Kant (1970[1797]), Russett and Oneal (2001), McMillan (1997), and Mansfield and Pollins (2001); (2) for alliance, Levy (1981), Singer and Small (1966), Faber and Weaver (1984), Moul (1988), Schroeder (1976), and Ostrom and Hoole (1978); (3) for contiguity and distance, Wallensteen (1981), Diehl (1985), Diehl and Goertz (1988), and Starr and Most (1976); (4) for the major power status, Singer and Small (1966), and Gochman (1980).

2. Data

The data to be used in this dyadic study are based on two dispute data sets. As noted above, Oneal and Russett have been leading proponents of the dyadic study of international conflicts, and I use their latest data set (from Oneal 2003 and Oneal, Russett, and Berbaum 2003)[53] as the baseline for this study. This data set is merged with the data set of each state's structural network power measures that I have created using six types of interaction network data among all states in the international system. Using the data on diplomatic exchanges, foreign student exchanges, and international telecommunications for one dimension (called "the dimension of communication patterns"), and arms transfers, international exports, and international assistance for the other dimension (called "the dimension of resource flows") of international system structure, I have derived each state's scores on different aspects of structural network power based on the social network perspective of international relations (more details on the measures can be found in Chapter 3).

[53] Some use so-called "politically relevant dyads" (dyads containing continuous states and dyads containing at least one major power, Maoz and Russett 1993) instead of all the dyads used in this project (see Bennett and Stam 2004 for a general discussion on the advantages/disadvantages of focusing on politically relevant dyads, esp., 61-62). I have decided to use all available dyads in the system instead of sub-samples such as politically relevant dyads, following (1) Hafner-Burton and Montgomery's argument that "the effects captured by taking only a subset of states (power projection capabilities, distance between dyads) are already included in" the model of using all dyads (2006, 12, footnote 10) and (2) the argument by Bennett (2005) and Lemke and Reed (2001a) that the use of relevant dyads introduces measurable selection bias. For example, Lemke and Reed (2001a) demonstrate that employing the set of politically relevant dyads introduces a measurable selection bias in analysis, although the size of the bias appears to be small. They also argue that the specific threats of selection bias from relevant dyad usage could arise in two ways: first, some control variables such as wealth, alliance, or democracy could be correlated to major power status; second, contiguity increases the likelihood of interactions, specifically concerning territory. Bennett (2005, 5-6) notes that "the bias emerges because a variety of the factors theorized to cause conflict (such as capabilities, wealth, and possibly democracy) correlate quite strongly with the selection criteria for political relevance. Major powers by definition have greater capabilities and wealth than the average state, and they tend to be disproportionately democratic. States with many contiguous neighbors may also have higher levels of capabilities than states facing few potential threats, and recent work suggests that regime type tends to cluster geographically" (for general discussion on politically relevant dyads, see also Bennett and Stam 2000b, 2004; for other sub-sample usage in conflict studies, see Quackenbush 2006, which addresses "politically active dyads" using contiguity, power status, and alliances as defining characteristics).

3. Measurements

The dichotomous *Onset of Dispute* dependent variable is coded as 1 if any kind of militarized dispute is ongoing between two states in a particular year; if there was no dispute, it is coded as 0.[54] Some use only the initial year of a dispute, arguing that events over time are not statistically independent. I count ongoing disputes following Russett and Oneal's argument that "rational leaders frequently reevaluate their positions, whether to escalate, deescalate, halt, or maintain the existing strategy" (Russett and Oneal 2001, 95, footnote 2).[55] The decision to include the ongoing conflict instead of using only the initial year of conflict has been also rationalized in Maoz and Russett (1993). They posit (631) that states' political systems and other variables typically change frequently during ongoing conflicts, and we have to take those changes into account when explaining states' conflict behaviors.[56]

The measurements on the main independent variables used (balance of structural network power measures) are presented in detail in Chapter 3. These variables measure the balance of structural network power between the two states in a dyad. They are based on five different measures of point centralities from network analyses of interaction data (i.e., degree, betweenness, flow-betweenness, coreness, ego network brokerage, and their composite index). Briefly, degree aspect of network power measures each node's (state's) centrality according to its total number of connections to other nodes (states) in the network (system). Betweenness aspect of network power measures each node's (state's) centrality according to its capacity in standing on the paths or geodesics (i.e., minimal length paths) that connect two other nodes (states) in the network (system). Flow-betweenness aspect of network power measures

[54] See Pevehouse (2004) for a general discussion on the measurement of the dependent variable, international conflict. He argues that widely used conflict data sets such as MID code all hostilities, but only report the highest level of hostility in the dispute and ignore the cooperative behavior among states. See Kadera (2001) for the discussion on the cooperation-conflict continuum (treating cooperation and conflict as separate dimensions versus as opposite sides of one dimension) (36-40). Also see the similar discussion in Barbieri 2002, esp., 50-53 (conceptualizing peace as the absence of militarized conflict, rather than the presence of cooperation, see also Domke 1988).

[55] Oneal and Russett also argued that more than half of all disputes involve change of level force over the course of the dispute or a new dispute that arises before the first has concluded (2001, 95, footnote 2).

[56] Please also see Bennett and Stam (2000b, 2004) for general discussion on including versus excluding ongoing disputes.

each node's (state's) centrality according to its capacity in standing on both the direct and indirect paths that connect two other nodes (states) in the network (system). Core aspect of network power measures each node's (state's) centrality according to its degree of coreness to the other nodes (states) in the network (system). Based on the concept of a core/periphery structure (a dense and cohesive core and a sparse and unconnected periphery), it measures how central each state is in terms of its network coreness in the continuous sense (with a high score representing a highly core state, and a low score representing a highly periphery state). Ego network brokerage aspect of network power measures each node's (state's) centrality according to its level of brokerage among the nodes (states) in its own ego network. To measure the egonet brokerage centrality, we first construct the ego network for every actor within the whole network and then compute each actor's brokerage centrality within its own ego network. The ego brokerage centrality is the number of (ordered, because I use only directed data) actor pairs, within its ego network, that are not directed connected. Based on the five different measures of point centralities, the final product is the log-transformed ratio of the stronger state's structural network power index to that of the weaker state, which has been the conventional measure of power balance variable used in the conflict models. The reasoning for this is that having greater power brings only declining marginal gains (i.e., a decreasing marginal advantage of increasing power difference, Russett and Oneal 2001, 103; Barbieri 2002, 66).[57] The measurements on all other independent variables used in this section of dyadic conflict analysis are presented in detail in Appendix 4.3.

4.3.2. Estimation Methods

The main estimation method in this dyadic study is the logistic regression assuming clustering on dyads. To check the robustness of results from the empirical tests, I employ three additional estimation methods: (1) logistic regression analysis clustered on periods, (2) ReLogit estimation, and (3) pooled GEE estimation. First, logistic analysis clustered on periods is based on the WSEV one-step approach,

[57] Whether a state has 100 or 1,000 times more power than its opponent makes little difference, because varying the power preponderance has little effect when power differences are great (Barbieri 2002, 63).

accounting for the dependences (temporal, spatial, and dyadic) on the covariance structures in my panel data (Heagerty, Ward, and Gleditsch 2002; Heagerty and Lumley 2000). Second, ReLogit analysis is based on the corrections of the biases in the logit estimations of rare events (King and Zeng 2001a, 2001b). Finally, I use the pooled GEE estimation, adjusting the AR1 process (Liang and Zeger 1986). The findings from these three different additional sensitivity analyses are generally with my main analysis, and therefore the discussions on the results in the following section are based on the results from my main method of analysis (logistic regression analysis clustered on dyads) in Table 4.7 (Appendix 4.4 displays the results from the three sensitivity analyses). To add the substantive meanings from the logistic results in Table 4.7, Table 4.8 displays the results from the marginal effects analysis for the main independent variables of the study, the balance of structural network power, using the Clarify program by King, Tomz, and Wittenberg (2000, 2003). This program, using stochastic simulation techniques, first "draws simulations of the main and ancillary parameters from their asymptotic sampling distribution," and second "converts the simulated parameters into substantively interesting quantities, such as predicted values, expected values, or first differences." I choose to simulate 1,000 sets of parameters (from my models) to produce the predicted values for each of my 18 models to be tested below.

4.3.3. Results and Discussion

Hypotheses 1 and 1' test the arguments advanced by "balance of power" theorists (that the power parity of states in a dyad leads to a decreased probability of dispute onset) and by "power preponderance" theorists (that power preponderance leads to a decreased probability of dispute onset), using the new concept of structural network power.[58] Table 4.7 displays the results from the logistic

[58] This section only discusses the results on the main hypotheses (balance of power versus power preponderance). The discussion on the remaining hypotheses is presented in Appendix 4.3.

regression of the onset of dyadic dispute: the logistic results for six models (five different aspects and their composite index).[59]

The results from the logistic regressions clustered by dyads (Tables 4.7) strongly support the arguments of power preponderance theorists at the dyadic level. In all but one model specification, the coefficient on the *Balance of Structural Network Power* is negative and statistically significant, suggesting that the more skewed the distribution of structural network power in a dyad, the less likely a militarized interstate dispute. In the other model specification, the coefficient is statistically indistinguishable from zero. The results from all other sensitivity analyses (logistic regression analysis clustered on periods, ReLogit analysis, and pooled GEE analysis) all support the power preponderance theory. It is clear from all the analyses that when two states in a dyad share disproportional structural network power (i.e., one state's power is disproportionate to the other state's power), they are less likely to be involved in conflicts with each other, supporting the power preponderance-leads-to-peace argument. As power preponderance theorists argue, the weaker state will not try to fight with the stronger state because it will certainly lose, and therefore the stronger state does not have to get into the fight to get what it wants. In other words, the power preponderance between states will preserve peace since it reduces the uncertainties of winners and losers in a dispute. As there is a highly asymmetric power distribution, a weaker state will more likely concede to a stronger state's demand since it knows it is less likely to prevail in a crisis bargaining situation. All in all, the results from all sets of dyadic analyses in this project provide the empirical evidence toward supporting the "power preponderance leads to peace" (or "power balance leads to conflict") theoretical argument from Organski (1968), Organski and Kugler (1980), Blainey (1988), Kugler and Lemke (1996), and Lemke (2002), and are in line with the empirical findings of Garnham (1976a), Garnham (1976b), Weede (1976), Organski and Kugler (1980), Bremer (1992), Maoz and Russett (1993), Oneal and Russett (1997, 1999, 2001), Oneal, Russett, and Davis (1998), Beck, Katz, and Tucker (1998), and Gartzke (1998).

[59] As I noted in Chapter 3, the structural network power measures were derived in this project using the international interaction data based on communication patterns and resource flows among international system members (the two dimensions of international system structure).

To add the substantive meanings from the logistic results in Tables 4.7, Table 4.8 displays the marginal effects analysis for the main independent variables of the study—the balance of structural network power—using the Clarify program of King, Tomz, and Wittenberg (2000, 2003). The results show that, for example, using the degree aspect of balance of structural network power, the baseline probability of the onset of a dispute, holding all other included variables at their means, is .00077 (this baseline rate represents the chance of a dispute for some "typical" dyad in the samples). Raising the level of structural network power balance from its minimum to the mean, while holding all other variables at their means, reduces the probability of onset by 22.9%. Increasing the change to its maximum triggers an additional decrease of 49.2%. Increasing the level of the variable from its minimum to its maximum reduces the probability of onset by 58.7% (a drop of more than half from the baseline rate in the likelihood that the two states in a dyad will have a dispute). As seen in Table 4.8, the reduction of predicted probabilities (changing the values for the balance of structural network power variable from the minimum to the maximum, holding all other independent variables at their means) ranges from 54.1% to 83.2% for the models. The results of the marginal impact analyses show that, in addition to the statistical results from Table 4.7, there are quite sizable effects of the balance of structural network power on the onset of militarized disputes. This finding supports power preponderance theory over balance of power theory.

All in all, three sets of findings stand out. First, regarding the debate on balance of power and power preponderance theory at the dyadic level, my empirical findings strongly support the argument by power preponderance theorists. Using different aspects of structural network power (e.g., degree, betweenness, flow-betweenness, coreness, egonet brokerage, and their composite index) and different estimation methods (logistic regression analysis clustered on dyads or on periods, ReLogit analysis, and pooled GEE analysis), the results consistently support the power preponderance theory—that preponderance of structural network power decreases the probability of dispute onset (or the more skewed the distribution of structural network power in a dyad, the less likely a militarized interstate dispute). Second, regarding the liberal peace theory, the economic interdependence pillar is weakly supported (mostly, at the .10 significance level) compared to that of the democratic pillar (mostly at better than the .001 level). However, the weak support of the "economic interdependence leads to peace" argument is not surprising on both theoretical and empirical grounds. Many realists (e.g., Waltz 1979; Gaddis 1986) theorize that economic interdependence rather increases conflict among states (i.e., interdependence is a source of friction that can lead to military conflict) or that economic interdependence and conflict among states are irrelevant (i.e., the interdependence is subordinate to other considerations in determining the incidence of international conflict). Recent empirical work using more advanced econometric methods have consistently found no relationship between economic interdependence and international conflict (e.g., Keshk, Pollins, and Reuveny 2004; Goenner 2004; Kim and Rousseau 2005). Finally, the marginal effects analysis using Clarify shows that all the variables of the three main hypotheses in this study have quite sizable and compatible effects; the reductions of the probability of dyadic onset (against the baseline rate in the likelihood that the two states in a dyad will have a dispute) for the *Balance of Structural Network Power* variable range from 54.1 % to 83.2% for six of my models; those for the *Interdependence Low* from 74.4% to 77.8%; and those for the *Democracy Low* from 76.0% to 85.8%. Not only are democratic states or economically interdependent states less likely to be involved in a dispute, but also states with sizable power differences (the weaker state in a dyad knowing it will certainly lose and, as a consequence, the stronger state getting what it wants without getting involved in a dispute). This set of results is consistently supported in all different estimation methods used and with different measures of structural network power utilized.

4.4. Model Comparisons for the Conflict Studies

4.4.1. Using Nonparametric Model Discrimination Test

To compare the conflict models using SNPI (Structural Network Power Index) variables against those using CINC (Composite Index of National Capability) or GNP variables, I first use Clarke's (2001a, 2001b, 2003) pair-signed test of nonnested model discrimination[60] (see also Conover 1980). Clarke

[60] The two sets of conflict models tested in this chapter are nonnested because one model cannot be reduced to the other model by imposing a set of linear restrictions on the parameter vector (see Clarke 2001a and 2001b for the definition of nonnested model).

(2001a, 2001b) posits that traditional methods of model discrimination such as likelihood ratio tests, F-test, and artificial nesting fail when applied to nonnested models. Clarke (2001a, 2003) also argues that a nonparametric approach for model discrimination such as the pair-signed test is more robust and performs better than other approaches of nonnested model comparison (e.g., the Vuong test). His model discrimination test compares two nonnested models by examining the predictions of each model. If both models produce similar predictions, they cannot be distinguished. If one model produces better predictions (statistically significant) than the other, we can conclude that the former model performs better (or has the greater explanatory power) than the latter. So, for example, in applying his tests to conflicts models examined in this chapter, if we find that the conflict models using SNPI variables produce the better predictions than the models using CINC variables, we can conclude that the former models performs better than the latter models. If we find that the opposite is true, we can argue that the latter models have greater explanatory power than the former models.

Clarke's model comparison tests proceed in two steps (Clarke 2001a, 2003). First, each model's predictions are generated for all available data points (calculating individual log-likelihood ratio for each case). Second, the predictions of each model are compared based on the median log-likelihood ratio to determine whether there is a statistically significant difference between the two models.[61] This nonparametric nonnested model discrimination approach has been applied to international relations research. For example, Clarke (2003) applies this approach to compare a political norms explanation against a political structure explanation on foreign policy decision-making (Huth and Allee, 2002) and

[61] Clarke (2003, 77–78) details the algorithm for applying his pair-signed test as follows:
a. Run model *f*, saving the individual log-likelihoods. For a binary choice model, the individual log-likelihoods are calculated by $y_i$log(^p_i) + (1 – y_i)log(1 - ^*p*i). For a linear dependent variable model, they are calculated by –log(2 * p_i * sum((residuals(x)) ^2)/N)/ 2- (1/2) * ((residuals(x)) / sqrt(sum((residuals(x)) ^2)/N) ^2). The former is in Clarke (2003, 77) and the latter is in Souva (2005, 159), and also has been confirmed by personal communication with Clarke.
b. Run model *g*, saving the individual log-likelihoods.
c. Compute the differences and count the number of positive and negative values.
d. The number of positive differences is distributed binomial (n, $p = .5$).

The test determines whether the median log-likelihood ratio is statistically different from zero. If the models are equally close to the true specification, half the log-likelihood ratios should be greater than zero and half should be less than zero. If model *f* is "better" than model *g*, more than half the log-likelihood ratios should be greater than zero. Conversely, if model *g* is "better" than model *f*, more than half the log-likelihood ratios should be less than zero.

finds that the former has greater explanatory power than the latter. He also finds that the two systemic long-cycle explanations of great power wars (research focused on global economic activities, such as Goldstein (1991), and those on global political order, such as Wallerstein (1983), Modelski and Thompson (1987), and Gilpin (1981)) cannot be discriminated from each other. Souva (2005) applies the test to compare the systemic realist explanation to the domestic-politics explanation of foreign policy decision-making and finds that the former model is statistically better than the latter.

Tables 4.9–4.10 present the results of pair-signed tests for both systemic and dyadic conflict models (comparing the models with the attribute-based power variables against those with the structural network power variables). For the systemic conflict study (systemic dispute and crisis onset models), Table 4.9 shows that ten of twelve models with SNPI variables have greater explanatory power than those with CINC variables (in the remaining two models, the model with SNPI performs equally well compared to the model with CINC). In other words, the model comparison test confirms that the models with SNPI generally account for more variation in systemic conflict (both dispute and crisis) onsets and are statistically better than the models with CINC. For example, in 59.5–69.0% of all the systemic dispute cases (depending on the models), the model with SNPI outperforms the model with CINC (if the two models perform equally, each should account for 50%). For all of the systemic crisis cases, four of six models with SNPI outperform the model with CINC in 54.8–69.0% of the cases. In all the models where the SNPI conflict models outperform the CNIC model, the null hypothesis of equality between the two models is rejected at the 0.001 level.

For the dyadic conflict study, Table 4.10 shows that for all six models, those with SNPI variables have greater explanatory power than those with either the CINC or GNP variable. This means that the model comparison test confirms that the models with structural network power variables account for more variation in dyadic conflict onsets and are statistically better than the models with the attribute-based power variables. For example, in 53.9–62.9% of all dyadic dispute cases, the model with SNPI outperforms the model with CINC. The same results are found when the SNPI conflict models are compared with the GNP model; all six models with SNPI outperform the model with GNP in 53.3–61.6% of the cases. In all of the conflict models, the null hypothesis of equality (between the two sets of models, with SNPI versus CINC and with SNPI versus GNP) is rejected at the 0.001 level. After comparing the conflict models, we conclude that the models with SNPI variables have greater explanatory power than (or statistically outperform) those with CINC (or GNP) variables in both systemic and dyadic conflict onsets.

4.4.2. Using Akaike and Bayesian Information Criteria

The second set of statistics used to compare the two sets of nonnested models in conflict studies are information criteria measures such as Akaike's (1973) information criteria (AIC) and the Bayesian information criteria (BIC) proposed by Raftery (1996). The basic idea behind both statistical model fit measures is to examine the complexity of the model together with the goodness of its fit to the sample data and to produce a measure that balances between the two (i.e., selection measures that balance model fit with some adjustment of parsimony).[62] The Bayesian information criteria (BIC) is proposed by Raftery (1996) and, compared to Akaike's measures, favors the models with fewer parameters and penalizes the complex models more heavily than AIC. The two measures permit the comparison of both nested and nonnested models and have been used to assess the relative performance of models (e.g., Fordham and McKeown 2003 for the study of constituency economic interests on foreign trade registration; Goenner 2004 for the study of economic interdependence on international conflicts; Gordon, Kim, and McKeown forthcoming for the study of U.S. federal research and development funding). The differences in the AICs or BICs from two models indicate which model is more likely to have generated the observed data, and the model with the smallest AIC or BIC is considered the better fitting model (Long 1997; Long and Freese 2001). Raftery (1996), adopting Jeffrey's (1961) conventions, suggests guidelines for the strength of evidence favoring one model against the other model based on the BIC difference (if $BIC_1 - BIC_2 < 0$ then the first model is preferred and if $BIC_1 - BIC_2 > 0$ then the second model is preferred): absolute difference of 0–2 as weak support of lower scoring model, 2–6 as positive support, of 6–10 as strong support, and of greater than 10 as very strong support.

[62] See Judge et al. (1985, 870-875) for a general discussion of information-based measures.

Tables 4.9-4.10 contain the AIC and BIC measures for both systemic and dyadic conflict models (comparing the models having the attribute-based power variables against those having the structural network power variables). For the systemic conflict study (systemic dispute and crisis onset models), Table 4.9 shows that in all twelve models, the conflict models with SNPI variables are favored against those with CINC variables. With BIC differences of 14.088–24.667, the systemic dispute models with SNPI are very strongly preferred over those with CINC. The BIC differences of 17.419–24.702 show that the same conclusion holds for the systemic crisis models. For the dyadic conflict study, Table 4.10 shows that five of six models with SNPI variables are favored against that with the CINC variable (with BIC differences of 2.013–52.515) and against that with the GNP variable (with BIC differences of 4.176–74.678). The evidence from the information criteria measures seems conclusive and confirms the findings with the nonparametric model discrimination tests; the models with SNPI variables statistically outperform and are preferred over those with CINC and GNP variables in both systemic and dyadic conflict studies.

4.5. Conclusion

This chapter examined the determinants of the onset of international conflicts from the social network perspective. In this chapter, the new social network power concept was applied to the previous empirical attempts of balance of power and power preponderance theories at both systemic and dyadic levels. The main hypotheses being: (1) do the increased levels of systemic structural network power concentration, change, and movement lead to the increased or decreased levels of systemic conflict onset, and (2) does the structural network power balance between the two states in a dyad increase or decrease the probability of dyad conflict onset? The focus of hypothesis testing in this empirical chapter was on how my new social network conceptions of international system structure and national power lead to more accurate and powerful empirical models than previous ones mainly rooted in attribute logic. This chapter took existing theories and tested them using my newer network conceptions of the international system and national power, focused on the conceptions of the international system as networks and of a state's power based on its relational structural network power, and was primarily interested in how these newer conceptions lead us to recast a great deal of existing empirical work on the subject. Does a structurally centralized or concentrated international system induce a more peaceful world, or just the opposite (for the systemic conflict analysis)? How is the structural network power balance between states related to their conflict behaviors (for the dyadic conflict analysis)? What are some distinctive characteristics of militarized disputes networks (for the graphical representations of conflicts)? These are some of the research questions that were examined in this chapter of social network application to militarized conflicts.

In examining the hypotheses on balance of power theory and power preponderance theory, this chapter found that: (1) at the system level the overall results do not reveal any clear support for either theory, but (2) at the dyadic level the overall results do strongly support power preponderance theory over balance of power theory. From the system level analyses, balance of power theory, in general, does support the hypotheses on systemic crises but, conversely, power preponderance theory generally does support the hypotheses on the systemic disputes. However, from the dyadic level analyses, the results are clear from all the analyses using four different estimation methods (i.e., logistic estimation clustered on dyads, WSEV estimation, ReLogit estimation, and the pooled GEE estimation controlling for the AR1 process) that when the two states in a dyad share disproportional structural network power, they will be far less likely to be involved in conflicts with each other (i.e., the more skewed the distribution of structural network power in a dyad, the less likely a militarized interstate dispute will occur), supporting the power preponderance-leads-to-peace argument. The marginal impact analysis also shows that the preponderance of structural network power has a strong effect on interstate dispute, cutting the probability of a dispute by 54.1% to 83.2% (depending on the model specifications) from the baseline rate. The evidence from nonparametric model discrimination statistics and information criteria measures also shows that those models with network power measures statistically outperform and are preferred over those with attributional power measures such as COW index and GNP in both systemic and dyadic conflict onsets studies.

In addition to the empirical analyses, this chapter also emphasized how useful sociograms (produced by the social network analysis) are in depicting and highlighting the distinctive characteristics of international dispute networks. First, the general graphical patterns of monadic and dyadic factors affecting the onset of disputes revealed from the sociograms in Figure 4.3 are also in line with the results from the dyadic dispute onset analysis. Second, the sociograms in Figures 4.1 and 4.2 revealed that a significant majority of international conflicts are “connected” conflicts, and that there are relatively few “disconnected” or “isolated” conflicts in the network of international conflicts (e.g., during the 1950s, only one crisis-dyad, Morocco-Spain, was isolated in the network that was composed of 75 different crisis-dyads). This provides graphical insight for why the conflict dyadic study needs to incorporate the extra-dyadic conflict information in the networks. The sociograms in Figures 4.1 and 4.2 also provide graphical insight for studies of “recurrent” international conflicts (e.g., on enduring rivalries). Third, the global maps of monadic dispute and crisis onset distributions in 1950–2000 in Figures 4.4 and 4.5 revealed the zones of conflict or peace in the world (i.e., groups of states that have relatively more or less conflict).

Table 4.1 Pearson Correlations of Systemic Structural Network Power Centralization and Density Measures with Systemic Conflicts, 1950–2000

	Centralization (Degree)	Centralization (Betweenness)	Centralization (Flow-Betweenness)	Centralization (SNPI)	Density
Proportion of MIDs	.061	.601***	.756***	.694***	.487***
Proportion of ICBs	-.001	.473***	.543***	.497***	.521***
Number of MIDs	.127	-.228	-.329*	-.205	-.322*
Number of ICBs	-.109	.236*	.237*	.175	.172

NOTE: All significant tests are two-tailed. *p < .10, *p < .01, ***p < .001.

Table 4.2 Pearson Correlations of Systemic Structural Network Power Concentration Measures with Systemic Conflicts, 1950–2000

	SCON (Degree)	SCON (Betweenness)	SCON (Flow-Betweenness)	SCON (Coreness)	SCON (Egonet Brokerage)	SCON (SNPI)
Proportion of MIDs	.477***	.425**	.718***	.306*	.638***	.582***
Proportion of ICBs	.426**	.545***	.682***	.301*	.562***	.525***
Number of MIDs	-.607***	-.372**	-.423**	-.485***	-.509***	-.593***
Number of ICBs	.372**	.454***	.405**	.323*	.339*	.396**

NOTE: All significant tests are two-tailed. *p < .10, *p < .01, ***p < .001.

Table 4.3 Pearson Correlations of Systemic Structural Network Power Change Measures with Systemic Conflicts, 1950–2000

	SCHANGE5 (Degree)	SCHANGE5 (Betweenness)	SCHANGE5 (Flow-Betweenness)	SCHANGE5 (Coreness)	SCHANGE5 (Egonet Brokerage)	SCHANGE5 (SNPI)
Proportion of MIDs	.160	-.406**	-.621***	-.043	-.060	-.077
Proportion of ICBs	.191	-.263*	-.422**	.090	-.037	.012
Number of MIDs	-.224	.093	.104	-.220	-.060	-.177
Number of ICBs	.015	.084	.058	.137	.045	.088

NOTE: All significant tests are two-tailed. *p < .10, *p < .01, ***p < .001.

Table 4.4 Pearson Correlations of Systemic Structural Network Power Movement Measures with Systemic Conflicts, 1950–2000

	SMOVE5 (Degree)	SMOVE5 (Betweenness)	SMOVE5 (Flow-Betweenness)	SMOVE5 (Coreness)	SMOVE5 (Egonet Brokerage)	SMOVE5 (SNPI)
Proportion of MIDs	-.184	.325*	.581***	.083	.058	-.015
Proportion of ICBs	-.181	.373*	.534***	.173	-.103	-.033
Number of MIDs	.192	-.158	-.225	-.027	.124	.166
Number of ICBs	.015	.174	.120	.092	-.094	-.011

NOTE: All significant tests are two-tailed. *p < .10, *p < .01, ***p < .001.

Table 4.5 Analysis of Systemic Conflict Onset, 1950–2000 (Proportion of MIDs and ICBs)

Dispute Onset	Model 1-1 (CINC)	Model 1-2 (Degree)	Model 1-3 (Betweenness)	Model 1-4 (Flow-Betweenness)	Model 1-5 (Coreness)	Model 1-6 (Egonet Brokerage)	Model 1-7 (SNPI)
SCON	-0.613**	-0.399***	-0.357*	-0.092	-0.075	-0.680***	-0.319***
	(0.207)	(0.106)	(0.184)	(0.064)	(0.046)	(0.129)	(0.091)
$SCON^2$	1.257***	0.777***	0.482*	0.152	0.072	1.877***	0.690**
	(0.355)	(0.227)	(0.250)	(0.099)	(0.076)	(0.360)	(0.222)
SCHANGE5	-0.031	-0.411*	-0.112*	-0.087*	0.038*	-0.063	-0.152*
	(0.049)	(0.156)	(0.045)	(0.039)	(0.020)	(0.068)	(0.075)
SMOVE5	-0.090	-0.237**	-0.028	-0.017	-0.051***	-0.046	-0.093*
	(0.160)	(0.079)	(0.036)	(0.028)	(0.013)	(0.030)	(0.044)
YEAR	0.000	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.054	0.355***	0.331***	0.220***	0.412***	0.375***	0.371***
	(0.189)	(0.048)	(0.058)	(0.042)	(0.046)	(0.071)	(0.055)
Crisis Onset							
SCON	0.118	-0.038	0.029	0.043	0.055*	-0.035	-0.010
	(0.136)	(0.078)	(0.112)	(0.039)	(0.031)	(0.092)	(0.063)
$SCON^2$	-0.218	0.098	-0.023	-0.052	-0.097*	0.153	0.055
	(0.234)	(0.167)	(0.153)	(0.060)	(0.051)	(0.256)	(0.155)
SCHANGE5	0.002	-0.036	-0.053*	-0.028	0.021	-0.054	-0.015
	(0.032)	(0.115)	(0.028)	(0.023)	(0.014)	(0.048)	(0.052)
SMOVE5	-0.086	-0.008	-0.016	-0.002	-0.002	-0.011	0.013
	(0.106)	(0.058)	(0.022)	(0.017)	(0.008)	(0.021)	(0.031)
YEAR	0.000	0.000	0.000***	0.000**	0.000***	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.042	0.062*	0.086*	0.054*	0.130***	0.052	0.055
	(0.125)	(0.036)	(0.036)	(0.025)	(0.031)	(0.050)	(0.039)

NOTE: Standard errors appear in parentheses below the coefficient estimates. All significant tests are two-tailed. *p < .10, *p < .01, ***p < .001.

Table 4.6 Analysis of Systemic Conflict Onset, 1950–2000 (Number of MIDs and ICBs)

Dispute Onset	Model 2-1 (CINC)	Model 2-2 (Degree)	Model 2-3 (Betweenness)	Model 2-4 (Flow-Betweenness)	Model 2-5 (Coreness)	Model 2-6 (Egonet Brokerage)	Model 2-7 (SNPI)
SCON	-106.252*	-34.514*	-50.529*	-16.856	-27.880***	-56.565*	-28.354*
	(44.275)	(19.559)	(30.023)	(11.401)	(8.020)	(24.673)	(16.173)
$SCON^2$	194.614**	61.142	63.205	22.104	42.168**	135.225*	49.652
	(75.417)	(42.024)	(40.917)	(17.683)	(13.516)	(69.322)	(39.746)
SCHANGE5	-8.490	-29.107	1.108	-3.545	0.759	14.452	6.398
	(10.076)	(29.606)	(7.714)	(6.865)	(3.465)	(13.089)	(13.442)
SMOVE5	6.618	-21.402	-3.021	-4.200	-3.841*	3.951	-5.516
	(34.928)	(14.960)	(5.986)	(4.938)	(2.125)	(5.813)	(7.699)
YEAR	0.001	0.000	0.006*	0.004	0.008*	-0.004	-0.004
	(0.019)	(0.005)	(0.003)	(0.003)	(0.004)	(0.006)	(0.005)
Constant	17.389	8.105	1.216	-1.651	-6.781	16.522	15.084
	(42.893)	(9.066)	(9.528)	(7.309)	(8.267)	(13.404)	(9.853)
/lnalpha	-3.652***	-4.002***	-3.986***	-3.769***	-3.986***	-3.671***	-3.950***
	0.393	(0.461)	(0.448)	(0.404)	(0.455)	(0.386)	(0.450)
Chris Onset							
SCON	457.941**	162.395**	127.026	91.303**	103.368***	357.527***	221.411***
	(157.296)	(57.809)	(108.432)	(33.880)	(27.923)	(92.651)	(50.342)
$SCON^2$	-879.039***	-230.125*	-154.085	-133.326*	-132.501**	-934.833***	-430.560***
	(276.656)	(113.241)	(146.719)	(52.125)	(42.663)	(251.790)	(114.258)
SCHANGE5	52.921	67.615	-13.958	-0.078	-34.873*	-24.405	6.803
	(38.634)	(67.104)	(24.975)	(20.786)	(13.911)	(40.677)	(32.092)
SMOVE5	-47.767	130.392**	-4.968	-1.735	34.603***	9.694	74.245***
	(108.231)	(44.652)	(19.816)	(15.699)	(9.353)	(17.083)	(23.338)
YEAR	-0.040	0.043**	-0.016*	-0.010	0.009	0.019	0.029*
	(0.056)	(0.014)	(0.010)	(0.010)	(0.012)	(0.019)	(0.013)
Constant	21.552	-110.984***	9.014	6.837	-34.880	-68.898*	-84.054**
	(124.327)	(29.725)	(33.879)	(21.208)	(24.658)	(41.873)	(27.042)
/lnalpha	-1.096***	-1.795***	-1.177***	-1.122***	-1.427***	-1.217***	-1.746***
	(0.314)	(0.335)	(0.312)	(0.310)	(0.315)	(0.309)	(0.345)

NOTE: Standard errors appear in parentheses below the coefficient estimates. All significant tests are two-tailed. *p < .10, *p < .01, ***p < .001.

Table 4.7 Analysis of Dyadic Dispute Onset, 1950–1992

Logit Analysis Clustered on Dyads	Model 3-1 (CINC)	Model 3-2 (GNP)	Model 3-3 (Degree)	Model 3-4 (Betweenness)	Model 3-5 (Flow-Betweenness)	Model 3-6 (Coreness)	Model 3-7 (Egonet Brokerage)	Model 3-8 (SNPI)
Balance of Power	-0.121** (0.047)	-0.116** (0.045)	-0.097*** (0.026)	-0.118*** (0.025)	-0.153*** (0.028)	0.010 (0.063)	-0.058*** (0.017)	-0.161*** (0.047)
Interdependence Low	-19.982* (11.927)	-24.769* (13.248)	-21.296* (12.382)	-26.922* (13.854)	-27.241* (13.686)	-16.988 (11.605)	-20.349* (12.105)	-21.712* (12.380)
Democracy Low	-0.049*** (0.013)	-0.047*** (0.013)	-0.047*** (0.013)	-0.045*** (0.013)	-0.045*** (0.013)	-0.050*** (0.013)	-0.048*** (0.013)	-0.047*** (0.013)
Allies	-0.431** (0.155)	-0.421** (0.156)	-0.400** (0.155)	-0.435** (0.156)	-0.387* (0.154)	-0.413** (0.156)	-0.397** (0.155)	-0.414** (0.156)
Contiguity	2.550*** (0.207)	2.530*** (0.203)	2.514*** (0.208)	2.503*** (0.199)	2.490*** (0.201)	2.564*** (0.208)	2.522*** (0.207)	2.525*** (0.208)
Distance	-0.581*** (0.078)	-0.569*** (0.075)	-0.555*** (0.079)	-0.554*** (0.071)	-0.559*** (0.073)	-0.575*** (0.079)	-0.559*** (0.079)	-0.554*** (0.079)
Major Power	1.735*** (0.166)	1.867*** (0.186)	1.693*** (0.165)	1.845*** (0.169)	1.831*** (0.168)	1.683*** (0.158)	1.669*** (0.164)	1.748*** (0.167)
Peace Year	-0.341*** (0.034)	-0.341*** (0.034)	-0.342*** (0.034)	-0.338*** (0.033)	-0.340*** (0.034)	-0.345*** (0.034)	-0.343*** (0.034)	-0.344*** (0.034)
Spline 1	-0.002*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)
Spline 2	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
Spline 3	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Constant	-0.410 (0.655)	-0.433 (0.627)	-0.549 (0.670)	-0.363 (0.606)	-0.357 (0.618)	-0.636 (0.670)	-0.559 (0.666)	-0.531 (0.667)

NOTE: Robust standard errors appear in parentheses below the coefficient estimates. All significant tests are two-tailed. *p < .10, *p < .01, ***p < .001.

Table 4.8 Changes in Predicted Probabilities of Dispute Onset from Fitted Logit Models

	Minimum	Mean (Baseline)	Maximum	Min => Mean	Mean => Max	Min => Mean (Reduction, %)	Mean => Max (Reduction, %)	Min => Max (Reduction, %)
Model 3-1	0.00092	0.00077	0.00031	-0.00015	-0.00045	-20.0	-59.2	-66.0
Model 3-2	0.00098	0.00077	0.00034	-0.00021	-0.00043	-27.6	-56.1	-65.6
Model 3-3	0.00094	0.00077	0.00039	-0.00018	-0.00038	-22.9	-49.2	-58.7
Model 3-4	0.00116	0.00077	0.00028	-0.00039	-0.00048	-50.9	-62.8	-75.3
Model 3-5	0.00111	0.00076	0.00019	-0.00035	-0.00057	-46.4	-75.3	-83.2
Model 3-7	0.00091	0.00077	0.00042	-0.00015	-0.00035	-19.4	-45.2	-54.1
Model 3-8	0.00098	0.00077	0.00019	-0.00020	-0.00058	-26.1	-74.9	-80.1

NOTE: The marginal analyses were calculated using Clarify software.

Table 4.9 Model Comparisons for the Systemic Conflict Analyses

	Model 1-1/2-1 (CINC)	Model 1-2/2-2 (Degree)	Model 1-3/2-3 (Betweenness)	Model 1-4/2-4 (Flow-Betweenness)	Model 1-5/2-5 (Coreness)	Model 1-6/2-6 (Egonet Brokerage)	Model 1-7/2-7 (SNPI)
Dispute Onset							
AIC	-456.799	-481.880	-472.652	-471.301	-477.396	-479.452	-477.592
BIC	-446.373	-471.040	-461.812	-460.461	-466.556	-468.612	-466.752
Clarke Tests							
Against CINC		59.5%	61.9%	59.5%	61.9%	69.0%	61.9%
Crisis Onset							
AIC	-491.817	-509.650	-516.933	-516.589	-513.058	-509.936	-510.051
BIC	-481.391	-498.810	-506.093	-505.749	-502.218	-499.096	-499.211
Clarke Tests							
Against CINC		50.0%	54.8%	50.0%	57.1%	64.3%	69.0%

Table 4.10 Model Comparisons for the Dyadic Conflict Analyses

	Model 3-1 (CINC)	Model 3-2 (GNP)	Model 3-3 (Degree)	Model 3-4 (Betweenness)	Model 3-5 (Flow-Betweenness)	Model 3-6 (Coreness)	Model 3-7 (Egonet Brokerage)	Model 3-8 (SNPI)
AIC	9432.946	9435.097	9424.009	9383.360	9380.418	9460.076	9430.177	9430.920
BIC	9559.551	9561.714	9550.626	9509.977	9507.036	9586.694	9556.794	9557.538
Clarke Tests								
Against CINC			62.6%	56.0%	62.9%	53.9%	60.8%	58.8%
Against GNP			56.7%	53.3%	61.6%	57.0%	53.9%	53.6%

Figure 4.1 Networks of Dyadic Dispute Onset, 1950–2000

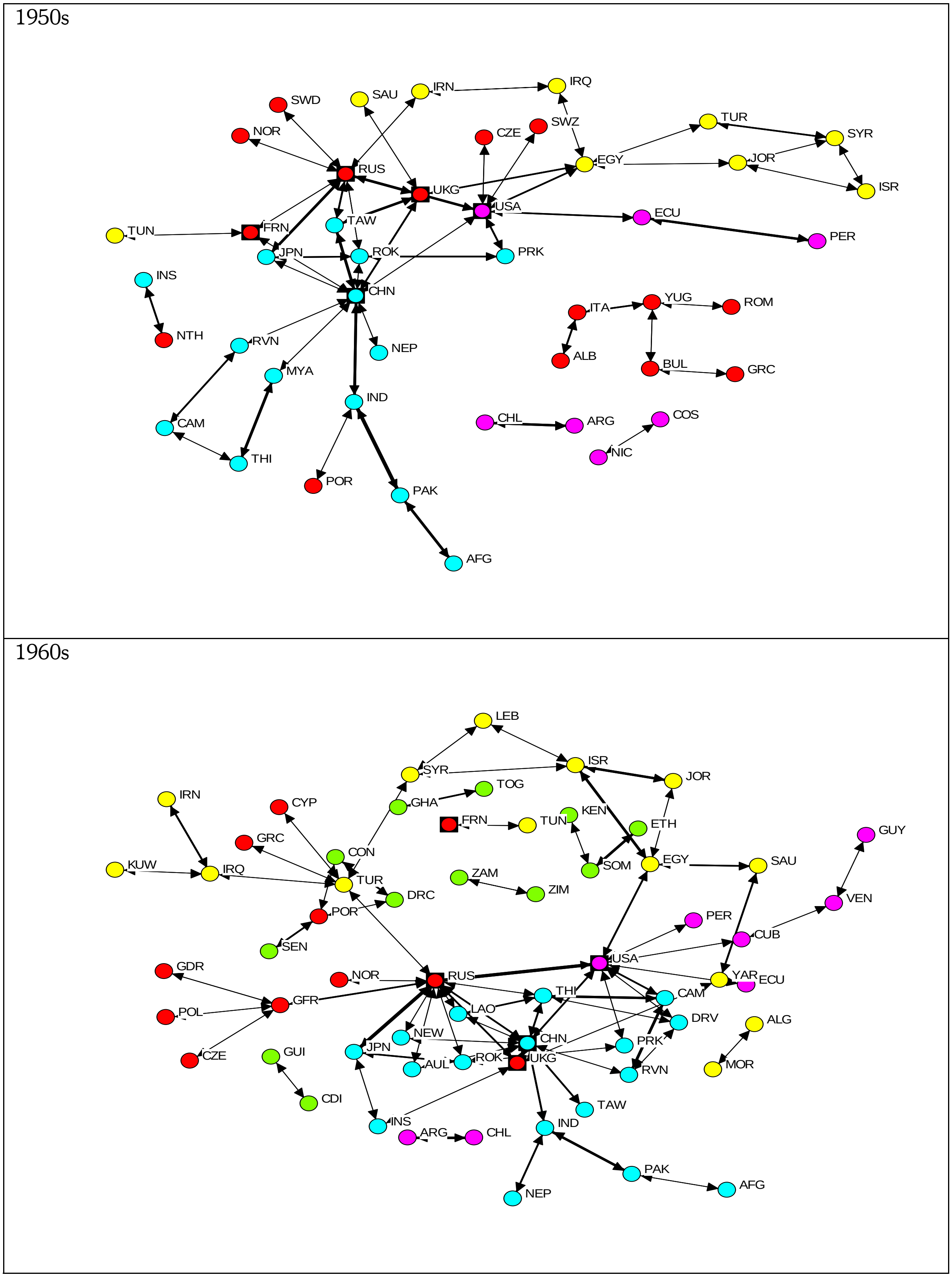


Figure 4.1 Networks of Dyadic Dispute Onset, 1950–2000 (Continued)

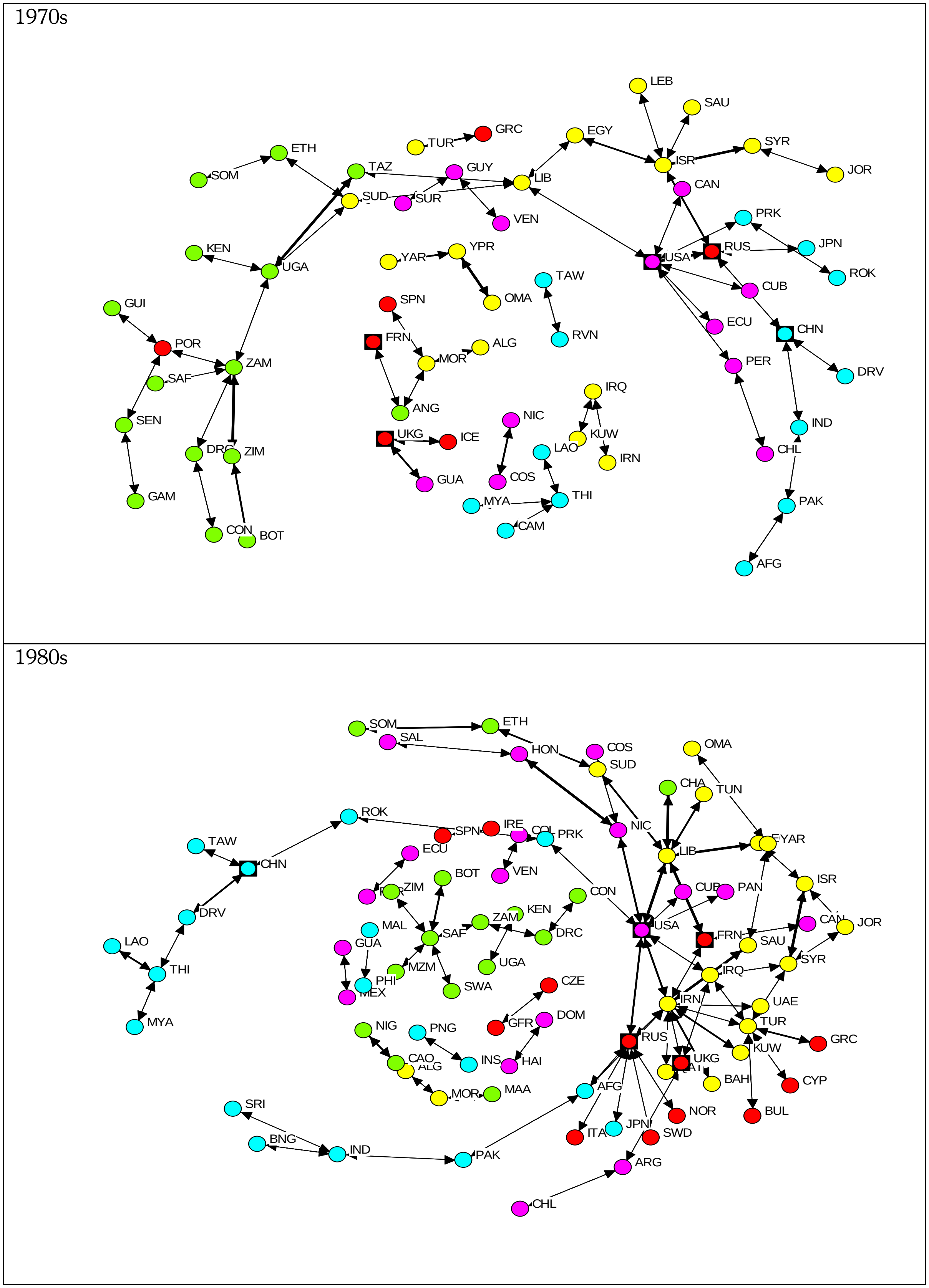


Figure 4.1 Networks of Dyadic Dispute Onset, 1950–2000 (Continued)

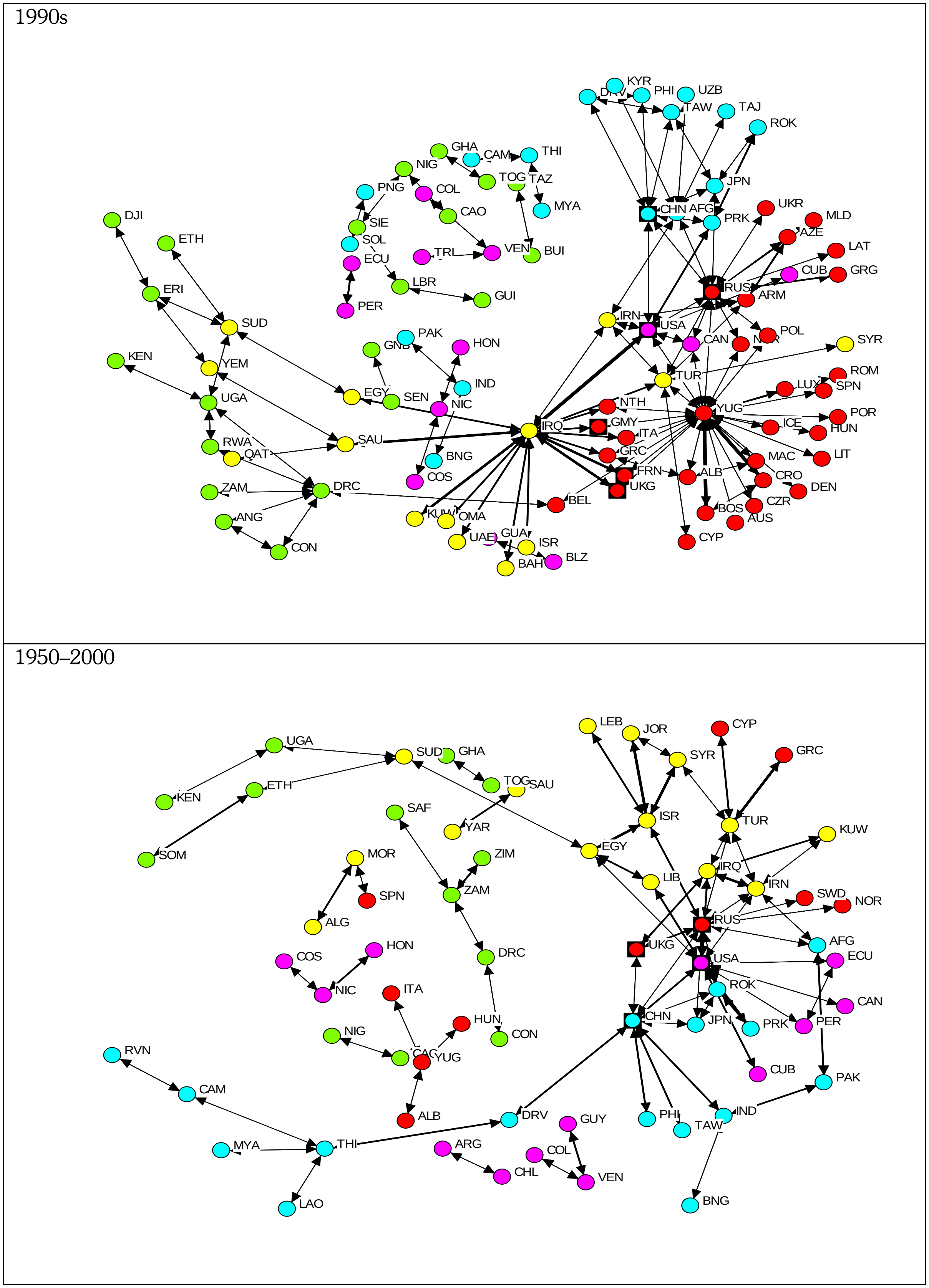


Figure 4.2 Networks of Dyadic Crisis Onset, 1950–2000

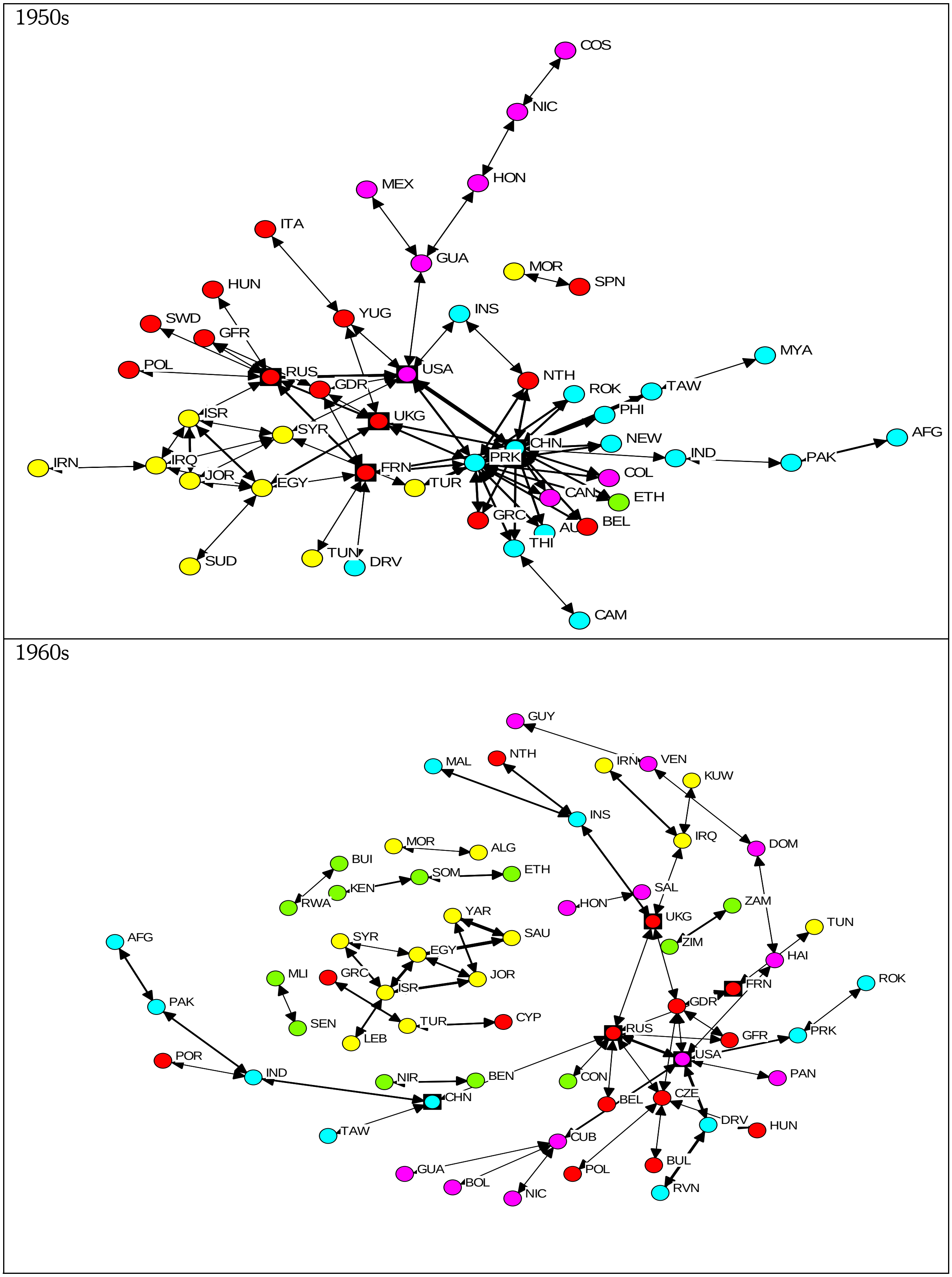


Figure 4.2 Networks of Dyadic Crisis Onset, 1950–2000 (Continued)

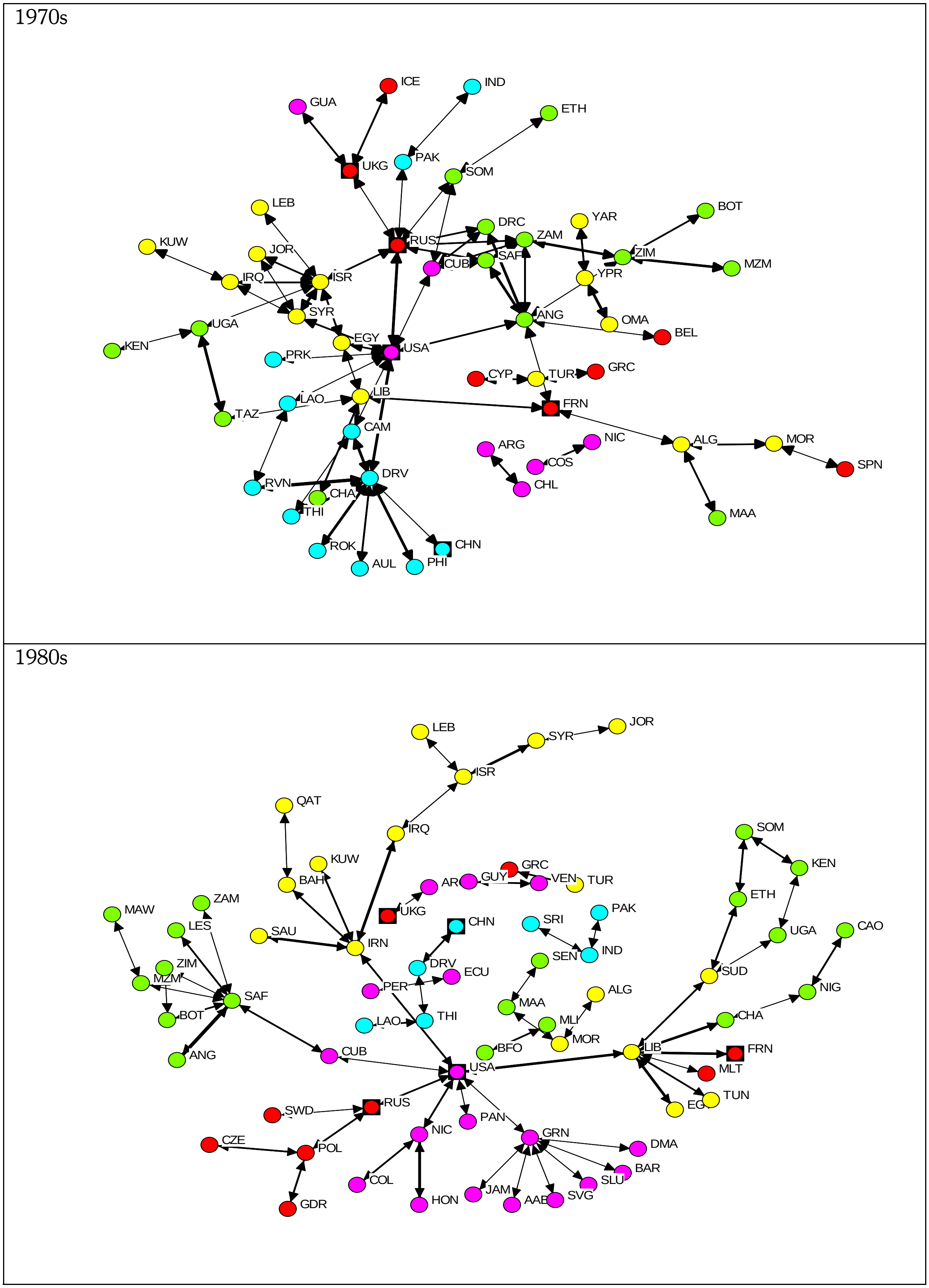


Figure 4.2 Networks of Dyadic Crisis Onset, 1950–2000 (Continued)

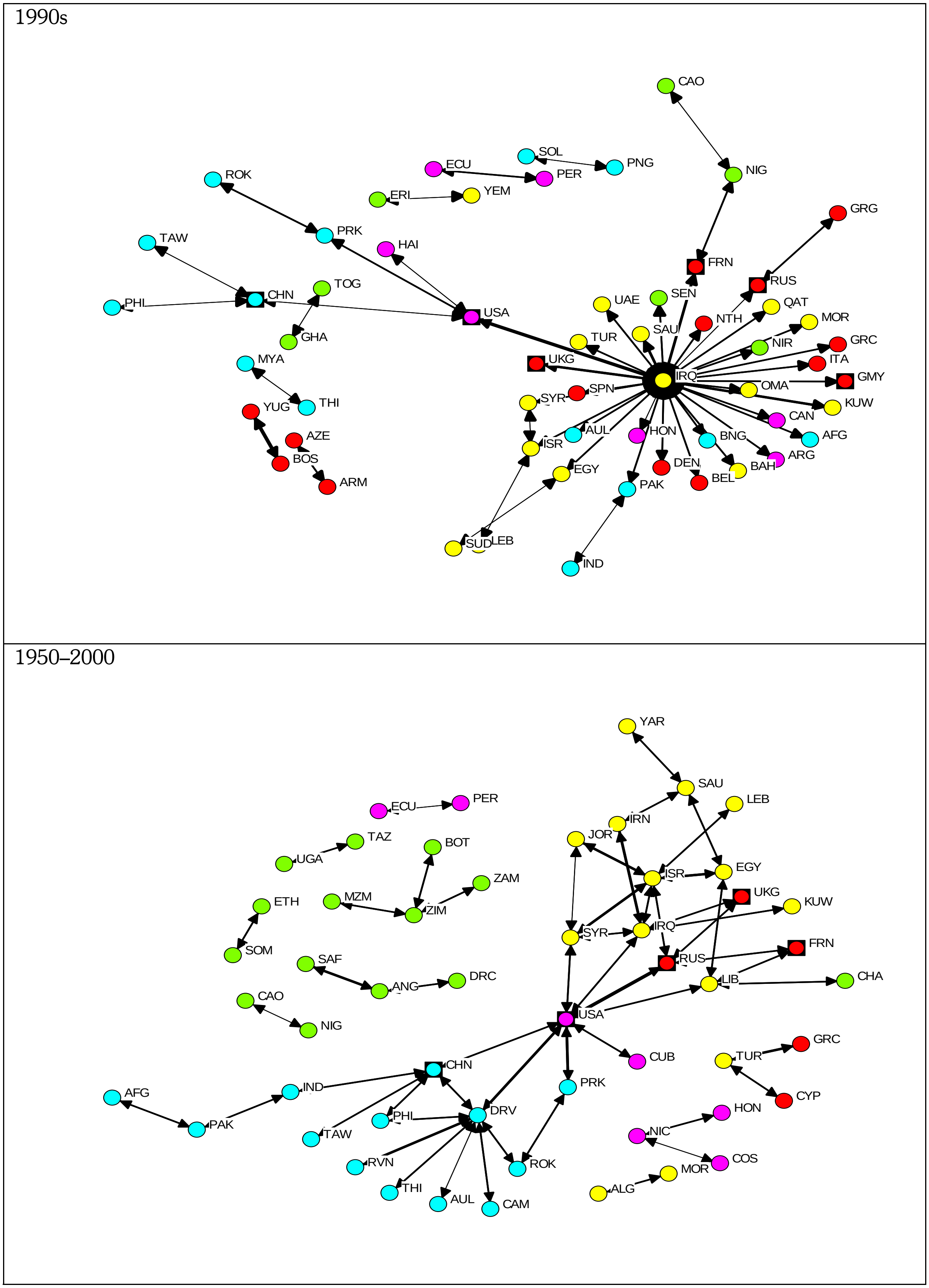
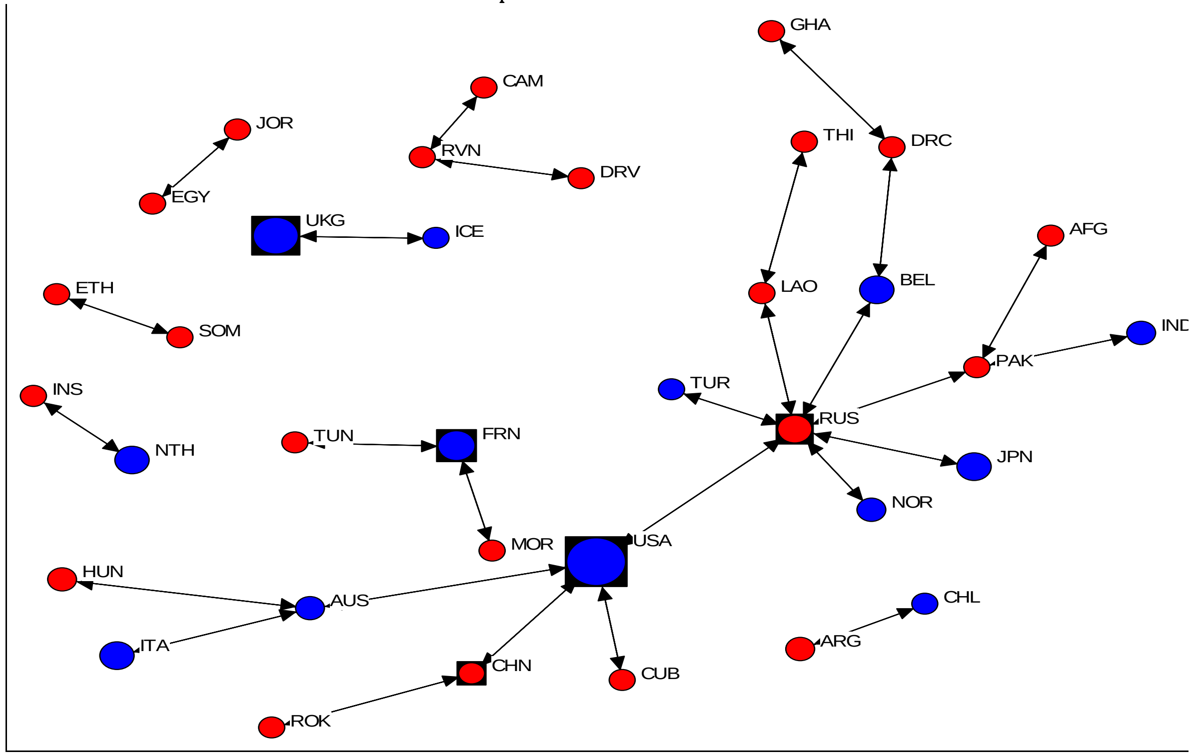


Figure 4.3 Networks of Dyadic Dispute Onset in 1960

Dispute Onset in 1960



Dispute Onset-Ally in 1960:
disputes between allied states represented by green arrow.

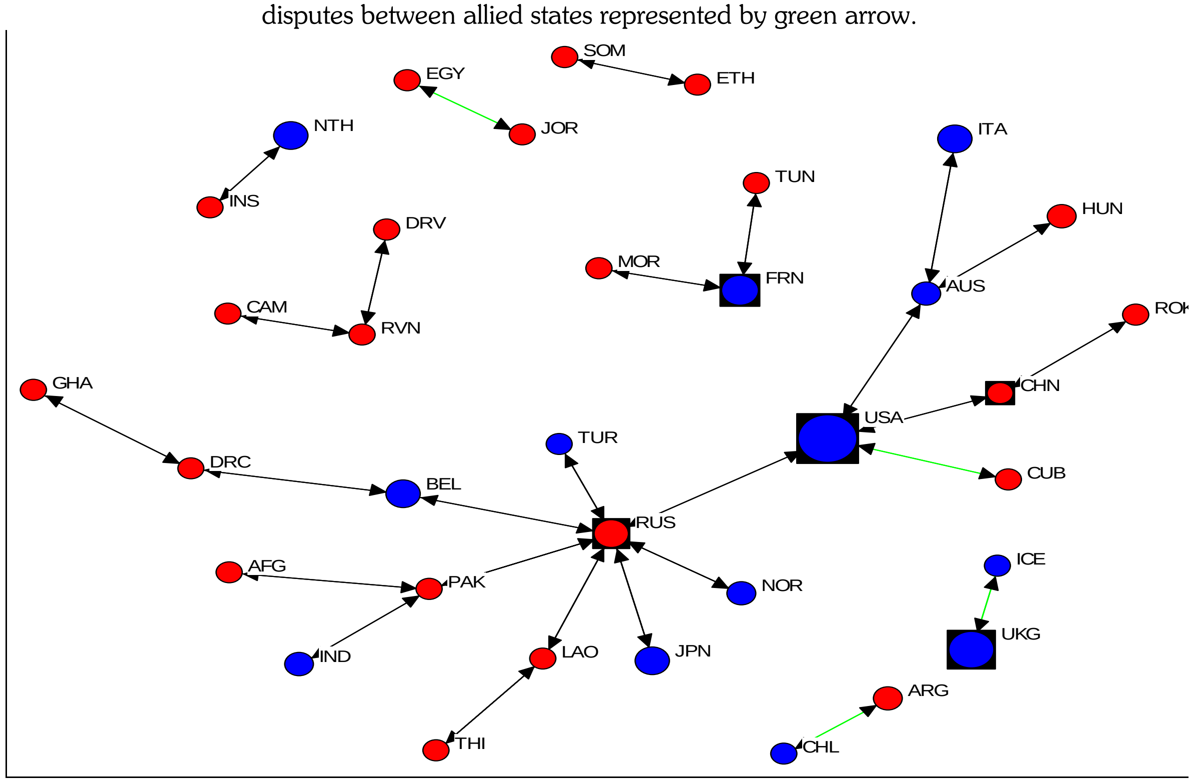
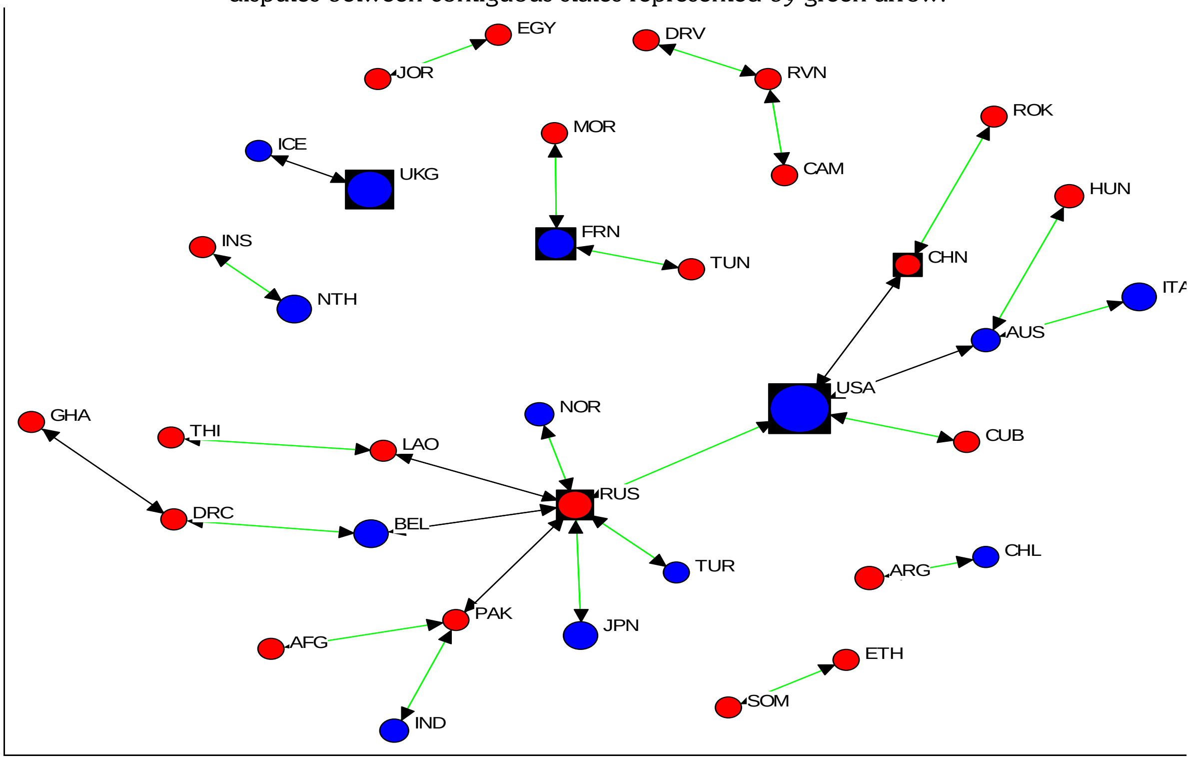


Figure 4.3 Networks of Dyadic Dispute Onset in 1960 (Continued)

Dispute Onset-Contiguity in 1960:
disputes between contiguous states represented by green arrow.



Dispute Onset-Distance in 1960:
disputes between distant states represented by green arrow.

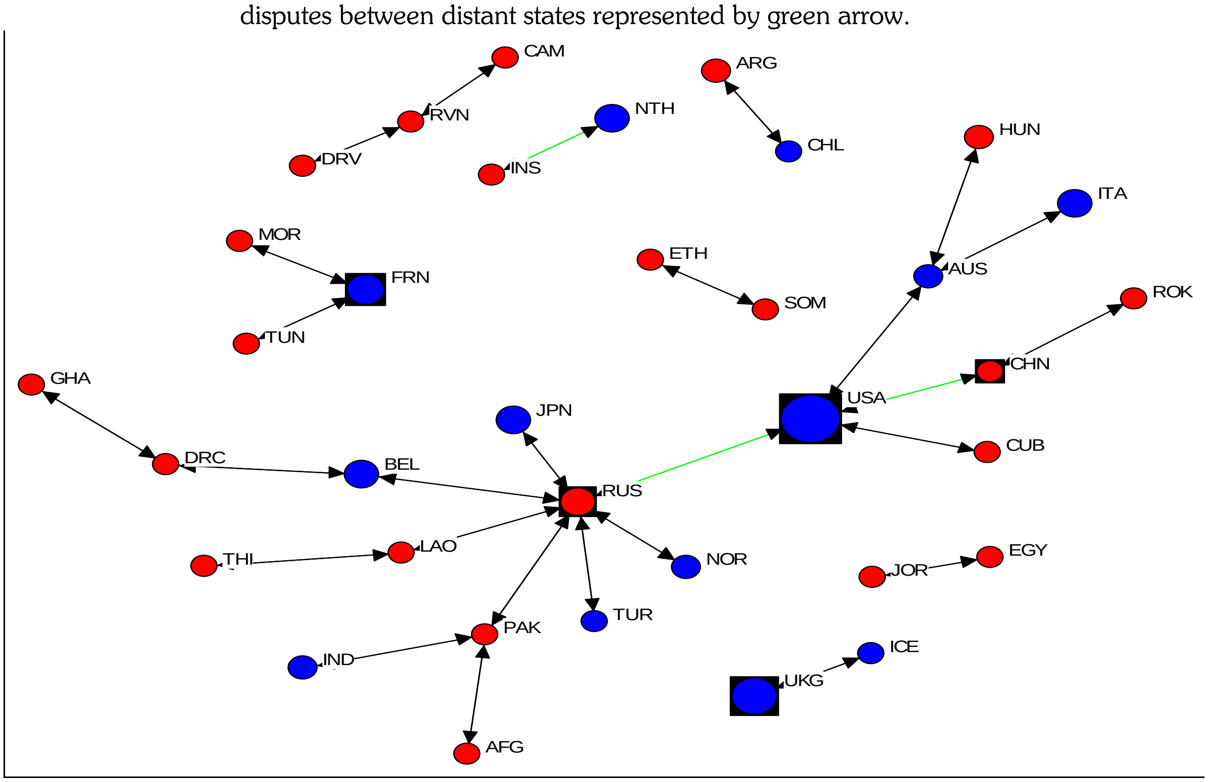
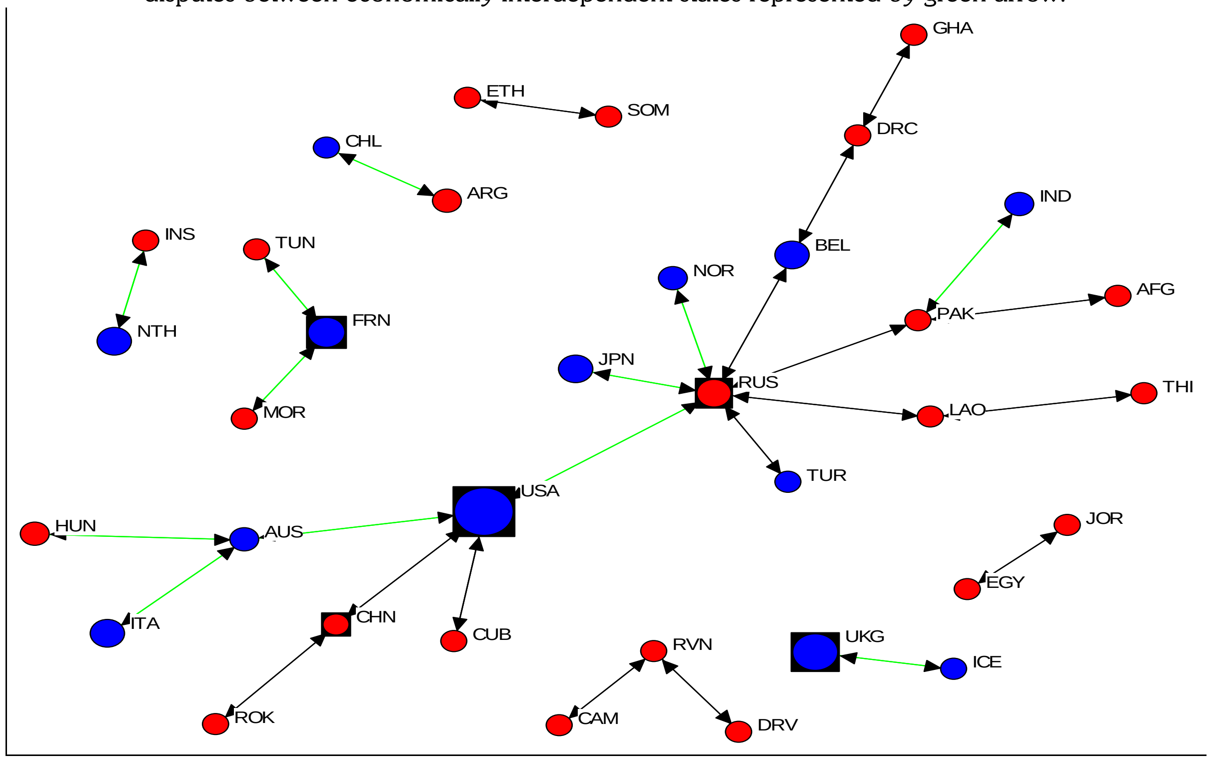


Figure 4.3 Networks of Dyadic Dispute Onset in 1960 (Continued)

Dispute Onset-Economic Interdependence in 1960:
disputes between economically interdependent states represented by green arrow.



Dispute Onset-Past Conflict Interaction Level in 1960:
disputes between hostile states represented by green arrow.

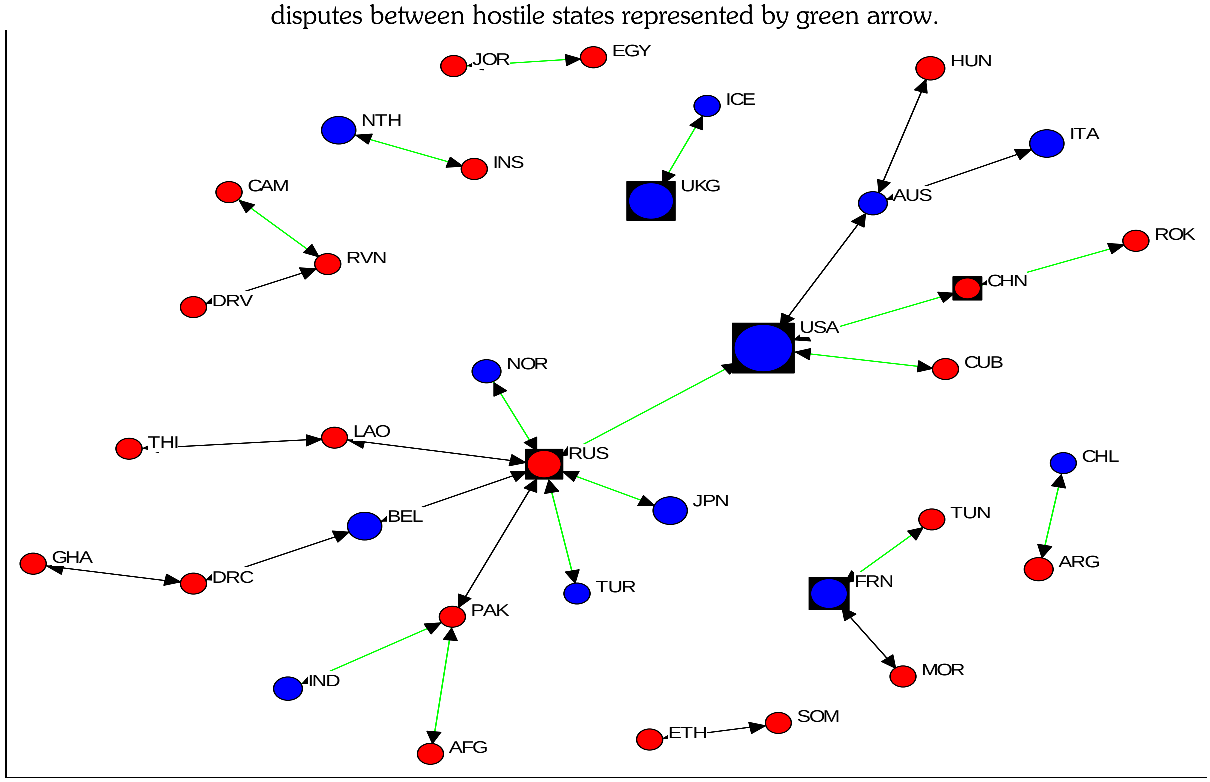


Figure 4.3 Networks of Dyadic Dispute Onset in 1960 (Continued)

Dispute Onset-Alliance Agreements in 1960:
disputes between states with alliance agreements represented by green arrow.

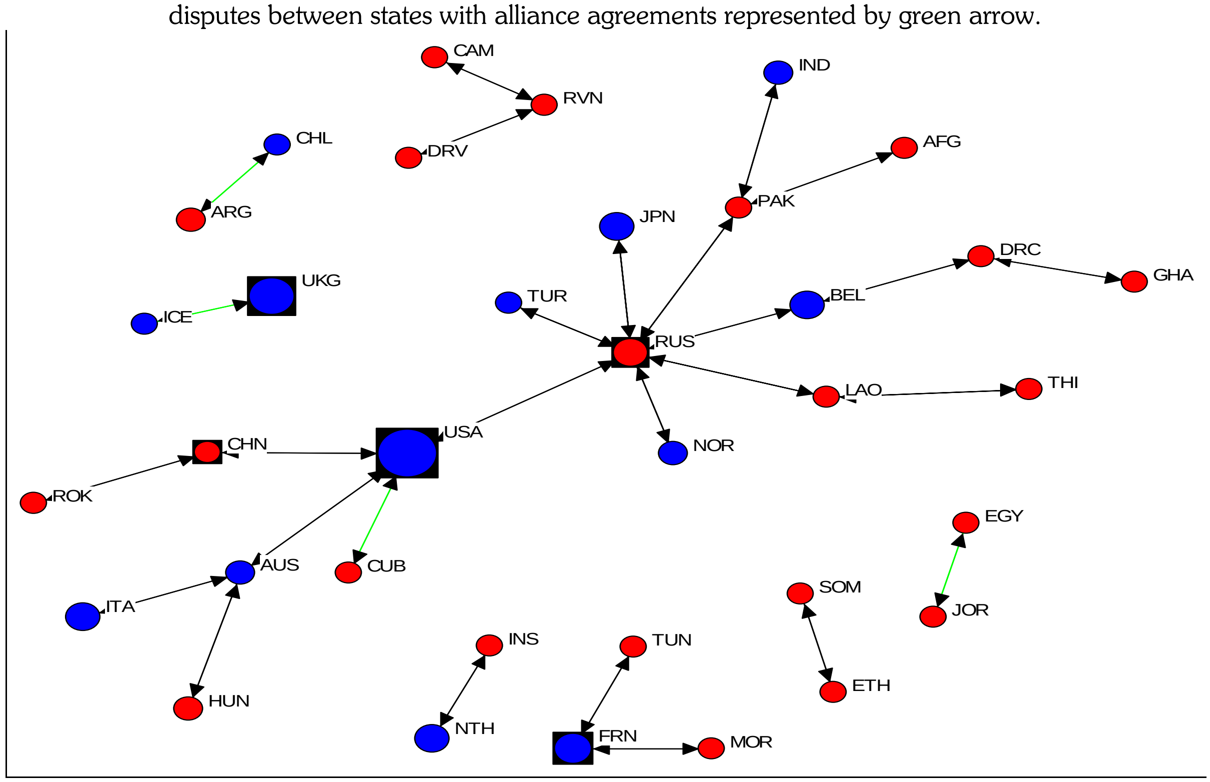
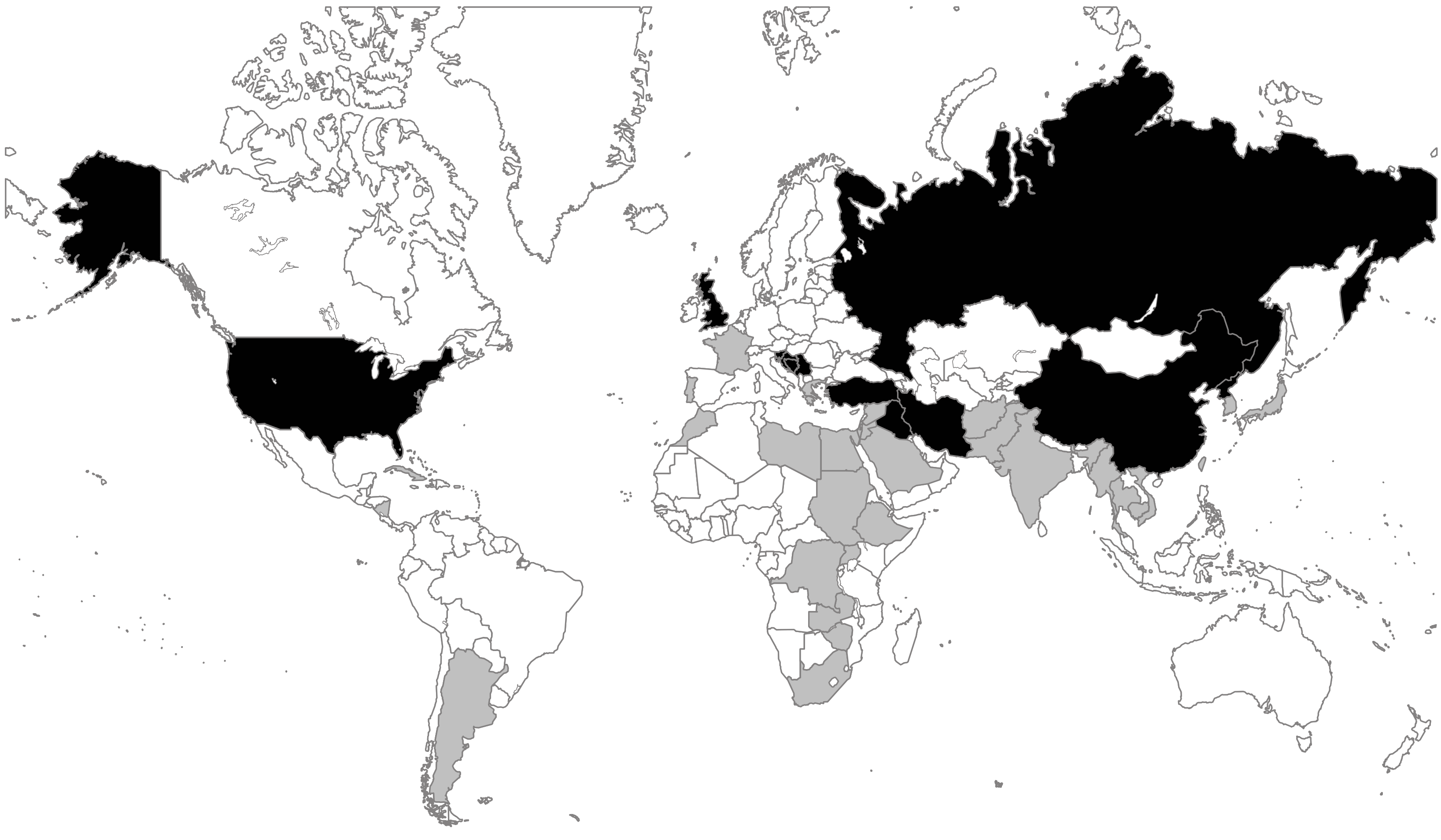
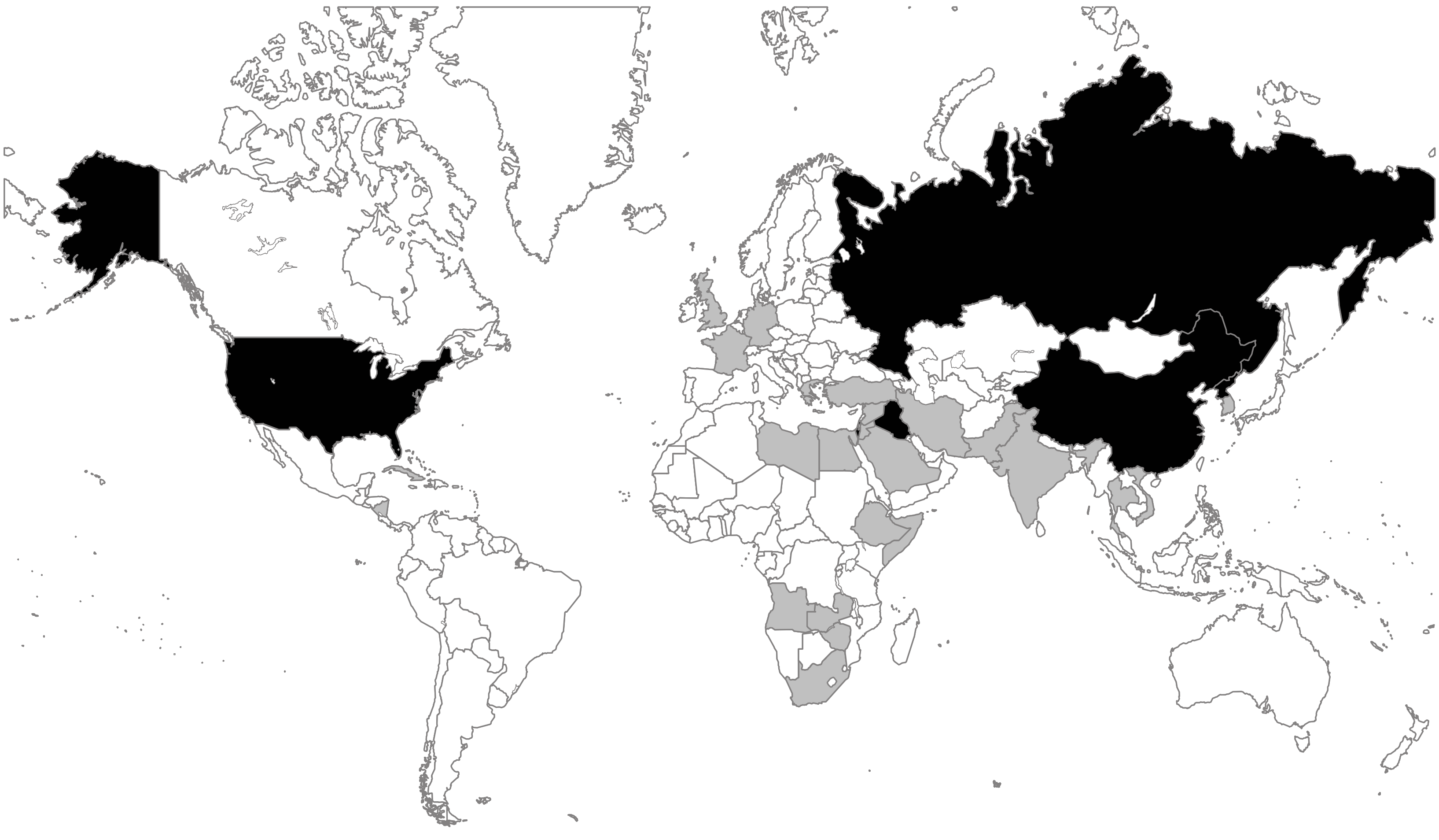


Figure 4.4 Global Map of Dispute Onset Distribution, 1950–2000



NOTE: Black (the top third of all dispute onsets); Gray (the middle third of all dispute onsets); White (the bottom third of all dispute onsets).

Figure 4.5 Global Map of Crisis Onset Distribution, 1950–2000



NOTE: Black (the top third of all crisis onsets); Gray (the middle third of all crisis onsets); White (the bottom third of all crisis onsets).

CHAPTER 5. DETERMINANTS OF THE ONSET AND SUCCESS OF ECONOMIC SANCTIONS

In addition to applying network analysis to the onset of militarized conflicts, it can also be applied to other international processes. Network analysis is likely to be especially relevant to studying sanctions because prior work has shown that sanctions success depends on whether a sufficiently large proportion of nations in the target state's trading network can be induced to join the sanctioning effort. Understanding the dynamics of that network is essential to understanding when sanctions are attempted and when they succeed.

In what follows I first present some graphical representations of international sanctions. This section argues for the importance of graphical representations of dyadic sanctions onsets from the social network perspective, and it focuses on describing how each set of figures from the social network perspective represents the study of economic sanctions. I then devote the next two sections to empirical analyses of economic sanctions using the sample selection method. First, regarding the first stage of sample selection analyses: even though there have been many recent efforts to identify the determinants of economic sanction success, we lack empirical analyses of the factors affecting the onset of economic sanctions; when do states initiate the use of economic sanctions? Although we now know quite a lot about the determinants of the onset of militarized interstate disputes, which was examined in Chapter 4, we know far less about the onset of economic sanctions. This study addresses this gap in empirical analysis. Second, regarding the second stage of sample selection analyses, many different attributes of the sender or target state, as well as the relationship between the two, have been hypothesized to affect the success of economic sanctions. However, I argue that two important factors have been neglected or tested inadequately in the previous empirical studies: the relative structural network power difference between sanctioning and target states, and the target's structural network power. I posit that the lower the difference in the levels of structural network power between sender and target, the higher the probability of success; and that the greater the structural network power for the target, the higher the probability of success. The measurements of structural network power (for the sender-target balance and for the target) are derived from six different interaction measures (on the dimensions of communication patterns and resource flows) using social network analysis. This chapter also argues that the previous research on the success of economic sanctions does not adequately take into account the selection effects that take place; states involved in economic sanctions do select or are selected into the sanction phase by a strategic process. To control for this selection bias, I use a censored probit model connecting sanction onset and sanction success. The use of censored probit in addition to the structural network power concept provides a more accurate picture of the factors affecting the success of economic sanctions. In addition to the more appropriate sample selection method, the focus of hypothesis testing in the latter two parts of this empirical chapter is on how my new social network conceptions (of international system structure and national power) lead to more accurate and powerful empirical models of economic sanctions than previous ones that are mainly rooted in attribute logic. The performance of sanction models (both on onset and success) using structural network power measures is compared against those using attribution-based power measures, through nonparametric model discrimination statistics and information measures.

5.1. Graphical Representations of Dyadic Economic Sanctions Onset

The sociograms of dyadic sanction onsets in the 1950s, 1960s, 1970s, 1980s, and through 1950–1990 show the following: (1) sanction onsets for all states, (2) sanction onsets by major powers, (3) sanction onset in each of five regions in the world, (4) changing patterns of sanction networks, and (5) connections among different sanction onsets in the international system.[63] More specifically, these sociograms of economic sanctions reveal how sanction cases are or are not connected to each other, some general structural characteristics of international sanction networks in each decade and their changing patterns over decades, and the bilateral relationships between some monadic or dyadic factors and dyadic

[63] See Appendix 4.1 for discussion of graphical network data representation (especially sociograms) versus tables and for an exercise that compares the two methods.

sanction onsets (e.g., regime type, economic development, major power status, alliance, contiguity, distance, economic interdependence, past conflict interaction level, and alliance agreements).

Figures 5.1–5.2 display the graphical representations of dyadic economic sanctions onset. In each of the sociograms, the two states involved in the onset of sanctions are connected by a one-way arrow from the sender to the target state. To account for the major power-sanction onset relationship, the five major powers as defined by the COW project (the U.S., the United Kingdom., France, the Soviet Union, and China) are represented by the circle-in-box shape rather than the circle shape used for all other states. To account for the pattern of regional sanctions[64], the region of each state as defined by the COW project is represented by a different color: yellow for the Middle East, pink for North and South America, green for Africa, blue for Asia, and red for Europe. To represent the pattern of recurrent sanctions[65], the frequency of sanction onset in a dyad is represented by the thickness of lines connecting the dyad.

The sociograms in the figures represent the networks of dyadic economic sanctions onset in the 1950s, 1960s, 1970s, 1980s, and throughout 1950–1990, and only successful cases of dyadic economic sanctions onset throughout 1950–1990. Each of the sociograms displays all pairs of states that had at least one sanction case in each period. If there was more than one sanction case for the same dyad, the frequencies of sanction onset are represented by the thickness of lines connecting the dyad; for example, the thickest arrow in the sociograms between the U.S. and the Soviet Union represents the highest number of sanction onsets in the networks of economic sanctions. We should be able to derive from the networks of dyadic sanctions onset several general characteristics of sanctions networks: the predominance of sanctions initiated by the U.S. (especially since 1960 and toward states in North and South America), the dominance of sanction initiations by just four major powers throughout the study period (the U.S., the United Kingdom, France, and the Soviet Union), the high connectedness of sanction

[64] A regional sanction is defined as a sanction where both sender and target states belong to the same region. For example, the sanction involving Spain and the United Kingdom in 1954 is identified as a regional sanction.

[65] A recurrent sanction identifies a situation where the same dyad experiences more than one sanction case. For example, the sanction between the United States and South Korea is identified as a recurrent sanction because the two states experienced more than one sanction (in 1973 and in 1975).

onset cases, especially in the later decades, and some isolated[66] (disconnected) sanction cases among communist countries, especially those initiated by the Soviet Union in the 1960s and China in the 1970s. The sociograms of sanction onsets (from Figures 5.1 and 5.2) also reveal: (1) how each of the sanction cases is connected to other sanction case(s), (2) which types of actors (major or non-major powers) of which regions are involved with which other actors in the network, (3) some major sanction cases to define the structural characteristics of sanction network in each decade (e.g., for the sanction network of 1950s, the sanction case in 1956 for "Nationalization of Suez Canal" involving such states as the U.S., the United Kingdom, France, and Egypt can be characterized in this way because it is connected with most of the other sanction cases in the period), and (4) the changing patterns of sanction onset networks over time (e.g., increased regional and recurrent sanctions).

The 1950s sanctions network in Figure 5.1 displays some general patterns of isolated and connected sanctions among different states in the network of economic sanctions. First, there are only a few isolated sanction cases (such as a sanction by Indonesia toward the Netherlands in 1957 for "West Irian" [as titled by HSE 1990] and a sanction by India toward Portugal in 1954 for "Surrender Goa"). Second, all other sanction cases in the 1950s are connected sanctions, mostly initiated by the four major powers (the U.S., France, the United Kingdom, and the Soviet Union). So, for example, with the sanction onset of the U.S. toward France in 1956 for "Suez," two sanction cases initiated by France (such as one against Egypt in 1956 for "Nationalization of Suez Canal" and the other against Tunisia in 1957 for "Halt Aid to Algerian Rebels") are connected to five sanction cases initiated by the U.S. (such as one against North Korea in 1950 for "Korean War," one against Iran in 1951 for "Expropriation," one against North Vietnam in 1954 for "Vietnam War and Its Aftermath," one against Israeli 1956 for "Palestinian and Border Questions," one against Laos in 1956 for "Prevent Communist Takeover," and, one against Egypt in 1956 for "Nationalization of Suez Canal"). Those sanction cases initiated by the U.S. and France are

[66] A sanction case is defined as "isolated" or "disconnected" in the network if it does not have any connection with other sanction cases in the network. The sanction case is defined as "connected" in the network if it has any connection to other sanction cases in the network.

also connected to two sanction cases initiated by the United Kingdom, with the United Kingdom sanction toward France in 1956 for "Suez."

Figure 5.3 shows us how the sociograms of economic sanctions reveal the general graphical patterns of monadic or dyadic factors affecting the onset of sanctions (of regime type[67], economic development, major power status, alliance, contiguity, distance, economic interdependence, past conflict interaction levels, and alliance agreements). For each of the sociograms in Figure 5.3, the two nodes (states) involved in a sanction are connected by a one-way arrow from the sender to the target state. Each state's regime type is represented by the color of the node (blue for a democratic regime, red for a non-democratic regime); each state's economic development level, measured by its total trade size, is represented by the size of the node (bigger for more economically developed, smaller for less economically developed); and each state's major power status is represented by the shape of the node (circle-in-box shape for major, circle for all others). We can see that, among 24 total sanctions dyads in the 1970s, only 4 (or 17%) were democratic-democratic sanctions dyads (the U.S. toward India, Turkey, Chile, and Uruguay), and major powers were involved in all 24 sanctions (2 sanctions by China, 1 sanction by the United Kingdom, and 21 sanctions by the U.S.). The remaining sociograms reveal that allied states were more involved than non-allied states. Contiguous states, including colonial contiguities, were far less involved than non-contiguous states. Distant states were more involved than non-distant states. Economically interdependent states, measured by bilateral trade, were far more involved than economically non-interdependent states. Hostile states, measured by the past conflict interaction level, were far less involved than non-hostile. States with alliance agreements, measured by Tau-b, were more involved than states without alliance agreements.

[67] The measurements and data sources for all the variables in this section will be discussed later in detail.

5.2. Analysis of the Onset of Economic Sanctions

5.2.1. General Approach

The second section of this chapter is devoted to the study of economic sanction onset. As noted in Chapter 2, research has been focused on the sanction success models rather than on the sanction onset models, that is, on whether implemented sanctions worked rather than when those sanctions are first implemented. Our model setup for sanction onset is based on some of the rare empirical literature on economic sanction onsets (e.g., Lektzian and Souva 2003; Sandoval-Bustos 2004; Goenner forthcoming;); I base my analysis on their sanction onset model setups to facilitate comparison with previous research. However, I performed a set of sensitivity analyses to check the robustness of the results found in the chapter (e.g., by varying the models through adding or dropping some of the control variables and by using different samples such as all dyads or major-power dyads); the overall pattern with the set of sensitivity tests confirms my findings. Equation (5-1) summarizes the set of hypotheses that will be tested for onset analysis of economic sanction (Table 5.1 summarizes the expected sign of each coefficient in the analysis):

$$\text{Onset of Economic Sanctions}_t = ß0 + ß1\text{*Interdependence Low}_t + ß2\text{*Democracy Low}_t + ß3\text{*Balance of Power}_t + ß4\text{*Allies}_t + ß5\text{*Contiguity}_t + ß6\text{*Distance}_t + ß7\text{*Major Power}_t + ß8\text{*Militarized Dispute Onset}_t + e \quad \text{(Equation 5-1)}$$

1. Hypotheses

Hypothesis 3. The preponderance of power decreases the probability of the onset of economic sanction. That is, the more skewed the distribution of power in a dyad, the less likely are sanctions.

Hypothesis 3'. Parity of power decreases the probability of the onset of economic sanction. That is, the less skewed the distribution of power in a dyad, the less likely are sanctions.

Regarding hypothesis 3 and 3', many realists (particularly "balance of force" theorists) argue that if a state enjoys a power advantage over its adversary, it will be more likely to use coercive actions because it is more likely to succeed and the cost of using coercive actions is likely to be low. Weaker states will view the initiation of violence as a very risky strategy that is likely to result in substantial costs. On the other hand, others ("power preponderance" theorists) argue that the power preponderance between states will preserve peace since it reduces the uncertainties of winners and losers in a coercive action. Power parity creates a greater opportunity for sanctions; as there is a highly asymmetric power distribution, the target will more likely concede to the sender's demand since it knows it is less likely to prevail in a crisis bargaining situation (Lektzian and Souva 2003). All the other hypotheses to be tested in this section of economic sanctions onset analysis (hypotheses 1–2, 4–8) are in Appendix 5.1 In this section, the main purpose of hypotheses testing will be to determine how the power hypotheses using the new power measures behave in models of economic sanction onsets.

2. Data and Measurements

I use the extensive data on economic sanction cases of the twentieth century collected by HSE (1990). They have collected 116 cases of economic sanctions imposed since World War I and prior to 1990. Even though there have been other data collection efforts on economic sanctions[68], researchers agree that the data collection of HSE is the best available in economic sanction studies (Drezner 1999; Ellings 1985; Mansfield 1995; Dashti-Gibson, Davis, and Radcliff 1997).[69] This data set is then merged

[68] Even though most of the literature has been using this data collection, there have been several other data collection efforts on economic sanctions (see Drezner 1999, 60–62; Drezner 2003, 652). First, Elings (1985) assembled information on 107 instances of economic sanctions between 1945 and 1981 (for the cause of sanction initiation). Second, Blessing (1975) collected data on 126 U.S. coercion attempts between 1948 and 1972 (for the causes of sanction initiation and outcome). Third, Bayard and Elliott (1994) compiled data on the use of U.S. economic coercion to extract trade concessions via Section 301 from 1975 to 1994. Fourth, Elliott and Richardson (1997) catalogued the threats and suspensions of Generalized System of Preferences benefits to developing countries to enforce core labor standards since the 1988 Omnibus Trade Act. Fifth, DeSombre (2000) chronicled U.S. sanctioning activity to raise other countries' environmental standards from the mid-1970s to the present. Sixth, Morgan, Bapat, and Krustev (2006) provide data collection of sanctions, focusing on the instances in which sanctions were threatened but not imposed (Threat and Imposition of Sanctions (TIES) Version 3.5, 1971–2000). See also Marinov (2005) and Drezner (2000) for other data collection efforts. The main problems with all of those data collections are that they are either based on a single sender country (usually, the U.S.), limited in the time frame of their collected cases, or missing many of the variables present in the HSE data set.

[69] Drezner (1999, 103) posits that "the [HSE] study provides the most comprehensive data about sanctions. No other data set contains as many documented cases of economic coercion." Ellings (1985, xvi) observes that the HSE effort "is very likely the best sanctions policy analysis yet to be published. Its

with the set of all politically relevant dyads[70] for the study period of 1950–1990.[71] The dichotomous *Onset of Economic Sanctions* dependent variable is coded as 1 if any kind of economic sanction is ongoing between two states in a particular year, based on the HSE (1990) database; if there was no sanction, it is coded as 0.[72] The measurements on all the independent variables used in this section of economic sanctions onset analysis are presented in detail in Appendix 5.1.

5.2.2. Estimation Methods

As noted earlier, research on the success of economic sanctions should take into account the selection effects.[73] I model the sample selection process of sanctions onset and sanctions success using the censored probit estimation, controlling for statistical linkages of the two dependent variables (more details on the issue of the censored probit or sample selection probit estimation versus the ordinary probit

---

data base is the largest of this genre of research." Mansfield (1995, 579) notes that the HSE data "are widely recognized as the best of their kind."

[70] HSE (1990, 10–11) posit that the majority of sanctions are imposed by major powers and most of the sanctions imposed by non-major powers are against neighboring states: "Among the cases we have documented, the countries that impose sanctions are for the most part large nations that pursue an active foreign policy. To be sure, there are instances of neighboring fights: Indonesia versus Malaysia in the 1950s until 1984; India versus Nepal over the latter's rapprochement with China in 1989-90."

[71] As in most empirical dyadic sanction studies, I deleted the sanction cases initiated by international organizations. For the sanction cases that involve multiple senders or targets, I disaggregated the cases into "state a – state b" format (i.e., dyadic format).

[72] See Chapter 4 for the discussion on including versus excluding ongoing events in the dyadic analyses.

[73] For a general discussion on sample selection bias (the nature of bias and econometric methods for correcting it), see Greene (1981), Heckman (1979, 1990), Puhani (2000), Stolzenberg and Relles (1997), Winship and Mare (1992), Vella (1992), and Vella and Verbeek (1999). The use of an economic approach to selection processes is, however, not limited to sanction studies. Other scholars have also used the approach (e.g., see Reed and Clark 2000, Clark and Reed 2003, and Sweeney 2003b for the unified model of war onset and outcome using the simple selection method; see the special issue of *International Interactions* 28(1), 2002, for more discussions on the selection bias and its effects on research in international relations).

estimation follow in the later section). This sample selection model has two stages: the sanctions onset for the first stage and the sanctions success for the second stage.[74]

My approach to estimation follows Greene (2003) and Reed (2000). Let y^*_1 be a latent variable that measures sanctions onset; let y^*_2 be a latent variable that measures sanctions success. I assume that y^*_i is influenced by a vector of observed explanatory variables X_i and a disturbance tem u_i. The latent variables y^*_1 and y^*_2 are not observed; instead we observe the dichotomous realizations of y_1 and y_2 (sanctions onset and success).

$$y^*_1 = X_1 \beta_1 + \mu_1$$

$$y^*_2 = X_2 \beta_2 + \mu_2$$

We can only observe sanctions success, y_2, if there is a sanctions onset, $y^*_{1i} > 0$. That is,

$$\text{Sanctions Onset } (y_1) = \begin{cases} 1, \text{ if } y^*_1 > 0 \\ 0, \text{ if } y^*_1 <= 0 \end{cases}$$

[74] Morgan and Schwebach (1997), Smith (1996), Van Bergeijk (1989), Tsebelis (1990), Blake and Klemm (2006), Losman (1979), Baldwin (1985, 1999-2000), Doxey (1987), Leyton-Brown (1987), Drezner (2003), Croco and Teo (2005), and Martin (1992) all suggest that the literature on economic sanctions suffers from selection bias because it focuses on situations in which economic sanctions were used or threatened. For example, Drezner (2003) asks two main questions on the selection bias in sanction studies, both of which he answers affirmatively: "Has there been a failure to appreciate the strategic interaction underlying the use of economic coercion?" and "Is there significant selection bias?" Baldwin (1999-2000) discusses in detail some methodological issues (including selection bias) that have been raised with respect to the study of economic sanctions. He points out that identifying the universe of cases is crucial when dealing with selection bias but that "it is not obvious how the universe should be defined" with respect to economic sanctions. He suggests several possible cases for economic sanctions (97): "instances in which economic sanctions were used or threatened," "instances in which sanctions were seriously considered," "instances in which an influence attempt was made," "instances in which an influence attempt was seriously considered," and "instances of international interactions in which an influence attempt could have been considered, regardless of whether it was or not." Drezner (2003, 644) also argues the difficulty in finding the right sample to address selection bias in sanction studies: "To test the selection effects argument, the crucial cases to study are those in which coercion is threatened but not implemented. If these cases exist in significant quantity and have an appreciably higher success rate than cases in which sanctions are imposed, it strengthens the argument that selection bias has adversely affected the trajectory of research about sanctions, underestimating the role of strategic interaction. However, locating these cases is an empirical challenge, because of the difficulty in identifying sanctions events that end at the threat stage." I believe that instead of disregarding selection bias in analyzing sanction outcome, due to the lack of available "perfect" samples to address selection bias, our next best strategy should be to use the sample selection technique based on one of the populations for sanction studies suggested by Baldwin (1999-2000). I use the politically relevant dyads that consist of major powers and continuous states. In fact, HSE (1990, 10–11) posit that the majority of sanctions are imposed by major powers and that most of the sanctions imposed by non-major powers are against neighboring states.

Sanctions Success (y_2) = observed, if $y_1 = 1$

unobserved, if $y_1 = 0$

5.2.3. Results and Discussion

Tables 5.2 and 5.3 display the results from the censored probit estimations of economic sanctions onset.[75] Hypotheses 3 and 3' test the argument that a preponderance or parity of power between the states decreases the probability of the onset of economic sanctions. The results weakly support power preponderance over balance of power hypothesis. In two sanction onsets models, the coefficients for the variable are negative and statistically significant. Dyads with highly asymmetric national power seem to be less likely to be involved in economic sanctions. As power preponderance theorists argue, power preponderance will preserve peace because it reduces the uncertainties of prospective winners and losers in a dispute. As there is a highly asymmetric power distribution, the target will more likely concede to the sender's demand, yielding the success of a sanction, since it knows it is less likely to prevail in a crisis bargaining situation (Lektzian and Souva 2003). This also implies that sanctions will be unnecessary, hence used less often.

5.3. Analysis of the Success of Economic Sanctions

5.3.1. General Approach

The third section of this chapter is devoted to the dyadic study of economic sanctions success. As noted in Chapter 2, even though there has been a large volume of empirical analyses on sanction success, HSE (1990) provide the benchmark for data analyses on sanction success. Our sanctions success model setup focuses on the HSE original analyses and the Drury (1998) revised model setup (see also Cox and Drury 2006), which have been regarded as fully specified models on sanction success. I base my analysis

[75] This section only provides the results on the main hypotheses (balance of power versus power preponderance) in the onset models. The discussion on the remaining hypotheses is presented in Appendix 5.1.

on their sanction success model to facilitate comparison with previous research. However, I performed a set of sensitivity analyses to check the robustness of the results (e.g., varying the models with adding or dropping some of the control variables and using different samples such as all dyads or major-power dyads); the overall pattern with this sensitivity test confirms my findings. Equation (5-2) summarizes the set of hypotheses on economic sanctions success that are tested below (see Table 5.1 for the expected sign of each coefficient in the analysis):

Success of Economic Sanctions$_t$ = ß0 + ß1*Relative Structural Network Power$_t$ or ß2*Target's Structural Network Power$_t$ + ß3*Sender Cooperation$_t$ + ß4*Institution Sanctions$_t$ + ß5*Sender Cooperation*Institution Sanctions$_t$ + ß6*Sender Cost$_t$ + ß7*National Security$_t$ + ß8*Additional Policies$_t$ + ß9*U.S. Sanctions$_t$ + ß10*Target Assistance$_t$ + ß11*Target Stabilities$_t$ + ß12*Target Cost$_t$ + ß13*Pre-sanctions Economics$_t$ + ß14*Pre-sanctions Relationships$_t$ + ß15*Pre-sanctions Trade Level$_t$ + ß16*Target Assistance*Pre-sanctions Trade Levels$_t$ + *e* (Equation 5-2)

1. Hypotheses

The main hypotheses to be tested (hypotheses 1 and 2) are presented in detail in Chapter 3; all other hypotheses to be tested in this section of economic sanction success analysis (hypotheses 3–15) are in Appendix 5.2. In addition to those hypotheses, the variable of *Year* will be controlled to capture the passage of time. The main purpose of this section's hypothesis testing is to determine how the two main hypotheses (regarding the power explanations) affect the success of dyadic economic sanctions, using the new power measures.

2. Data and Measurements

The data to be used in this empirical chapter are from international economic sanction cases from 1950 to 1990, as obtained from the HSE (1990) collection of each sanction's episodes[76]. This data set is

[76] The sanction episodes by HSE (1990, 2) are described as "the deliberate, government inspired withdrawal, or threat of withdrawal, of customary trade or financial resources," where foreign policy goals

merged with my data set of each state's structural network power. Using the data on diplomatic exchanges, foreign student exchanges, and international telecommunications for the dimension of communication patterns, and arms transfers, international exports, and international assistance for the dimension of resource flows of international system structure, I have derived each state's scores on different aspects of structural network power based on the social network perspective of international relations (details on the measures can be found in Chapter 3).

I use a dichotomous dependent variable to indicate the policy result. HSE (1990) assessed both the "policy result" (that measures "the extent to which the outcome sought by the sender was in fact achieved") and the "sanctions contribution" (that measures "the extent to which the sanctions contributed to a positive result," 1990, 41), and then these two measurements, which have ordinal values between 1 and 4, are multiplied to get their "success score" dependent variable. However, some problems have been noticed with this procedure. As Dashti-Gibson, Davis, and Radcliff (1997, 611) point out, there is a reliability problem with the HSE measurements of both "policy result" and "sanctions contribution." In addition, Dashti-Gibson, Davis, and Radcliff (1997, 611) and Bergeijk (1989) argue that there is "no theoretical, empirical, or statistical reason for the policy outcome to be multiplied by another variable designed to assess the contribution of sanctions to the observed result." To overcome some of these problems, following the convention of sanction empirical studies, I dichotomize the "policy result" variable of HSE by taking the value of 1 (success) when there is a successful outcome (the values of 3 and 4 from HSE) and of 0 (failure) otherwise.[77] By using the dichotomous dependent variables, I expect to avoid

"encompass changes expressly and purportedly sought by the sender state in the political behavior of the target state" (see also Goenner forthcoming). For the participants in a sanction episode, the term "sender" designates the country (or international organization) that is "the principal author of the sanction episode" (35) and "target" designates the country that is "the immediate object of the episode" (36). However, some scholars use different definitions of sanctions in their studies: Morgan and Miers (2002) define sanction as an "action that one or more countries take to limit or end their economic relations with a target country in an effort to persuade that country to change its policies" (117); Blanchard, Mansfield, and Ripsman (2000, 3) define sanction as an action "taken by one state—the sender—to interfere with the economy of another state—the target—for the purpose of coercing its compliance with the sender's wishes." Drezner (2003) uses the terms "economic sanctions," "economic coercion," and "economic statecraft" interchangeably, but Baldwin (1985) provides the rationale to differentiate among those terms.

[77] The conventional wisdom in the sanction success study is to use a "policy result" dependent variable by dichotomizing the four-point scale variable by HSE; in fact, HSE define economic sanction as financial or

some of the unreliability and ambiguity of the data from HSE (see Appendix 5.3 for the three issues that have been raised regarding the dependent variable of sanction success used in this project – the definition, measurement, and rate of economic sanction success).

The measurements of the main independent variables (relative structural network power and target's structural network power) are presented in detail in Chapter 3. These variables measure the balance of structural network power between the two states in a dyad (for the former) and target's structural network power (for the latter). They are based on five different measures of point centralities from network analyses of interaction data (i.e., degree, betweenness, flow-betweenness, coreness, ego network brokerage, and their composite index). The measurements used for this section's other independent variables of economic sanctions success analysis are presented in detail in Appendix 5.2.

5.3.2. Results and Discussion

Tables 5.2 and 5.3 display the results from the censored probit estimations of economic sanctions success. Table 5.2 shows the censored probit results of sanctions success with hypothesis 1 of structural network power balance between sender and target (based on five different aspects and their composite index), and Table 5.3 shows the censored probit results of economic sanctions success with hypothesis 2 of structural network power of target[78] (based on five different aspects and their composite index). The

---

trade restrictions used by a state in order to change another nation's policies in some pre-specified manner, see also Drury (1998, 500). Drury (1998) argues that using a "sanctions contribution" (or its interaction with "policy result") dependent variable causes redundancy and endogenous problems (contribution affecting some of the conventional independent variables). Drezner (1999) argues that "using a dependent variable that consists partially of whether sanctions contributed to the outcome is tautological in the extreme. The goal of the research effort is to determine if the dependent variables have an effect on the policy outcome. Their contribution is determined by the sign and significance of their coefficients in a multivariate regression. Including the contribution part of the dependent variable distorts the results" (68, footnote 21). Dashti-Gibson, Davis, and Radcliff (1997) and many others emphasize the ambiguity in the four-point scales of the HSE "policy result" variable and recommend using the binary version of the variable.

[78] The two hypotheses are not completely distinct, and hypothesis 2 is rather contained to the hypothesis 1. This will be clear when we consider how the measures to test the two hypotheses are constructed; to measure the relative structural network power difference of sanctioning and target states (for hypothesis 1), one would first have to measure the target's structural network power (for hypothesis 2). For this reason, I run two different sets of censored probit estimations of economic sanctions onset and success.

two main hypotheses are generally supported by the results.[79] Hypothesis 1 argues that economic sanctions are less likely to be successful when the difference in the levels of structural network power between sender and target is high (i.e., the more skewed the distribution of structural network power between sanctioning state and target, the less likely an economic sanction is to be successful). The results in Table 5.2 show that the coefficient on the variable is negative as expected and statically significant in five of my models (in one model when we use the structural network power measure of egonet brokerage, the coefficient on the variable has the expected negative signs, but the p-value is just outside the conventional significance .10 level—.202). The result from sample selection analysis reveals that sanctions in cases of disproportionate structure network power between sender and target are less likely to be successful. This set of results is consistent with the argument that the larger the sender's power relative to the target's, the lower the stakes involved and therefore the weaker the commitment of the sender (Elliott and Uimonen 1993, 408–9). Either the low stakes involved or the low commitment of the sender ultimately leads to sanction failure. The results are also in line with the empirical findings of HSE (1990), Lam (1990), Elliottt and Uimonen (1993), and Drezner (1998, 1999).

Table 5.4 displays the results from the marginal effects analysis for the statistically significant variables found from the censored probit estimations. I calculate the changes of conditional probability of economic sanctions being successful given that they occurred in the first place. For the model of degree aspect which uses the relative structural network power of sender/target, the marginal impact analysis shows that the baseline conditional probability of sanctions success, holding all the included variables at their means, is 2.0%[80] (this baseline rate represents the chance of the "typical" sanction being successful). Increasing the degree aspect of relative structural network power from one standard deviation below the mean of the variable to its mean, while holding all other independent variables at their means, decreases the probability of sanctions success by 55.0%. Increasing the change to one standard deviation above the

[79] This section only discusses the results for the two main hypotheses. The discussion on the remaining hypotheses is presented in Appendix 5.2.

[80] The value is the conditional (on selection) predicted probability of success; i.e., Pr (depvar_outcome=1 | depvar_seletion=1) = Pr (depvar=1,depvar_selection=1) / Pr(depvar_selection=1).

mean triggers an additional decrease of 2.0%. In other words, increasing the level of the variable from one standard deviation below the mean to one standard above the mean decreases sanctions success by 57.1% (a drop of more than half from the baseline rate in the likelihood that the sanction will be successful). As seen in Table 5.4, the decrease of predicted probabilities of sanction success (changing the values for the relative structural network power variable from one standard below the mean to one standard above the mean, holding all other independent variables at their means), ranges from 29.6% to 57.1%.

Hypothesis 2 argues that economic sanctions are more likely to be successful when the structural network power of the target is high. The results in Table 5.3 show that the coefficient of the variable is positive as expected and statistically significant in five of my models (in one model when we use the structural network power measure of coreness, the coefficient on the variable has the expected positive sign, but the p-value is just outside the conventional significance .10 level, .191). The result from sample selection analysis reveals that sanction cases with the target state possessing high structural network power are more likely to be successful. This set of results supports the argument that the sender is usually less likely to put much importance on foreign policy goals (of economic sanctions) toward a less powerful target (Lam 1990, 245), and that this low resolve or commitment of the sender toward a less powerful target leads to sanction failure.

Regarding the marginal effect analysis for hypothesis 2—for the model of degree aspect with the target's structural network power—the marginal impact analysis (in Table 5.4) shows that the baseline conditional probability of sanctions success, holding all the included variables at their means, is 1.1%. Increasing the degree aspect of the target's structural network power from one standard deviation below the mean of the variable to its mean, while holding all other independent variables at their means, increases the probability of sanctions success by 1.1%. Increasing the change to one standard deviation above the mean triggers an additional increase of 57.4%. Specifically, the predicted probability of being successful increases from 0.0% to 58.5%, an increase of more than half from the baseline rate in the likelihood that the sanctions will be successful. As seen in Table 5.4, the increase of predicted probabilities (changing the values for the target's structural network power variable from one standard below the mean to one standard above the mean, holding all other independent variables at their means), ranges from 19.0% to 58.5%. The results from the censored probit analysis displayed in Tables 5.2 and 5.3, and from the marginal impact analysis displayed in Table 5.4, all show that our two main hypotheses in the study are strongly supported: the higher sender/target structural network power balance is associated with the decreased probability and the higher target structural network power is associated with the increased probability of economic sanctions success.

As I noted earlier, this set of results (supporting the two main hypotheses in the study) also provides insight into the relationship between the levels of globalization of sender and target and the success of economic sanctions. In Chapter 3, I argue that the structural network power of each state also represents how well it is globalized (communication globalization from the first dimension of communication patterns, economic globalization from the second dimension of resource flows). Structural network power also represents each state's level of globalization (or openness) in the system. How centrally each state is positioned in the network of relations shows how well each state is globalized in the web of network relations. The results also provide evidence that a highly globalized target (i.e., a target with relatively high structural network power) will be more severely hurt by economic sanctions and therefore be more likely to concede to the sender's demands, because the sender usually puts forward its best efforts to disconnect a target's globalization web (i.e., isolate the target from its interactive relations with other states), especially in the economic arena (e.g., the target's access to international trade or investment market). The well-globalized target will be more seriously hurt by the sanction, and the high cost paid by the target ultimately leads it to concede to the sender. Since economic sanctions are usually initiated by highly-globalized senders such as the U.S. (i.e., senders with relatively high structural network power), if the above argument holds (suggesting the higher globalization level of target leads to the higher sanction success rate), the lower sender/target globalization level balance (meaning highly-globalized senders initiate sanctions on highly-globalized targets) should be associated with increased probability of sanction success. As a consequence, sanction cases with a higher globalization level balance between sanctioning and target states (meaning highly globalized senders initiate sanctions on less-globalized targets) will be less likely to be successful as the results from both sample selection analysis and marginal impact analysis indicate.

5.4. Model Comparisons for the Sanction Studies

5.4.1. Using Nonparametric Model Discrimination Test

To compare the sanction models using SNPI (Structural Network Power Index) variables against the sanction models using CINC (Composite Index of National Capability) or GNP variables, I first use Clarke's (2001a, 2001b, 2003) pair-signed test of nonnested model discrimination[81] (see also Conover 1980). The general discussion and specific procedures for the nonparametric discrimination test and its applications in the international relations field can be found in Chapter 4. Tables 5.5–5.6 present the results of pair-signed tests for both sanction onset and success models (comparing the models with the attribute-based power variables against those with the structural network power variables). For the sanction onset study, the results show that in all twelve models, the sanction onset models with SNPI variables have greater explanatory power than that with CINC or GNP variables. In other words, the model comparison test confirms that the models with SNPI account for more variation in sanction onsets and are statistically better than the model with CINC or GNP. For example, in 50.7–66.6% of all the sanction cases, the models with SNPI outperform the model with CINC (if the two models performs equally, each should account for 50%). In all the models, the null hypothesis of equality (between the two sets of models) is rejected at the 0.001 level. The comparison of the models with SNPI against the model with GNP also shows the similar results: in 50.6–63.7% of all the sanction cases, the former outperforms the latter. The results for the sanction success study also reveal the similar patterns. In all twelve models, the sanction success models with SNPI variables perform better than that with CINC or GNP variables. In 50.6–74.7% of all the sanction cases, the models with SNPI outperform the model with CINC; in 58.7–

[81] The two sets of sanction models tested in this chapter are nonnested because one model cannot be reduced to the other model by imposing a set of linear restrictions on the parameter vector (see Clarke 2001a and 2001b for the definition of nonnested models).

78.7% of all the sanction cases, the models with SNPI outperform that with GNP. In all the models, the null hypothesis of equality (between the two sets of models) is rejected at the 0.001 level. After comparing the models head-to-head, we can conclude that the models with SNPI variables have greater explanatory power than (or statistically outperforms) those with CINC or GNP variables for both sanctions onsets and success studies.

5.4.2. Using Akaike and Bayesian Information Criteria

The second set of statistics used to compare the two sets of nonnested models in sanction studies are information criteria measures such as Akaike's (1973) information criteria (AIC) and the Bayesian information criteria (BIC) proposed by Raftery (1996). The general discussion for information criteria measures used in this section can be found in Chapter 4. Tables 5.5–5.6 contain the AIC and BIC measures for the dyadic sanction models (comparing the models with the attribute-based power variables against those with the structural network power variables). In eleven out of twelve models, the models with SNPI variables are favored against those with CINC variables. With the BIC differences of 2.836–21.574, the sanction models with SNPI are preferred over that with CINC. The statistics also show that all twelve models with SNPI variables are favored against that GNP variable (with the BIC difference of 5.159–25.827). The evidence with the information criteria measures seems pretty conclusive and confirms the findings with the nonparametric model discrimination tests; the models with SNPI variables statistically outperform and are preferred over those with CINC or GNP variables for both sanctions onsets and success studies.

5.5. Censored Probit Estimates versus Ordinary Probit Estimates

How do the results from the sample selection analysis of sanctions success differ from those of the ordinary probit analysis of sanctions effectiveness ignoring the selection bias (in the previous empirical studies of economic sanctions)? I model this sample selection process of sanctions onset and sanctions success using the censored probit estimation, controlling for statistical linkages of the two dependent variables. This sample selection model has two stages: the sanctions onset for the first stage, and the sanctions success for the second stage as I noted earlier (see also Greene 2003 and Reed 2000).

The important question that should be answered before we conclude that this was the right procedure to use is whether the statistics show that, in addition to the theoretical linkage, the two processes are indeed linked to each other, and therefore should be estimated simultaneously. The parameter rho from the censored probit models provides us the information we need; the statistically significant rho reveals that there is a statistically significant correlation between the errors in the selection model (the sanctions onset model) and the outcome model (the sanctions success model). Therefore, the separate probit estimations of each process will yield biased and inconsistent coefficients. The results in Tables 5.2 and 5.3 show that in the rho is negative and statistically significant in all but one model, thus validating the decision to combine the sanctions onset and the sanctions success. The next question should be how to interpret the sign of rho in my models. As Sweeney (2004) points out, the interpretation of rho is very tricky since it is sensitive to the model specifications; rho is a correlation between the selection and outcome equations and we all know that the errors are related to the model specification. However, based on Sweeney's suggestion, we can argue that the negative (and statically significant) rho in my models shows that any unobservable component of the error that makes the sanctions selection more likely will make the sanctions success less likely.

If the reasons to use the censored sample selection models are appropriate, then separate probit equations will yield biased and inconsistent coefficients (Greene 2003 and Reed 2000). How are the results from the separate probit analysis in Appendix 5.4 (of sanctions onset and success) compared to those from the sample selection analysis in Tables 5.2 and 5.3? First, regarding the sanctions onset equation, the results show that there is no difference between the two estimations; this is also found in other empirical research of the sample selection model (e.g., the models of existence of rivalry and the onset of war by Lemke and Reed 2001b; the models of conflict onset and escalation by Reed 2000). The results for the sanctions success, however, differ for mainly two hypotheses (hypothesis 3: international cooperation with the sender decreasing sanctions success; hypothesis 12: cost to target increasing sanctions success). The coefficients for the two variables are (with the expected signs) statistically significant in the ordinary probit estimations but not in my censored probit estimations. The previous research on sanctions success (e.g., the negative effect of international cooperation and positive effects of target GNP cost found in Drury [1998]) might have been misleading empirical findings because of a lack of control of the selection bias.

5.6. Conclusion

This chapter examined the determinants of onset and success of economic sanctions from the social network perspective. In this chapter, the new social network power concept was compared to previous empirical explorations of the power or capability-based treatments of the subject. I found that the two main hypotheses are generally supported by the results of the sample selection analyses (controlling for statistical linkages of the processes of sanction onset and sanction success). Regarding the determinants of sanction onset, I found that the shared military alliance, geographical proximity, and existence of militarized dispute between states are all associated with a decreased probability of sanction onset. Regarding the determinants of sanction success, the first main hypothesis of this study argued that economic sanctions are less likely to be successful when the difference in the levels of structural network power between sender and target is high. The result from sample selection analysis and marginal impact analysis revealed that sanction cases with disproportional structural network power between sender and target were far less likely to be successful (i.e., the more skewed the distribution of structural network power between sanctioning state and target, the less likely an economic sanction is to be successful). The chapter also posited that the result does provide evidence that the lower sender/target globalization level balance (meaning highly globalized senders initiate sanctions upon highly globalized targets) is associated with an increased probability of sanction success. The second main hypothesis argued that economic sanctions are more likely to be successful when the structural network power of the target is high. The result from sample selection analysis and marginal impact analysis revealed that sanction cases with the target state possessing high structural network power were far more likely to be successful. The chapter also posited that the result provides the evidence that a highly globalized target (i.e., a target with relatively high structural network power) will be more severely hurt by the economic sanction, and therefore more likely to concede to the sender's demands. The evidence from nonparametric model discrimination statistics and information criteria measures also shows that the models with network power measures statistically outperform and are preferred over those with attributional power measures, such as COW index and GNP in both sanctions onsets and success studies.

In addition to the empirical analyses, this chapter also emphasized how useful the sociograms (produced by the social network analysis) are in depicting and highlighting the distinctive characteristics of international sanction networks. First, the general graphical patterns of monadic and dyadic factors affecting the onset of sanctions revealed from the sociograms in Figure 5.3 are also in line with the results from the sanction onset analysis. Second, the sociograms in Figures 5.1 and 5.2 revealed that a significant majority of international sanctions are "connected" sanctions and there are relatively few "disconnected" or "isolated" sanctions in the network of economic sanctions (e.g., during the 1980s, only two sanction onset dyads, France-Australia and India-Nepal, were isolated in the network that was composed of 26 different sanction onset dyads; during the 1970s, no successful sanction onset dyad was isolated in the network that was composed of 16 different successful sanction onset dyads), and this provides graphical insight as to why the dyadic sanction onset and success studies need to incorporate the extra-dyadic sanction information in the networks. The sociograms in Figures 5.1 and 5.2 also provide graphical insight for the studies of "recurrent" international sanctions where the same dyad experiences more than one economic sanction.

Table 5.1 Hypotheses for Analyses of Dyadic Sanctions Onset and Success

Hypothesis	Expected Sign of the Hypothesis
Sanctions Success Analysis (Outcome Equation)	
Hypothesis 1	Relative Structural Network Power of Sender/Target -----(-)-----> Sanctions Success
Hypothesis 2	Target's Structural Network Power -----(+)-----> Sanctions Success
Hypothesis 3	International Cooperation with Sender -----(-)-----> Sanctions Success
Hypothesis 4	Sanctions of International Institution -----(+)-----> Sanctions Success
Hypothesis 5	International Cooperation with Sender*Sanctions of International Institution -----(-)-----> Sanctions Success
Hypothesis 6	Cost to Sender -----(-)-----> Sanctions Success
Hypothesis 7	Sanctions with National Security of Sender -----(+)-----> Sanctions Success
Hypothesis 8	Sanctions with Additional Policies of Sender -----(+)-----> Sanctions Success
Hypothesis 9	Sanctions of the U.S. -----(+)-----> Sanctions Success
Hypothesis 10	International Assistance to Target -----(-)-----> Sanctions Success
Hypothesis 11	Political and Economic Stabilities of Target -----(-)-----> Sanctions Success
Hypothesis 12	Cost to Target -----(+)-----> Sanctions Success
Hypothesis 13	Pre-sanction Relationship of Sender/Target -----(+)-----> Sanctions Success
Hypothesis 14	Pre-sanction Trade Levels of Sender/Target -----(+)-----> Sanctions Success
Hypothesis 15	International Assistance to Target* Pre-sanction Trade Levels of Sender/Target -----(-)-----> Sanctions Success
Sanctions Onset Analysis (Selection Equation)	
Hypothesis 1	Economic Interdependence -----(-)-----> Sanctions Onset
Hypothesis 2	Democracy -----(-)-----> Sanctions Onset
Hypothesis 3	Balance of Structural Network Power -----(-) or (+)-----> Sanctions Onset
Hypothesis 4	Shared Alliance Ties -----(-)-----> Sanctions Onset
Hypothesis 5	Contiguity -----(+)-----> Sanctions Onset
Hypothesis 6	Distance -----(-)-----> Sanctions Onset
Hypothesis 7	Major Power -----(-)-----> Sanctions Onset
Hypothesis 8	Militarized Dispute Onset -----(+)-----> Sanctions Onset

Table 5.2 Censored Probit Analysis of Dyadic Sanctions Onset and Success, 1950–1990 (Models for Sender/Target Power Balance)

(Sanctions Success Model)	Model 1-1 (CINC)		Model 1-2 (GNP)		Model 1-3 (Degree)		Model 1-4 (Betweenness)	
Power Balance	-0.146	(0.106)	-0.212*	(0.103)	-0.301*	(0.126)	-0.126*	(0.058)
Sender Cooperation	-0.202	(0.271)	-0.013	(0.228)	-0.061	(0.254)	0.041	(0.195)
Institution Sanction	3.192**	(1.232)	3.638**	(1.366)	3.801*	(1.822)	3.445*	(1.504)
Sender Cooperation* Institution Sanction	-1.398*	(0.565)	-1.699**	(0.602)	-1.884*	(0.872)	-1.652*	(0.679)
Sender Cost	0.186	(0.285)	0.087	(0.276)	0.387	(0.349)	0.164	(0.210)
National Security	0.292	(0.409)	0.315	(0.418)	0.210	(0.393)	0.053	(0.341)
Additional Policies	-0.639*	(0.348)	-0.595*	(0.356)	-0.129	(0.359)	-0.275	(0.324)
U.S. Sanction	-0.139	(0.396)	0.302	(0.394)	0.230	(0.298)	0.220	(0.306)
Target Assistance	0.292	(0.712)	0.147	(0.629)	0.697	(0.530)	0.328	(0.528)
Target Stabilities	-0.638*	(0.275)	-0.681*	(0.284)	-0.796*	(0.317)	-0.663**	(0.243)
Target Cost	0.113	(0.100)	0.145	(0.101)	0.192	(0.164)	0.106	(0.076)
Pre-sanction Relationships	0.485*	(0.265)	0.438	(0.280)	0.586*	(0.326)	0.629*	(0.269)
Pre-sanction Trade Level	0.018*	(0.007)	0.021*	(0.009)	0.018*	(0.009)	0.017*	(0.008)
Target Assistance* Pre-sanction Trade Levels	0.004	(0.014)	0.008	(0.014)	-0.002	(0.012)	0.007	(0.012)
Year	-0.059***	(0.016)	-0.063***	(0.018)	-0.062**	(0.020)	-0.064***	(0.017)
Constant	118.839***	(31.383)	126.764***	(35.108)	125.965***	(39.642)	129.333***	(33.781)
(Sanctions Onset Model)								
Interdependence Low	1.087	(7.265)	1.750	(6.631)	1.608	(6.994)	-5.877	(11.268)
Democracy Low	-0.005	(0.008)	-0.005	(0.008)	-0.004	(0.008)	-0.006	(0.008)
Balance of Power	0.010	(0.028)	0.013	(0.028)	0.005	(0.011)	-0.015	(0.014)
Allies	-0.221***	(0.052)	-0.219***	(0.052)	-0.216***	(0.056)	-0.224***	(0.053)
Contiguity	-0.328	(0.342)	0.413***	(0.107)	-0.374	(0.385)	-0.400	(0.362)
Distance	0.410***	(0.106)	-0.341	(0.348)	0.414***	(0.110)	0.400***	(0.106)
Major Power	-0.251	(0.377)	-0.283	(0.377)	-0.330	(0.387)	-0.260	(0.374)
Militarized Dispute Onset	1.103***	(0.129)	1.104***	(0.129)	1.106***	(0.138)	1.080***	(0.133)
Constant	-5.236***	(0.832)	-5.248***	(0.849)	-5.201***	(0.937)	-4.991***	(0.862)
/athrho	-1.107*	(0.436)	-1.133*	(0.481)	-1.318*	(0.612)	-1.435**	(0.479)
Rho	-0.803	(0.155)	-0.812	(0.164)	-0.866	(0.153)	-0.893	(0.097)

NOTE: Robust standard errors appear in parentheses below the coefficient estimates. All significant tests are two-tailed. *p < .10, *p < .01, ***p < .001.

Table 5.2 Censored Probit Analysis of Dyadic Sanctions Onset and Success, 1950–1990 (Models for Sender/Target Power Balance, Continued)

(Sanctions Success Model)	Model 1-5 (Flow-Betweenness)		Model 1-6 (Coreness)		Model 1-7 (Egonet Brokerage)		Model 1-8 (SNPI)	
Power Balance	-0.186*	(0.076)	-0.378*	(0.203)	-0.053	(0.040)	-0.334*	(0.149)
Sender Cooperation	0.106	(0.225)	-0.092	(0.235)	-0.002	(0.231)	0.042	(0.189)
Institution Sanction	3.353*	(1.637)	3.399**	(1.263)	3.768*	(1.508)	3.166	(2.195)
Sender Cooperation* Institution Sanction	-1.561*	(0.712)	-1.494**	(0.536)	-1.751**	(0.677)	-1.497	(0.967)
Sender Cost	0.249	(0.241)	0.190	(0.265)	0.241	(0.273)	0.125	(0.213)
National Security	0.144	(0.375)	0.409	(0.412)	0.168	(0.450)	0.191	(0.373)
Additional Policies	-0.284	(0.316)	-0.472	(0.339)	-0.411	(0.376)	-0.298	(0.300)
U.S. Sanction	0.336	(0.329)	0.418	(0.447)	-0.136	(0.405)	0.259	(0.315)
Target Assistance	0.579	(0.543)	0.266	(0.698)	0.044	(0.640)	0.177	(0.451)
Target Stabilities	-0.742**	(0.277)	-0.604*	(0.286)	-0.646*	(0.292)	-0.623*	(0.265)
Target Cost	0.085	(0.100)	0.087	(0.091)	0.116	(0.102)	0.133	(0.085)
Pre-sanction Relationships	0.685*	(0.323)	0.481*	(0.264)	0.594*	(0.335)	0.586*	(0.271)
Pre-sanction Trade Level	0.018*	(0.010)	0.018**	(0.006)	0.018*	(0.008)	0.016	(0.013)
Target Assistance* Pre-sanction Trade Levels	-0.003	(0.012)	0.003	(0.014)	0.010	(0.014)	0.009	(0.012)
Year	-0.074***	(0.022)	-0.051**	(0.018)	-0.065***	(0.018)	-0.054*	(0.022)
Constant	148.401***	(43.125)	103.921**	(34.443)	129.814***	(35.411)	109.222*	(43.514)
(Sanctions Onset Model)								
Interdependence Low	-4.133	(10.790)	8.078**	(2.870)	-5.139	(10.797)	2.075	(6.173)
Democracy Low	-0.006	(0.008)	-0.005	(0.008)	-0.006	(0.008)	-0.004	(0.008)
Balance of Power	-0.016	(0.015)	-0.165***	(0.026)	-0.011	(0.008)	0.017	(0.029)
Allies	-0.216***	(0.056)	-0.199***	(0.052)	-0.216***	(0.056)	-0.215***	(0.057)
Contiguity	-0.405	(0.378)	-0.296	(0.368)	-0.362	(0.375)	-0.369	(0.362)
Distance	0.401***	(0.107)	0.410***	(0.117)	0.406***	(0.105)	0.412***	(0.117)
Major Power	-0.289	(0.387)	-0.443	(0.380)	-0.269	(0.390)	-0.335	(0.372)
Militarized Dispute Onset	1.080***	(0.136)	1.112***	(0.138)	1.074***	(0.135)	1.103***	(0.142)
Constant	-5.017***	(0.887)	-5.458***	(0.974)	-5.092***	(0.853)	-5.210***	(0.958)
/athrho	-1.414*	(0.649)	-1.073**	(0.361)	-1.005*	(0.399)	-1.540	(1.252)
Rho	-0.888	(0.137)	-0.791	(0.135)	-0.763	(0.167)	-0.912	(0.210)

NOTE: Robust standard errors appear in parentheses below the coefficient estimates. All significant tests are two-tailed. *p < .10, *p < .01, ***p < .001.

Table 5.3 Censored Probit Analysis of Dyadic Sanctions Onset and Success, 1950–1990 (Models for Target's Power)

(Sanctions Success Model)	Model 2-1 (CINC)		Model 2-2 (GNP)		Model 2-3 (Degree)		Model 2-4 (Betweenness)	
Target's Power	0.147	(0.110)	0.190*	(0.115)	0.341*	(0.140)	0.136*	(0.063)
Sender Cooperation	-0.133	(0.231)	-0.075	(0.238)	-0.085	(0.269)	0.027	(0.206)
Institution Sanction	2.813*	(1.453)	3.687**	(1.318)	4.226*	(1.857)	3.649*	(1.517)
Sender Cooperation* Institution Sanction	-1.227*	(0.699)	-1.659**	(0.581)	-2.095*	(0.887)	-1.733*	(0.685)
Sender Cost	0.223	(0.267)	0.223	(0.280)	0.431	(0.395)	0.182	(0.223)
National Security	0.333	(0.396)	0.376	(0.425)	0.208	(0.409)	0.104	(0.365)
Additional Policies	-0.654*	(0.347)	-0.692*	(0.410)	-0.072	(0.380)	-0.291	(0.346)
U.S. Sanction	-0.202	(0.372)	-0.211	(0.393)	-0.179	(0.333)	-0.087	(0.330)
Target Assistance	0.130	(0.650)	0.022	(0.732)	0.856	(0.558)	0.284	(0.575)
Target Stabilities	-0.682*	(0.301)	-0.773*	(0.330)	-0.800*	(0.327)	-0.694**	(0.253)
Target Cost	0.107	(0.094)	0.122	(0.107)	0.197	(0.182)	0.105	(0.081)
Pre-sanction Relationships	0.485*	(0.271)	0.540*	(0.300)	0.547	(0.337)	0.678*	(0.301)
Pre-sanction Trade Level	0.017*	(0.008)	0.020*	(0.008)	0.021*	(0.010)	0.017*	(0.008)
Target Assistance* Pre-sanction Trade Levels	0.007	(0.013)	0.010	(0.015)	-0.005	(0.013)	0.008	(0.013)
Year	-0.058***	(0.016)	-0.071***	(0.018)	-0.068***	(0.021)	-0.065***	(0.016)
Constant	118.149***	(31.486)	141.265***	(35.862)	136.934***	(40.206)	132.510***	(31.856)
(Sanctions Onset Model)								
Interdependence Low	0.874	(6.957)	1.733	(6.709)	1.573	(7.073)	-5.750	(11.396)
Democracy Low	-0.005	(0.008)	-0.005	(0.008)	-0.005	(0.008)	-0.006	(0.008)
Balance of Power	0.006	(0.028)	0.014	(0.028)	0.005	(0.011)	-0.015	(0.015)
Allies	-0.219***	(0.052)	-0.218***	(0.053)	-0.218***	(0.056)	-0.224***	(0.054)
Contiguity	-0.333	(0.344)	0.414***	(0.106)	-0.364	(0.379)	-0.398	(0.371)
Distance	0.401***	(0.107)	-0.334	(0.352)	0.414***	(0.110)	0.404***	(0.104)
Major Power	-0.259	(0.371)	-0.280	(0.386)	-0.321	(0.382)	-0.275	(0.391)
Militarized Dispute Onset	1.070***	(0.135)	1.110***	(0.128)	1.107***	(0.137)	1.080***	(0.133)
Constant	-5.145***	(0.852)	-5.263***	(0.839)	-5.210***	(0.922)	-5.019***	(0.855)
/athrho	-1.179*	(0.493)	-1.007*	(0.422)	-1.267*	(0.566)	-1.299***	(0.400)
Rho	-0.827	(0.156)	-0.765	(0.175)	-0.853	(0.154)	-0.861	(0.103)

NOTE: Robust standard errors appear in parentheses below the coefficient estimates. All significant tests are two-tailed. *p < .10, *p < .01, ***p < .001.

Table 5.3 Censored Probit Analysis of Dyadic Sanctions Onset and Success, 1950–1990 (Models for Target's Power, Continued)

(Sanctions Success Model)	Model 2-5 (Flow-Betweenness)		Model 2-6 (Coreness)		Model 2-7 (Egonet Brokerage)		Model 2-8 (SNPI)	
Target's Power	0.218**	(0.083)	0.055	(0.040)	0.613*	(0.258)	0.386**	(0.147)
Sender Cooperation	0.093	(0.238)	-0.006	(0.232)	-0.053	(0.201)	0.038	(0.200)
Institution Sanction	3.418*	(1.468)	3.833*	(1.543)	3.290*	(1.357)	3.615*	(1.782)
Sender Cooperation* Institution Sanction	-1.568*	(0.638)	-1.783**	(0.694)	-1.531**	(0.581)	-1.741*	(0.819)
Sender Cost	0.273	(0.281)	0.253	(0.276)	0.262	(0.242)	0.198	(0.223)
National Security	0.180	(0.382)	0.165	(0.453)	0.245	(0.395)	0.181	(0.358)
Additional Policies	-0.301	(0.319)	-0.399	(0.380)	-0.355	(0.343)	-0.229	(0.328)
U.S. Sanction	-0.018	(0.292)	-0.172	(0.417)	0.028	(0.323)	-0.068	(0.340)
Target Assistance	0.591	(0.558)	0.033	(0.647)	0.075	(0.598)	0.068	(0.497)
Target Stabilities	-0.772*	(0.280)	-0.659*	(0.297)	-0.665*	(0.273)	-0.713**	(0.248)
Target Cost	0.071	(0.110)	0.115	(0.102)	0.109	(0.084)	0.125	(0.088)
Pre-sanction Relationships	0.763*	(0.340)	0.593*	(0.338)	0.483*	(0.259)	0.578*	(0.310)
Pre-sanction Trade Level	0.018*	(0.008)	0.018*	(0.008)	0.015*	(0.008)	0.018*	(0.010)
Target Assistance* Pre-sanction Trade Levels	-0.002	(0.012)	0.010	(0.014)	0.008	(0.013)	0.012	(0.012)
Year	-0.076***	(0.020)	-0.066***	(0.018)	-0.054**	(0.018)	-0.063***	(0.019)
Constant	154.242***	(39.820)	132.709***	(35.691)	111.741***	(34.772)	127.996***	(36.562)
(Sanctions Onset Model)								
Interdependence Low	-4.063	(10.832)	-5.103	(10.801)	7.998**	(2.831)	2.478	(6.014)
Democracy Low	-0.006	(0.008)	-0.006	(0.008)	-0.006	(0.008)	-0.005	(0.008)
Balance of Power	-0.015	(0.015)	-0.011	(0.008)	-0.168***	(0.026)	0.021	(0.030)
Allies	-0.218***	(0.055)	-0.216***	(0.056)	-0.197***	(0.052)	-0.216***	(0.055)
Contiguity	-0.410	(0.384)	-0.361	(0.375)	-0.313	(0.372)	-0.356	(0.364)
Distance	0.405***	(0.104)	0.406***	(0.104)	0.409***	(0.118)	0.416***	(0.109)
Major Power	-0.309	(0.395)	-0.269	(0.391)	-0.481	(0.375)	-0.343	(0.381)
Militarized Dispute Onset	1.078***	(0.136)	1.075***	(0.135)	1.108***	(0.137)	1.109***	(0.136)
Constant	-5.034***	(0.882)	-5.096***	(0.852)	-5.424***	(0.991)	-5.252***	(0.895)
/athrho	-1.370**	(0.522)	-0.985*	(0.398)	-1.223*	(0.513)	-1.404*	(0.668)
Rho	-0.879	(0.119)	-0.755	(0.171)	-0.840	(0.151)	-0.886	(0.143)

NOTE: Robust standard errors appear in parentheses below the coefficient estimates. All significant tests are two-tailed. *p < .10, *p < .01, ***p < .001.

Table 5.4 Changes in Predicted Probabilities of Sanctions Success from Fitted Censored Probit Models

Sender/Target Power Balance (Models 1-1 ~ 1-8) Target's Power (Models 2-1 ~ 2-8)	Minus 1 SD	Mean	Plus 1 SD	Minus 1 SD => Mean	Mean => Plus 1 SD	Minus 1 SD => Plus 1 SD
Model 1-1	0.220	*0.094*	0.031	-12.6%	-6.3%	-18.9%
Model 1-2	0.436	*0.137*	0.021	-29.8%	-11.6%	-41.4%
Model 1-3	0.571	*0.020*	0.000	-55.0%	-2.0%	-57.1%
Model 1-4	0.310	*0.062*	0.005	-24.9%	-5.7%	-30.6%
Model 1-5	0.355	*0.044*	0.001	-31.1%	-4.3%	-35.4%
Model 1-6	0.321	*0.113*	0.025	-20.8%	-8.8%	-29.6%
Model 1-8	0.380	*0.058*	0.002	-32.2%	-5.6%	-37.8%
Model 2-1	0.050	*0.121*	0.243	7.1%	12.2%	19.3%
Model 2-2	0.050	*0.098*	0.174	4.8%	7.6%	12.5%
Model 2-3	0.000	*0.011*	0.585	1.1%	57.4%	58.5%
Model 2-4	0.008	*0.075*	0.312	6.7%	23.6%	30.3%
Model 2-5	0.001	*0.039*	0.381	3.9%	34.2%	38.0%
Model 2-7	0.031	*0.093*	0.221	6.3%	12.7%	19.0%
Model 2-8	0.053	*0.127*	0.252	7.4%	12.5%	19.9%
Model 1-3						
	0		1			0 -> 1
Institution Sanction	0.000		0.998			99.8%
	0	2	4	0 -> 2	2 -> 4	0 -> 4
Sender Cooperation* Institution Sanction	0.998	0.000	0.000	-99.8%	0.0%	-99.8%
	1	2	3	1 -> 2	2 -> 3	1 -> 3
Target Stabilities	0.409	0.042	0.001	-36.7%	-4.1%	-40.8%
	0		1			0 -> 1
Pre-sanction Relationships	0.013		0.135			12.1%
	Minus 1 SD	Mean	Plus 1 SD	Minus 1 SD -> Mean	Mean -> Plus 1 SD	Minus 1 SD -> Plus 1 SD
Pre-sanction Trade Level	0.001	0.039	0.359	3.8%	32.0%	35.8%
	1950	1970	1990	1950 -> 1970	1970 -> 1990	1950 -> 1990
Year	0.359	0.057	0.000	-30.2%	-5.7%	-35.9%
Model 2-3						
	0		1			0 -> 1
Institution Sanction	0.000		0.999			99.9%
	0	2	4	0 -> 2	2 -> 4	0 -> 4
Sender Cooperation* Institution Sanction	0.904	0.000	0.000	-90.4%	0.0%	-90.4%
	1	2	3	1 -> 2	2 -> 3	1 -> 3
Target Stabilities	0.355	0.034	0.000	-32.1%	-3.3%	-35.4%
	0		1			0 -> 1
Pre-sanction Relationships	0.011		0.101			9.0%
	Minus 1 SD	Mean	Plus 1 SD	Minus 1 SD -> Mean	Mean -> Plus 1 SD	Minus 1 SD -> Plus 1 SD
Pre-sanction Trade Level	0.000	0.034	0.404	3.3%	37.0%	40.4%
	1950	1970	1990	1950 -> 1970	1970 -> 1990	1950 -> 1990
Year	0.779	0.049	0.000	-72.9%	-4.9%	-77.9%

NOTE: The values are the conditional (on selection) predicted probabilities of success. The baseline predicted probabilities for each model, holding all variables at their means or modes, are set in italic.

Table 5.5 Model Comparisons for the Sanctions Onset and Success Analyses (Models for Sender/Target Power Balance)

	Model 1-1 (CINC)	Model 1-2 (GNP)	Model 1-3 (Degree)	Model 1-4 (Betweenness)	Model 1-5 (Flow-Betweenness)	Model 1-6 (Coreness)	Model 1-7 (Egonet Brokerage)	Model 1-8 (SNPI)
AIC	1041.580	1042.440	1028.861	1031.052	1028.575	1020.005	1037.135	1034.620
BIC	1255.540	1256.401	1242.821	1245.013	1242.536	1233.966	1251.096	1248.581
Clarke Tests (Onset)								
Against CINC			53.0%	50.8%	55.4%	63.5%	50.7%	62.6%
Against GNP			58.6%	50.6%	55.6%	63.7%	50.7%	50.9%
Clarke Tests (Success)								
Against CINC			65.3%	74.7%	74.7%	56.0%	62.7%	72.0%
Against GNP			72.4%	71.1%	71.1%	58.7%	69.3%	65.8%

Table 5.6 Model Comparisons for the Sanctions Onset and Success Analyses (Models for Target's Power)

	Model 2-1 (CINC)	Model 2-2 (GNP)	Model 2-3 (Degree)	Model 2-4 (Betweenness)	Model 2-5 (Flow-Betweenness)	Model 2-6 (Coreness)	Model 2-7 (Egonet Brokerage)	Model 2-8 (SNPI)
AIC	1035.619	1042.074	1028.016	1031.360	1027.914	1016.202	1036.914	1032.782
BIC	1249.579	1256.034	1241.977	1245.321	1241.875	1230.162	1250.875	1246.743
Clarke Tests (Onset)								
Against CINC			66.6%	54.0%	51.4%	64.3%	51.1%	53.5%
Against GNP			50.6%	50.8%	54.7%	62.2%	50.6%	53.3%
Clarke Tests (Success)								
Against CINC			66.7%	70.3%	71.6%	67.6%	60.8%	71.6%
Against GNP			74.2%	74.7%	78.7%	70.7%	66.7%	66.7%

Figure 5.1 Networks of Dyadic Sanctions Onset, 1950–1990

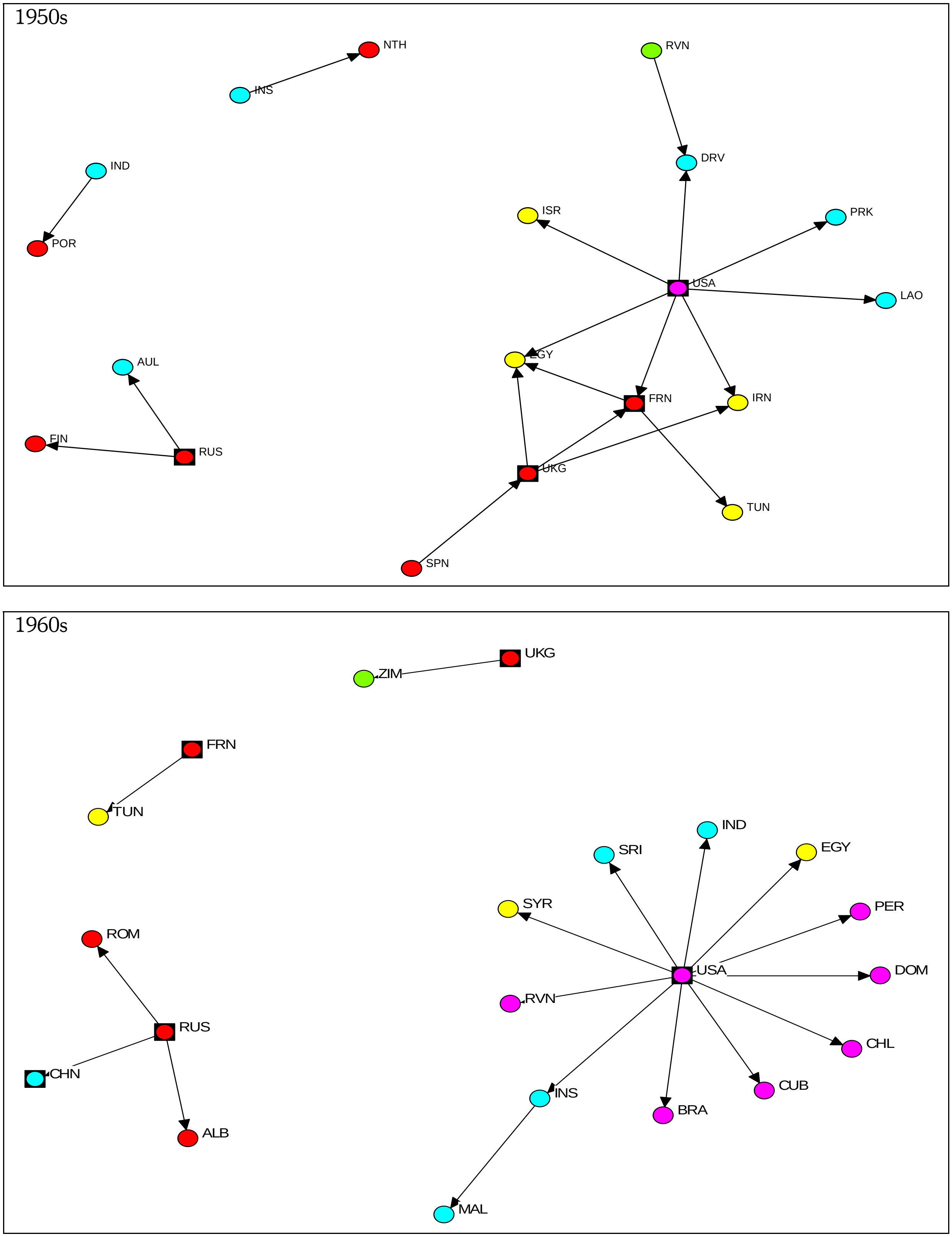


Figure 5.1 Networks of Dyadic Sanctions Onset, 1950–1990 (Continued)

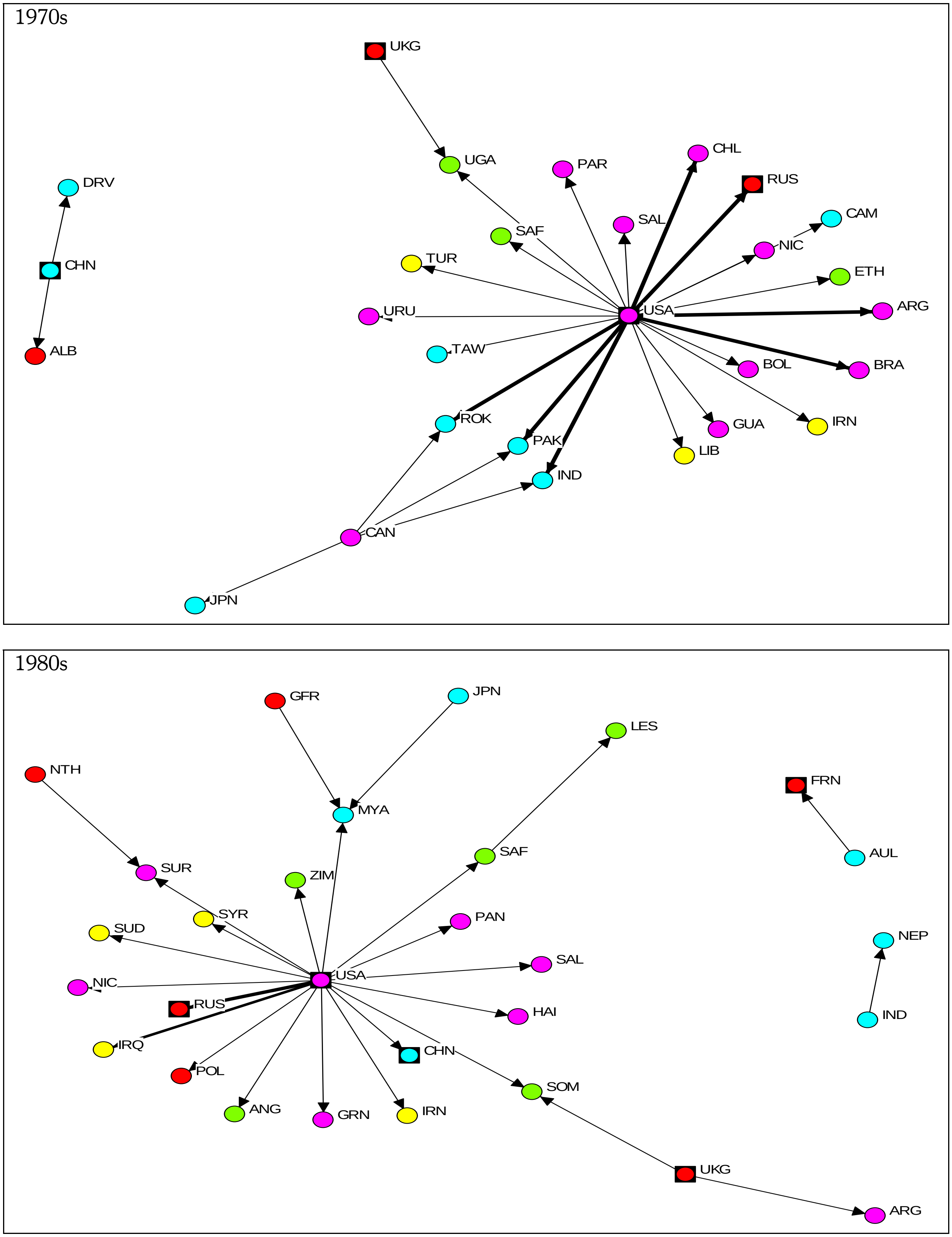


Figure 5.1 Networks of Dyadic Sanctions Onset, 1950–1990 (Continued)

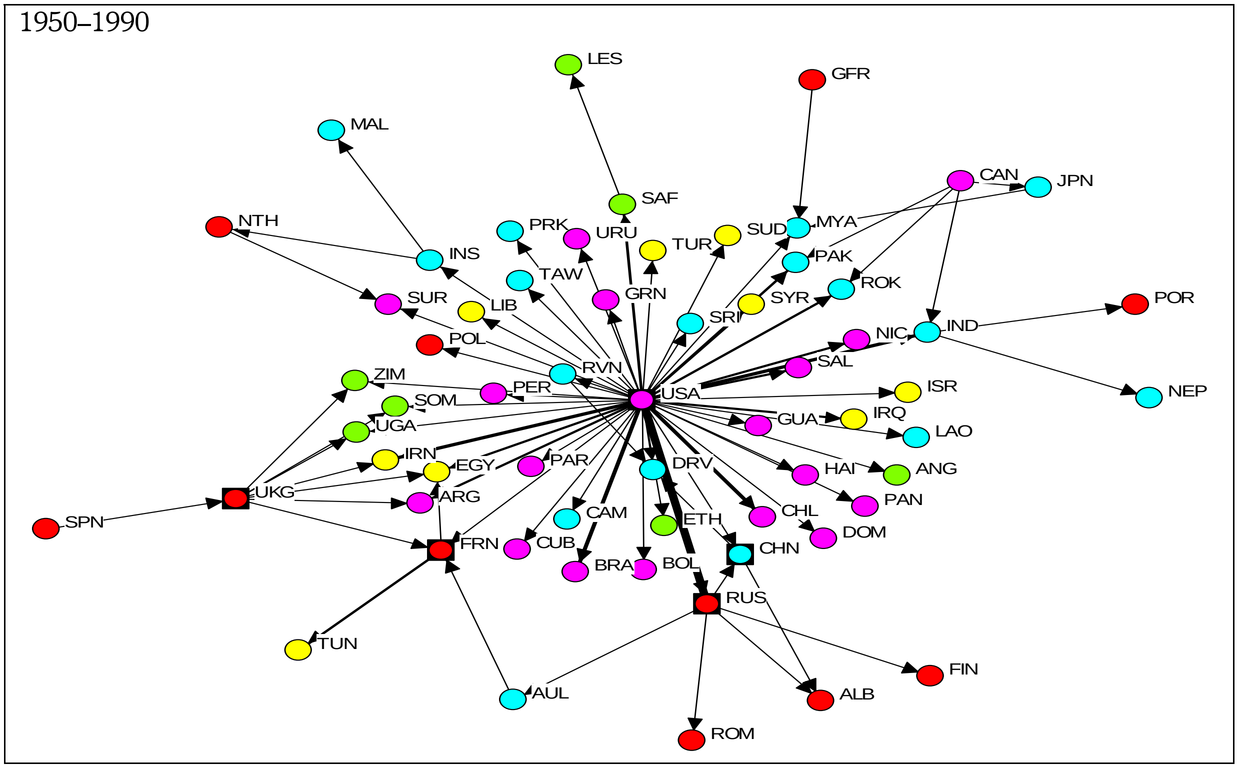


Figure 5.2 Networks of Successful Dyadic Sanctions Onset, 1950–1990

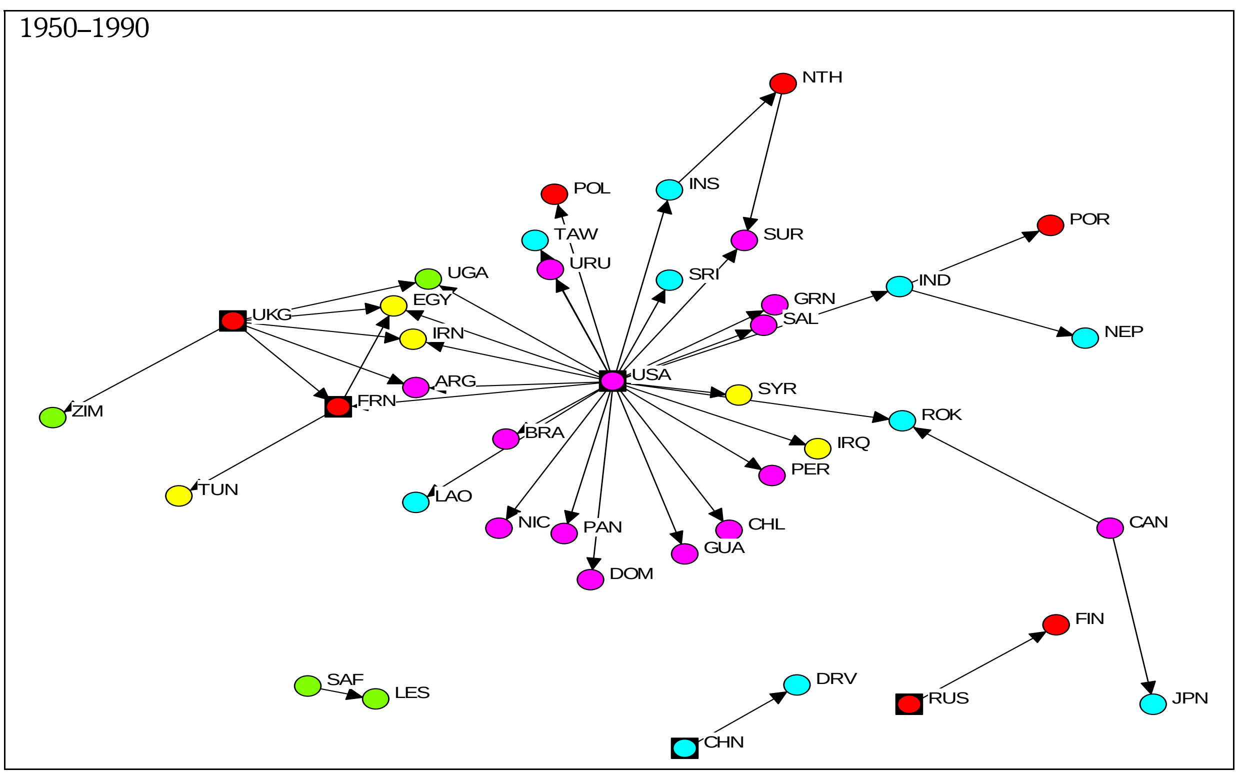
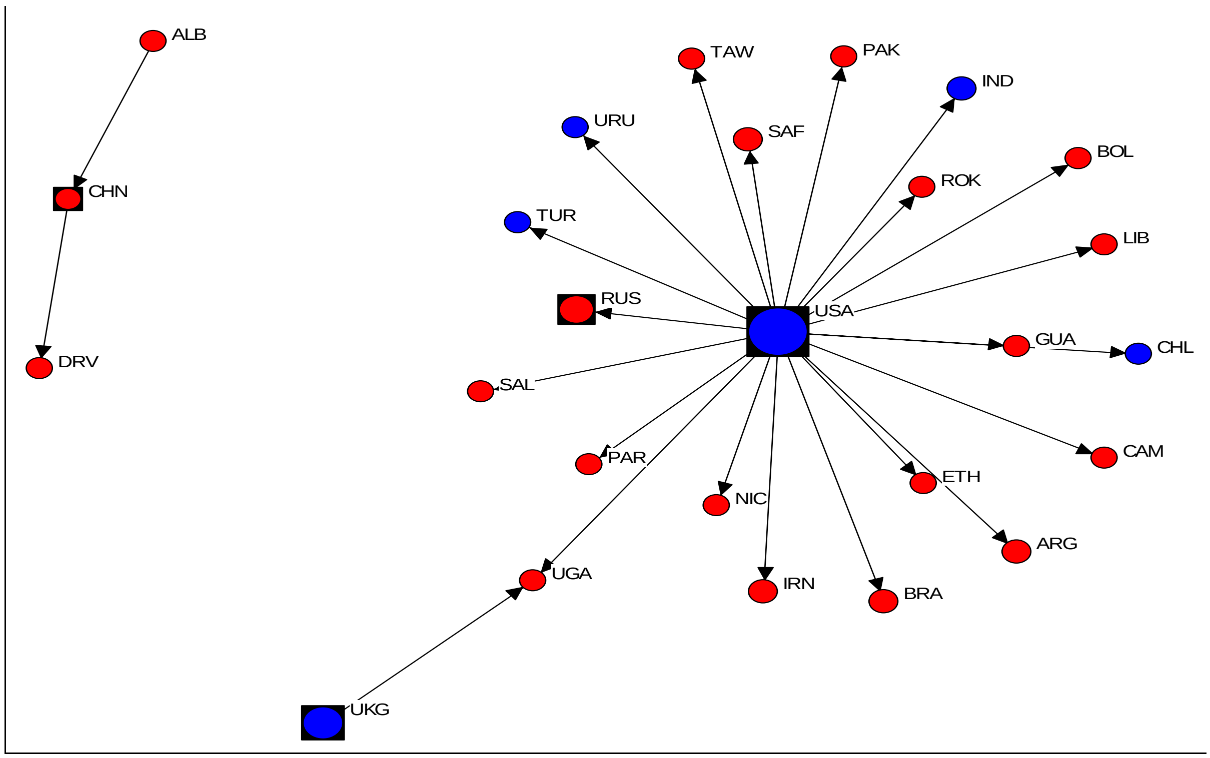


Figure 5.3 Networks of Dyadic Sanctions Onset in the 1970s

Sanctions Onset in the 1970s



Sanctions Onset-Ally in the 1970s:
sanctions between allied states represented by green arrow.

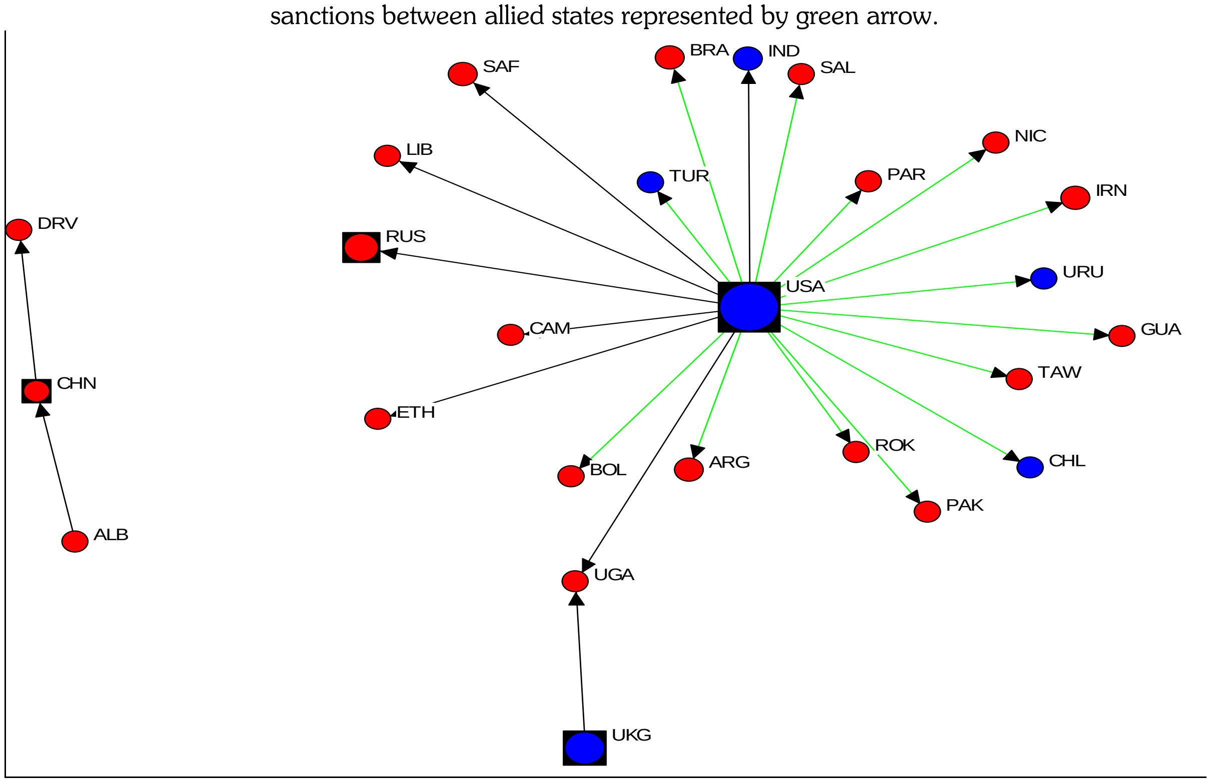
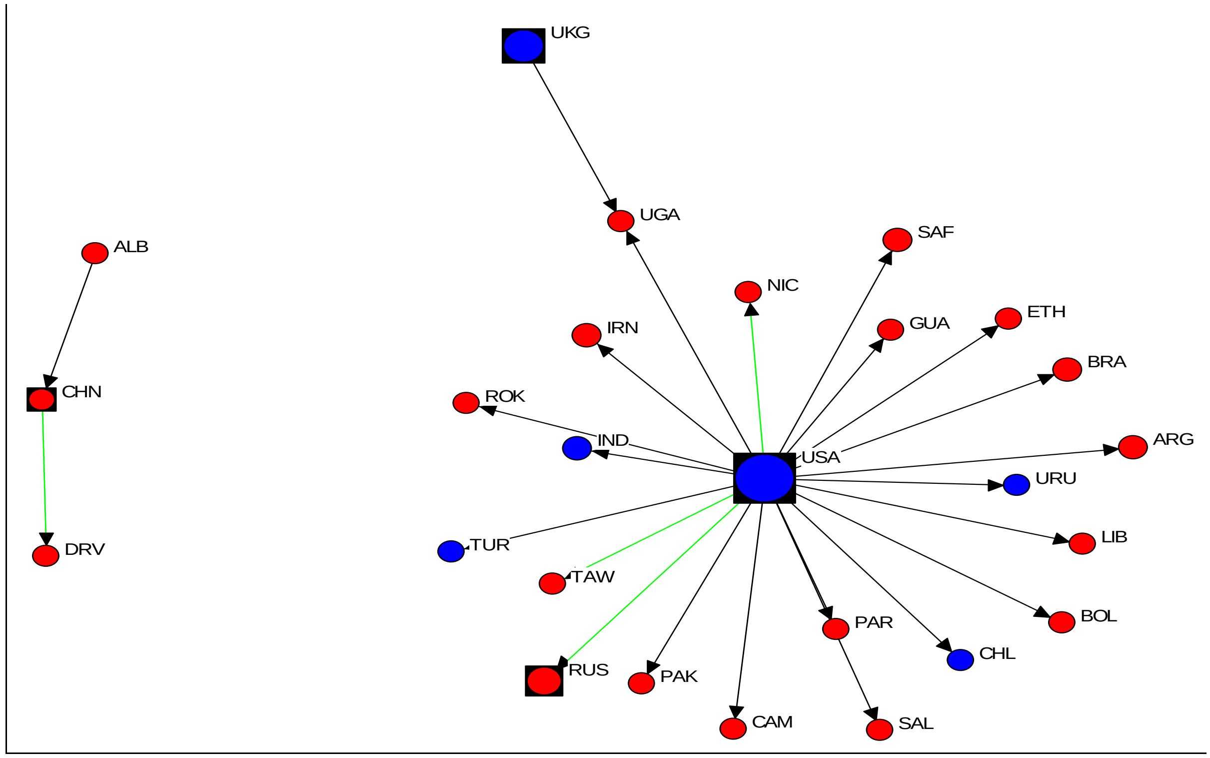


Figure 5.3 Networks of Dyadic Sanctions Onset in the 1970s (Continued)

Sanctions Onset-Contiguity in the 1970s:
sanctions between contiguous states represented by green arrow.



Sanctions Onset-Distance in the 1970s:
sanctions between distant states represented by green arrow.

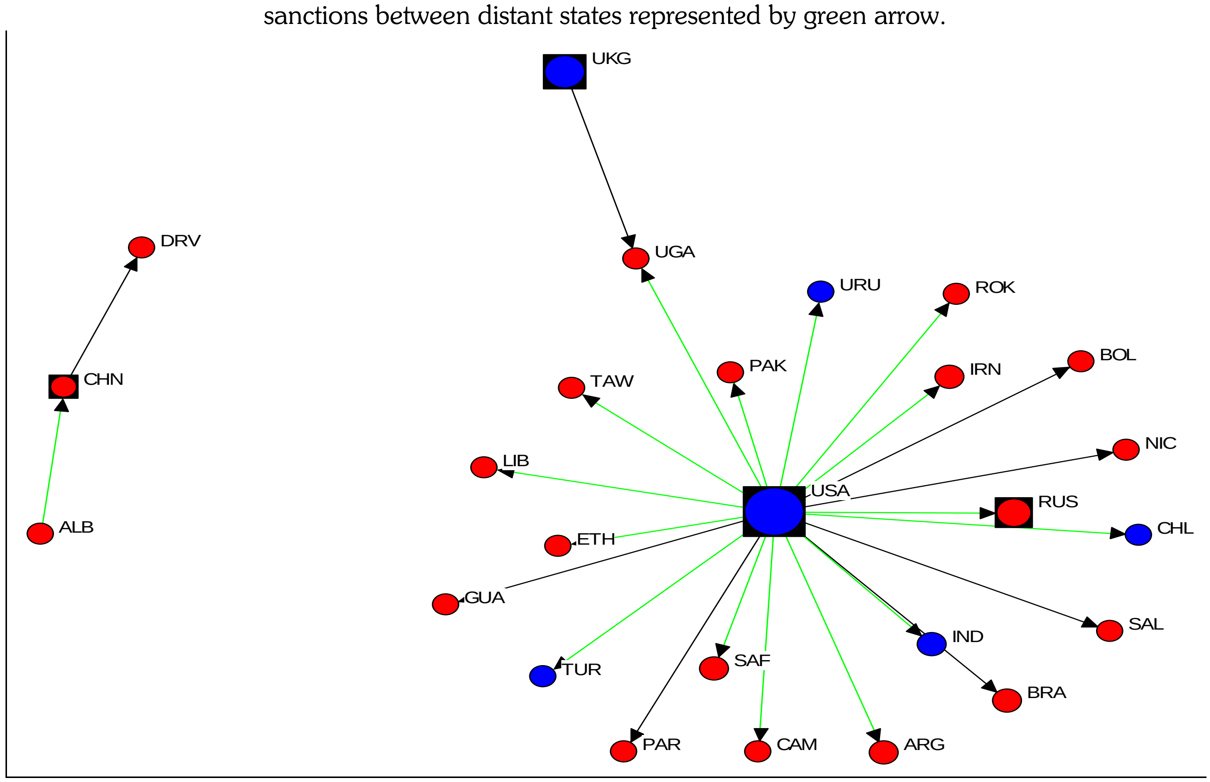
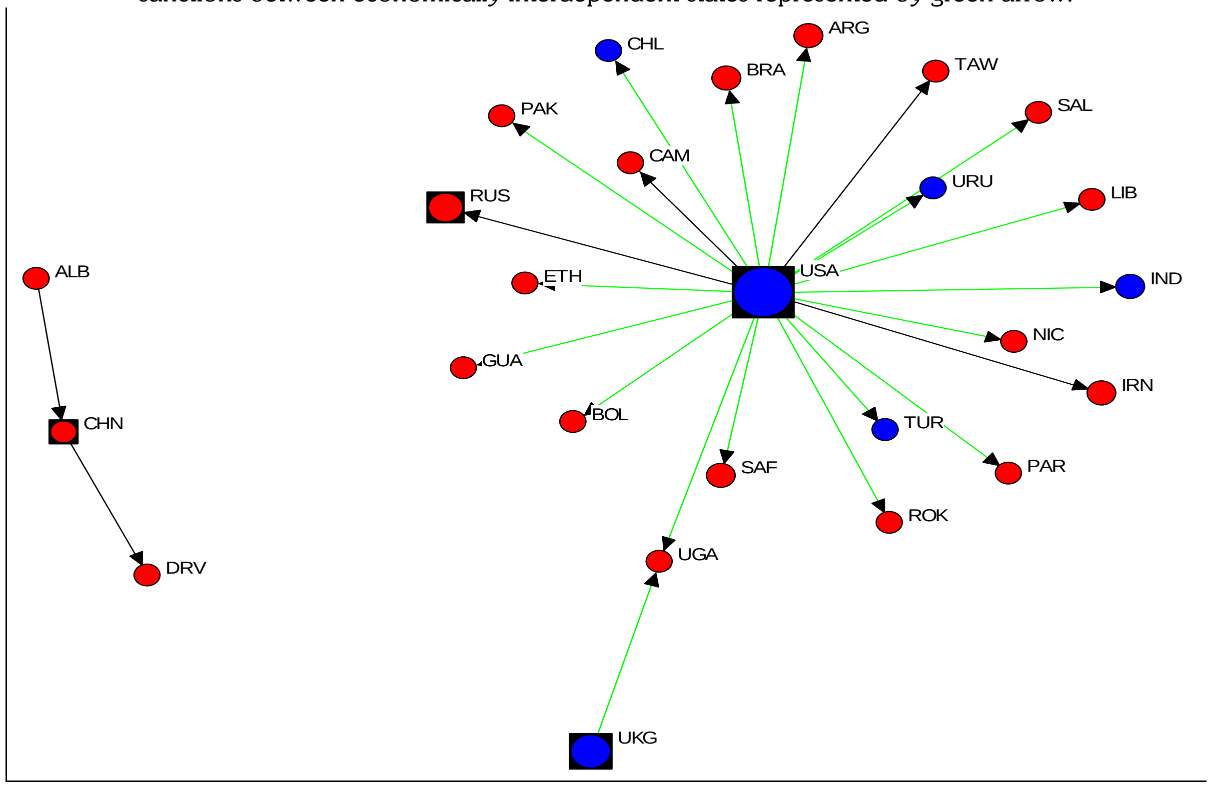


Figure 5.3 Networks of Dyadic Sanctions Onset in the 1970s (Continued)

Sanctions Onset-Economic Interdependence in the 1970s:
sanctions between economically interdependent states represented by green arrow.



Sanctions Onset-Past Conflict Interaction Level in the 1970s:
sanctions between hostile states represented by green arrows.

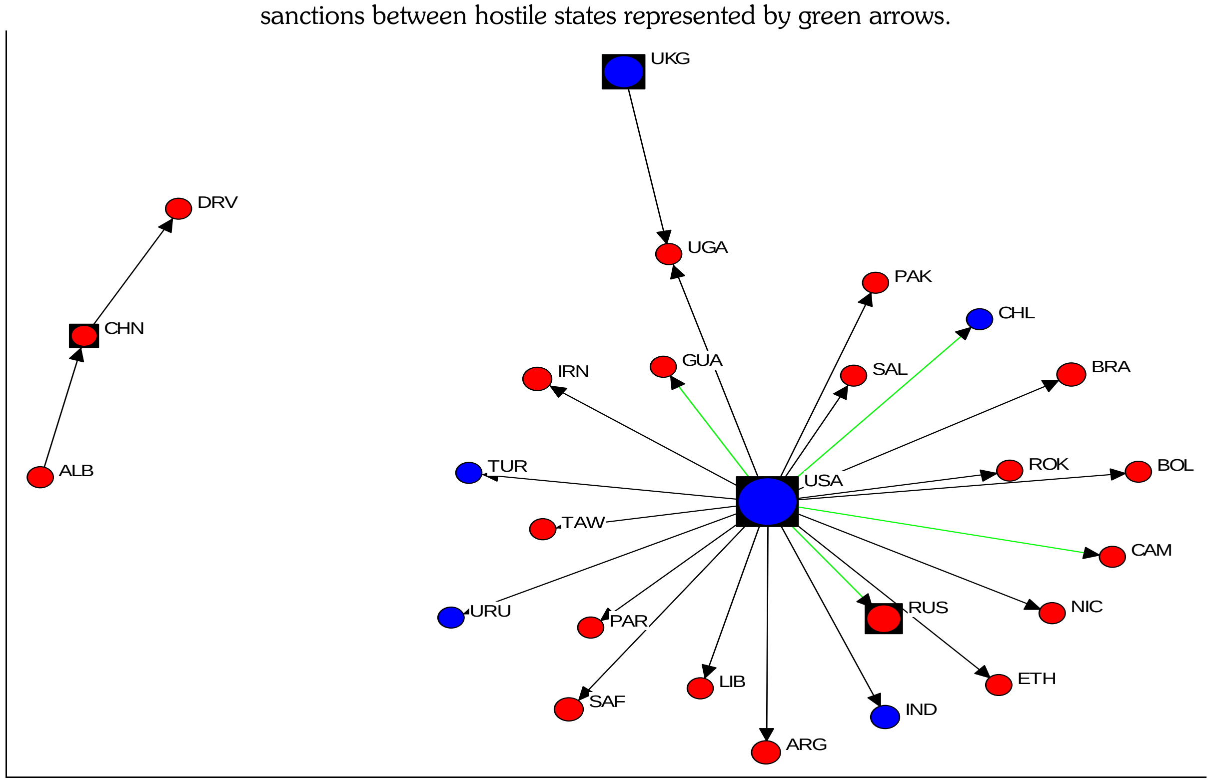
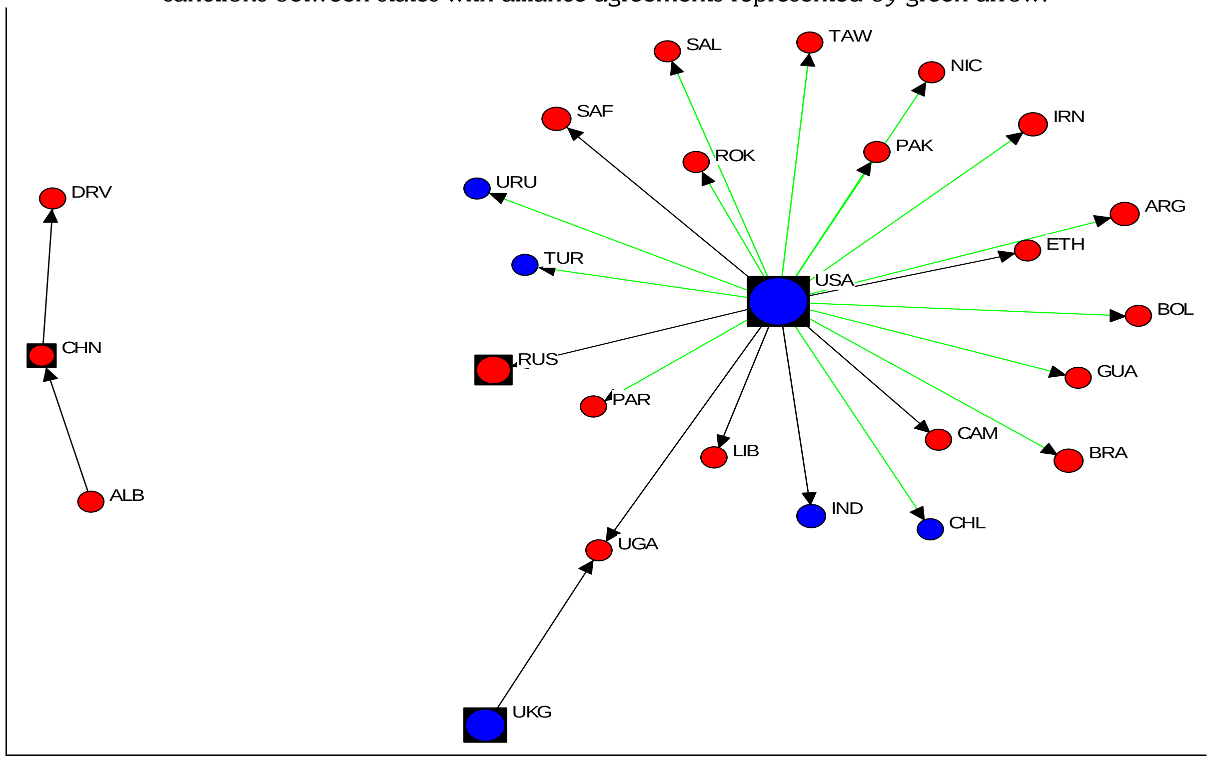


Figure 5.3 Networks of Dyadic Sanctions Onset in the 1970s (Continued)

Sanctions Onset-Alliance Agreements in the 1970s:
sanctions between states with alliance agreements represented by green arrow.



CHAPTER 6. CONCLUSION

The central focus of this project was on the new social network conceptualizations of international system structure and national power. This project examined the following two traditional questions using the new social network conceptualizations: (1) how do we conceive an individual state's national power, and (2) how does the distribution of national power define the structure of the international system? The project also answered the following question (applying the above two questions to the empirical phenomena of international relations): how does redefining "power" and "system" in this way contribute to a better understanding of international politics? This project posited that: (1) the old conception of national power, which is focused on a state's attributes (its national capabilities), misses the true conception of national power; and (2) the old depiction of international system structure, which is focused on the distribution of national attributional powers (its distribution of national capabilities), as a consequence, misrepresents the true characteristics of the international system (which are, among others: how the components are connected or interact with each other; and how interaction patterns among those components are shaped or defined by the structure). The project also argued that defining "power" or "system" in terms of the attributes of nations fails to capitalize on information that we already possess about the patterned nature of international interaction, and is too coarse a conception to describe a system with a wide and continuous range of variation. This project provides social network conceptualizations of international system structure and individual state's national power. Power in a social network perspective focuses on an individual state's relational power: unlike the attributional power concept in the previous studies, a state's power in a social network perspective focuses on its interactive behaviors with all other states in a network of relations. International system structure from a social network perspective is conceived by considering social network powers of all system members, focusing on the different types of interaction networks in which they participate. This is unlike the previous studies, where only a handful of the most powerful actors in the system are considered (e.g., polarity theory, power transition theory, and hegemonic stability theory).

The Major Findings of this Dissertation

The two empirical chapters examined the determinants of the onset of international conflicts and the determinants of the onset and success of international sanctions from the social network perspective. In the first empirical chapter, the new social network power concept was applied to the previous empirical attempts of balance of power and power preponderance theories at both systemic and dyadic levels. The main hypotheses included: (1) do the increased levels of systemic structural network power concentration, change, and movement lead to the increased or decreased levels of systemic conflict onset, and (2) does the structural network power balance between the two states in a dyad increase or decrease the probability of dyad conflict onset? In the second empirical chapter, the new social network power concept was applied to the previous empirical attempts of the power explanations on the subject. The main hypotheses included: (1) does the structural network power balance between sanctioning and target states in a dyad increase or decrease the probability of sanction success, and (2) does the structural network power of target in a dyad increase or decrease the probability of sanction success? The focus of hypothesis testing in the two empirical chapters was on how my new social network conceptions of international system structure and national power lead to more accurate and powerful empirical models than previous ones mainly rooted in attribute logic. In other words, the empirical chapters took existing theories and tested them using my newer network conceptions of the international system and national power. The chapters focused on the conceptions of the international system as networks and of a state's power based on its relational structural network power, and were primarily interested in how these newer conceptions lead us to recast a great deal of existing empirical work on the subject. The two empirical chapters also provided the graphical representations of militarized conflicts and sanctions networks to reveal some of the main network characteristics of each type of network. Does a structurally centralized or concentrated international system induce a more peaceful world, or is just the opposite (for the systemic conflict analysis)? Furthermore, how is the structural network power balance between states related to their conflict behaviors (for the dyadic conflict analysis)? What are some distinctive characteristics of militarized disputes networks (for the graphical representations of conflicts)? These were some of the research questions that were examined in this project of social network application to militarized conflicts. What factors determine the onset of economics sanctions (for the sanction onset analysis)? How are the structural network powers of the sanction sender and its target, as well as the structural power balance between the two, related to the success of economic sanctions (for the sanction success analysis)? What are some distinctive characteristics of economic sanctions networks (for the graphical representations of sanctions)? These were some of the research questions that were examined in this project of social network application to economic sanctions.

After examining the hypotheses on balance of power theory and power preponderance theory using the social network perspective, the empirical chapter on militarized conflicts found that: (1) at the system level, the overall results do not reveal any clear support for either theory, but (2) at the dyadic level, the overall results do strongly support power preponderance theory over balance of power theory. From the system level analyses, the balance of power theory generally supports the hypotheses on systemic crises but, conversely, the power preponderance theory generally supports the hypotheses on systemic disputes. However, from the dyadic level analyses, the results are clear from using four different estimation methods (i.e., logistic estimation clustered on dyads, WSEV estimation, ReLogit estimation, and the pooled GEE estimation controlling for the AR1 process) that when the two states in a dyad share disproportional structural network power, they will be far less likely to be involved in conflicts with each other (i.e., the more skewed the distribution of structural network power in a dyad, the less likely there will be a militarized interstate dispute), thus supporting the "power preponderance leads to peace" argument. The marginal impact analysis also showed that the preponderance of structural network power has a strong effect on interstate dispute, cutting the probability of a dispute by 54.1% to 83.2% (depending on the model specifications) from the baseline rate. The evidence from nonparametric model discrimination statistics and information criteria measures also shows that the models with network power measures statistically outperform and are preferred over those with attributional power measures such as COW index and GNP in both systemic and dyadic conflict onsets studies.

In addition to the empirical analyses, this chapter also emphasized how useful the sociograms (produced by the social network analysis) are in depicting and highlighting the distinctive characteristics of international dispute networks. First, the general graphical patterns of monadic and dyadic factors affecting the onset of disputes revealed from the sociograms in Figure 4.3 are also in line with the results from the dyadic dispute onset analysis. Second, the sociograms in Figures 4.1 and 4.2 revealed that a significant majority of international conflicts are "connected" conflicts, and that there are relatively few "disconnected" or "isolated" conflicts in the network of international conflicts (e.g., during the 1950s, only one crisis-dyad, Morocco-Spain, was isolated in the network that was composed of 75 different crisis-dyads), and this provides the graphical insight of why the conflict dyadic study needs to incorporate the extra-dyadic conflict information in the networks. Those sociograms in Figures 4.1 and 4.2 also provided graphical insight for the studies of "recurrent" international conflicts (e.g., on enduring rivalries). Third, the global maps of monadic dispute and crisis onset distributions in 1950–2000 in Figures 4.4 and 4.5 revealed the zones of conflict or peace in the world (i.e., groups of states that have relatively more or less amounts of conflicts in the world).

The empirical chapter on economic sanctions found that the two main hypotheses of the study are generally supported by the results of the sample selection analyses (controlling for statistical linkages of the processes of sanction onset and sanction success). Regarding the determinants of sanction onset, I found that the shared military alliance, geographical proximity, and nonexistence of militarized disputes between states are all associated with the decreased probability of sanction onset. Regarding the determinants of sanction success, the first main hypothesis of this study argued that economic sanctions are less likely to be successful when the difference in the levels of structural network power between the sender and target is high. The results from the sample selection and marginal impact analyses revealed that sanction cases with disproportional structure network power between the sender and target were far less likely to be successful (i.e., the more skewed the distribution of structural network power between the sanctioning state and the target, the less likely is an economic sanction to be successful). The chapter also posited that the result provides the evidence that the lower sender/target globalization level balance (meaning highly globalized senders initiate sanctions on highly globalized targets) should be associated with the increased probability of sanction success. The second main hypothesis argued that economic sanctions are more likely to be successful when the structural network power of the target is high. The results from the sample selection and marginal impact analyses revealed that sanction cases with target states possessing high structural network power were far more likely to succeed. The chapter also posited that the result does provide the evidence that a highly globalized target (i.e., a target with relatively high structural network power) will be more severely hurt by the economic sanction, and therefore more likely to concede to the sender's demands. The evidence from nonparametric model discrimination statistics and information criteria measures also showed that the models with network power measures statistically outperform and are preferred over those with attributional power measures such as COW index and GNP in both sanctions onsets and success studies.

In addition to the empirical analyses, this chapter also emphasized how useful the sociograms produced by the social network analysis are in depicting and highlighting the distinctive characteristics of international sanction networks. First, the general graphical patterns of monadic and dyadic factors affecting the onset of sanctions revealed from the sociograms in Figure 5.3 are also in line with the results from the sanction onset analysis. Second, the sociograms in Figures 5.1 and 5.2 revealed that a significant majority of international sanctions are "connected" sanctions and there are relatively few "disconnected" or "isolated" sanctions in the network of economic sanctions (e.g., during the 1980s, only two sanction-onset dyads, France-Australia and India-Nepal, were isolated in the network that was composed of 26 different sanction-onset dyads; during the 1970s, no successful sanction-onset dyad was isolated in the network that was composed of 16 different successful sanction-onset dyads), and this provides the graphical insight of why the dyadic sanction onset and success studies need to incorporate the extra-dyadic sanction information in the networks. Those sociograms in Figures 5.1 and 5.2 also provided graphical insight for the studies of "recurrent" international sanctions, where the same dyad experiences more than one economic sanction.

Future Directions from this Dissertation

This project offers several opportunities for future research. The central focuses of this project were that the international system is composed of different social networks along the two dimensions of communication and resource flows (e.g., networks of diplomatic exchanges, foreign student exchanges, and international telecommunication for the first dimension; and networks of arms transfers, international trade, and international assistance for the second dimension), and that the structural network power of the state and its distribution in the system should be measured using a wide set of different interaction network data employing a social network perspective. However, we should be able to extend our social network conceptualizations of international system structure and national power in the following manner. First, we might want to add some other international interaction networks to depict each of the two dimensions used in the project. In Chapter 3, I presented three theoretical and empirical rules to justify the international networks used in this project: the international networks on dynamic (rather than static) behaviors focused on the directional (rather than non-directional) characteristics of relationships among states in the system whose data are available for all the system members over the long period of time studied in this project. Some international networks that satisfy the two theoretical decision rules had to be excluded due to the lack of consistent data available, either for the time period of this project or for all the system member states (e.g., the networks of international mail or Internet correspondence for the communication dimension and those of international migration for the resource dimension), and I will follow up my initial contacts with the relevant international institute or agency for the availability of such data in the future. Second, we might want to add some other dimensions of international system structure. During the early stages of this project, I attempted to include the dimension of authority patterns among the system members to depict international system structure. Some of the possible candidate networks to depict this dimension (i.e., formal alliance membership, IGO membership, and PTA agreement membership) were unable to be used, because they lacked the directional characteristics of relationships among states in the system (i.e., unable to differentiate between “choices made” and “choices received”) (Chapter 3). Some other possible candidates with semi-directional characteristics might be the voting records and the member contribution records in different international organizations. Also, if we can find some longitudinal survey materials conducted on governmental officials (or even citizens) available for all international system members, we might be able to include them to depict the additional authority pattern dimension of international system structure.

This project emphasized the graphical representations of states' interactions within different social networks of international relations in the formats of global maps and sociograms. However, as in Kinsella (2003, 2004, 2006) for the arms transfer networks, this project was primarily focused on using such graphical representations as descriptive tools (i.e., display, identify, and highlight spatial patterns of different interaction networks). For example, in Chapters 4 and 5, the graphical representations of international conflict and sanction networks revealed that the significant majority of conflicts and sanctions are indeed the "connected" and "recurrent" conflicts and sanctions (Chapters 4 and 5), and that the general graphical patterns of factors affecting the onset of disputes and sanctions revealed from the sociograms are also in line with the results from the dispute and sanctions onset analyses. However, we might also want to go further than using those graphical representations as descriptive tools. For example, among many others who used the spatial analyses (Anselin and O'Loughlin 1990, 1991; Kirby and Ward 1987; Ward and Gleditsch 2002; O'Loughlin et al 1998; Gleditsch and Ward 2005; Braithwaite and Li 2005; Braithwaite 2005), Braithwaite and Li (2005) used the local spatial statistic G_i* (Getis and Ord 1992; Ord and Getis 1995) to identify local "hot spots" of international conflicts and examined how the location of a state in the local hot spot of terrorism affects the level of transnational terrorism a country experiences. Gelditsch and Ward (2005) used the spatial statistic to identify the local spots of democracy and conflict/peace and examined the relationship between the democracy and international conflicts using spatial analysis. In addition to the use of the spatial statistic derived from the graphical representations, we might also want to use many other network measures which identify the distinctive characteristics of networks as a whole developed by social network theorists. For example, Krackhardt (1994) developed several measures to describe the organization network as a whole, namely the degree of network connectedness, hierarchy, efficiency, and least upper boundness. Employing his measures, we might want to examine, for example, how the level of connectedness in the international conflict network affects the amount of conflicts at the system level.

This project applied the social network perspectives of international system structure and national power to two international empirical phenomena in the international security arena and the international economy arena: militarized conflicts and economic sanctions. However, the potential of the two introduced social network conceptualizations are not limited to these two international phenomena. For example, among others, we might want to extend the analyses to the study of international terrorism. There have been quite a few empirical analyses of transnational terrorism (examining the behavior of terrorist organizations focusing on domestic and international variables), especially since 9/11 (e.g., the special issue of *Journal of Conflict Resolution* 49:2 [2005]); however, long before the recent interest in transnational terrorism, economists have studied transnational terrorism focusing on terrorists as rational actors who maximize some goal subject to resource constraints (e.g., Landes 1978; Sandler, Tschirhart, and Cauley 1983). The new social network conceptualizations developed in this project can be applied to transnational terrorism analysis. For example, in Chapters 3 and 5, I argued that the structural network power of each state also represents how well it is globalized in the international system (communication globalization from the first dimension of communication patterns, economic globalization from the second dimension of resource flows); in other words, how powerfully each state is structurally positioned in the network of relations shows how well each state is globalized in the web of network relations. If this argument holds, we can certainly examine Li and Schaub's (2004, 243) assertion that transnational terrorist incidents and globalization either at the systemic or national levels may trend in opposite directions, using the social network power measures derived from this project. More specifically, we might want to test such hypotheses as "does a level of systemic economic globalization or communication globalization affect transnational terrorism in the international system?" and "does a level of national economic globalization or communication globalization affect the transnational terrorism that each state experiences?" In addition, we might also want to examine transnational terrorism networks using the graphical methods used in this project. We should be able to identify and highlight the distinctive characteristics of international terrorism networks as we did for the international conflicts and sanctions networks in Chapters 4 and 5.

This project focused on (1) developing the social network conceptualizations of international system structure and national power, and comparing/contrasting the new conceptualizations to the older "scalar" measures in the field of international relations; and (2) applying the new conceptualizations to answer the empirical questions of the old material-based power theories and to improve our understanding of the two phenomena in international relations. In other words, the project took existing theories and tested them using my newer network conceptions, primarily interested in how these newer conceptions lead us to recast a great deal of existing empirical work. However, this project represents more of a beginning than an end in the application of social network perspectives on international relations. In addition, we might want to develop more hypotheses directly originating from the social network perspectives of international relations. Some of the possible candidate hypotheses might be: how is each type of international network created and how does it evolve over time (the creation and evolution of international networks), what are some transformation mechanisms active in each type of international network (the transformation of international networks), and what is the relationship between different types of international networks (e.g., how does the creation, evolution, or transformation of one type of international network affect the creation, evolution, or transformation of other types of international network)?

Appendix 1.1 Raw Binary and Valued Directional Matrices (Europe in 1960)

(Binary Diplomatic Exchange Matrix)

	ALB	BEL	BUL	CZE	DEN	FIN	FRN	GRC	HUN	ICE	IRE	ITA	LUX	NOR	NTH	POL	POR	ROM	RUS	SPN	SWD	SWZ	UKG	YUG
ALB	.	0	1	1	0	1	1	0	1	0	0	1	0	0	0	1	0	1	1	0	0	0	0	1
BEL	0	.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
BUL	0	1	.	1	1	1	1	1	1	0	0	1	0	1	1	1	0	1	1	0	1	1	1	1
CZE	0	1	1	.	1	1	1	1	1	1	0	1	0	1	1	1	0	1	1	0	1	1	1	1
DEN	0	1	0	1	.	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1
FIN	0	1	0	1	1	.	1	0	1	1	0	1	0	1	1	1	1	1	1	0	1	1	1	1
FRN	0	1	1	1	1	1	.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
GRC	0	1	1	1	1	1	1	.	1	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1
HUN	0	1	1	1	1	1	1	1	.	0	0	1	0	1	1	1	0	1	1	0	1	1	1	1
ICE	0	0	0	0	1	1	1	0	0	.	0	0	0	1	1	0	1	1	1	1	0	0	1	1
IRE	0	1	0	0	0	0	1	0	0	1	.	1	0	0	1	0	1	0	0	1	1	1	1	0
ITA	0	1	1	1	1	1	1	1	1	1	1	.	0	1	1	1	1	1	1	1	1	1	1	1
LUX	0	1	0	0	1	0	1	0	0	0	0	1	.	1	1	1	1	1	1	1	1	0	1	1
NOR	0	1	0	1	1	1	1	1	1	1	1	1	0	.	1	1	1	1	1	1	0	1	1	1
NTH	0	1	0	1	1	1	1	1	1	1	1	1	1	1	.	1	1	1	1	1	1	1	1	1
POL	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	.	0	1	1	0	1	1	1	1
POR	0	1	0	0	1	1	1	1	0	1	1	0	0	1	1	0	.	0	0	1	1	1	1	0
ROM	0	1	1	1	1	1	1	0	1	1	0	1	0	1	1	1	0	.	1	0	1	1	1	1
RUS	0	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	.	0	1	1	1	1
SPN	0	1	0	0	1	1	1	0	0	1	1	1	0	1	1	0	1	0	0	.	1	1	1	0
SWD	0	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	.	1	1	1
SWZ	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	.	1	1
UKG	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	.	1
YUG	0	1	1	1	1	0	1	1	1	0	0	1	0	1	1	1	0	1	1	0	1	1	1	.

Appendix 1.1 Raw Binary and Valued Directional Matrices (Europe in 1960, Continued)

(Valued Foreign Student Exchange Matrix)

	ALB	BEL	BUL	CZE	DEN	FIN	FRN	GRC	HUN	ICE	IRE	ITA	LUX	NOR	NTH	POL	POR	ROM	RUS	SPN	SWD	SWZ	UKG	YUG
ALB	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BEL	3	.	1	3	3	1	127	74	67	1	18	108	213	4	176	21	34	3	8	54	3	48	40	16
BUL	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CZE	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DEN	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FIN	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FRN	1	234	42	22	74	20	.	435	194	9	18	380	283	73	123	166	77	47	36	410	73	244	883	149
GRC	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HUN	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICE	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IRE	0	5	0	0	0	1	9	3	1	0	.	2	1	5	10	11	10	0	0	8	5	2	1068	1
ITA	3	2	6	3	2	8	26	1096	39	1	3	.	1	4	4	7	6	3	2	23	1	65	26	20
LUX	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0
NOR	0	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0
NTH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0
POL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0
POR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0
ROM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0
RUS	0	0	1268	88	0	0	0	0	1310	0	0	0	0	0	0	503	0	10	.	0	0	0	0	60
SPN	10	12	0	2	4	1	66	5	5	0	5	59	0	76	7	4	37	5	13	.	5	12	24	4
SWD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0
SWZ	1	78	11	5	16	14	582	299	499	4	15	292	157	204	128	32	38	6	3	96	51	.	121	34
UKG	0	21	3	4	16	14	53	180	119	27	90	56	6	221	63	34	42	4	13	45	25	55	.	42
YUG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.

Appendix 1.1 Raw Binary and Valued Directional Matrices (Europe in 1960, Continued)

(Binary Foreign Student Exchange Matrix)

	ALB	BEL	BUL	CZE	DEN	FIN	FRN	GRC	HUN	ICE	IRE	ITA	LUX	NOR	NTH	POL	POR	ROM	RUS	SPN	SWD	SWZ	UKG	YUG
ALB	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BEL	0	.	0	0	0	0	1	1	1	0	1	1	1	0	1	1	1	0	0	1	0	1	1	1
BUL	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CZE	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DEN	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FIN	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FRN	0	1	1	1	1	1	.	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
GRC	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HUN	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICE	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IRE	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	1	0
ITA	0	0	0	0	0	0	1	1	1	0	0	.	0	0	0	0	0	0	0	1	0	1	1	1
LUX	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0
NOR	0	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0
NTH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0
POL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0
POR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0
ROM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0
RUS	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	.	0	0	0	0	1
SPN	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	1	0	0	.	0	0	1	0
SWD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0
SWZ	0	1	0	0	1	0	1	1	1	0	1	1	1	1	1	1	1	0	0	1	1	.	1	1
UKG	0	1	0	0	1	0	1	1	1	1	1	1	0	1	1	1	1	0	0	1	1	1	.	1
YUG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.

Appendix 1.1 Raw Binary and Valued Directional Matrices (Europe in 1960, Continued)

(Valued Arms Transfer Matrix)

	ALB	BEL	BUL	CZE	DEN	FIN	FRN	GRC	HUN	ICE	IRE	ITA	LUX	NOR	NTH	POL	POR	ROM	RUS	SPN	SWD	SWZ	UKG	YUG
ALB	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BEL	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BUL	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CZE	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	21	572	0	0	0	0	0
DEN	0	0	0	0	.	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FIN	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FRN	0	0	0	0	10	0	.	0	0	0	24	4	0	0	0	0	0	0	0	0	0	0	0	0
GRC	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HUN	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICE	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IRE	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0
ITA	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	4	0	0	0	0
LUX	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0
NOR	0	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0
NTH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0
POL	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0
POR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0
ROM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0
RUS	46	0	504	311	0	3	0	0	876	0	0	0	0	0	0	604	0	173	.	0	0	0	0	11
SPN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0
SWD	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0
SWZ	0	0	0	0	0	0	0	0	0	0	0	119	0	0	0	0	0	0	0	0	0	.	0	0
UKG	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	177	.	8
YUG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.

Appendix 1.1 Raw Binary and Valued Directional Matrices (Europe in 1960, Continued)

(Binary Arms Transfer Matrix)

	ALB	BEL	BUL	CZE	DEN	FIN	FRN	GRC	HUN	ICE	IRE	ITA	LUX	NOR	NTH	POL	POR	ROM	RUS	SPN	SWD	SWZ	UKG	YUG
ALB	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BEL	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BUL	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CZE	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
DEN	0	0	0	0	.	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FIN	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FRN	0	0	0	0	1	0	.	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
GRC	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HUN	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICE	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IRE	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0
ITA	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	1	0	0	0	0
LUX	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0
NOR	0	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0
NTH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0
POL	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0
POR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0
ROM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0
RUS	1	0	1	1	0	1	0	0	1	0	0	0	0	0	0	1	0	1	.	0	0	0	0	1
SPN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0
SWD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0
SWZ	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	.	0	0
UKG	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	.	1
YUG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.

Appendix 1.1 Raw Binary and Valued Directional Matrices (Europe in 1960, Continued)

(Valued International Export Matrix)

	ALB	BEL	BUL	CZE	DEN	FIN	FRN	GRC	HUN	ICE	IRE	ITA	LUX	NOR	NTH	POL	POR	ROM	RUS	SPN	SWD	SWZ	UKG	YUG
ALB	.	0	2	8	0	0	0	0	4	0	0	0	0	0	0	3	0	1	24	0	0	0	0	0
BEL	0	.	5	22	67	31	376	33	12	1	12	111	691	40	771	15	43	8	18	21	106	101	202	9
BUL	3	2	.	55	0	1	4	2	12	0	0	13	0	0	1	20	0	8	307	1	1	2	6	8
CZE	8	10	62	.	8	11	14	9	112	3	1	23	1	8	17	128	1	64	659	3	10	13	25	24
DEN	0	14	0	7	.	26	22	4	2	10	3	68	1	67	28	13	3	1	16	4	131	21	393	4
FIN	0	36	1	9	34	.	46	7	4	2	10	21	1	13	59	17	1	3	140	2	43	5	236	2
FRN	2	492	7	17	72	59	.	35	19	1	10	401	21	39	186	22	54	25	116	84	118	314	347	30
GRC	0	2	3	7	1	3	10	.	5	0	0	13	0	1	5	6	1	3	19	0	2	3	19	9
HUN	0	4	0	0	3	3	8	5	.	0	0	18	0	2	4	0	0	26	0	1	6	7	11	34
ICE	0	0	0	3	2	2	1	1	0	.	0	2	0	4	2	1	2	0	10	0	4	0	10	0
IRE	0	4	0	0	1	0	4	0	0	0	.	4	0	0	3	0	1	0	0	2	3	1	315	0
ITA	2	91	8	17	35	17	276	40	23	1	5	.	4	25	107	21	21	16	79	35	73	244	250	105
LUX	0	7	0	1	3	1	16	1	0	0	1	5	.	2	32	1	2	0	1	1	4	4	8	0
NOR	0	18	1	7	56	18	23	3	2	5	1	31	1	.	33	5	4	2	13	7	107	10	199	2
NTH	0	552	2	11	103	39	237	20	6	4	15	129	23	68	.	14	20	3	12	25	191	92	441	14
POL	3	10	0	0	22	29	15	5	0	1	2	37	0	5	8	.	1	23	0	2	23	8	101	0
POR	0	10	0	2	5	1	11	2	0	0	1	11	0	3	9	1	.	1	3	3	9	4	44	0
ROM	2	2	9	63	0	4	20	4	42	0	0	26	0	2	3	21	2	.	281	0	2	11	15	8
RUS	0	27	0	0	29	151	95	28	0	13	2	126	1	19	44	0	2	266	.	3	63	6	220	57
SPN	0	20	1	5	9	5	58	2	3	0	2	68	1	9	24	2	5	1	7	.	14	19	126	3
SWD	0	103	2	12	169	107	100	13	7	3	8	84	4	234	131	20	12	4	38	23	.	40	410	9
SWZ	0	64	2	15	35	20	127	9	8	1	3	156	3	21	78	13	22	7	10	30	54	.	110	19
UKG	0	281	8	25	254	138	276	54	13	9	333	261	12	202	353	42	70	12	149	85	376	148	.	41
YUG	0	4	9	26	2	0	8	19	20	0	0	75	0	1	6	22	0	6	53	0	5	8	44	.

Appendix 1.1 Raw Binary and Valued Directional Matrices (Europe in 1960, Continued)

(Binary International Export Matrix)

	ALB	BEL	BUL	CZE	DEN	FIN	FRN	GRC	HUN	ICE	IRE	ITA	LUX	NOR	NTH	POL	POR	ROM	RUS	SPN	SWD	SWZ	UKG	YUG
ALB	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
BEL	0	.	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	0
BUL	0	0	.	1	0	0	0	0	1	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0
CZE	0	0	1	.	0	1	1	0	1	0	0	1	0	0	1	1	0	1	1	0	0	1	1	1
DEN	0	1	0	0	.	1	1	0	0	0	0	1	0	1	1	1	0	0	1	0	1	1	1	0
FIN	0	1	0	0	1	.	1	0	0	0	0	1	0	1	1	1	0	0	1	0	1	0	1	0
FRN	0	1	0	1	1	1	.	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
GRC	0	0	0	0	0	0	0	.	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0
HUN	0	0	0	0	0	0	0	0	.	0	0	1	0	0	0	0	0	1	0	0	0	0	1	1
ICE	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IRE	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	0	0	0	1	0
ITA	0	1	0	1	1	1	1	1	1	0	0	.	0	1	1	1	1	1	1	1	1	1	1	1
LUX	0	0	0	0	0	0	1	0	0	0	0	0	.	0	1	0	0	0	0	0	0	0	0	0
NOR	0	1	0	0	1	1	1	0	0	0	0	1	0	.	1	0	0	0	1	0	1	0	1	0
NTH	0	1	0	1	1	1	1	1	0	0	1	1	1	1	.	1	1	0	1	1	1	1	1	1
POL	0	0	0	0	1	1	1	0	0	0	0	1	0	0	0	.	0	1	0	0	1	0	1	0
POR	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	.	0	0	0	0	0	1	0
ROM	0	0	0	1	0	0	1	0	1	0	0	1	0	0	0	1	0	.	1	0	0	1	1	0
RUS	0	1	0	0	1	1	1	1	0	1	0	1	0	1	1	0	0	1	.	0	1	0	1	1
SPN	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	.	1	1	1	0
SWD	0	1	0	1	1	1	1	1	0	0	0	1	0	1	1	1	1	0	1	1	.	1	1	0
SWZ	0	1	0	1	1	1	1	0	0	0	0	1	0	1	1	1	1	0	0	1	1	.	1	1
UKG	0	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	.	1
YUG	0	0	0	1	0	0	0	1	1	0	0	1	0	0	0	1	0	0	1	0	0	0	1	.

Appendix 1.2 Ranking of Countries on Structural Network Power Measures

Degree	1950		1960		1970		1980		1990		2000	
Ranking	Country	Value										
1	U.S.A.	0.634	U.S.A.	0.595	U.S.A.	0.551	U.S.A.	0.600	U.S.A.	0.592	U.S.A.	0.580
2	U.K.	0.502	U.K.	0.437	U.K.	0.488	France	0.528	France	0.540	France	0.513
3	France	0.385	France	0.399	France	0.469	U.K.	0.509	U.K.	0.487	U.K.	0.489
4	Italy	0.292	Italy	0.271	Italy	0.345	Italy	0.375	Italy	0.400	Canada	0.406
5	Belgium	0.265	West Germany	0.269	Canada	0.272	Belgium	0.316	Canada	0.390	Italy	0.391
6	Switzerland	0.246	Belgium	0.238	West Germany	0.265	Japan	0.308	Belgium	0.324	Belgium	0.327
7	Canada	0.230	Switzerland	0.222	Japan	0.262	West Germany	0.301	Japan	0.317	Germany	0.324
8	Sweden	0.175	Japan	0.201	Belgium	0.259	Netherlands	0.294	Netherlands	0.316	Japan	0.320
9	Netherlands	0.165	Canada	0.195	Switzerland	0.249	Switzerland	0.289	Switzerland	0.311	Switzerland	0.319
10	Argentina	0.164	Spain	0.183	Netherlands	0.230	Canada	0.282	West Germany	0.299	Netherlands	0.319
11	Brazil	0.156	Netherlands	0.183	Spain	0.192	Sweden	0.235	Sweden	0.260	Spain	0.307
12	Russia	0.141	Austria	0.158	Sweden	0.188	Spain	0.223	Spain	0.240	Sweden	0.294
13	Spain	0.128	Sweden	0.156	Austria	0.173	Australia	0.190	Australia	0.205	Australia	0.272
14	India	0.126	Russia	0.156	Russia	0.163	Nigeria	0.187	Egypt	0.203	Denmark	0.213
15	Czechoslovakia	0.124	Argentina	0.144	Denmark	0.158	Argentina	0.187	Germany	0.201	Indonesia	0.212
Betweenness	1950		1960		1970		1980		1990		2000	
Ranking	Country	Value										
1	U.S.A.	0.161	U.S.A.	0.100	U.S.A.	0.097	U.S.A.	0.101	U.S.A.	0.100	U.S.A.	0.106
2	U.K.	0.067	France	0.075	France	0.066	France	0.051	France	0.048	France	0.038
3	France	0.052	U.K.	0.048	U.K.	0.060	U.K.	0.046	U.K.	0.035	U.K.	0.034
4	Italy	0.015	West Germany	0.034	West Germany	0.024	Italy	0.024	Italy	0.023	Germany	0.033
5	Russia	0.014	Russia	0.020	Italy	0.021	Japan	0.019	Germany	0.018	Italy	0.033
6	Belgium	0.014	Italy	0.015	Japan	0.021	West Germany	0.015	Japan	0.015	Russia	0.019
7	Netherlands	0.011	Japan	0.013	Russia	0.017	Russia	0.013	West Germany	0.015	South Africa	0.013
8	Switzerland	0.009	Netherlands	0.009	Spain	0.009	Saudi Arabia	0.011	Russia	0.014	China	0.012
9	Saudi Arabia	0.009	China	0.009	Australia	0.009	South Africa	0.011	South Africa	0.009	Japan	0.012
10	Argentina	0.009	Belgium	0.007	Belgium	0.009	Netherlands	0.010	Canada	0.009	Canada	0.012
11	Australia	0.008	Saudi Arabia	0.007	Netherlands	0.009	Belgium	0.009	Belgium	0.009	Spain	0.011
12	Brazil	0.007	Australia	0.006	Canada	0.009	Spain	0.008	Netherlands	0.008	Belgium	0.010
13	India	0.007	India	0.006	Saudi Arabia	0.006	Canada	0.008	Spain	0.008	Netherlands	0.009
14	Czechoslovakia	0.007	Canada	0.006	South Africa	0.006	Australia	0.008	Australia	0.006	Turkey	0.008
15	Taiwan	0.007	Brazil	0.005	India	0.005	Switzerland	0.007	Switzerland	0.006	Poland	0.007

Appendix 1.2 Ranking of Countries on Structural Network Power Measures (Continued)

Flow-Betweenness	1950		1960		1970		1980		1990		2000	
Ranking	Country	Value										
1	U.S.A.	0.131	U.S.A.	0.075	U.S.A.	0.069	U.S.A.	0.068	U.S.A.	0.071	U.S.A.	0.062
2	U.K.	0.052	France	0.059	France	0.052	France	0.040	France	0.042	France	0.034
3	France	0.031	U.K.	0.035	U.K.	0.048	U.K.	0.040	U.K.	0.031	U.K.	0.024
4	Argentina	0.015	West Germany	0.025	Russia	0.026	Italy	0.019	Italy	0.018	Italy	0.023
5	Taiwan	0.015	Russia	0.021	West Germany	0.019	Japan	0.017	Germany	0.016	Russia	0.022
6	Belgium	0.013	Italy	0.014	Italy	0.018	Russia	0.015	Japan	0.015	Germany	0.020
7	Italy	0.013	Japan	0.014	Japan	0.017	West Germany	0.013	Russia	0.014	South Africa	0.016
8	India	0.012	China	0.011	Australia	0.011	Australia	0.012	West Germany	0.013	Canada	0.013
9	Netherlands	0.011	Netherlands	0.009	Afghanistan	0.010	Netherlands	0.012	Canada	0.011	China	0.013
10	Canada	0.011	Australia	0.008	Belgium	0.010	Saudi Arabia	0.011	Belgium	0.011	Japan	0.012
11	Russia	0.011	Belgium	0.007	Spain	0.010	Belgium	0.010	Spain	0.009	Ghana	0.011
12	Australia	0.010	Taiwan	0.006	Netherlands	0.009	South Africa	0.009	Australia	0.009	Belgium	0.011
13	Switzerland	0.009	India	0.006	Canada	0.009	Spain	0.009	Ghana	0.009	Australia	0.010
14	Brazil	0.008	Canada	0.006	China	0.007	Canada	0.008	Netherlands	0.008	South Korea	0.010
15	Czechoslovakia	0.007	Argentina	0.006	Brazil	0.006	Switzerland	0.007	South Africa	0.008	Sudan	0.009
Coreness	1950		1960		1970		1980		1990		2000	
Ranking	Country	Value										
1	U.S.A.	0.502	U.S.A.	0.493	U.S.A.	0.257	U.S.A.	0.407	U.S.A.	0.378	U.S.A.	0.347
2	U.K.	0.262	U.K.	0.227	U.K.	0.254	France	0.220	Italy	0.226	U.K.	0.253
3	Canada	0.205	France	0.197	France	0.224	U.K.	0.210	France	0.225	Canada	0.229
4	France	0.205	Italy	0.171	Russia	0.215	Italy	0.175	U.K.	0.224	France	0.211
5	Switzerland	0.173	Belgium	0.166	West Germany	0.202	West Germany	0.164	Netherlands	0.201	Switzerland	0.208
6	Italy	0.171	Switzerland	0.156	Switzerland	0.174	Switzerland	0.164	Switzerland	0.194	Italy	0.199
7	Belgium	0.170	West Germany	0.152	Canada	0.164	Belgium	0.153	Canada	0.185	Sweden	0.185
8	Sweden	0.114	Canada	0.147	Italy	0.149	Japan	0.151	West Germany	0.185	Japan	0.170
9	Netherlands	0.103	Austria	0.131	Belgium	0.143	Netherlands	0.143	Japan	0.168	Netherlands	0.167
10	Brazil	0.094	Japan	0.126	Japan	0.136	Canada	0.139	Belgium	0.160	Austria	0.155
11	Spain	0.088	Spain	0.114	Austria	0.129	Spain	0.137	Sweden	0.131	Norway	0.153
12	Argentina	0.083	Netherlands	0.108	Netherlands	0.124	Sweden	0.134	Spain	0.120	Spain	0.152
13	Iran	0.082	Sweden	0.106	Sweden	0.105	Austria	0.117	Austria	0.114	Belgium	0.150
14	Greece	0.082	Denmark	0.084	Spain	0.103	Argentina	0.104	Australia	0.108	Australia	0.147
15	Norway	0.082	Saudi Arabia	0.083	Denmark	0.100	Australia	0.095	Nigeria	0.105	Nigeria	0.132

Appendix 1.2 Ranking of Countries on Structural Network Power Measures (Continued)

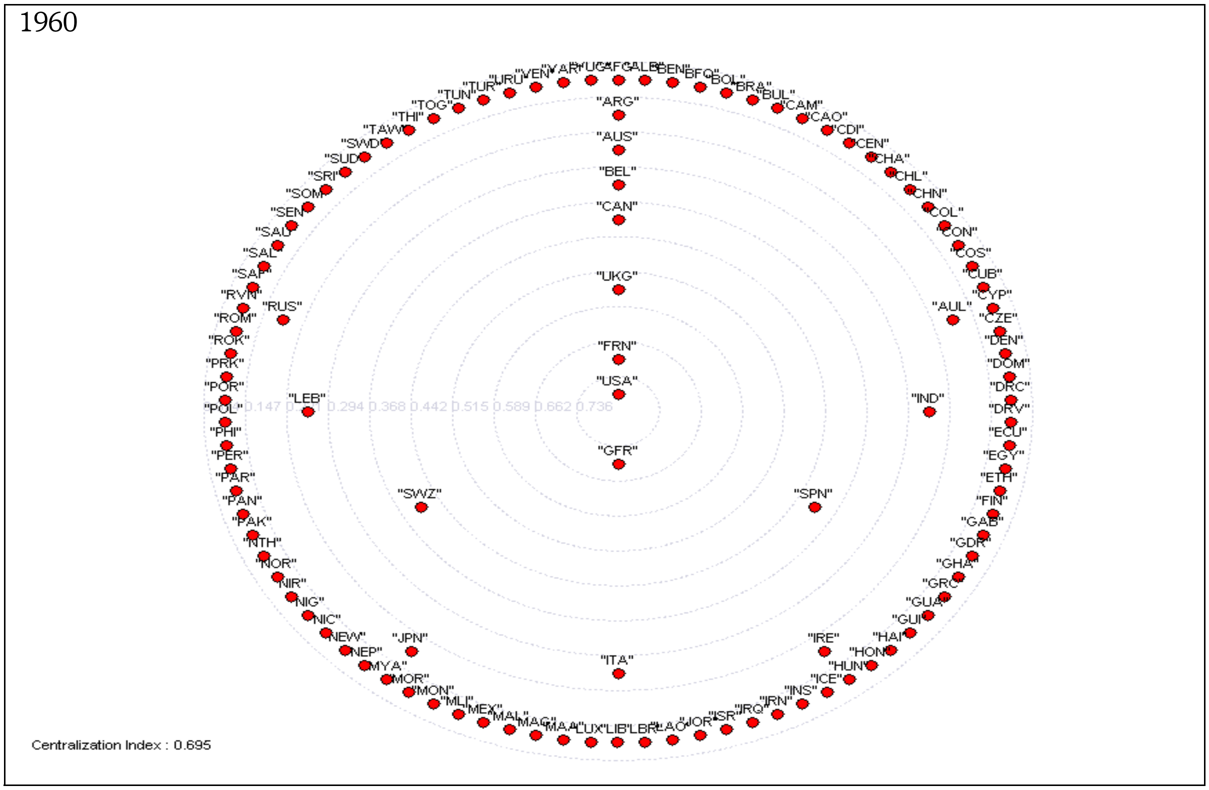
Egonet Brokerage	1950		1960		1970		1980		1990		2000	
Ranking	Country	Value										
1	U.S.A.	0.892	U.S.A.	0.876	U.S.A.	0.876	U.S.A.	0.877	U.S.A.	0.872	U.S.A.	0.870
2	U.K.	0.881	U.K.	0.858	U.K.	0.874	U.K.	0.857	France	0.847	France	0.838
3	Italy	0.796	France	0.844	France	0.857	France	0.849	U.K.	0.832	U.K.	0.818
4	Canada	0.689	Italy	0.785	Italy	0.821	Italy	0.809	Canada	0.782	Italy	0.798
5	France	0.670	West Germany	0.719	Canada	0.749	Japan	0.752	Italy	0.770	Canada	0.778
6	Belgium	0.594	Belgium	0.689	West Germany	0.725	West Germany	0.738	West Germany	0.751	Spain	0.725
7	Netherlands	0.523	Canada	0.642	Switzerland	0.666	Switzerland	0.712	Australia	0.701	Netherlands	0.699
8	Switzerland	0.485	Japan	0.585	Japan	0.604	Australia	0.679	Spain	0.700	Belgium	0.670
9	Australia	0.436	Netherlands	0.531	Belgium	0.575	Sweden	0.642	Switzerland	0.693	Switzerland	0.664
10	Sweden	0.435	Sweden	0.480	Australia	0.563	Canada	0.621	Belgium	0.680	Sweden	0.663
11	Russia	0.417	Russia	0.479	Netherlands	0.556	Austria	0.607	Netherlands	0.677	Russia	0.620
12	Taiwan	0.348	Norway	0.460	Sweden	0.523	Netherlands	0.573	Sweden	0.657	Austria	0.565
13	Norway	0.331	Switzerland	0.447	Austria	0.450	Belgium	0.568	Austria	0.586	Australia	0.563
14	Argentina	0.324	Austria	0.400	Russia	0.417	Norway	0.466	Japan	0.564	Belarus	0.560
15	Syria	0.294	Argentina	0.388	Lebanon	0.361	Saudi Arabia	0.434	Russia	0.500	Japan	0.551

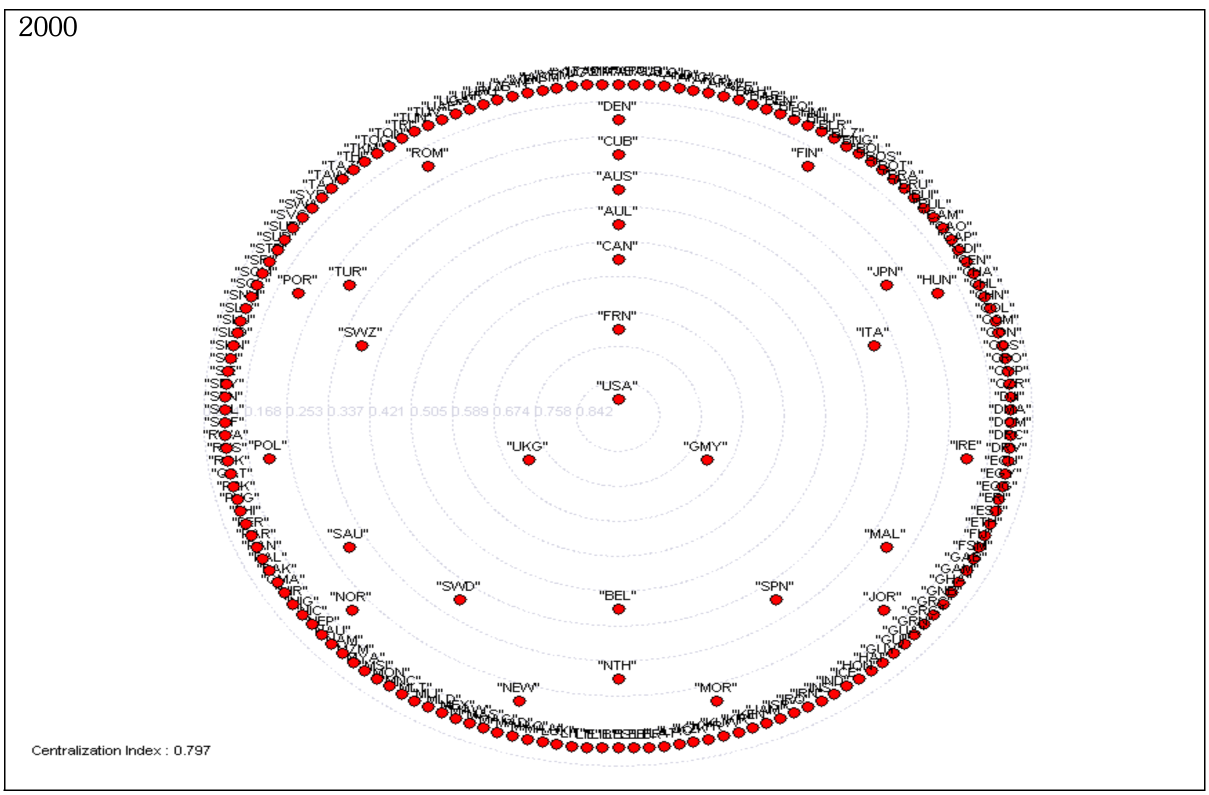
Appendix 1.2 Ranking of Countries on Structural Network Power Measures (Continued)

SNPI	1950		1960		1970		1980		1990		2000	
Ranking	Country	Value										
1	U.S.A.	0.464	U.S.A.	0.428	U.S.A.	0.370	U.S.A.	0.410	U.S.A.	0.403	U.S.A.	0.393
2	U.K.	0.353	U.K.	0.321	U.K.	0.345	France	0.337	France	0.340	France	0.327
3	France	0.269	France	0.315	France	0.333	U.K.	0.332	U.K.	0.322	U.K.	0.323
4	Italy	0.257	Italy	0.251	Italy	0.271	Italy	0.280	Italy	0.287	Italy	0.289
5	Canada	0.228	West Germany	0.240	West Germany	0.247	Japan	0.250	Canada	0.275	Canada	0.288
6	Belgium	0.211	Belgium	0.221	Canada	0.240	West Germany	0.246	West Germany	0.252	Spain	0.241
7	Switzerland	0.185	Canada	0.199	Switzerland	0.220	Switzerland	0.236	Netherlands	0.242	Netherlands	0.240
8	Netherlands	0.162	Japan	0.188	Japan	0.208	Canada	0.212	Switzerland	0.242	Switzerland	0.240
9	Sweden	0.147	Netherlands	0.168	Belgium	0.199	Belgium	0.211	Belgium	0.237	Belgium	0.234
10	Russia	0.127	Switzerland	0.167	Netherlands	0.185	Netherlands	0.206	Japan	0.216	Sweden	0.230
11	Australia	0.124	Sweden	0.150	Russia	0.168	Sweden	0.204	Spain	0.216	Japan	0.213
12	Argentina	0.119	Russia	0.146	Sweden	0.165	Australia	0.197	Sweden	0.211	Australia	0.200
13	Norway	0.108	Austria	0.139	Australia	0.162	Austria	0.180	Australia	0.206	Austria	0.185
14	Brazil	0.107	Norway	0.132	Austria	0.152	Spain	0.158	Austria	0.178	Russia	0.181
15	India	0.099	Argentina	0.122	Spain	0.124	Saudi Arabia	0.141	Denmark	0.146	Germany	0.177
16	Czechoslovakia	0.094	Spain	0.120	Denmark	0.111	Brazil	0.137	Russia	0.143	Denmark	0.169
17	Denmark	0.090	Denmark	0.112	Lebanon	0.100	Norway	0.136	Saudi Arabia	0.135	Norway	0.163
18	Venezuela	0.088	India	0.111	Norway	0.100	Argentina	0.132	Egypt	0.131	Finland	0.145
19	Taiwan	0.087	Australia	0.110	Argentina	0.099	Denmark	0.126	Yugoslavia	0.130	Israel	0.138
20	Spain	0.080	Brazil	0.098	Saudi Arabia	0.091	India	0.110	Brazil	0.121	Saudi Arabia	0.137
21	Syria	0.077	Turkey	0.098	Brazil	0.090	Russia	0.110	Norway	0.117	Portugal	0.136
22	Saudi Arabia	0.077	Czechoslovakia	0.090	India	0.090	Mexico	0.109	Israel	0.108	Poland	0.130
23	Mexico	0.076	Yugoslavia	0.086	Czechoslovakia	0.090	Greece	0.101	India	0.107	South Africa	0.129
24	Egypt	0.076	Taiwan	0.086	China	0.090	Israel	0.100	Germany	0.106	China	0.128
25	Iran	0.070	Lebanon	0.083	Israel	0.089	Nigeria	0.099	Argentina	0.103	South Korea	0.127
26	Greece	0.070	Venezuela	0.080	Taiwan	0.079	Egypt	0.096	Turkey	0.101	Ireland	0.126
27	Yugoslavia	0.068	Egypt	0.077	Egypt	0.079	Ivory Coast	0.090	Nigeria	0.100	Argentina	0.124
28	Lebanon	0.068	Saudi Arabia	0.073	Poland	0.077	China	0.089	Portugal	0.099	Belarus	0.123
29	Turkey	0.068	China	0.070	Mexico	0.076	Senegal	0.088	Ivory Coast	0.099	Cyprus	0.123
30	Poland	0.060	Pakistan	0.061	Yugoslavia	0.072	Turkey	0.087	Senegal	0.099	New Zealand	0.122

Appendix 1.3 Distributions of Centralities, using Concentric Layout Algorithm

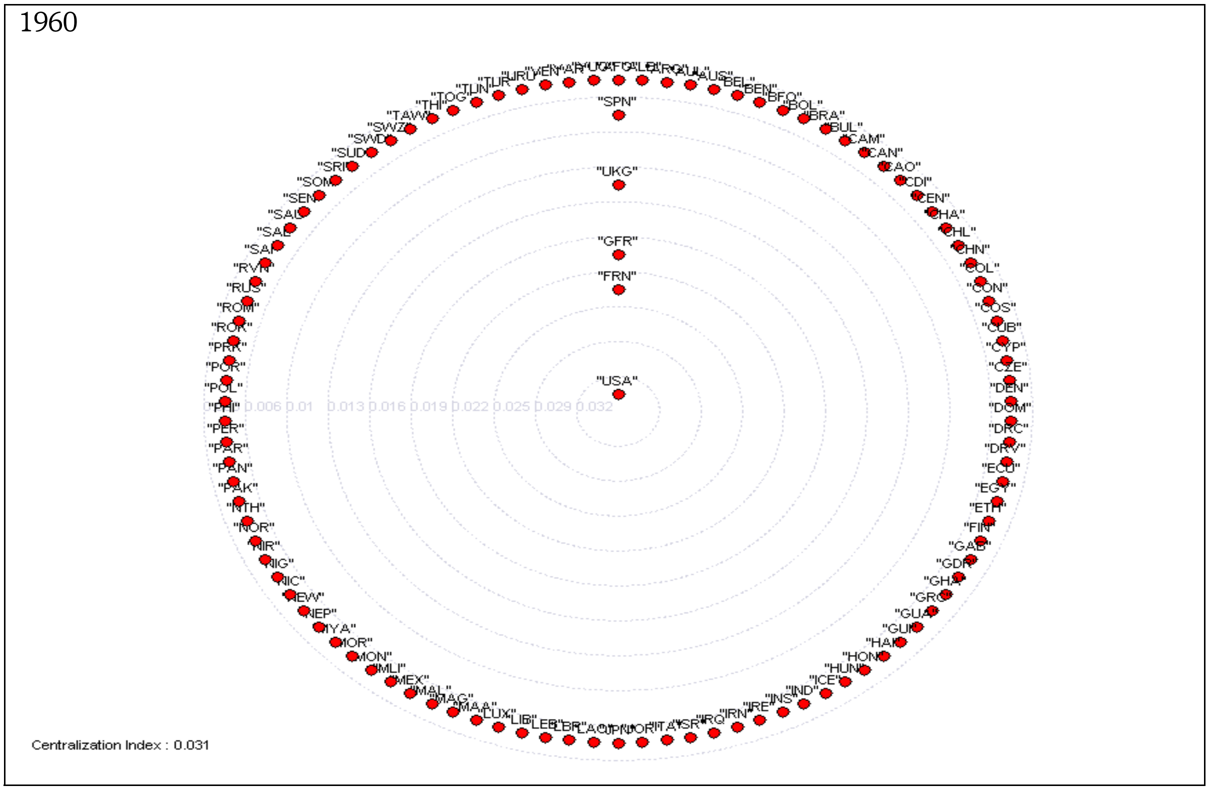
(Degree Centralities; Foreign Student Exchanges)

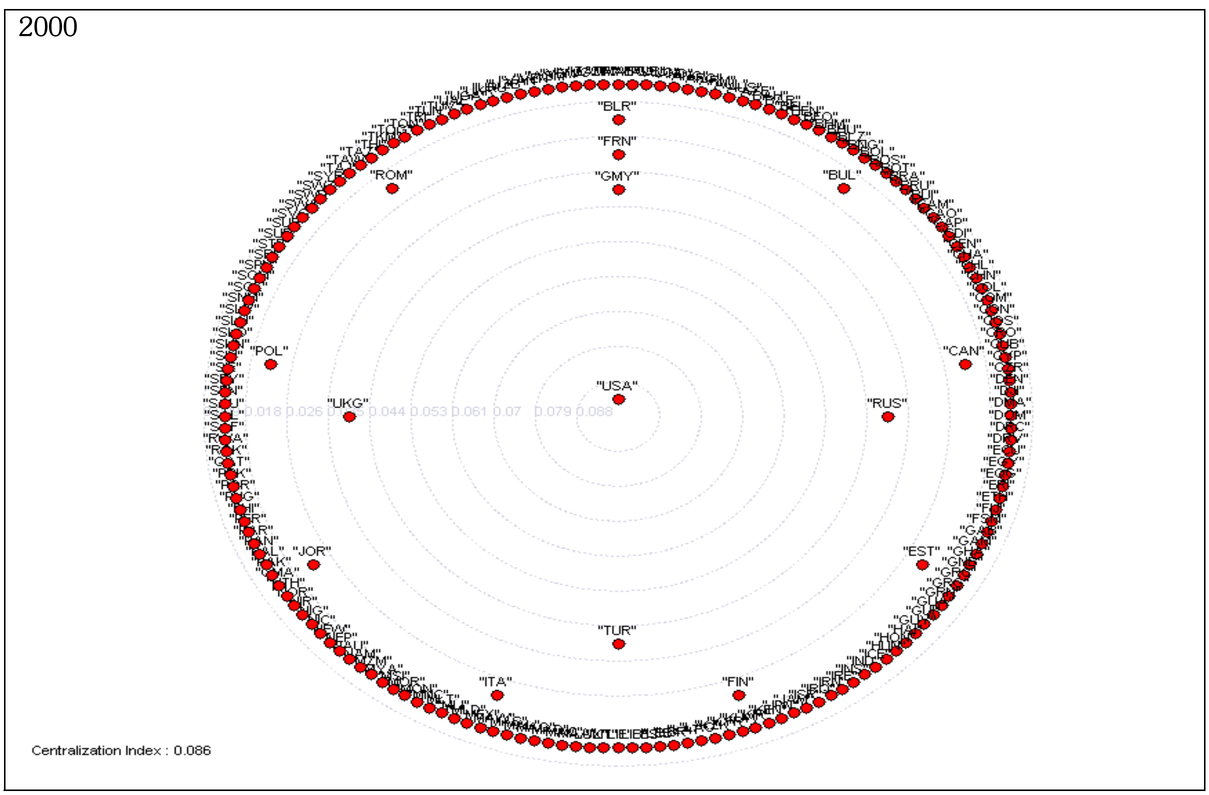




Appendix 1.3 Distributions of Centralities, using Concentric Layout Algorithm (Continued)

(Betweenness Centralities; Foreign Student Exchanges)

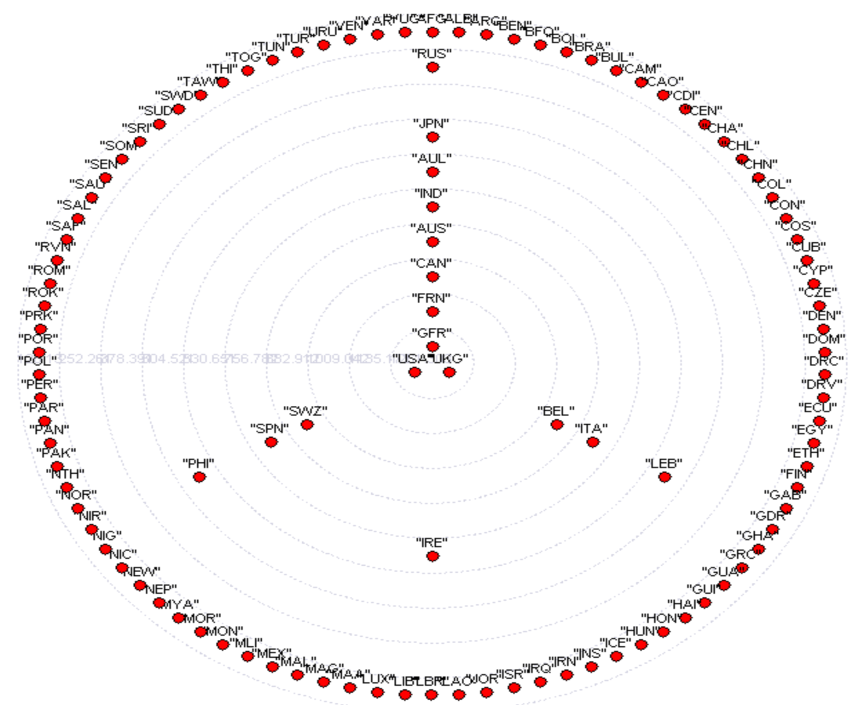




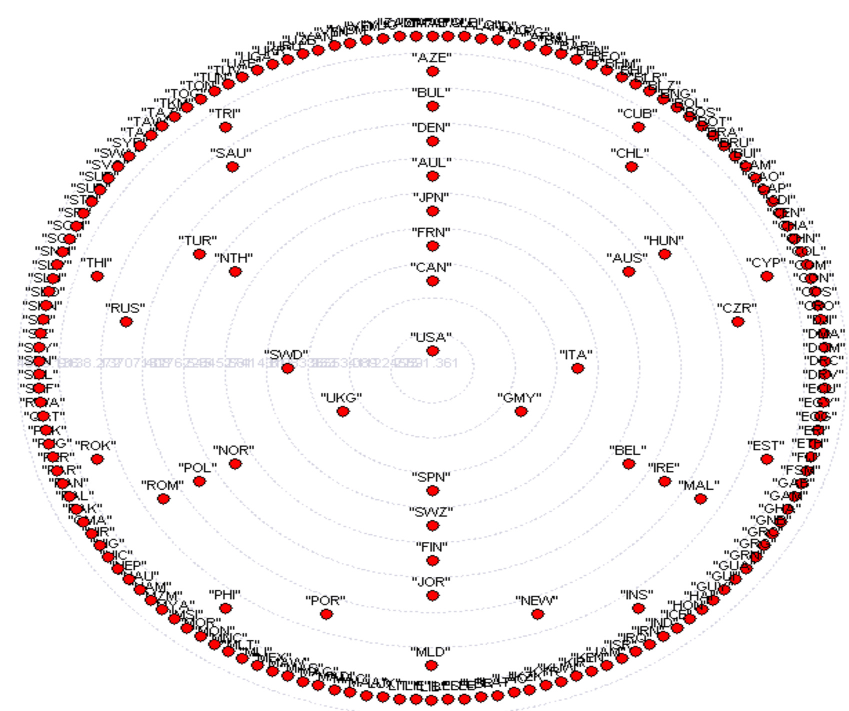
Appendix 1.3 Distributions of Centralities, using Concentric Layout Algorithm (Continued)

(Flow-Betweenness Centralities; Foreign Student Exchanges)

1960

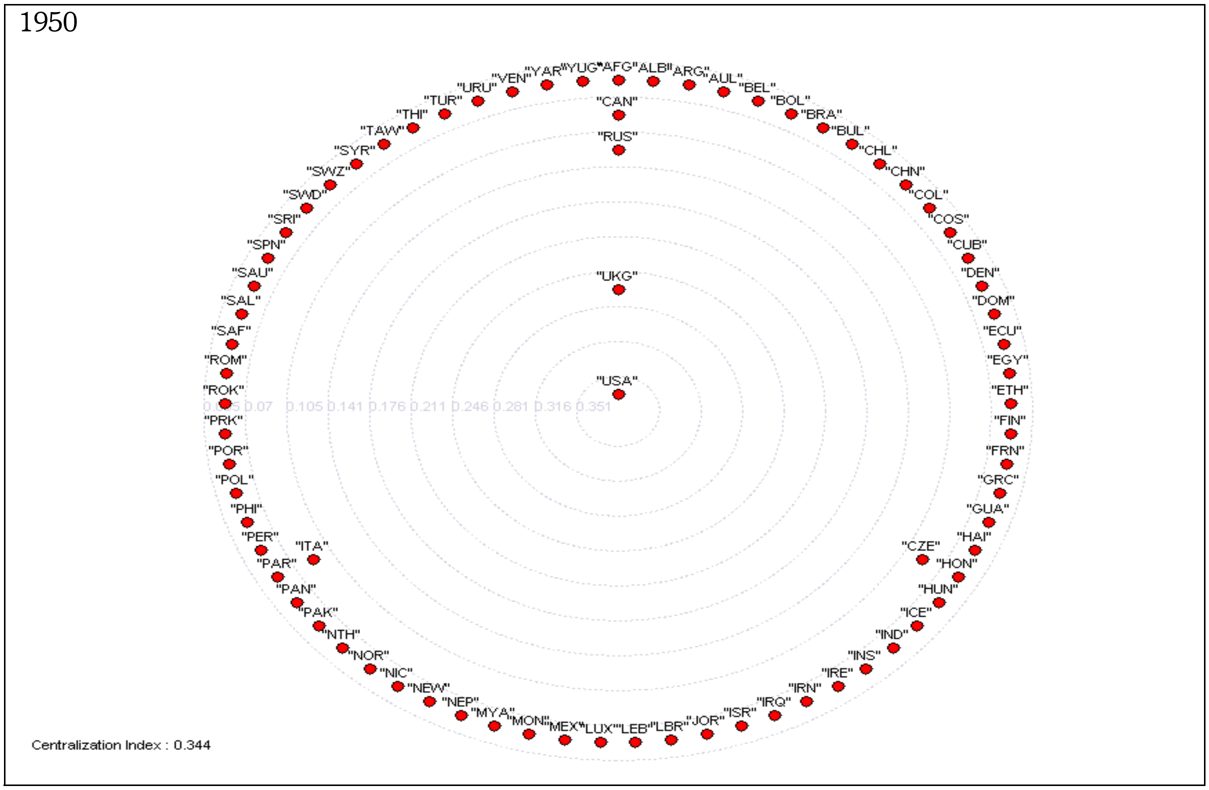


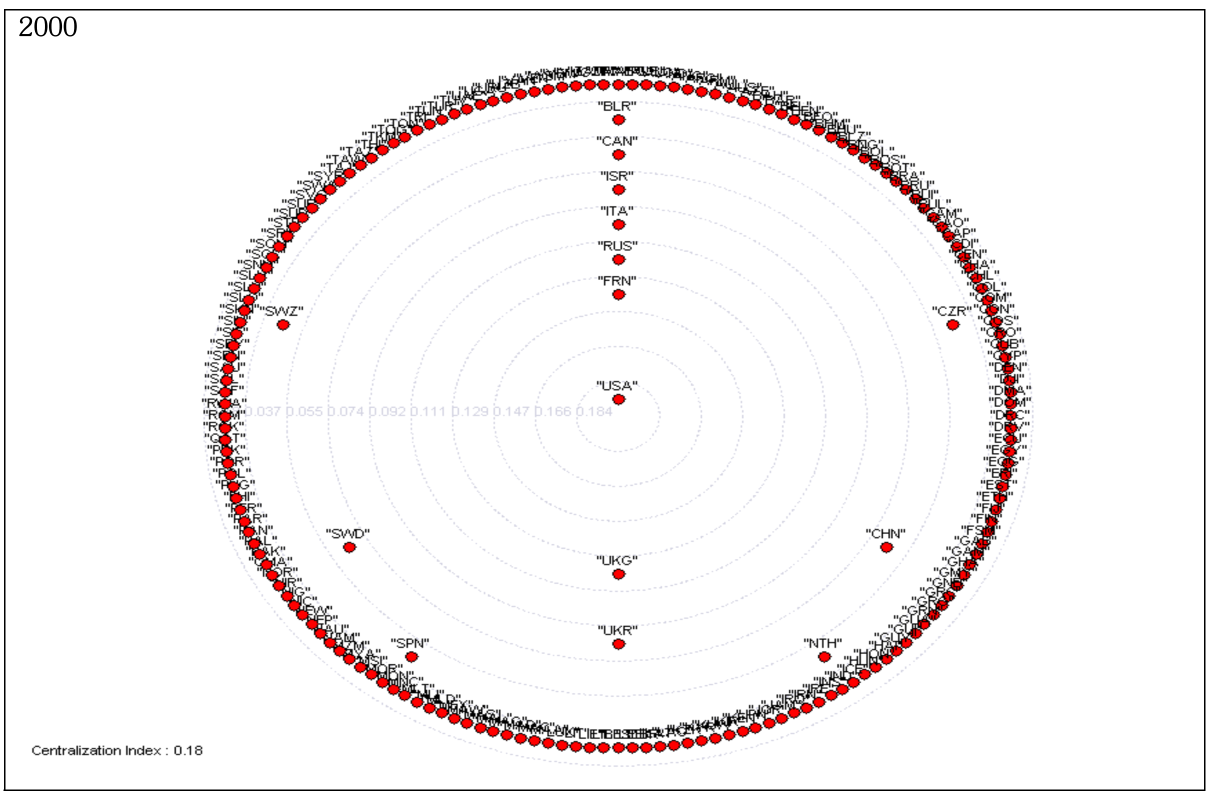
2000



Appendix 1.3 Distributions of Centralities, using Concentric Layout Algorithm (Continued)

(Degree Centralities; Arms Transfers)

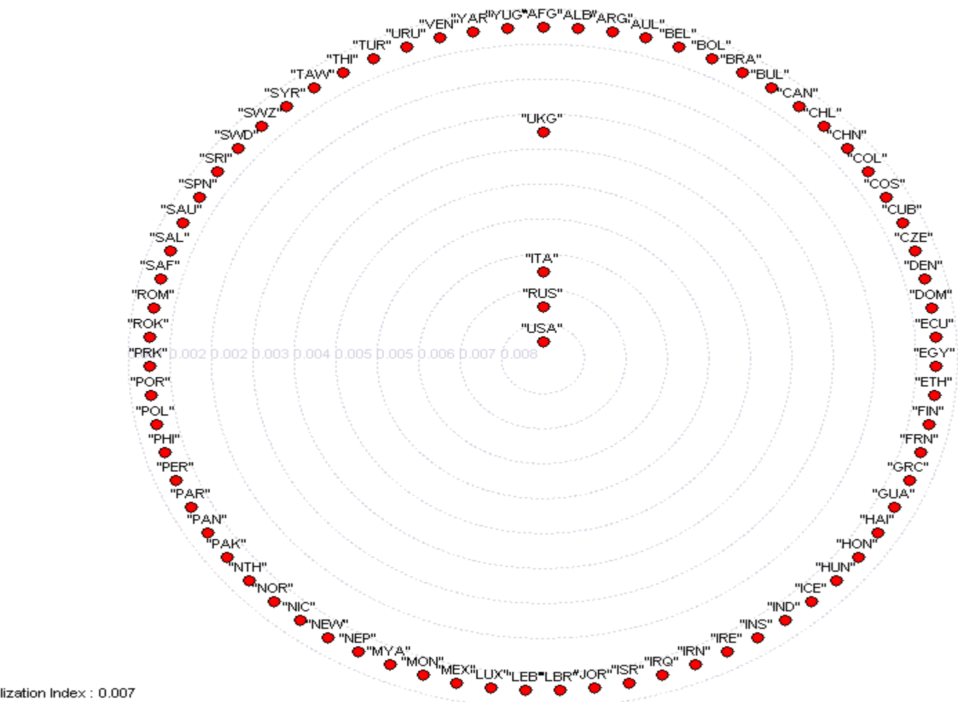




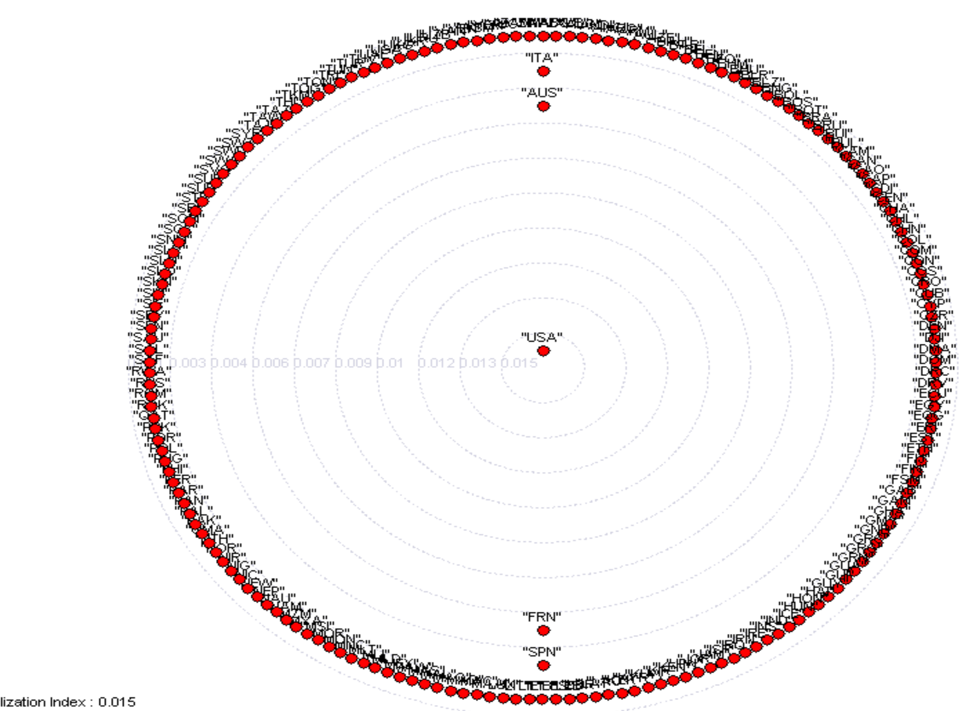
Appendix 1.3 Distributions of Centralities, using Concentric Layout Algorithm (Continued)

(Betweenness Centralities; Arms Transfers)

1950

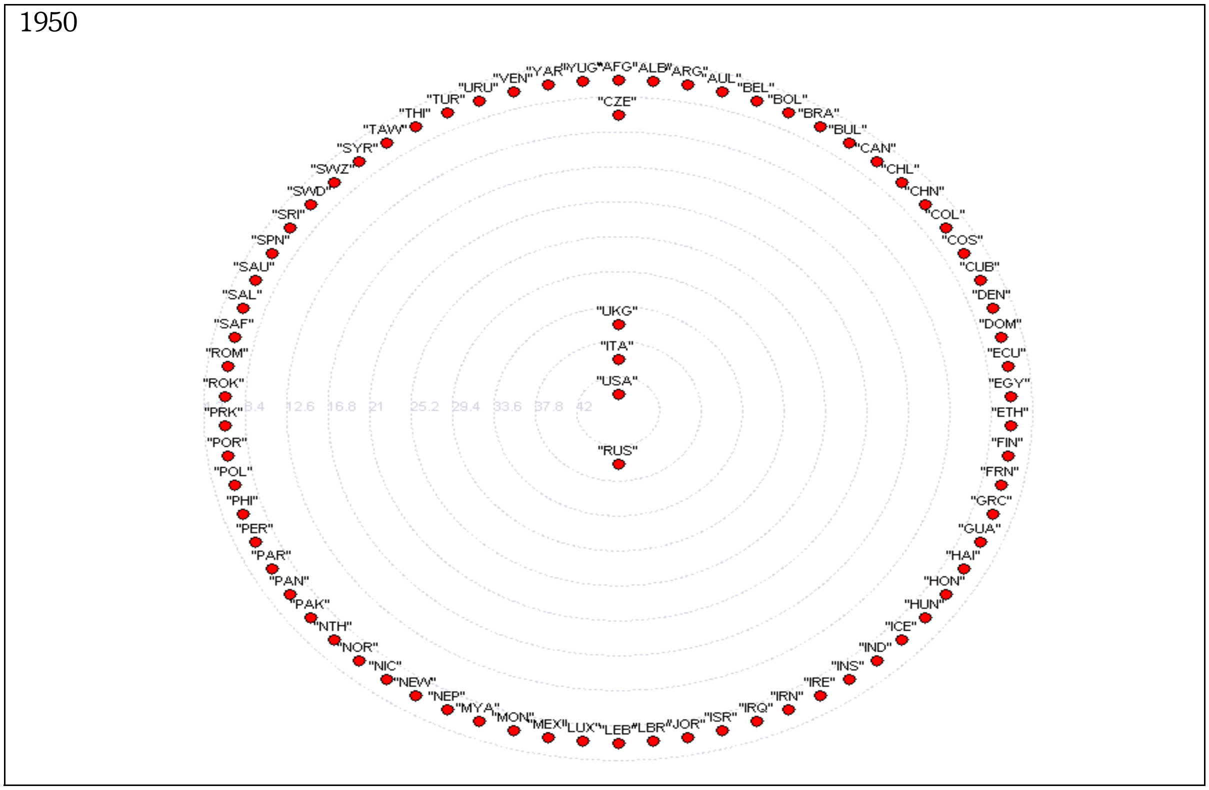


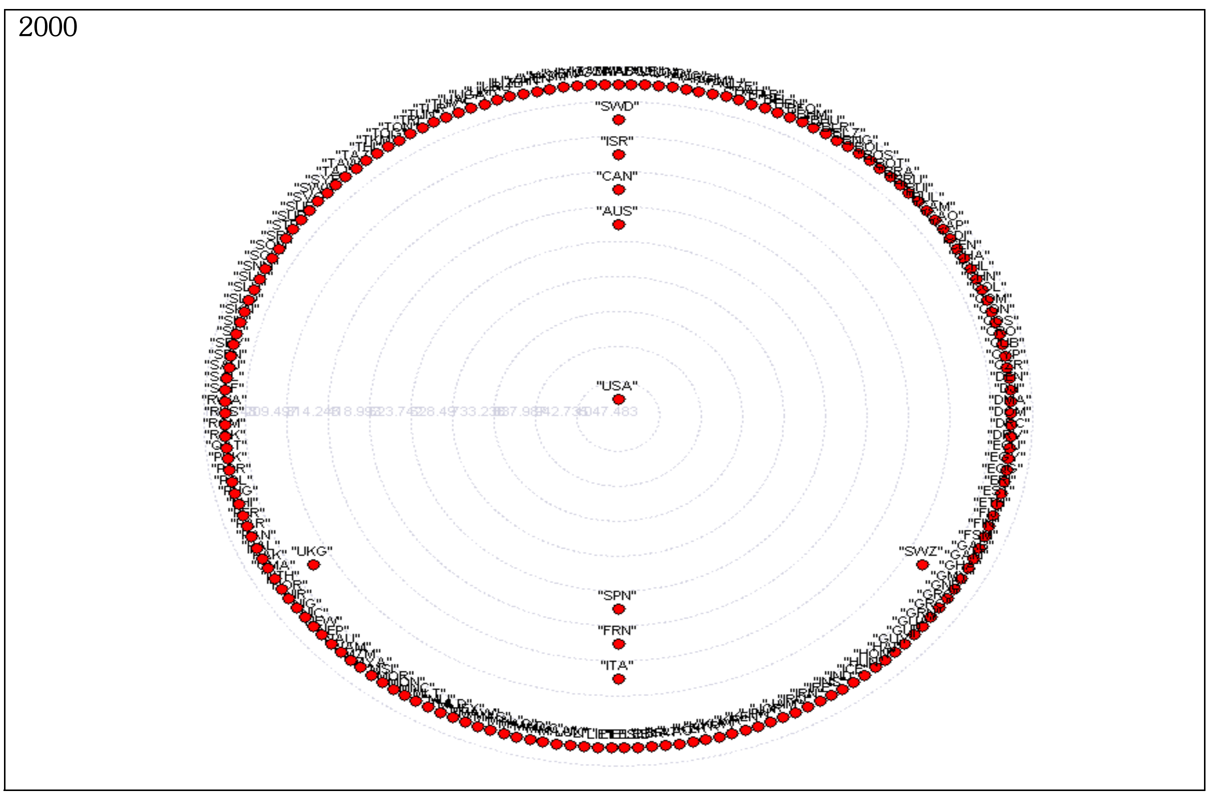
2000



Appendix 1.3 Distributions of Centralities, using Concentric Layout Algorithm (Continued)

(Flow-betweenness Centralities; Arms Transfers)





Appendix 2.1 Previous Research on Measuring National Power

Single Variable Indicators: Military. There have been several studies using single military indicators to define/measure national power. For example, Claude (1962) and Deutsch (1968) focus on gross military capability as their proxy for national power. Alcock and Newcombe (1970) use "military expenditures in millions of purchasing power-equivalent dollars" as one of their national power indices. Modelski and Thompson (1988), in their book *Seapower in Global Politics, 1494–1983*, use the size of naval forces as an indicator of projectable national power.

Single Variable Indicators: Economic. Other scholars have used single economic indicators to define/measure national power. For example, Davis (1954, 208) argues that national income is one of the best indices of national power because it "expresses the grand result of all the productive forces at a nation's command." Hitch and McKean (1960) argue for the use of a country's gross domestic/national product (GDP or GNP) to measure national power. Russett (1968) posits that total consumption of fuel and electric energy is the best index of national power. This idea is also shared by the work of Morgenstern, Knorr, and Heiss (1973). For Organski (1958, 436), three determinants of national power are the size of the nation-state's population, the skill and efficiency of its government, and its level of economic development. Multiplying two of the elements, population and level of economic development (measured by GNP per capita), Organski (1958) and Organski and Kugler (1980) argue in their power transition theory that national income, measured by GNP, is the best index of national power available

Multivariate Indicators. Instead of using single indicators (either military or economic), many other scholars in the field of international relations have used multivariate indicators to define/measure national power. For example, German's (1960) index of national power is based on four dimensions: land (with territory and densities of population and railway), population (with workforce and technical efficiency), industrial base (with production of steel, coal, lignite, crude oil, and hydroelectricity; the presence or absence of directed economy; and surpluses or deficits in steel, oil, minerals, and engineering), and military size (with military personnel). These four dimensions are then multiplied by a state's nuclear capability. Fucks (1965), using three variables of population size, energy production, and steel production, generates nine formulas of national power. By applying his formulas to 29 industrial countries, he argues that his last formula fits best. Alcock and Newcombe (1970) provide three equations of national power calculation, using the data on GNP per capita, population, and population density. By applying their three equations to the factor analysis results from Russett (1968) of the Yale Data Program, they concluded that their latter two equations fit best.

Cline (1980) perceives national power as the product of capability and commitment. He argues that capability measures critical mass (including population and territory), economic capacity (including income and the production of energy, critical nonfuel minerals, manufacturing, foods, and trade), and military capacity (with strategic balance, combat capabilities, and military effort) and that commitment measures national strategy and will (including national integration, strength of national leadership, and relevance of strategy to national interest). Boulding (1962), Tufte (1983), and Bueno de Mesquita (1981) all emphasize the impact of distance on measuring national power. Boulding (1962) argues that national power is linked to the distance between the two parties in the relationship. Tufte (1983) uses an example of the invasion of Russia to argue how the capabilities of Napoleon's army and the Russian army depended on their distances from home supplies and argues that this directly impacted the defeat of French troops. Bueno de Mesquita (1981) suggests that measuring national power should involve adjusting for distance between capitals of states and the time required to travel this distance. Deutsch (1968) suggests that the capabilities in the Cold War era are nuclear; a similar view is shared by Brodie (1946). Organski and Kugler (1980) provide another index of national power by multiplying a state's GNP by its index of tax effort (their other element of power is the capacity of the political system); however, they argue that the measure of effectiveness of political system should be "one of the major tasks that remains for political scientists to accomplish in the years ahead" (208). The formal definition of their index is as follows: National Power = (Internal Component of National Capabilities) + (Externally Provided Capabilities); the former component of the index is (Population * Productivity * Index of Governmental

Extraction) = (GNP/Population * Population * Tax Effort^a) = (GNP * Tax Effort^a) where a=1.75 and the latter component is (Foreign Aid * Tax Effort of Recipient).

Singer and colleagues (Singer, Bremer, and Stuckey 1972; Singer 1987) have developed the most widely used national material power capability index (from their Correlates of War Project). They use three dimensions of power capabilities: (1) demographic capabilities (using the data on total population and urban population), (2) industrial capabilities (using the data on energy consumption and iron/steel production), and (3) military capabilities (using the data on total military expenditures and size of the armed forces). This Composite Index of National Capability (CINC) has been updated several times since its launch, and the current version of the data set (National Material Capabilities v.3.02) runs from 1816 to 2001. The index is formulated in the following two steps. First, a nation's share of each capability measure is calculated (e.g., a nation X's share of the entire system's total population): $\%TPOP_X = TPOP_X / (TPOP_X + \sum TPOP_{OTHERS})$, where $TPOP_X$ is nation X's total population and $\sum TPOP_{OTHERS}$ is the sum of all other nations' total population. After calculating all six components of the index, their arithmetic mean comprises the index of CINC (e.g., a nation X's CINC score is based on the average share of the six aspects of capabilities): $CINC_X = (\%TPOP_X + \%UPOP_X + \%ENERGY_X + \%IRST_X + \%MELEX_X + \%MELPER_X) / 6$.

Despite widespread use of this index, especially in the field of international relations, some assert that it should be revised. For example, Doran and Parsons (1980) argue that nuclear capability should be incorporated as a distinct element of the Correlates of War (COW) index. They argue that the inclusion of a nuclear element would distinguish superpowers from other countries. Bremer (2001) points out that (1) we might need to add another aspect of power called the "information society" power aspect, in addition to the original three aspects of demographic, industrial, and military power; and (2) we might need to use some other measure of the quality of population (e.g., using data based on education) instead of the current urban population measure. Kadera (2001) and Kadera and Sorokin (2004) suggest a modification to CINC, which they call the GINC indicator; the new index is based on the geometric rather than arithmetic mean of COW capability components.

Appendix 3.1 Procedures to Derive the Binary Directional Matrices

All the data for each type of resource dimension are first transformed from the dyadic interaction data (state A, state B, Year, Dyadic Data Var.) to the n*n (n=number of states in the international system) square matrices of each year (using the SAS Proc Transpose procedure). These valued directional square matrices are then transformed to the binary directional square matrices to be used in the social network analyses (using the procedures in Ucinet). Appendix 1.1 is included to illustrate these procedures: the original and binary matrices of arms transfers and international trade (more specifically, exports) of goods and services in 1960 (for only European continent, to save space). For example, for the arms transfers matrix in 1960, Russia transferred arms to 8 states in Europe with a minimum transfer of 3 million U.S. current dollars to FIN (Finland) and a maximum transfer of 876 million dollars to HUN (Hungary); but it received arms from only one state, CZE (Czechoslovakia), with the amount of 572 million dollars (thus the *directional* matrix where the raw and column of the data entries are different). These valued matrices of arms transfers are then binalized to be used in the social network analyses using the cutoff point with the average amount of arms transfers in the whole system (e.g., in 1960, 1.179 million dollars). For the international exports of goods and services matrix, we can see the amount of exports from Russia to all other states in Europe in 1960 by taking a look at the raw of RUS (Russia) in Appendix 1.1 (e.g., Russia exported goods/services to YUG [Yugoslavia] in the amount of 57 million dollars); the amount of exports from all other states in Europe to Russia can be seen by taking a look at the column of RUS in Appendix 1.1 (e.g., Russia imported goods/services from YUG [Yugoslavia] in the amount of 53 million dollars). These valued matrices of international exports are then binalized to be used in the social network analyses by using the average value of cells in the whole matrix as the cutoff points (e.g., the cutoff point in 1960 international exports network is $10.403 million; if the cell is greater than or equal to $10.403 million, the cell is coded as 1, otherwise it is coded as 0).

Appendix 3.2 Calculations of Degree Centrality Measures

I will illustrate how degree measures of structural network power are calculated using one type of data for the communication dimension (foreign student exchanges) and one type of data for the resource dimension (arms transfers) in two time points. For example, in 2000, there were 191 independent states in the international system, and this leads to 36,290 distinctive directed dyads (191*191 minus 191) in the system. The total arms transfers in 2000 were $13.694 billion, which makes the average arms transfers per dyad $0.377 million (network total arms transfers of $13.694 billion divided by network total dyads of 36,290), which is the cutoff value for the dichotomous 0-1 value for the new directed binary matrix. In other words, if state i in 2000 exported more than 0.377 million dollars to state j, then the dyad ij is coded as 1; otherwise it is coded as 0. The United States exported more than $0.377 million of arms to 35 states; therefore its normalized outdegree is 35/190, which is 0.184. The state with next highest outdegree is France who exported more than 0.377 million dollars to 22 states, which makes its normalized outdegree 0.116 (22/190). In 2000, the mean observed outdegree was 1.047, with a standard deviation of 4.052 (the maximum outdegree 35 and the minimum 0). The mean observed normalized outdegree was 0.006 with a standard deviation of 0.021 (the maximum normalized outdegree 0.184 and the minimum 0). The network centralization was 0.180 (I will discuss the centralization index later in more detail, but briefly what it measures is how centralized each system is compared to the "star" system, where one state holds all the powers obtainable in the network—the centralization index of star network equals 1).

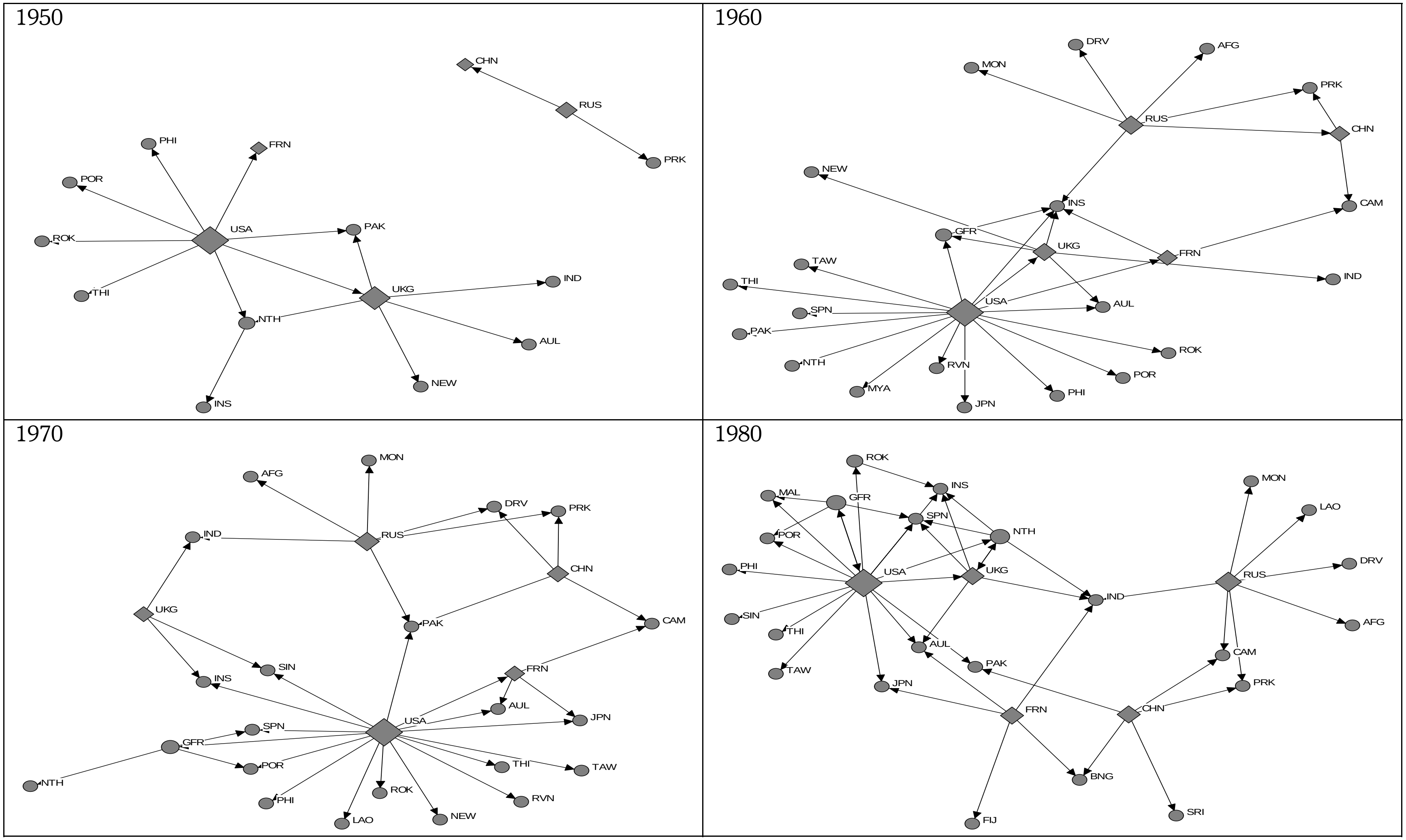
This is compared to 1950, when there were 75 independent states in the international system, leading to 5,550 distinctive directed dyads (75*75 minus 75). The total arms transfers in 1950 were 6.166 billion dollars, which makes the average amount of arms transfers per dyad $1.111 million (network total arms transfers of $6.166 billion divided by network total dyads of 5,550), which is the cutoff value for the dichotomous 0-1 value for the new directed binary matrix. In other words, if state i in 1950 exported more than 1.111 million dollars to state j, then the dyad ij is coded as 1; otherwise it is coded as 0. The United States exported more than 1.111 million dollars of arms transfers to 26 states; therefore its normalized outdegree is 26/74, which is 0.351. The state with next highest outdegree is the United Kingdom, which exported more than 1.111 million dollars to 17 states, making its normalized outdegree 0.230 (17/74). In 1950, the mean observed outdegree was 0.867, with a standard deviation of 3.675 (the maximum outdegree 26 and the minimum 0). The mean observed normalized outdegree was 0.012 with a standard deviation of 0.050 (the maximum normalized outdegree 0.351 and the minimum 0). The network centralization was 0.344. Compared to the 2000 arms transfer network, the 1950 network shows: (1) that the top suppliers of arms transfers were less concentrated in 2000 (for 36 and 22 destinations or 18% and 12% of the total system member, by the top two suppliers) than in 1950 (for 26 and 17 destinations or 36% and 23% of the total system members by the top two suppliers); but (2) that there was less variability of arms supplies across the actors in 2000 than in 1950, meaning that not many other states (considering the increased number of system members) joined in the supplier group (in 2000). The top suppliers (such as the U.S., the United Kingdom, and Russia) transferred arms to fewer different destinations in terms of the proportions of total international system members (now than before), but only a handful of states (such as France and Italy) joined the supplier group of transferring arms.

For the foreign student exchange network, the total student population abroad in 2000 was 1,628,275, or an average of 44.868 per dyad (network total students abroad of 1,628,275 students divided by network total dyads of 36,290), which is the cutoff value for the dichotomous 0-1 value for the new directed binary matrix. In other words, if state i in 2000 received more than 44.868 students from state j, then the dyad ij is coded as 1, otherwise it is coded as 0. The United States received more than 44.868 students from 160 states, and therefore its normalized indegree is 160/190, which is 0.842. The state with the next highest indegree is France, which received more than 44.868 students from 121 states, making its normalized indegree 0.637 (121/190). In 2000, the mean observed indegree was 9.272 with a standard deviation of 23.501 (the maximum indegree 160 and the minimum 0). The mean observed normalized indegree was 0.049 with a standard deviation of 0.124 (the maximum normalized indegree 0.842 and the minimum 0), and the network centralization was 0.797.

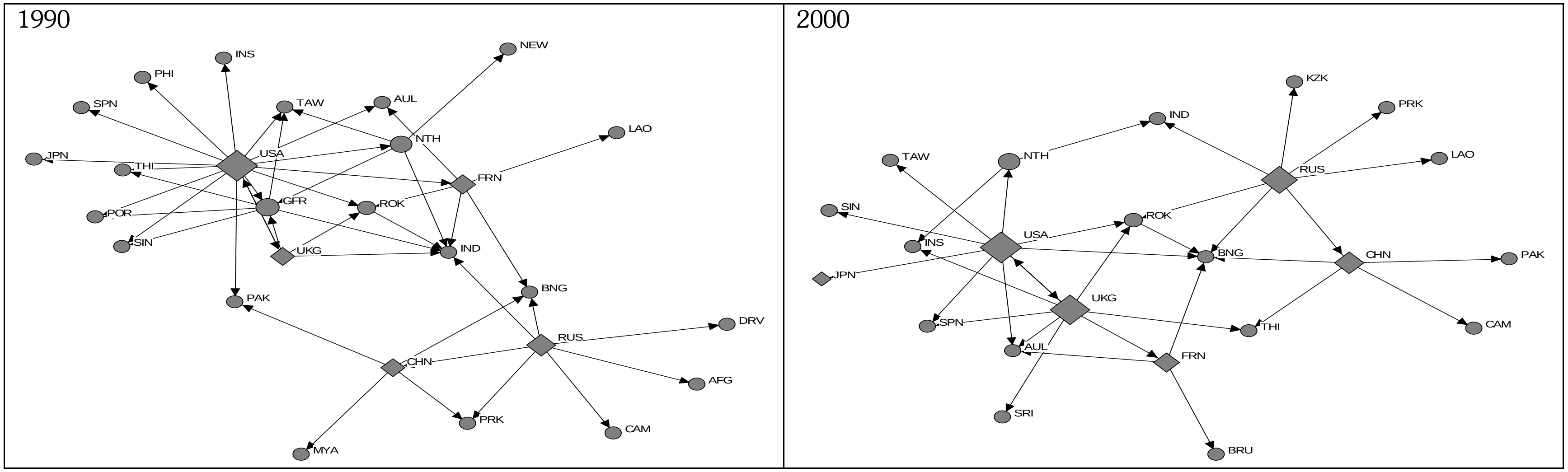
This is compared to 1960, when there were 107 independent states in the international system, leading to 11,342 distinctive directed dyads (107*107 minus 107). The total foreign students abroad in 1960 were 164,365, which makes the average amount of foreign students abroad per dyad as 14.492

(network total students abroad of 164,365 students divided by network total dyads of 11,342); this is the cutoff value for the dichotomous 0-1 value for the new directed binary matrix. In other words, if state i in 1960 received more than 14.492 students from state j, then the dyad ij is coded as 1, otherwise it is coded as 0. The United States received more than 14.492 students from 78 states, therefore its normalized indegree is 78/106, or 0.736. The state with the next highest indegree is France, which received more than 14.492 students from 64 states, making its normalized outdegree 0.604 (64/106). In 1960, the mean observed indegree was 5.028 with a standard deviation of 13.996 (the maximum indegree 78 and the minimum 0). The mean observed normalized indegree was 0.047 with a standard deviation of 0.132 (the maximum normalized indegree 0.736 and the minimum 0), and the network centralization was 0.695. Compared to the 2000 foreign student exchange network, the 1960 network shows: (1) that the top destinations of overseas study were more concentrated in 2000 (161 and 121 origins or 84% and 64% of the total system member, by the top two destinations) than in 1960 (78 and 64 origins or 74% and 60% of the total system members by the top two destinations), but (2) that there was slightly more variability of overseas study destinations across the actors in 2000 than in 1960, meaning that many other states also joined in the destination group (in 2000). The top destinations (such as the U.S., the United Kingdom, France, and Germany) host overseas students of more different origins in terms of the proportions of total international system members, but many other states (such as Canada, Spain, Australia, Sweden, Italy, Austria, and Switzerland) also join in the destination group of hosting overseas students.

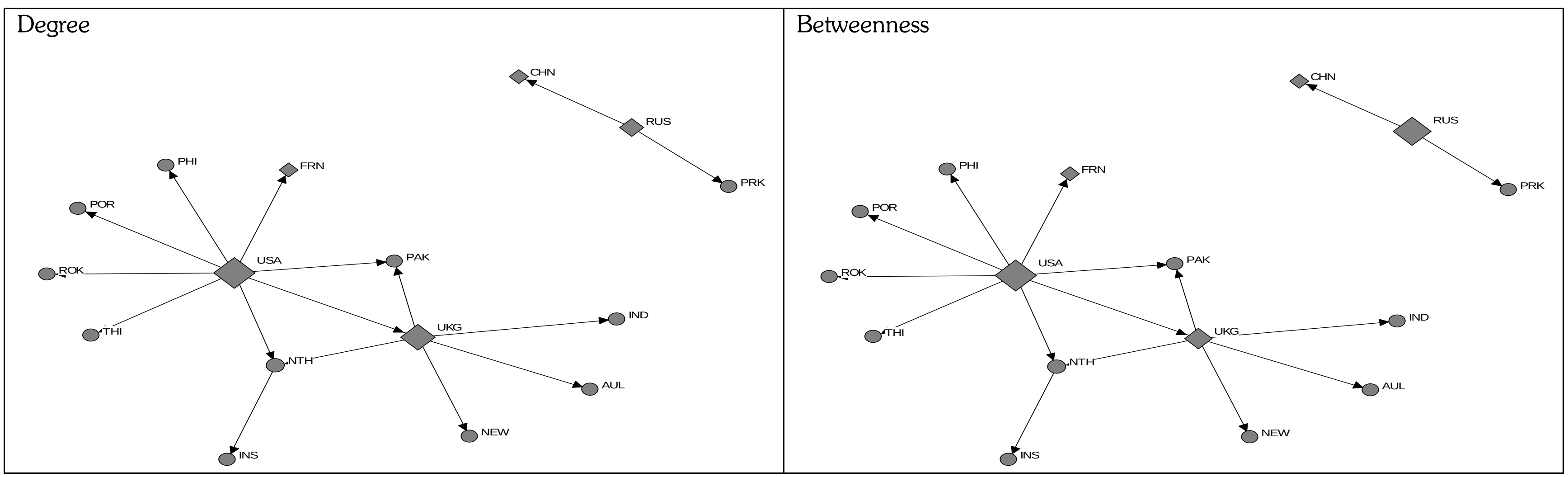
Appendix 3.3 Arms Transfer Networks of Asian Region, 1950–2000: Social Network Perspective of International System Structure



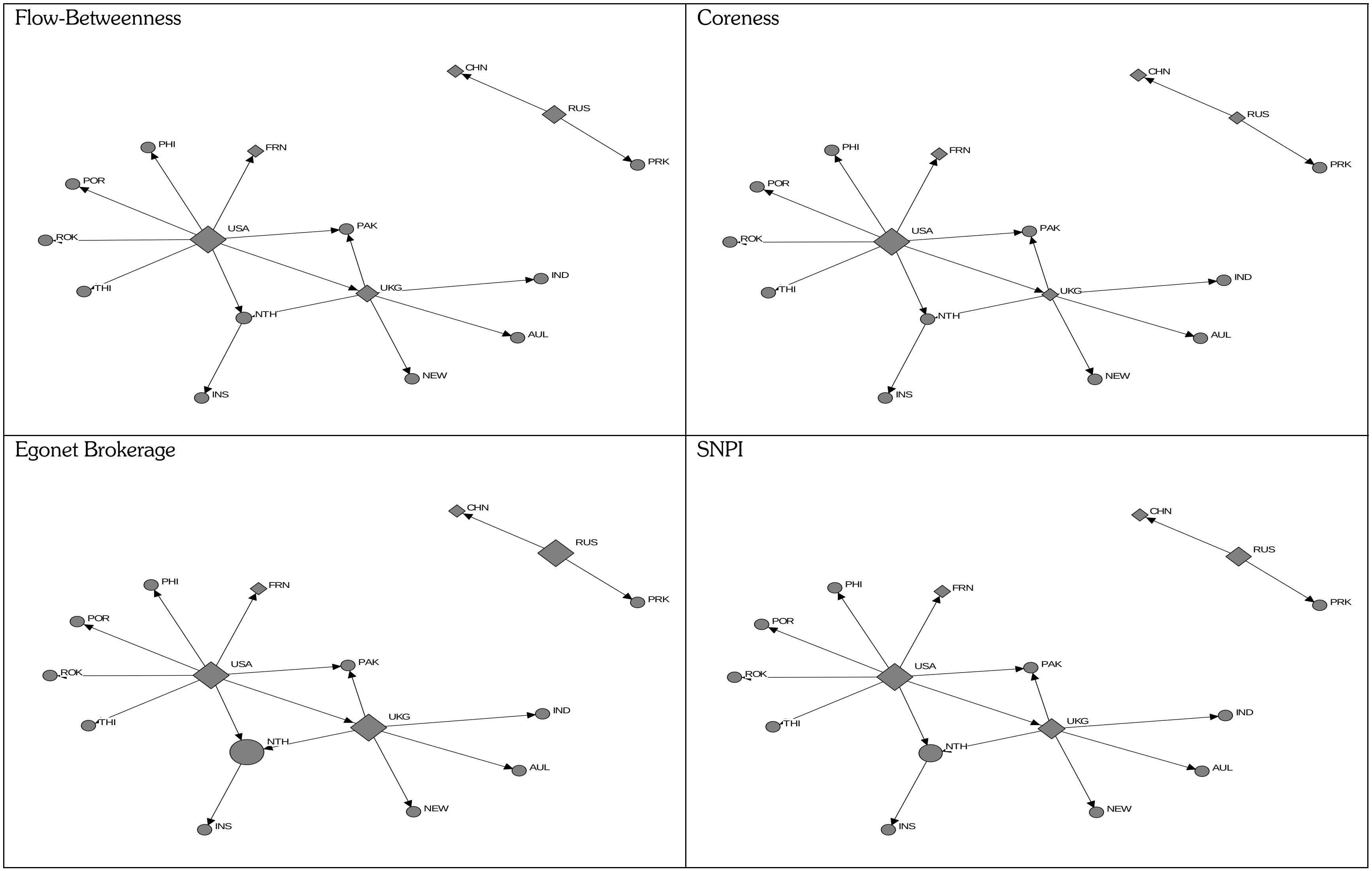
Appendix 3.3 Arms Transfer Networks of Asian Region, 1950–2000: Social Network Perspective of International System Structure (Continued)



Appendix 3.4 Arms Transfer Networks of Asian Region in 1950: Social Network Perspective of National Power



Appendix 3.4 Arms Transfer Networks of Asian Region in 1950: Social Network Perspective of National Power (Continued)



Appendix 4.1 Displaying Network Data in Graphs versus Tables

There have been discussions on utilizing graphic forms to display network data and on their strengths over tabular form. For example, Brandes et al. (1999) and Tufte (1983) emphasize the importance of network visualization through representations such as sociograms, arguing that "data graphics [in the form of sociograms] can do much more than simply substitute for tabular descriptions….A simple description of relational data by means of tables is extremely limited in its explorative power" (Brandes et al. 1999, 76–77) and that "at their best, graphics [in the form of sociograms] are instruments for reasoning about quantitative information. Often the most effective way to describe, explore, and summarize a set of numbers—even a very large set—is to look at pictures of those numbers" (Tufte 1983, 9). Gelman, Pasarica and Dodhia (2002) posit that tables are best suited for looking up specific information, and graphs are better for perceiving trends and making comparisons and predictions (see also Meyer, Shamo, and Gopher 1999; Dibble 1997; Jarvenpaa and Dickson 1988; Carter 1947). They argue that "one thing we have learned in this research is that there is a good reason to be lazy – it takes a lot of work to make nice graphs! But the other, more important, thing we've learned is that nice graphs are possible, especially when we think hard about why we want to display these numbers in the first place" (129). Brandes, Raab, and Wagner (2001) also argue that the aggregate indices presented in tabular form are insufficient to fully appreciate and understand the structural information contained in network data. Meyer, Shinar, and Leiser (1997), Remus (1984), Coll, Coll, and Thakur (1994), and Lohse (1993) all provide a similar argument of the advantage of using the graphical representation in displaying and highlighting network data.

Recently, other scholars in social science have made similar arguments. For example, Kastellec and Leoni (2006, 1) argue that using graphs instead of tables improves the presentation of empirical results in political science and that "a move away from tables and towards graphs would increase the quality of the discipline's communicative output and make empirical findings more accessible to every type of audience" (see also Bowers and Drake 2005; Epstein, Martin and Schneider forthcoming; Gelman, Pasarica, and Dodhia 2002). Kastellec and Leoni (2006, 5) point out one of the most important reasons why researchers are reluctant to use graphs (with the belief that it is simply infeasible to present certain information graphically) and stick instead to the table forms of representing political science data: "It simply takes more work to produce graphs. With current software, greater knowledge of the nuances of the statistical/graphical packages is needed to produce effective graphs. More importantly, creating informative statistical graphs involves repeated iterations, trial-and-error and much thought about both the deeper issue of what message the researcher is trying to convey and the practical issue of producing a graph that effectively communicates that message. This process can be quite time-consuming; simply put, it takes a much greater amount of effort to produce a quality graph than a table." However, they correctly argue that "the costs of producing graphs are outweighed by the benefits, and many of the concerns regarding their production are either overstated or misguided altogether. While producing graphs does require greater effort, the very process of graph creation is one of the main benefits of using graphs instead of tables in that it provides incentives for the researcher to present the results more directly and cleanly" (5).

We can try to prove the advantage of using graphs over tables by comparing Figure 4.1 and the table in below. The first sociogram in Figure 4.1 presents the relation data of dyadic disputes among all states in the 1950s as well as the network (the conflict network in the 1950s) participants' (i.e., states') attributional data such as their regions and major-power status. The same information (from the sociogram) can be also presented in tabular form as in the table in below. I have opted to present the information as a sociogram rather than in tabular form because the latter would fail to reveal some of the most important information and the former is a more efficient way of presenting the structural information at hand, especially for relational data.[82] The exercise of trying to explore the structural patterns that are revealed by the sociogram in Figure 4.1, such as "connected," "recurrent," and regional conflicts (for definitions of these terms, see footnotes 38–40), by looking at the data in the table in below, demonstrates

[82] Brandes et al. (1999) posit that "[given] the fact that already a simple description of the data in the form of a matrix is difficult to read, it seems obvious that an exploration of the data through tables becomes practically impossible. In contrast, a visual presentation allows basic features of the network, as well as a great number of additional information on its structural characteristics, to be observed" (77).

the superiority of the sociogram in revealing structural patterns. Contemplating the numbers in the table below long enough might allow for discerning some of the patterns that readily emerge from the sociogram, but this requires far more (unnecessary) cognitive work (see also Epstein, Martin and Schneider forthcoming, the estimated ideology of the U.S. Courts of Appeals in 2000, and Doreian and Albert 1989) and is still unable to reveal some of the structural characteristics observed from the conflict sociograms.

STATE	MAJPOW	REGION
AFG	0	4
ALB	0	1
ARG	0	5
AUL	0	4
AUS	0	1
BEL	0	1
BOL	0	5
BRA	0	5
BUL	0	1
CAM	0	4
CAN	0	5
CHL	0	5
CHN	1	4
COL	0	5
COS	0	5
CUB	0	5
CZE	0	1
DEN	0	1
DOM	0	5
DRV	0	4
ECU	0	5
EGY	0	2
ETH	0	3
FIN	0	1
FRN	1	1
GDR	0	1
GFR	0	1
GHA	0	3
GRC	0	1
GUA	0	5
GUI	0	3
HAI	0	5
HON	0	5
HUN	0	1
ICE	0	1
IND	0	4
INS	0	4
IRE	0	1
IRN	0	2
IRQ	0	2
ISR	0	2
ITA	0	1
JOR	0	2
JPN	0	4
LAO	0	4
LBR	0	3
LEB	0	2
LIB	0	2
LUX	0	1
MAL	0	4
MEX	0	5
MON	0	4
MOR	0	2

STATE	MAJPOW	REGION
MYA	0	4
NEP	0	4
NEW	0	4
NIC	0	5
NOR	0	1
NTH	0	1
PAK	0	4
PAN	0	5
PAR	0	5
PER	0	5
PHI	0	4
POL	0	1
POR	0	1
PRK	0	4
ROK	0	4
ROM	0	1
RUS	1	1
RVN	0	4
SAF	0	3
SAL	0	5
SAU	0	2
SPN	0	1
SRI	0	4
SUD	0	2
SWD	0	1
SWZ	0	1
SYR	0	2
TAW	0	4
THI	0	4
TUN	0	2
TUR	0	2
UKG	1	1
URU	0	5
USA	1	5
VEN	0	5
YAR	0	2
YUG	0	1

STATE1	STATE2	DISPUTE
AFG	PAK	4
CAM	RVN	3
CHL	ARG	4
CHN	IND	6
CHN	JPN	2
CHN	MYA	2
CHN	NEP	2
CHN	ROK	2
CHN	RVN	2
CHN	TAW	5
ECU	PER	5
EGY	JOR	2
FRN	CHN	2
FRN	RUS	2
FRN	TUN	2
GRC	BUL	2
IND	PAK	7
IRN	IRQ	2
IRQ	EGY	2
ITA	ALB	3
ITA	YUG	3
JOR	ISR	2
MYA	THI	4
NIC	COS	2
NTH	INS	3
POR	IND	2
PRK	ROK	3
ROK	JPN	3
RUS	IRN	2
RUS	JPN	4
RUS	NOR	2
RUS	ROK	2
RUS	SWD	2
RUS	TAW	3
SYR	ISR	2
SYR	JOR	2
THI	CAM	2
TUR	EGY	2
TUR	SYR	3
UKG	CHN	3
UKG	EGY	3
UKG	RUS	6
UKG	SAU	2
UKG	TAW	5
USA	CHN	2
USA	CZE	2
USA	ECU	3
USA	EGY	3
USA	PRK	3
USA	RUS	6
USA	SWZ	2
YUG	BUL	2
YUG	ROM	2

Appendix 4.2 Dyadic Conflict Onset Distribution in the System, 1950–2000

1950–2000			
Total MIDs	%	cum. %	State
196	6.08	6.08	Russia
172	5.33	11.41	U.S.
128	3.97	15.38	China
114	3.53	18.91	Iraq
106	3.29	22.19	Yugoslavia
80	2.48	24.67	United Kingdom
77	2.39	27.06	Iran
66	2.05	29.11	Israel
66	2.05	31.15	Turkey
61	1.89	33.04	North Korea
59	1.83	34.87	Thailand
58	1.80	36.67	Egypt
58	1.80	38.47	India
52	1.61	40.08	Japan
50	1.55	41.63	France
48	1.49	43.12	South Korea
44	1.36	44.48	Libya
41	1.27	45.75	Syria
41	1.27	47.02	Taiwan
40	1.24	48.26	Dem. Rep. of Congo
38	1.18	49.44	Pakistan
38	1.18	50.62	Uganda
35	1.08	51.70	Afghanistan
35	1.08	52.79	Vietnam
33	1.02	53.81	Cambodia
32	0.99	54.80	Cuba
32	0.99	55.80	Jordan
32	0.99	56.79	Sudan
31	0.96	57.75	Saudi Arabia
30	0.93	58.68	Zambia
29	0.90	59.58	Argentina
28	0.87	60.45	Portugal
27	0.84	61.28	Ethiopia
27	0.84	62.12	Nicaragua
27	0.84	62.96	South Africa
26	0.81	63.76	Myanmar
25	0.77	64.54	Morocco
25	0.77	65.31	Zimbabwe
24	0.74	66.06	Greece

1950–2000			
Total ICBs	%	cum. %	State
65	6.53	6.53	U.S.
53	5.32	11.85	Iraq
48	4.82	16.67	China
41	4.12	20.78	Russia
39	3.92	24.70	Israel
38	3.82	28.51	Vietnam
36	3.61	32.13	North Korea
29	2.91	35.04	Libya
28	2.81	37.85	Egypt
24	2.41	40.26	France
22	2.21	42.47	United Kingdom
21	2.11	44.58	Syria
18	1.81	46.39	South Africa
16	1.61	47.99	Angola
15	1.51	49.50	Iran
15	1.51	51.00	Turkey
14	1.41	52.41	Saudi Arabia
13	1.31	53.71	Jordan
13	1.31	55.02	Thailand
12	1.20	56.22	Cuba
12	1.20	57.43	Nicaragua
12	1.20	58.63	Zimbabwe
11	1.10	59.74	Greece
10	1.00	60.74	Ethiopia
10	1.00	61.75	German Democratic Republic
10	1.00	62.75	India
10	1.00	63.76	Pakistan
10	1.00	64.76	Republic of Vietnam
9	0.90	65.66	South Korea
9	0.90	66.57	Somalia
9	0.90	67.47	Zambia

Appendix 4.3 Hypotheses, Measurements, and Results for the Dyadic Dispute Onset Analysis

1. Hypotheses

Hypothesis 2. The increased levels of economic interdependence (of a less constrained state[83]) decrease the probability of the onset of dispute.

This hypothesis reflects the unconditional liberal belief that economic ties increase the costs of dispute involvement and therefore decrease the probability of being involved in a dispute.[84] While a null finding for this hypothesis could support either the conditional school or the irrelevant school, a positive finding (i.e., interdependence *increases* conflict) would clearly support realist arguments by Waltz (1979) and Gaddis (1986). For an extensive review of theory and literature, see Barbieri and Schneider (1999); Gartzke, Li, and Boehmer (2001); Mansfield and Pollins (2001, 2003); McMillan (1997); Reuveny (2000); Schneider, Barbieri, and Gleditsch (2003); and the special issue of *Journal of Peace Research* 36(4) (1999). Empirical analyses finding support for the interdependence pillar include Gartzke and Li (2003a, 2003b); Oneal and Russett (1997); and Russett and Oneal (2001). Authors finding no pacifying effect of economic interdependence include Barbieri (1996, 2002); Beck, Katz, and Tucker (1998); Keshk, Pollins, and Reuveny (2004); Goenner (2004); Green, Kim, and Yoon (2001); and Kim and Rousseau (2005).

Hypothesis 3. The increased levels of democracy (of a less constrained state) decrease the probability of the onset of dispute.

This hypothesis probes the "democratic peace" pillar of the liberal peace. The dyadic democratic peace argument has received empirical support in Bennett and Stam (2004); Dixon and Senese (2002); Doyle (1986); Huth and Allee (2002); Maoz and Abdolali (1989); Maoz and Russett (1993); Peceny, Beer and Sanchez-Terry (2002); Rasler and Thompson (2001); Rousseau et al. (1996); and Russett and Oneal

[83] The convention of empirical dyadic conflict study is that the likelihood of conflict depends on how strong the constraints are on the less constrained state in a dyad (the "weak link in the chain of peaceful dyadic relations" in Dixon [1994]) primarily because this state is the principal threat to peace (Russett and Oneal 2001, 99).

[84] For more detailed discussion on hypotheses and measurements in this section, see Kim and Rousseau (2005).

(2001). Authors finding support for the monadic democratic peace argument include Bennett and Stam (2000b, 2004); Bremer (1992); Huth and Allee (2002); Ireland and Gartner (2001); Morgan and Schwebach (1992); Oneal and Russett (1997); Rousseau (2005); Russett and Oneal (2001); and Schultz (1999, 2001).

Hypothesis 4. The shared military alliance decreases the probability of the onset of dispute.

Realists also claim that shared security interests influence a state's decision to be involved in a dispute because a state fears losing the security benefit that it gains from alliance ties with the other actor in a dispute (Bennett and Stam 2004; Huth and Allee 2002; and Russett and Oneal 2001).

Hypothesis 5. A shared common border increases the probability of the onset of dispute.

Hypothesis 6. Geographic distance decreases the probability of the onset of dispute.

Hypothesis 7. When one of the two states in a dyad is a major power, the probability of the onset of dispute is increased.

These three hypotheses are another set of realist constraints. The first two hypotheses on geographical proximity are included to test the realist argument that the potential for international violence exists when the actor can reach its adversary with military force (Bennett and Stam 2004; Russett and Oneal 2001). The other hypothesis is based on the argument that major powers have been engaged in more international disputes compared to other states, based on their wider-ranging interests (Russett and Oneal 2001; Schultz 2001).

2. Measurements

Lower Economic Interdependence has been operationalized in a variety of ways in the literature (for the recent debate, see Barbieri and Peters II 2003; Gartzke and Li 2003a, 2003b; Oneal 2003). Although all operationalizations of interdependence have both strengths and weaknesses, I believe that imports plus exports divided by GDP nicely captures interdependence.[85] Following the weak-link

[85] Four strengths of this operationalization stand out (Kim and Rousseau 2005). First, the fact that the operationalization has been used extensively in the literature facilitates comparisons with previous research (Oneal and Russett 1997; Russett, Oneal, and Davis 1998; Oneal and Russett 1999; Russett and

assumption (Dixon 1994), this variable is measured by using the score from the less interdependent state in a dyad. The data for the variable is taken from the *Expanded Trade and GDP Data* Version 4.1 by Gleditsch (2002, 2004).

Lower Democracy. This independent variable is constructed by subtracting the *Polity IV*[86] autocracy index from the democracy index to produce a variable that ranges from -10 to 10. The value of -10 in the final product indicates the fully autocratic state and that of 10 indicates the fully democratic state. Following the weak-link assumption (Dixon 1994), this variable is measured by using the score from the less-democratic state in a dyad.

Shared Alliance Ties. This dummy variable takes the value of 1 when the two states in the dyad share a defense pact, neutrality pact, or an entente. Otherwise the value is 0. Sources for this variable come from COW 2 Formal Alliances Version 3.03 (Gibler and Sarkees 2004).

Contiguity, Distance, and Major Power. If the two states in a dyad share a boundary on land or are separated by less than 150 miles of water either directly or through their colonies or other dependencies, the variable *Contiguity* is coded 1; otherwise, it is coded 0. The variable *Distance* is the natural logarithm of the great circle distance between the two states in a dyad. Finally, the variable *Major Power* is coded as 1 if at least one of the states in a dyad is a major power identified by the COW project: the U.S., France, the United Kingdom, the Soviet Union, and China qualify as major powers for the entire time period of my analysis, and Germany and Japan gained major power status in 1992. The data for all three variables are taken from EUGene Version 2.30 by Bennett and Stam (2000a).

Oneal 2001; Oneal 2003; Oneal, Russett, and Berbaum 2003). Second, using the ratio of trade to the size of the economy allows the measure to capture the importance of trade to the economy. Third, the operationalization captures the broad connectedness the two states in a dyad have with the world market (Gartzke and Li 2003a). Fourth, the operationalization provides a useful measure of sensitivity interdependence: it captures how the economies of trade partners are intertwined (Mansfield and Pollins 2003: 12-13).

[86] Like the conflict data, some other data have been also used to measure democracy in the models of conflict behaviors; Freedom House (2006) focuses on the political rights and civil liberty (for 192 states for 1972-2005) and Vanhanen (2000) focuses on the electoral competition and participation (for 187 states for 1810-1998).

Peace Year, Spline1, Spline2, and Spline3. To control for temporal dependences in dyads, I constructed the variables for the length and three natural cubic splines associated with non-eventual binary spells (Beck, Katz, and Tucker 1998).

3. Results and Discussion

The results from Table 4.7 generally support all the other hypotheses on the dyadic dispute onset. Hypothesis 2 predicts that the coefficient on the *Interdependence Low* variable will be negative. This hypothesis implies that if a state is economically interdependent with its opponent in a dispute, it is less likely to be involved in a dispute because it fears losing the benefits of trade. The results support this assertion; the estimated coefficient for *Interdependence Low* is negative and statistically significant in most of the models. The "democratic peace" pillar of the liberal peace is strongly supported by the data. The *Democracy Law* variable is negative as expected and statistically significant at better than the 0.001 level in all models, meaning that democratic states are less likely to be involved in a dispute. The marginal effects analysis for the two variables supports the results. Holding all other variables at their means, increasing the level of the *Interdependence Low* variable from its minimum to its maximum reduces the probability of onset by from 74.4% to 77.8%. The *Democracy Low* variable has the similar effects; increasing the level of the *Democracy Low* variable from its minimum to its maximum reduces the probability of onset by from 76.0% to 85.8%.

Hypothesis 4 predicts that the coefficient on the *Shared Alliance Ties* will be negative. The results support this hypothesis; the coefficient on the variable is negative as expected and statistically significant in all models (usually, at better than 0.01 level), supporting the realist argument that allies are less likely to be involved in a dispute when they fear losing the security benefit of the alliance. Hypotheses 5, 6, and 7 are also supported by the regression analysis, supporting the realists' arguments that: (1) the potential for international violence exists when the actor can reach its adversary with military force, and (2) major powers have been engaged in more international disputes compared to other states, based on their wider-ranging interests. Hypothesis 5 predicts that a shared common border decreases the probability of the onset of dispute. As expected, the coefficient on *Contiguity* is positive and statistically significant at better than .001 level (in all models). Hypothesis 6 argues that the geographic distance decreases the probability of the onset of dispute. Again, as expected, the coefficient on *Distance* is negative and statistically significant. Finally, hypothesis 7 predicts that when one of the two states in a dyad is a major power, the probability of the onset of dispute is increased. As expected, the *Major Power* estimated coefficient is positive and statistically significant at better than .001 level in all models.

Appendix 4.4 Sensitivity Analysis of Dyadic Dispute Onset, 1950–1992

ReLogit Analysis Clustered on Dyads	Model 3-1 (CINC)	Model 3-2 (GNP)	Model 3-3 (Degree)	Model 3-4 (Betweenness)	Model 3-5 (Flow-Betweenness)	Model 3-6 (Coreness)	Model 3-7 (Egonet Brokerage)	Model 3-8 (SNPI)
Balance of Power	-0.121** (0.047)	-0.116** (0.045)	-0.095*** (0.026)	-0.118*** (0.025)	-0.153*** (0.028)	0.011 (0.063)	-0.058*** (0.017)	-0.160*** (0.047)
Interdependence Low	-19.025 (11.926)	-23.810* (13.247)	-20.333 (12.381)	-26.017* (13.853)	-26.331* (13.686)	-15.979 (11.604)	-19.376 (12.104)	-20.754* (12.380)
Democracy Low	-0.049*** (0.013)	-0.047*** (0.013)	-0.047*** (0.013)	-0.044*** (0.013)	-0.044*** (0.013)	-0.050*** (0.013)	-0.048*** (0.013)	-0.047*** (0.013)
Allies	-0.431** (0.155)	-0.421** (0.156)	-0.400** (0.155)	-0.435** (0.156)	-0.387* (0.154)	-0.413** (0.156)	-0.396** (0.155)	-0.414** (0.156)
Contiguity	2.548*** (0.207)	2.529*** (0.203)	2.513*** (0.208)	2.502*** (0.199)	2.489*** (0.201)	2.562*** (0.208)	2.521*** (0.207)	2.524*** (0.208)
Distance	-0.580*** (0.078)	-0.568*** (0.075)	-0.554*** (0.079)	-0.553*** (0.071)	-0.558*** (0.073)	-0.574*** (0.079)	-0.558*** (0.079)	-0.553*** (0.079)
Major Power	1.734*** (0.166)	1.865*** (0.186)	1.692*** (0.165)	1.844*** (0.169)	1.829*** (0.168)	1.682*** (0.158)	1.668*** (0.164)	1.747*** (0.167)
Peace Year	-0.341*** (0.034)	-0.341*** (0.034)	-0.342*** (0.034)	-0.337*** (0.033)	-0.340*** (0.034)	-0.345*** (0.034)	-0.343*** (0.034)	-0.343*** (0.034)
Spline 1	-0.002*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)
Spline 2	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
Spline 3	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Constant	-0.412 (0.654)	-0.435 (0.627)	-0.551 (0.670)	-0.364 (0.606)	-0.358 (0.618)	-0.638 (0.670)	-0.560 (0.666)	-0.533 (0.667)

NOTE: Robust standard errors appear in parentheses below the coefficient estimates. All significant tests are two-tailed. *p < .10, *p < .01, ***p < .001.

Appendix 4.4 Sensitivity Analysis of Dyadic Dispute Onset, 1950–1992 (Continued)

XTGEE Analysis	Model 3-1 (CINC)	Model 3-2 (GNP)	Model 3-3 (Degree)	Model 3-4 (Betweenness)	Model 3-5 (Flow-Betweenness)	Model 3-6 (Coreness)	Model 3-7 (Egonet Brokerage)	Model 3-8 (SNPI)
Balance of Power	-0.137* (0.058)	-0.138* (0.057)	-0.072** (0.026)	-0.112*** (0.030)	-0.152*** (0.033)	0.067 (0.077)	-0.051** (0.020)	-0.139* (0.057)
Interdependence Low	-47.939* (20.173)	-57.880* (23.355)	-49.208* (21.107)	-59.719* (23.855)	-58.950* (23.113)	-41.940* (19.941)	-48.882* (21.005)	-50.256* (21.320)
Democracy Low	-0.062*** (0.015)	-0.061*** (0.015)	-0.062*** (0.015)	-0.060*** (0.015)	-0.060*** (0.015)	-0.064*** (0.015)	-0.063*** (0.015)	-0.062*** (0.015)
Allies	-0.774*** (0.182)	-0.749*** (0.181)	-0.758*** (0.182)	-0.759*** (0.180)	-0.740*** (0.180)	-0.756*** (0.183)	-0.754*** (0.182)	-0.769*** (0.182)
Contiguity	2.994*** (0.228)	2.983*** (0.223)	2.997*** (0.229)	2.984*** (0.223)	2.973*** (0.225)	3.009*** (0.230)	2.994*** (0.228)	3.001*** (0.229)
Distance	-0.672*** (0.083)	-0.655*** (0.082)	-0.652*** (0.085)	-0.648*** (0.081)	-0.656*** (0.082)	-0.671*** (0.084)	-0.653*** (0.084)	-0.649*** (0.084)
Major Power	1.698*** (0.188)	1.857*** (0.218)	1.634*** (0.186)	1.788*** (0.185)	1.778*** (0.187)	1.607*** (0.177)	1.620*** (0.186)	1.687*** (0.185)
Constant	-1.421* (0.701)	-1.476* (0.680)	-1.631* (0.715)	-1.435* (0.684)	-1.388* (0.693)	-1.703* (0.718)	-1.627* (0.713)	-1.606* (0.713)

NOTE: Robust standard errors appear in parentheses below the coefficient estimates. All significant tests are two-tailed. *p < .10, *p < .01, ***p < .001.

Appendix 4.4 Sensitivity Analysis of Dyadic Dispute Onset, 1950–1992 (Continued)

Logit Analysis Clustered on Periods	Model 3-1 (CINC)	Model 3-2 (GNP)	Model 3-3 (Degree)	Model 3-4 (Betweenness)	Model 3-5 (Flow-Betweenness)	Model 3-6 (Coreness)	Model 3-7 (Egonet Brokerage)	Model 3-8 (SNPI)
Balance of Power	-0.121*** (0.033)	-0.116*** (0.029)	-0.097*** (0.025)	-0.118*** (0.025)	-0.153*** (0.033)	0.010 (0.054)	-0.058* (0.023)	-0.161*** (0.042)
Interdependence Low	-19.982* (11.647)	-24.769* (13.495)	-21.296* (12.010)	-26.922* (14.205)	-27.241* (13.800)	-16.988 (10.850)	-20.349* (11.715)	-21.712* (12.070)
Democracy Low	-0.049*** (0.011)	-0.047*** (0.011)	-0.047*** (0.011)	-0.045*** (0.011)	-0.045*** (0.011)	-0.050*** (0.011)	-0.048*** (0.011)	-0.047*** (0.011)
Allies	-0.431*** (0.135)	-0.421*** (0.126)	-0.400** (0.133)	-0.435*** (0.127)	-0.387** (0.127)	-0.413*** (0.128)	-0.397** (0.130)	-0.414** (0.131)
Contiguity	2.550*** (0.144)	2.530*** (0.145)	2.514*** (0.140)	2.503*** (0.142)	2.490*** (0.135)	2.564*** (0.148)	2.522*** (0.142)	2.525*** (0.140)
Distance	-0.581*** (0.051)	-0.569*** (0.048)	-0.555*** (0.051)	-0.554*** (0.046)	-0.559*** (0.046)	-0.575*** (0.052)	-0.559*** (0.052)	-0.554*** (0.051)
Major Power	1.735*** (0.106)	1.867*** (0.137)	1.693*** (0.117)	1.845*** (0.145)	1.831*** (0.142)	1.683*** (0.103)	1.669*** (0.114)	1.748*** (0.124)
Peace Year	-0.341*** (0.032)	-0.341*** (0.032)	-0.342*** (0.034)	-0.338*** (0.031)	-0.340*** (0.032)	-0.345*** (0.031)	-0.343*** (0.033)	-0.344*** (0.032)
Spline 1	-0.002*** (0.001)	-0.002*** (0.001)	-0.002*** (0.001)	-0.002*** (0.001)	-0.002*** (0.001)	-0.002*** (0.001)	-0.002*** (0.001)	-0.002*** (0.001)
Spline 2	0.001* (0.000)	0.001** (0.000)	0.001* (0.000)	0.001** (0.000)	0.001** (0.000)	0.001** (0.000)	0.001* (0.000)	0.001* (0.000)
Spline 3	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Constant	-0.410 (0.348)	-0.433 (0.319)	-0.549* (0.330)	-0.363 (0.341)	-0.357 (0.326)	-0.636* (0.338)	-0.559 (0.346)	-0.531 (0.334)

NOTE: Robust standard errors appear in parentheses below the coefficient estimates. All significant tests are two-tailed. *p < .10, *p < .01, ***p < .001.

Appendix 5.1 Hypotheses, Measurements, and Results for the Dyadic Sanctions Onset Analysis

1. Hypotheses

Hypothesis 1. Increased levels of economic interdependence (of a less constrained state[87]) decrease the probability of the onset of an economic sanction.

Hypothesis 2. Increased levels of democracy (of a less constrained state) decrease the probability of the onset of economic sanction.

Hypothesis 1 reflects the unconditional liberal belief that economic ties increase the costs of using coercive actions and therefore decrease the probability of initiating economic sanctions. As Lektzian and Souva (2003) point out, political leaders in a sender state prefer to sanction states with whom they are less economically interdependent because it will cost less in their home states than sanctioning states with high economic interdependence. Hypothesis 2 probes the "democratic peace" pillar of the liberal peace. Lektzian and Souva (2003) argue that the pacifying effects of democratic institutions extend beyond the military arena and into the economic one (see also Drury 2003).

Hypothesis 4. A shared military alliance decreases the probability of the onset of economic sanctions. Regarding hypothesis 4, realists also claim that shared security interests influence a state's decision to use coercive actions because a state fears losing the security benefit that it gains from alliance ties with the other actor in an economic sanction. States with similar preferences have less incentive to dispute, so they also have less incentive to be involved in sanctions (Lektzian and Souva 2003).

Hypothesis 5. A shared common border increases the probability of the onset of economic sanctions.

Hypothesis 6. Geographic distance decreases the probability of the onset of economic sanctions.

Hypothesis 7. When one of the two states in a dyad is a major power, the probability of the onset of economic sanctions is increased.

[87] The convention of empirical dyadic conflict study is that the likelihood of conflict depends on how strong the constraints are on the less constrained state in a dyad (the "weak link in the chain of peaceful dyadic relations" in Dixon 1994) primarily because this state is the principal threat to the peace (Russett and Oneal 2001, 99).

The next three hypotheses (5, 6, and 7) are another set of realists' constraints. The first two hypotheses on geographical proximity are included to test the realists' argument that the potential for coercive actions exists when the actor can reach its adversary with military force (Bennett and Stam 2004, Russett and Oneal 2001). However, as Lektzian and Souva (2003) point out, political leaders in a sender state prefer to sanction states that are far away because it will cost less in their home states than sanctioning states that are near; the same also applies to the argument that states that share borders are less likely to be involved in sanctions. The other hypothesis is based on the argument that major powers have been engaged in more international coercive actions compared to other non-major states, based on their wider-ranging interests.

> *Hypothesis 8*. The onset of militarized interstate dispute increases the probability of the onset of economic sanctions.

Hypothesis 8 is based on Baldwin's (1985) argument of the ranking order of policy options for decision makers: diplomatic negations, economic sanctions, and militarized dispute (see also Drury and Park [2004] for the argument that economic sanctions and militarized disputes are more complementary policies than substitutable alternatives). Baldwin also argues that economic sanctions, in most cases, increase international tension and therefore increase the probability of militarized conflict (143). Blanchard and Ripsman (2000) posit that sanctions, as one of the instruments in the national policy toolbox, may be applied simultaneously with other types of political instruments of coercion.

2. Measurements

Lower Economic Interdependence has been operationalized in a variety of ways in the literature (for the recent debate, see Barbieri and Peters II 2003; Gartzke and Li 2003a, 2003b; Oneal 2003). Although all operationalizations of interdependence have both strengths and weaknesses, I believe that imports plus exports divided by GDP nicely captures interdependence. The data for the variable is taken from the *Expanded Trade and GDP Data* Version 4.1 by Gleditsch (2002, 2004). Following the weak-link assumption (Dixon 1994), this variable is measured by using the score from the less interdependent state in a dyad.[88]

Lower Democracy. This independent variable is constructed by subtracting the *Polity IV* autocracy index from the democracy index to produce a variable that ranges from -10 to 10. The value of -10 in the final product indicates a fully autocratic state, and that of 10 indicates a fully democratic state. Following the weak-link assumption (Dixon 1994), this variable is measured by using the score from the less democratic state in a dyad.

Balance of Structural Network Power. This variable is measured using structural network power index. It ranges from 0, where there is a maximum network power difference between the two states in a dyad, to 1, where there is perfect network power parity.

Shared Alliance Ties. This dummy variable takes the value of 1 when the two states in the dyad share a defense pact, neutrality pact, or an entente. Otherwise the value is 0. Sources for this variable come from COW 2 Formal Alliances Version 3.03 (Gibler and Sarkees 2004).

Contiguity, Distance, and Major Power. If the two states in a dyad share a boundary on land or are separated by less than 150 miles of water either directly or through their colonies or other dependencies, the variable *Contiguity* is coded 1; otherwise, it is coded 0. The variable *Distance* is the natural logarithm of the great circle distance between the two states in a dyad. Finally, the variable *Major Power* is coded as 1 if at least one of the states in a dyad is a major power identified by the COW project: the U.S., France, United Kingdom, the Soviet Union, and China qualify as major powers for the entire time period of our analysis; Germany and Japan gained major power status in 1992. The data for all three variables are taken from EUGene version 2.30 by Bennett and Stam (2000a).

Onset of Militarized Dispute. If there is an onset of interstate militarized dispute between the two states in a dyad, it is coded as 1; otherwise, it is coded as 0.

[88] For more detailed discussion on measurements in this section, see Kim and Rousseau (2005).

3. Results and Discussion

Hypotheses 1 and 2 test the liberal peace arguments on economic sanctions onset: economically interdependent states or democratic states are less likely to be involved in economic sanctions. The results do not seem to support the hypotheses. Even though most of the coefficients on the two variables have the expected negative signs, they are indistinguishable from zero, meaning that there is no evidence of either interdependent states or democratic states being less involved in economic sanctions. The two hypotheses that have been well-supported in many empirical tests for the onset of militarized disputes have failed to be supported for the onset of economic sanctions. Neither democratic regime-dispute onset nor economic interdependence-dispute onset relationships in the dyadic dispute studies seem to hold after onset of economic sanctions analysis.

Realists also claim that shared security interests influence a state's decision to use coercive actions because a state fears losing the security benefit that it gains from alliance ties with the other actor in an economic sanction situation. In addition, alliance ties can be taken as a proxy for common interests (Bueno de Mesquita and Lalman 1992). Because states with similar preferences have fewer reasons to enter a dispute, they have fewer reasons to be involved in economic sanctions (Lektzian and Souva 2003). Hypothesis 4 tests this claim that the shared military alliance decreases the probability of the onset of economic sanctions. The results strongly support hypothesis 4. The coefficients for the variable are negative and statistically significant at better than $p = 0.001$ in all 16 models of sanction onsets. Dyads with shared alliance commitments seem to be less likely to be involved in economic sanctions.

I will now discuss the next three realist hypotheses. First, geographical distance between the two states in a dyad rather increases the probability of sanctions onset; the coefficient on the variable is negative and statically significant at better than $p = 0.001$ in 14 models. The coefficient on the variable for hypothesis six is negative but statistically indistinguishable from zero. Two states at a distance and not sharing a common border are more likely to be involved in economic sanctions. These results are in line with the argument by Lektzian and Souva (2003) that political leaders in a sender state prefer to sanction states that are far away because it will cost less in their home states than sanctioning states that are nearby. I also think that the results are partly due to the fact that economic sanctions were primarily initiated by the U.S. (78 cases) on many states outside of the North American region (see the sociograms in Figure 5.1). Second, the results show that the presence of a major power in a dyad does not increase the probability of sanctions onset; the coefficient on the variable is negative but indistinguishable from zero. Finally, the hypothesis derived from Baldwin's argument of the policy options for decision makers is supported by the results; the coefficient is positive as expected and statistically significant at better than 0.001 in all models. Baldwin (1985, 143) argues that economic sanctions in most cases increase international tension and therefore increase the probability of militarized conflict. Blanchard and Ripsman (2000) also point out that sanctions, as one of the instruments in the national policy toolbox, may be applied simultaneously with other types of political instruments of coercion.

Appendix 5.2 Hypotheses, Measurements, and Results for the Dyadic Sanctions Success Analysis

1.Hypotheses

<u>The Hypotheses Regarding the Sender of Sanction</u>

The next seven hypotheses (3–9) are related to the “sender” of economic sanctions.

Hypothesis (Sender) 3. The greater the international cooperation with the sender, the lower the probability of success.

Hypothesis (Sender) 4. Sanctions by an international institution as a leading sender have the higher probability of success.

Hypothesis (Sender) 5. The greater the international cooperation for sanctions by international institutions, the lower the probability of success.

This set of hypotheses is one of the main controversies in the determinants of sanction success (the effectiveness of multilateral sanctions vs. unilateral sanctions, as well as that of sanctions by international institutions). First, policy makers in general believe that multilateral sanctions are more likely to be effective; empirical research of sanction success has found otherwise. HSE argue that sanctions will be less likely to be effective if a greater number of states is needed to implement the denial measures (1990, 89). However, for Martin (1992) and other researchers, international cooperation to impose sanctions is *the most important factor* to determine the effectiveness of these sanctions. For example, Martin argues that “sanctions cannot work if they are unilateral” and that “cooperation is one step removed from success, a necessary if not sufficient precondition” (1992, 6). Another important determinant of sanction success would be sanctions by international institutions such as League of Nations, Arab League, and the UN, and there have been 24 cases of this type so far. Martin (1992) argues that “the leading sender has to demonstrate a credible commitment to the threats [for the success of its sanction]” and that one of the important mechanisms that accompany the credible commitments is the use of international institutions (413). By making cooperation among other possible sanctioners easier and the free ride among those countries more difficult, sanctions by international institutions have a higher probability of success. Drezner (2000) finds that without support from international institutions, the increased levels of cooperation from other states leads to significantly fewer concessions from the target; when there is a support from international institutions, cooperation from other states has a positive effect on the target's concessions. Drury (1998) also finds that international cooperation has a negative effect on sanction success only when international institutions are not involved.

Hypothesis (Sender) 6. The higher the cost to the sender, the lower the probability of success.

Hypothesis (Sender) 7. Sanctions involving national security issues of the sender have a higher probability of success.

Hypothesis (Sender) 8. Sanctions with additional policies by the sender (such as covert action or limited use of force) have a higher probability of success.

Hypothesis (Sender) 9. Sanctions by the U.S. as a leading sender have a higher probability of success.

HSE find that "the costs imposed on domestic firms in the sender country are generally higher in cases that fail than those that succeed" and give us one of their commandments regarding the economic sanctions: "if you need to ask the price, you can't afford the yacht" (1990, 87–8). However, other researchers such as Martin (1992) assert that because high-cost sanctions are related to *the high credibility of the sender*, they are more likely to succeed. By communicating the clear message to impose and continue its sanctions in spite of their high cost, the sender country can more easily obtain the target country's surrender. Drury (1998, 503) argues that if a sanction involves the national security issue of a sender (such as a threat to a sender's national security), the sender state is more likely to be severe in making its effort successful (Powell 1994), and therefore it is more likely to be successful. Following Drury's (1998) argument that it is possible that any relationship between sanction and its success would be spurious, I control the effects of the sender's additional policies (such as covert action and limited use of force). In the study of the effect of sender reputation on the success of sanction cases that are measured by the sender's previous sanctions in a period of 10 years, Bergeijk (1989) finds that U.S. sanctions have the higher probability of success.

The Hypotheses Regarding the Target of Sanction

The next three hypotheses (10–12) are related to the "target" of economic sanctions.

Hypothesis (Target) 10. The more international assistance the target has, the lower the probability of success.

Hypothesis (Target) 11. The higher the political and economic stability of the target before sanctions, the lower the probability of success.

Hypothesis (Target) 12. The higher the cost to the target, the higher the probability of success.

If the target can get international assistance, it can easily diminish the damages that are caused by the imposed sanctions. For example, if the target has an alternative source to overcome its export and import restrictions by the imposed sanction, the goals of senders in sanction cases to dampen the target cannot easily be accomplished. For example, the U.S. sanction against Cuba since 1960 has been understood as a failure, and many people argue that one important reason is the USSR's support for the target country—"[in] 1960, the USSR [began] extensive program of shipping goods, extending credits to Cuba; program lasts into 1980s" (HSE 1990, 318). HSE point out that "countries in distress or experiencing significant problems are *far more likely to succumb* to the policy objectives of the sender country. When specific goals are at issue, the health and stability of the target country is usually an important determinant in the success of the episode" (1990, 83, emphasis added). This is somewhat proved by the failures of such episodes as the U.S. 1983 sanctions against France over its nuclear weapons testing and against the USSR over its downing of a Korean Airlines plane. In general, a sanction tends to work if it is imposed on both politically and economically unstable small target countries in the Third World. HSE also find that sanctions that put a heavy cost on the target are generally successful: "Sanctions that bite are sanctions that work" (102).

<u>The Hypotheses Regarding the Sender/Target Relationship of Sanction</u>

The next four hypotheses (13–15) are related to the "relationships between sender and target" of economic sanctions.

Hypothesis (Relationship) 13. The more cordial the relationship between sender and target before the sanction imposes, the higher the probability of success.

Hypothesis (Relationship) 14. The closer the prior trade relationship between the sender and the target, the higher the probability of success.

Hypothesis (Relationship) 15. If there is international assistance to the target ("black nights"), the positive effect of pre-sanction trade levels will be mitigated.

"Attack your allies, not your adversaries" is one of the HSE (1990) commandments. A sanction against the target country that has long been an adversary of the sender, or has little trade with the sender, is generally less successful (HSE 1990, 84–86). This is because "[the] higher compliance with sanctions by allies and trading partners reflects their willingness to bend on specific issues in deference to an overall relationship with the sender country" (84). Bergeijk (1989) finds in his models that the trade linkage variable, which is defined as the sender's trade flows to the target as percentage of the target's GNP in the year prior to the sanction, has the expected negative coefficient and statistical significance. Drury (1998, 502) argues that higher trade levels lead to higher cost to the target (i.e., more damage to target), and this in turn leads to more effective imposed sanctions. He also argues, however, that when there is international assistance to a target, the positive effect of pre-sanction levels will be mitigated (503).

2. Measurements

<u>The Variables Regarding the Sender of Sanction</u>

Sender Cooperation. This variable measures the degree of cooperation for the leading sender in the sanction episode. HSE (1990, 34–36) measure this variable with values of 1 ("no cooperation: a single sender country imposes sanctions, and usually seeks no cooperation," e.g., the U.S. sanctions against Brazil in 1962), 2 ("minor cooperation: the sender country enlists verbal support and possibly token restraints from other countries," e.g., the U.S. sanctions against the USSR in 1981), 3 ("modest cooperation: the sender country obtains meaningful restraints—but limited in time and coverage—from some but not all the important trading partners of the target country," e.g., the U.S. sanctions against Cuba in 1960), and 4 ("significant cooperation: the important trading partners make a major effort to limit trade, although linkages may still exist through neutral countries," e.g., sanctions related to World Wars I and II). There have been sanction cases of 53, 28, 20, and 15, respectively (based on the HSE data collection).

Institution Sanction. There have been not a few sanctions imposed by diverse international institutions such as the League of Nations, Arab League, Coordinating Committee on Export Controls (COCOM), China Committee of the Paris Consultative Group (CHINCOM), Organization of African Unity, OECD, and the UN. If so, this variable is coded 1; otherwise, 0. There have been 24 cases of this type.

*Sender Cooperation * Institution Sanction.* This interaction variable takes the value of 0 when international institutions were not involved, and of the values on *Sender Cooperation* when international institutions were involved.

Sender Cost. HSE (1990, 38–39) try to measure the cost to the sender in each sanction episode. They code the sender cost with four values: 1 for "net gain to sender: usually cases where aid is withheld" (e.g., U.S. sanctions against Sudan in 1989), 2 for "little effect on sender: cases where a trivial dislocation occurs" (e.g., U.S. sanctions against China in 1989), 3 for "modest loss to sender: some trade is lost, but neither the size nor concentration of the loss is substantial" (e.g., U.S. sanctions against Panama in 1987), and 4 for "major loss to sender: large volumes of trade are adversely affected" (e.g., the U.S. and UN joint sanctions against Iraq in 1990). There have been 40 "net gain," 54 "little effect," 16 "modest loss," and 6 "major loss" cases for each value, respectively.

National Security. If there was a threat to the national security of the sender, it is coded 1; otherwise, 0. The definition of national security comes from Drury (1998, 501): "military dispute between any involved nations, nuclear proliferation, threat to sender's macro-economy, threat to alliance, or threat of communist expansion."

Additional Policies. If the sender used additional policies such as covert action, limited use of force, or regular military, then it is coded as 1; if the sender used no additional policies, it is coded as 0 (Drury 1998).

U.S. Sanction. The U.S. has been the primary leading sender in the history of economic sanctions: it has imposed 78 unilateral or joint sanctions since 1914. This variable is coded 1 if the U.S.

initiated the sanctions either unilaterally or jointly with other countries or an international institution; otherwise, 0. However, the unilateral sanctions by an international institution are not counted as 1 for this variable even though the U.S. is one of the participants in that institution (such as the UN).

<u>The Variables Regarding the Target of Sanction</u>

Target Assistance. This variable is dichotomous; if there was international assistance (overt military or economic aid) to the target, it is coded as 1; otherwise, 0. Among 116 sanction cases, the target could get international assistance in 27. Recent examples are Libya's assistance to the target in the U.S. sanctions against Panama in 1987, and the USSR's assistance in the U.S. sanction against Poland in 1981.

Target Stabilities. This variable is measured by assessing the overall economic health and political stability of the target country throughout the period of the sanction case (HSE 1990, 36–7). This variable has three values: 1 for "distress: a country with acute economic problems, exemplified by high unemployment and rampant inflation, coupled with political turmoil bordering on chaos" (e.g., Sudan in the U.S. sanctions of 1989), 2 for "significant problems: a country with severe economic problems, such as a foreign exchange crisis, coupled with substantial internal dissent" (e.g., Iraq in the U.S. and UN joint sanctions of 1990), and 3 for "strong and stable: a country with the government in firm country and an economy experiencing only the normal range of inflation, unemployment, and small ills" (e.g., China in the U.S. sanctions of 1989). There have been 24 "distress," 52 "significant problems," and 40 "strong and stable" cases of each type, respectively.

Target Cost. This variable is measured by the annual cost of sanctions to the target as a percentage of its GNP. Based on the HSE collection, the mean of this variable is 1.8%; the minimum is -5.5% (e.g., the U.S. sanction against Ethiopia in 1976 where Ethiopia got much more aid and loans from the USSR than their loss from the suspension of U.S. aid and loans). The maximum is 48.0% (the U.S. and U.N. joint sanctions against Iraq in 1990).

The Variables Regarding the Sender/Target Relationship of Sanction

Pre-sanction Relationships. HSE (1990, 37–38) measure this variable of pre-sanction relationship with three values: 1 for "antagonistic: the sender and target countries are in opposing camps" (e.g., the U.S. with Syria in 1986 sanctions episode); 2 for "neutral: the sender country does not have strong ties to the target," (e.g., the U.S. with Haiti in 1987 sanctions episode); and 3 for "cordial: the sender and target countries are close friends and allies" (e.g., the U.S. and the United Kingdom with Somalia in 1988 sanctions episode). There have been sanction cases of 23, 55, and 38, respectively.

Pre-sanction Trade Level and *Target Assistance * Pre-sanction Trade Levels.* The first variable is measured as the target's total bilateral trades (exports to and imports from the sender) as a percentage of the target's total world trade. The second variable is an interactive term of *Target Assistance* and *Pre-sanction Trade Levels* variables.

3. Results and Discussion

Several of the other hypotheses concerning sanctions success are supported by the results of my sample selection probit and marginal impact analyses. For example, hypothesis 4 argues that sanctions that involve an international institution will be more likely to be successful, namely because they display credible commitment and prevent free riders among the involved parties in the international institute sanctions. The results from the model of sanctions success support this argument; the coefficient on the variable is positive and statistically significant in all but one model. Hypothesis 5 of the interactive effect of international cooperation and international institution involvement is also supported by the results: the coefficient for the variable is negative as expected and statistically significant in all but one model. Adding the non-significant results for hypothesis 3 of international cooperation, the results indicate that the involvement of international institutions increases the success of economic sanctions, and that international cooperation with the sender decreases the success of economic sanctions only when international institutions are involved. These results regarding hypotheses 4 and 5 are also in line with those from Martin (1992), Drezner (2000), and Drury (1998). Martin (1992) argues that "the leading sender has to demonstrate a credible commitment to the threats [for the success of its sanction]," and that one of the important mechanisms that accompanies the credible commitment is the use of international institutions (413). By making cooperation among other possible sanctioners easier and the free ride among those countries more difficult, sanctions by international institutions have a greater probability of success. Drezner (2000) also finds that without support from the international institutions, the increased levels of cooperation from other states leads to significantly fewer concessions from the target; when there is support from international institutions, cooperation from other states has a positive effect on the target's concessions. Drury (1998) finds that international cooperation has a negative effect on sanction success only when international institutions are not involved.

The argument by hypothesis 11— that sanctions imposed on the target in distress or experiencing significant problems are more likely to be successful— is also supported by the results: the coefficient for the variable is negative and statistically significant in all models, meaning that sanctions toward politically and economically stable targets are less likely to be successful. The marginal impact analysis (from Table 5.4) shows that the conditional probability of sanctions success, holding all the included variables at their means, is: (1) for Model 1-3, 40.9% (when target is in "distress"), 4.2% (when target experiences "significant problems"), and 0.1% (when target is "strong and stable"); (2) for Model 2-3, 35.5%, 3.4%, and 0.0%, respectively. These results regarding hypothesis 11 are also in line with those from Bergeijk (1989) and partly from Dashti-Gibson, Davis, and Radcliff (1997). HSE also point out that "countries in distress or experiencing significant problems are far more likely to succumb to the policy objectives of the sender country. When specific goals are at issue, the health and stability of the target country are usually important determinants in the success of the episode" (1990, 83).

Two other hypotheses from HSE (1990, 84–86) regarding the relationship between sender and target are also supported by the results. Sanctions against a target country that has long been an ally or friend of the sender (hypothesis 13), or has a cordial pre-sanction trade relationship with the sender (hypothesis 14), are more likely to be successful. The coefficients for the two variables are positive as expected and statistically significant at better than the 0.10 level in the majority of the models (all but one model for pre-sanctions relationship and all but two models for pre-sanctions trade level). The marginal impact analysis for hypothesis 13 (from Table 5.4) shows that the conditional probability of sanctions success, holding all the included variables at their means, is: (1) for Model 1-3, 1.3% ("antagonistic: the sender and target countries are in opposing camps") and 13.5% ("cordial: the sender and target countries are close friends and allies"); (2) for Model 2-3, 1.1% and 10.1%, respectively. The marginal impact analysis for hypothesis 14 (from Table 5.4) shows that, for Model 1-3, increasing the pre-sanctions trade level from one standard deviation below the mean of the variable to its mean, while holding all other independent variables at their means, increases the conditional probability of sanctions success by 3.8% (3.3% for Model 2-3). Increasing the change to one standard deviation above the mean triggers an additional increase of 32.0% (37.0% for Model 2-3). Specifically, the predicted probability of being successful increases from 0.1% to 35.9% (from 0.0% to 40.4% for Model 2-3). The results regarding hypothesis 13 are also in line with those from Bergeijk (1989) and Bonetti (1998), and the results regarding hypothesis 14 are in line with those from Bonetti (1998). The results also show that sanctions are less effective as time progresses. A sanction against the target country that has long been an adversary of the sender or has little trade with sender is generally less successful (HSE 1990, 84–86); in fact, "Attack your allies, not your adversaries" is one of the HSE (1990) commandments. This is primarily because "[the] higher compliance with sanctions by allies and trading partners reflects their willingness to bend on specific issues in deference to an overall relationship with the sender country" (84). Bergeijk (1989) also finds in his analysis that the trade linkage variable, which is defined as the sender's trade flows to the target as a percentage of the target's GNP in the year prior to the sanction, has the expected positive coefficient and statistical significance. Finally, Drury (1998, 502) argues that higher trade levels lead to a higher cost to the target (i.e., more damage to the target), and that this in turn leads to greater effectiveness of imposed sanctions.

Appendix 5.3 Definitions, Measurements, and Rates of Economic Sanctions Success

There are three issues regarding the dependent variable in use: definition, measurement, and rate of sanction success.[89] As in Baldwin (1999–2000), Bolks and Al-Sowayel (2000), Cortright and Lopez (2000), Drezner (2000), and others, there have been ongoing discussions about how to define and measure "success" in a sanction episode (also see Baldwin 1985 for a general discussion). Baldwin (1999–2000) notes that "[The] debate over whether economic sanctions 'work' is mired in a scholarly limbo" (80) and that success is a slippery concept (87). He continues to argue that we should ask the question of what "success" means before making empirical estimates of sanction success (87). Bolks and Al-Sowayel (2000) point out that definition of sanction success is contentious in the literature (see also Cortright and Lopez 2000). Hovi, Husby, and Sprinz (2005) argue that there are two plausible definitions of sanction success: first, "sanctions are successful if—and to the extent that—they extract political concessions from the target country"; and second, "sanctions might be successful, namely, by making noncompliance impossible" (483-484). Baldwin (1985) argues for a broad definition of success in evaluating the utility of "economic statecraft."[90] Baldwin (1999–2000) also posits that it could be measured based on the five dimensions of sanction success: the effectiveness of sanctions in achieving goals, costs to the sender(s), costs to the target(s), stakes for the sender(s), and stakes for the target(s) (87–92). Doxey (1987, 144) emphasizes the importance of identifying whether a goal is coercive or symbolic, and that the sanction should be designed accordingly. Malloy (1990) takes a different tack, arguing that the effectiveness of sanctions should be judged against the immediate "instrumental" goal (denying goods, markets, or finance) and not confused with the effectiveness of the overall foreign policy that sanctions serve. Drezner (2000, 73) posits that "sanction success measures the extent to which the target country met the sender's publicly stated demand."

---

[89] The debate on how to understand "success" in international affairs is not limited to the sanction study. For example, see Wayman, Singer, and Goertz (1983) for discussion on how to measure "success" in an international dispute (conflict).

[90] Some use the terms economic coercion, economic statecraft, and economic sanctions interchangeably (Drezner 2003); others differentiate among those terms (Baldwin 1985).

Also related is the issue of the success rate of economic sanctions (see also Drezner 2003 for a discussion on selection bias related to the success rate). For example, in the debate between Pape (1997, 1998) and Elliott (1998), who asked different questions and employed different research designs, the former finds that sanctions succeeded in only 5 out of 115 original cases or 4 percent of the total (for the period of 1914–1990), compared to the original study (also cited in Elliott 1998), where it was found that sanctions succeeded in 40 of 115 cases or 35 percent of the total (one in three sanctions events between 1900 and 1990, and one in four since 1973). There is also a long and distinguished line of authors who argue that sanctions do not work (see Galtung 1967; Knorr 1975; Bienen and Gilpin 1980; von Amerongen 1980; Lindsay 1986; Doxey 1987; Pape 1997; Haass 1997). However, other scholars suggest that sanctions may be more effective than is contended by earlier empirical research. Drezner (2003) asserts that the lack of observed success in sanctions is the result of a selection bias in the research and not a failing of sanctions themselves, noting that "the threat of sanctions is often enough to prompt changes in the behavior of some states" and "focusing only on cases where sanctions are actually applied ignores the large number of episodes where the threat of economic coercion did result in policy changes" (643).

Appendix 5.4 Probit Analysis of Dyadic Sanctions Onset and Success, 1950–1990

(Sanctions Onset Analysis)

	Model 1-1/2-1 (CINC)		Model 1-2/2-2 (CNP)		Model 1-3/2-3 (Degree)		Model 1-4/2-4 (Betweenness)	
Interdependence Low	-29.259	(19.819)	159.110*	(96.103)	1.001	(9.594)	-6.317	(14.081)
Democracy Low	-0.007	(0.008)	-0.006	(0.012)	-0.004	(0.008)	-0.005	(0.008)
Balance of Power	-0.104***	(0.030)	0.000	(0.000)	0.006	(0.011)	-0.015	(0.014)
Allies	-0.237***	(0.050)	-0.164**	(0.057)	-0.217***	(0.051)	-0.218***	(0.051)
Contiguity	-0.436	(0.350)	-0.399	(0.293)	-0.331	(0.374)	-0.366	(0.371)
Distance	0.421***	(0.104)	0.205	(0.152)	0.422***	(0.107)	0.412***	(0.103)
Major Power	-0.102	(0.409)	-0.629*	(0.256)	-0.270	(0.405)	-0.234	(0.417)
Militarized Dispute Onset	1.045***	(0.130)	0.401*	(0.170)	1.106***	(0.135)	1.084***	(0.131)
Constant	-4.978***	(0.783)	-1.789	(1.320)	-5.327***	(0.869)	-5.136***	(0.816)

	Model 1-5/2-5 (Flow-Betweenness)		Model 1-6/2-6 (Coreness)		Model 1-7/2-7 (Egonet Brokerage)		Model 1-8/2-8 (SNPI)	
Interdependence Low	-4.896	(13.419)	8.120*	(3.483)	-5.589	(13.262)	2.658	(7.836)
Democracy Low	-0.005	(0.008)	-0.005	(0.008)	-0.006	(0.008)	-0.004	(0.008)
Balance of Power	-0.016	(0.015)	0.173***	(0.024)	-0.011	(0.007)	0.022	(0.028)
Allies	-0.215***	(0.051)	-0.194***	(0.048)	-0.214***	(0.051)	-0.216***	(0.051)
Contiguity	-0.360	(0.372)	-0.284	(0.372)	-0.354	(0.374)	-0.323	(0.369)
Distance	0.410***	(0.103)	0.414***	(0.115)	0.412***	(0.103)	0.422***	(0.107)
Major Power	-0.242	(0.414)	-0.459	(0.401)	-0.260	(0.406)	-0.290	(0.413)
Militarized Dispute Onset	1.083***	(0.133)	1.104***	(0.136)	1.076***	(0.132)	1.113***	(0.134)
Constant	-5.141***	(0.829)	-5.513***	(0.934)	-5.158***	(0.828)	-5.357***	(0.856)

NOTE: Robust standard errors appear in parentheses below the coefficient estimates. All significant tests are two-tailed. *p < .10, *p < .01, ***p < .001.

Appendix 5.4 Probit Analysis of Dyadic Sanctions Onset and Success, 1950–1990 (Continued)

(Sanctions Success Analysis)

	Model 1-1 (CINC)		Model 1-2 (CNP)		Model 1-3 (Degree)		Model 1-4 (Betweenness)	
Relative Power	0.027	(0.102)	-0.000**	(0.000)	-0.138**	(0.047)	-0.103*	(0.048)
Sender Cooperation	-0.434*	(0.202)	-0.436*	(0.195)	-0.481*	(0.201)	-0.515**	(0.196)
Institution Sanction	1.397	(0.933)	1.764*	(0.954)	0.996	(1.100)	1.585	(1.183)
Sender Cooperation* Institution Sanction	-0.416	(0.376)	-0.671*	(0.400)	-0.194	(0.481)	-0.431	(0.473)
Sender Cost	0.094	(0.277)	0.117	(0.275)	0.044	(0.261)	0.003	(0.274)
National Security	0.200	(0.377)	0.234	(0.377)	0.194	(0.380)	0.124	(0.374)
Additional Policies	0.083	(0.379)	-0.068	(0.387)	0.143	(0.400)	0.171	(0.402)
U.S. Sanction	-0.021	(0.375)	-0.018	(0.386)	-0.046	(0.349)	0.115	(0.364)
Target Assistance	0.260	(0.665)	0.367	(0.686)	0.273	(0.659)	0.451	(0.715)
Target Stabilities	-0.586*	(0.283)	-0.533*	(0.272)	-0.912***	(0.269)	-0.832**	(0.272)
Target Cost	0.125	(0.082)	0.145	(0.089)	0.183*	(0.094)	0.124	(0.080)
Pre-sanction Relationships	0.651*	(0.314)	0.652*	(0.317)	0.747*	(0.318)	0.724*	(0.303)
Pre-sanction Trade Level	0.004	(0.005)	0.006	(0.005)	0.003	(0.005)	0.007	(0.005)
Target Assistance* Pre-sanction Trade Levels	-0.010	(0.010)	-0.010	(0.010)	-0.013	(0.010)	-0.011	(0.010)
Year	-0.032*	(0.015)	-0.036*	(0.015)	-0.024	(0.015)	-0.029*	(0.015)
Constant	64.056*	(28.804)	71.910*	(29.575)	49.276*	(28.777)	58.636	(29.015)

NOTE: Robust standard errors appear in parentheses below the coefficient estimates. All significant tests are two-tailed. *p < .10, *p < .01, ***p < .001.

Appendix 5.4 Probit Analysis of Dyadic Sanctions Onset and Success, 1950–1990 (Continued)

(Sanctions Success Analysis)

	Model 1-5 (Flow-Betweenness)		Model 1-6 (Coreness)		Model 1-7 (Egonet Brokerage)		Model 1-8 (SNPI)	
Relative Power	-0.163***	(0.051)	0.007	(0.176)	-0.051*	(0.031)	-0.135	(0.130)
Sender Cooperation	-0.456*	(0.206)	-0.454*	(0.195)	-0.496**	(0.193)	-0.481*	(0.192)
Institution Sanction	1.488	(1.156)	1.387	(0.946)	1.590	(1.130)	1.399	(1.018)
Sender Cooperation* Institution Sanction	-0.345	(0.483)	-0.399	(0.393)	-0.467	(0.458)	-0.370	(0.414)
Sender Cost	0.003	(0.265)	0.089	(0.279)	0.047	(0.276)	0.039	(0.278)
National Security	0.218	(0.381)	0.184	(0.370)	0.101	(0.379)	0.169	(0.371)
Additional Policies	0.113	(0.413)	0.087	(0.381)	0.175	(0.392)	0.128	(0.389)
U.S. Sanction	0.109	(0.350)	-0.025	(0.454)	-0.088	(0.365)	0.083	(0.379)
Target Assistance	0.345	(0.715)	0.273	(0.653)	0.344	(0.656)	0.262	(0.677)
Target Stabilities	-0.987***	(0.282)	-0.610*	(0.266)	-0.758**	(0.276)	-0.717**	(0.274)
Target Cost	0.133	(0.086)	0.126	(0.082)	0.138*	(0.083)	0.132	(0.082)
Pre-sanction Relationships	0.785**	(0.299)	0.654*	(0.313)	0.702*	(0.311)	0.687*	(0.307)
Pre-sanction Trade Level	0.008	(0.005)	0.004	(0.005)	0.005	(0.005)	0.005	(0.005)
Target Assistance* Pre-sanction Trade Levels	-0.013	(0.011)	-0.010	(0.010)	-0.010	(0.010)	-0.009	(0.010)
Year	-0.032*	(0.015)	-0.032*	(0.015)	-0.029*	(0.015)	-0.027*	(0.014)
Constant	65.032*	(29.355)	64.501*	(29.632)	58.197*	(28.913)	54.991*	(28.331)

NOTE: Robust standard errors appear in parentheses below the coefficient estimates. All significant tests are two-tailed. *p < .10, *p < .01, ***p < .001.

Appendix 5.4 Probit Analysis of Dyadic Sanctions Onset and Success, 1950–1990 (Continued)

(Sanctions Success Analysis)

	Model 2-1 (CINC)		Model 2-2 (GNP)		Model 2-3 (Degree)		Model 2-4 (Betweenness)	
Target's Power	-0.066	(0.106)	0.000	(0.001)	0.170***	(0.050)	0.149**	(0.050)
Sender Cooperation	-0.444*	(0.214)	-0.453*	(0.197)	-0.516*	(0.219)	-0.556**	(0.206)
Institution Sanction	0.984	(0.955)	1.388	(0.945)	1.043	(1.174)	1.789	(1.317)
Sender Cooperation* Institution Sanction	-0.229	(0.411)	-0.394	(0.391)	-0.198	(0.530)	-0.507	(0.535)
Sender Cost	0.195	(0.296)	0.090	(0.277)	0.061	(0.263)	-0.041	(0.275)
National Security	0.213	(0.379)	0.184	(0.371)	0.197	(0.397)	0.121	(0.386)
Additional Policies	-0.052	(0.386)	0.086	(0.379)	0.263	(0.406)	0.275	(0.417)
U.S. Sanction	0.185	(0.425)	-0.015	(0.375)	-0.238	(0.362)	-0.135	(0.370)
Target Assistance	0.005	(0.749)	0.267	(0.662)	0.741	(0.564)	0.859	(0.663)
Target Stabilities	-0.601*	(0.302)	-0.601*	(0.283)	-0.960***	(0.281)	-0.884***	(0.277)
Target Cost	0.102	(0.078)	0.126	(0.083)	0.223*	(0.104)	0.144*	(0.084)
Pre-sanction Relationships	0.557*	(0.320)	0.654*	(0.313)	0.778*	(0.335)	0.774*	(0.307)
Pre-sanction Trade Level	0.004	(0.005)	0.004	(0.005)	0.003	(0.005)	0.007	(0.005)
Target Assistance* Pre-sanction Trade Levels	-0.008	(0.010)	-0.010	(0.010)	-0.020*	(0.009)	-0.016	(0.010)
Year	-0.039*	(0.015)	-0.031*	(0.015)	-0.026*	(0.015)	-0.027*	(0.015)
Constant	76.711*	(30.008)	62.916*	(30.478)	54.886*	(29.025)	57.325*	(29.600)

NOTE: Robust standard errors appear in parentheses below the coefficient estimates. All significant tests are two-tailed. *p < .10, *p < .01, ***p < .001.

Appendix 5.4 Probit Analysis of Dyadic Sanctions Onset and Success, 1950–1990 (Continued)

(Sanctions Success Analysis)

	Model 2-5 (Flow-Betweenness)		Model 2-6 (Coreness)		Model 2-7 (Egonet Brokerage)		Model 2-8 (SNPI)	
Target's Power	0.217***	(0.056)	0.486*	(0.256)	0.066*	(0.031)	0.326*	(0.130)
Sender Cooperation	-0.498*	(0.228)	-0.480*	(0.197)	-0.514**	(0.197)	-0.531**	(0.202)
Institution Sanction	1.599	(1.240)	1.512	(1.111)	1.719	(1.213)	1.635	(1.210)
Sender Cooperation* Institution Sanction	-0.369	(0.532)	-0.385	(0.452)	-0.519	(0.494)	-0.447	(0.509)
Sender Cost	-0.031	(0.270)	0.043	(0.271)	0.046	(0.276)	0.009	(0.269)
National Security	0.247	(0.402)	0.156	(0.378)	0.081	(0.383)	0.154	(0.384)
Additional Policies	0.216	(0.425)	0.257	(0.385)	0.230	(0.396)	0.287	(0.396)
U.S. Sanction	-0.218	(0.365)	-0.030	(0.366)	-0.145	(0.367)	-0.090	(0.366)
Target Assistance	0.889	(0.613)	0.509	(0.659)	0.525	(0.628)	0.666	(0.641)
Target Stabilities	-1.035***	(0.292)	-0.739**	(0.271)	-0.798**	(0.278)	-0.856**	(0.279)
Target Cost	0.173*	(0.095)	0.182*	(0.093)	0.151*	(0.085)	0.169*	(0.090)
Pre-sanction Relationships	0.862**	(0.310)	0.645*	(0.307)	0.707*	(0.313)	0.711*	(0.308)
Pre-sanction Trade Level	0.008	(0.005)	0.005	(0.005)	0.005	(0.005)	0.006	(0.005)
Target Assistance* Pre-sanction Trade Levels	-0.021*	(0.010)	-0.013	(0.010)	-0.012	(0.009)	-0.015	(0.010)
Year	-0.031*	(0.015)	-0.024	(0.015)	-0.030*	(0.015)	-0.025*	(0.015)
Constant	64.371*	(29.260)	49.683*	(29.432)	60.860*	(29.108)	52.814*	(29.285)

NOTE: Robust standard errors appear in parentheses below the coefficient estimates. All significant tests are two-tailed. *p < .10, *p < .01, ***p < .001.

REFERENCES

Akaike, H. 1973. “Information Theory and an Extension of the Maximum Likelihood Principle.” In *Second International Symposium on Information Theory*, eds. B. N. Petrov and F. Csaki. Budapest: Akademiai Kiado, 267-281.

Alcock, Norman Z. and Alan G. Newcombe. 1970. “The Perception of National Power.” *Journal of Conflict Resolution* 14(3): 335-343.

Alderson, Arthur S. and Jason Beckfield. 2004. “Power and Position in the World City System.” *The American Journal of Sociology* 109(4): 811-851.

Anselin, Luc and John O’Loughlin. 1990. “Spatial Econometric Analysis of International Conflict.” In *Dynamics and Conflict in Regional Structural Change*, eds. M. Chatterji and R. E. Kuenne. New York: New York University Press, 325-345.

Anselin, Luc and John O’Loughlin. 1991. “Geography of International Conflict and Cooperation: Spatial Dependence and Regional Context in Africa.” In *The New Geopolitics*, ed. Michael D. Ward. Philadelphia, PA.: Gordon and Breach, 39-75.

Baldwin, David A. 1971a. “Money and Power.” *Journal of Politics* 33(3): 578-614.

Baldwin, David A. 1971b. “The Power of Positive Sanctions.” *World Politics* 24(1): 19-38.

Baldwin, David A. 1980. “Interdependence and Power: A Conceptual Analysis.” *International Organization* 34(4): 471-506.

Baldwin, David A. 1985. *Economic Statecraft*. Princeton, NJ: Princeton University Press.

Baldwin, David A. 1999–2000. “The Sanctions Debate and the Logic of Choice.” *International Security* 24(3): 80-107.

Barbieri, Katherine and Gerald Schneider. 1999. “Globalization and Peace: Assessing New Directions in the Study of Trade and Conflict.” *Journal of Peace Research* 36(4): 387-404.

Barbieri, Katherine and Richard Alan Peters II. 2003. “Measure for Mis-measure: A Response to Gartzke & Li.” Journal of Peace Research 40(6): 713-719.

Barbieri, Katherine. 1996. “Economic Interdependence: A Path to Peace or a Source of Interstate Conflict?” *Journal of Peace Research* 33(1): 29-49.

Barbieri, Katherine. 2002. *The Liberal Illusion: Does Trade Promote Peace?* Ann Arbor: University of Michigan Press.

Barnett, G.A. 1999. “The Social Structure of International Telecommunications.” In *Progress In Communication Sciences*, eds. H. Sawhney and G.A. Barnett. Greenwich, CT: Ablex, 151-186.

Barnett, G.A. and J.G.T. Salisbury. 1996. “Communication and Globalization: A Longitudinal Analysis of the International Telecommunication Network.” *Journal of World-Systems Research* 2(16): 1-17.

Barnett, G.A. and Y. Choi. 1995. “Physical Distance and Language as Determinants of the International Telecommunication Network.” *International Political Science Review* 16: 249-265.

Barnett, G.A. and Y. Wu. 1995. "The International Student Exchange Network: 1970 and 1989." *Higher Education* 30: 353-368.

Barnett, G.A., T.L. Jacobson, Y. Choi and S.L. Sun-Miller. 1996. "An Examination of the International Telecommunication Network." *The Journal of International Communication* 3:19-43.

Baron, R M. and D. A. Kenny. 1986. "The Moderator-Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations." *Journal of Personality and Social Psychology* 51(6): 1173-1182.

Bavelas, Alex. 1948. "A Mathematical Model for Group Structure." *Applied Anthropology* 7: 16-30.

Bayard, Thomas O. and Kimberly Ann Elliot. 1994. *Reciprocity and Retaliation in U.S. Trade Policy*. Washington, DC: Institute for International Economics.

Beck, Nathaniel, Jonathan N. Katz and Richard Tucker. 1998. "Taking Time Seriously: Time-Series-Cross-Sectional Analysis with a Binary Dependent Variable." *American Journal of Political Science* 42(4): 1260-1288.

Bell, Coral. 1971. *The Conventions of Crisis: A Study in Diplomatic Management.* London, New York: Oxford University Press for the Royal Institute of International Affairs.

Bennett D. Scott. 2005. "Exploring Operationalizations of Political Relevance." Unpublished Manuscript.

Bennett, D. Scott and Allan C. Stam. 2000b. "Research Design and Estimator Choices in the Analysis of Interstate Disputes: When Decisions Matter." *Journal of Conflict Resolution* 44(5): 653-685.

Bennett, D. Scott and Allan C. Stam. 2004. *The Behavioral Origins of War*. Ann Arbor, MI: University of Michigan Press.

Bennett, D. Scott, and Allan Stam. 2000a. "EUGene: A Conceptual Manual." *International Interactions* 26: 179-204. <http://eugenesoftware.org>.

Bentler, Peter M. 1990. "Comparative Fit Indexes in Structural Models." *Psychological Bulletin.* 107(2): 238-46.

Bentler, Peter M. and Bornett D. G. 1980. "Significant Tests and Goodness of Fit in the Analysis of Covariance Structures." *Psychological Bulletin* 88: 588-606.

Bergeijk, Peter A. G. van. 1989. "Success and Failure of Economic Sanctions." *Kyklos* 42(3): 385-404.

Bienen. Henry and Robert Gilpin, 1980. "Economic Sanctions as a Response to Terrorism." *Journal of Strategic Studies* 3(1): 89-98.

Blainey, Geoffrey. 1988. *The Causes of War*. 3rd Edition. New York: The Free Press.

Blake, Charles H. and Noah Klemm. 2006. "Reconsidering the Effectiveness of International Economic Sanctions: An Examination of Selection Bias." *International Politics* 43(1): 133-149.

Blanchard, Jean-Marc F. and Norrin M. Ripsman. 2000. "Asking the Right Question: When Do Economic Sanctions Work Best?" *Security Studies* 9: 219-253.

Blanchard, Jean-Marc F., Edward D. Mansfield, and Norrin Ripsman. 2000. “The Political Economy of National Security: Economic Statecraft, Interdependence, and International Conflict.” *Security Studies* 9(1-2): 1-14.

Blanton, Shannon Lindsey. 2000. “Promoting Human Rights and Democracy in the Developing World: U.S. Rhetoric versus U.S. Arms Exports.” *American Journal of Political Science* 44(1): 123-131.

Blau, Judith R. and Richard D. Alba. 1982. “Empowering Nets of Participation.” *Administrative Science Quarterly* 27(3): 363-379.

Blessing, James Alan. 1975. “The Suspension of Foreign Aid of the United States, 1948-1972.” Ph.D. diss. State University of New York at Albany.

Blok, Anton. 1974. *The Mafia of a Sicilian Village, 1860–1960: A Study in Violent Peasant Entrepreneurs*. Oxford: Blackwell.

Boissevain, Jeremy. 1974. *Friends of Friends: Networks, Manipulators and Coalitions*. Oxford: Basil Blackwell.

Boje, David M. and Whetten, David A. 1981. “Effects of Organizational Strategies and Contextual Constraints on Centrality and Attributions of Influence in Interorganizational Networks.” *Administrative Science Quarterly* 26(3): 378-395.

Bolks, Sean M. and Dina Al-Sowayel. 2000. “How Long Do Economic Sanctions Last? Examining the Sanctioning Process through Duration.” *Political Research Quarterly* 53(2): 241-265

Bollen, Kenneth A and J. Scott Long, eds. 1993. *Testing Structural Equation Models.* Newbury Park: Sage Publications.

Bollen, Kenneth A. 1980. “Issues in the Comparative Measurement of Political Democracy.” American Sociological Review 45(3): 370-390.

Bollen, Kenneth A. 1989. “A New Incremental Fit Index for General Structural Equation Models.” *Sociological Methods & Research* 17(3): 303-316.

Bonetti, Shane. 1998. “Distinguishing Characteristics of Degrees of Success and Failure in Economic Sanctions Episodes.” *Applied Economics* 30(6): 805-813.

Borgatti, S.P. and M.G. Everett. 1999. “Models of Core / Periphery Structures.” *Social Networks* 21: 375-395.

Borgatti, S.P., M.G. Everett, and L.C. Freeman. 2002. Ucinet for Windows: Software for Social Network Analysis. Harvard, MA: Analytic Technologies.

Boulding, Kenneth Ewart. 1962. *Conflict and Defense: A General Theory*. New York: Harper.

Bowers, Jake and Katherine W. Drake. 2005. “EDA for HLM: Visualization when Probabilistic Inference Fails.” *Political Analysis* 13(4):301-326.

Braithwaite, Alex and Quan Li. 2005. “Hot Spots and the Spatial Diffusion of Transnational Terrorism.” The Pennsylvania State University. Typescript.

Braithwaite, Alex. 2005. “Location, Location, Location…Identifying Hot Spots of International Conflict.” *International Interactions* 31(3):251-273.

Brams, Steven J. 1966. “Transaction Flows in the International System.” *American Political Science Review* 60(4): 880-898

Brams, Steven J. 1968. “Measuring the Concentration of Power in Political Systems.” *American Political Science Review* 62(2): 461-475.

Brandes, Ulrik and Thomas Erlebach, eds. 2005. *Network Analysis: Methodological Foundations*. Berlin; New York: Springer.

Brandes, Ulrik, Jörg Raab, and Dorothea Wagner. 2001 “Exploratory Network Visualization: Simultaneous Display of Actor Status and Connections.” *Journal of Social Structure* 2(4): 1-28.

Brandes, Ulrik, Patrick Kenis, Jörg Raab, Volker Schneider, and Dorothea Wagner. 1999. “Explorations into the Visualization of Policy Networks.” *Journal of Theoretical Politics* 11(1): 75-106.

Brass Daniel .J. and Marlene E. Burkhardt. 1992. “Centrality and Power in Organizations.” In *Networks and Organizations*, eds. Nitin Nohria and Robert Eccles. Boston, MA: Harvard Business School Press.

Brass, Daniel J. 1984. “Being in the Right Place: A Structural Analysis of Individual Influence in an Organization.” *Administrative Science Quarterly* 29(4): 518-539.

Brass, Daniel J. 1992. “Power in Organizations: A Social Network Perspective.” In *The Political Consequences of Social Networks*, eds. Gwen Moore and J. Allen Whitt. Greenwich, Conn.: JAI Press: 295-323.

Brass, Daniel J. and Marlene E. Burkhardt. 1993. “Potential Power and Power Use: Investigation of Structure and Behavior.” *Academy of Management Journal* 36(3): 441-470.

Brecher, Michael, Jonathan Wilkenfeld, and Patrick James. 1989. *Crisis, Conflict and Instability*. Oxford, New York: Pergamon Press.

Brecher, Michael. 1977. “Toward a Theory of International Crisis Behavior: A Preliminary Report.” *International Studies Quarterly* 21(1): 39-74.

Bremer, Stuart A. 1992. “Dangerous Dyads: Conditions Affecting the Likelihood of Interstate War, 1816–1965.” *Journal of Conflict Resolution* 36(2): 309-341.

Bremer, Stuart A. 1993. "Democracy and Militarized Interstate Conflict, 1816–1965." *International Interactions* 18: 231-249.

Bremer, Stuart A. 2001. “Revision of CINC.” <http://cow2.la.psu.edu/>.

Brodie, Bernard, ed. 1946. *The Absolute Weapon: Atomic Power and World Order*. New York: Harcourt, Brace and Company.

Brody, Richard A. 1963. “Some Systemic Effects of the Spread of Nuclear Weapons Technology: A Study through Simulation of a Multi-Nuclear Future.” *Journal of Conflict Resolution* 7(4): 663-753.

Browne, Michael W. and Robert Cudeck. 1992. "Alternative Ways of Assessing Model Fit." *Sociological Methods & Research* 21(2): 230-258.

Buchan, Alastair. 1964. "The Multilateral Force: A Study in Alliance Politics." *International Affairs* 40(4): 619-637.

Bueno de Mesquita, Bruce, and David Lalman. 1988. "The Empirical Support for Systemic and Dyadic Explanations of International Conflict." *World Politics* 41(1): 1-20.

Bueno de Mesquita, Bruce, and David Lalman. 1992. *War and Reason: Domestic and International Imperatives*. New Haven: Yale University Press.

Bueno de Mesquita, Bruce. 1980. "An Expected Utility Theory of Conflict." *American Political Science Review* 74(4): 917-931.

Bueno de Mesquita, Bruce. 1981. *The War Trap*. New Haven: Yale University Press.

Bueno de Mesquita, Buce and J. David Singer. 1973. "Alliance, Capabilities and War: A Review and Synthesis." *Political Science Annual* 4: 237-280.

Bueno de Mesquita, Buce. 1975. "Measuring Systemic Polarity." *Journal of Conflict Resolution* 19(2): 187-216.

Burkhardt, Marlene E. and Daniel J. Brass. 1990. "Changing Patterns or Patterns of Change: The Effects of a Change in Technology on Social Network Structure and Power." *Administrative Science Quarterly* 35(1): 104-127.

Burt, Ronald S. 1976. "Positions in Networks." *Social Forces* 55(1): 93-122.

Cannizzo, Cynthia. 1978. "Capability Distributions and Major Power War Experiences, 1816–1965." *Orbis* 21: 947-959.

Carleton, David and Michael Stohl. 1987. "The Role of Human Rights in U.S. Foreign Assistance Policy: A Critique and Reappraisal." *American Journal of Political Science* 31(4): 1002-1018.

Carr, Edward Hallett. 1951. *German-Soviet Relations Between the Two World Wars, 1919–1939*. Baltimore: Johns Hopkins Press.

Carter, L. F. 1947. "An Experiment on the Design of Tables and Graphs Used for Presenting Numerical Data." *Journal of Applied Psychology* 31: 640-650.

Cartwright, Dorwin. 1965. "Influence, Leadership, Control." In *Handbook of Organizations*, ed. James March. Chicago: Rand McNally, 1-47.

Chen, T.M. and G.A. Barnett. 2000. "Research on International Student Flows from a Macro Perspective: A Network Analysis of 1985, 1989 and 1995." *Higher Education* 39: 435-453.

Chirot, Daniel. 1977. *Social Change in the Twentieth Century*. New York: Harcourt Brace Jovanovich.

Cingranelli, David L. and Thomas E. Pasquarello. 1985. "Human Rights Practices and the Distribution of U.S. Foreign Aid to Latin American Countries." *American Journal of Political Science* 29(3): 539-563.

Clark, David H. and William Reed. 2003. "A Unified Model of War Onset and Outcome." *Journal of Politics* 65(1): 69-91.

Clarke, Kevin A. 2001a. "Testing Nonnested Models of International Relations." Ph.D. diss. University of Michigan.

Clarke, Kevin A. 2001b. "Testing Nonnested Models of International Relations: Reevaluating Realism." *American Journal of Political Science* 45(3): 724-744.

Clarke, Kevin A. 2003. "Nonparametric Model Discrimination in International Relations." *Journal of Conflict Resolution* 47(1): 72-93.

Claude, Inis L. 1962. *Power and International Relations*. New York: Random House.

Cline, Ray S. 1980. *World Power Trends and U.S. Foreign Policy for the 1980's*. Boulder: Westview Press.

Cohn, B. S. and M. Marriott. 1958. "Networks and Centres of Integration in Indian Civilization." *Journal of Social Research* 1: 1-9.

Coleman, James Samuel. 1964. *Introduction to Mathematical Sociology.* New York: Free Press of Glencoe.

Coll, Richard A., Joan H. Coll, and Canesh Thakur. 1994. "Graphs and Tables: A Four-Factor Experiment." *Communications of the ACM archive* 37(4): 76-86.

Conover, W. J. 1980. *Practical Nonparametric Statistics*. 2nd Edition. New York: John Wiley.

Corradino, C. 1990. "Proximity Structure in a Captive Colony of Japanese Monkeys (Macaca fuscata fuscata): An Application of Multidimensional Scaling." *Primates* 31(3): 351-362.

Cortright, David and George A. Lopez. 2000. *The Sanctions Decade: Assessing UN Strategies in the 1990s.* Boulder: Lynne Rienner Publishers.

Cox, Dan G. and A. Cooper Drury. 2006. "Democratic Sanctions: Connecting the Democratic Peace and Economic Sanctions." *Journal of Peace Research* 43(6): 709-722.

Croco, Sarah and Tze Teo. 2005. "Assessing the Dyadic Approach to Interstate Conflict Processes: A.k.a. 'Dangerous' Dyad-Years." *Conflict Management and Peace Science* 22(1): 5-18.

Cummings, W. K. 1993. "Global Trends in Overseas Study." In *International Investment in Human Capital: Overseas Education for Development*, ed. C. D. Goodwin. New York: Institute of International Education.

Cutler, Robert M., Laure Despres, and Aaron Karp. 1987. "The Political Economy of East-South Military Transfers." *International Studies Quarterly* 31(3): 273-299.

Dahl, Robert Alan. 1961. *Who Governs? : Democracy and Power in an American City.* New Haven: Yale University Press.

Dahl, Robert Alan. 1966. "Further Reflections on 'The Elitist Theory of Democracy.'" *American Political Science Review* 60(2): 296-305.

Dashti-Gibson, Jaleh, Patricia Davis, and Benjamin Radcliff. 1997. “On the Determinants of the Success of Economic Sanctions: An Empirical Analysis.” *American Journal of Political Science* 41(2): 608-618.

Davis, Kingley. 1954. “The Demographic Foundations of National Power.” In *Freedom and Control in Modern Society*, eds. Morrow Berger, Theodore Abel and Charles H. Page. New York: Van Nostrand.

Degenne, Alain and Michel Forsé. 1999. *Introducing Social Networks*. London: SAGE.

DeSombre, Elizabeth R, 2000. *Domestic Sources of International Environmental Policy: Industry, Environmentalists and U.S. Power.* Cambridge, Mass: MIT Press.

Deutsch, Karl Wolfgang and J. David Singer. 1964. “Multipolar Power Systems and International Stability.” *World Politics* 16(3): 390-406

Deutsch, Karl Wolfgang. 1953. *Nationalism and Social Communication; An Inquiry into the Foundations of Nationality*. New York: Wiley.

Deutsch, Karl Wolfgang. 1954. *Political Community at the International Level: Problems of Definition and Measurement*. Garden City, N.Y.: Doubleday.

Deutsch, Karl Wolfgang. 1968. *The Analysis of International Relations*. Englewood Cliffs, N.J.: Prentice-Hall.

Dibble, Emily. 1997. “The Interpretation of Graphs and Tables.” Ph.D. diss. University of Washington.

Diehl, Paul F. 1985. “Contiguity and Military Escalation in Major Power Rivalries, 1816–1980.” *Journal of Politics* 47(4): 1203-1211.

Diehl, Paul F. and Gary Goertz. 1988. “Territorial Changes and Militarized Conflict.” *Journal of Conflict Resolution* 32(1): 103-122

Dixon, William J. 1994. “Democracy and the Peaceful Settlement of International Conflict.” *The American Political Science Review* 88(1): 14-32.

Dixon, William J. and Paul D. Senese. 2002. “Democracy, Disputes, and Negotiated Settlements.” *Journal of Conflict Resolution* 46(4): 547-571.

Domke, William Kinkade. 1988. *War and the Changing Global System.* New Haven: Yale University Press.

Doran, Charles F. and Parsons, Wes. 1980. “War and the Cycle of Relative Power.” *The American Political Science Review* 74(4): 947-965.

Doreian, P. 1985. “Structural Equivalence in a Psychology Journal Network.” *Journal of the American Society for Information Science* 36: 411-417.

Dorelan, Patrick and Louis H. Albert. 1989. “Partitioning Political Actor Networks: Some Quantitative Tools for Analyzing Qualitative Networks.” *Journal of Quantitative Anthropology* 1: 279-291.

Doxey, Margaret P. 1987. *International Sanctions in Contemporary Perspective*. New York: St. Martin's Press.

Doyle, Michael W. 1986. "Liberalism and World Politics." *American Political Science Review* 80(4): 1151-1169.

Drezner, Daniel W. 1998. "Conflict Expectations and Paradox of Economic Coercion." *International Studies Quarterly* 42(4): 709-731.

Drezner, Daniel W. 1999. *The Sanctions Paradox: Economic Statecraft and International Relations*. New York: Cambridge University Press

Drezner, Daniel W. 2000. "Bargaining, Enforcement, and Multilateral Economic Sanctions: When is Cooperation Counterproductive?" *International Organization* 54(1): 73-102.

Drezner, Daniel W. 2003. "The Hidden Hand of Economic Coercion." *International Organization* 57(3): 643-650.

Drury, A. Cooper. 1998. "Revisiting Economic Sanctions Reconsidered." *Journal of Peace Research* 35(4): 497-509.

Drury, A. Cooper. 2000. "U.S. Presidents and the Use of Economic Sanctions." *Presidential Studies Quarterly* 30(4): 623-642.

Drury, A. Cooper. 2003. "Democracy, Autocracy, and Economic Sanctions: How Regime Type Affects the Use of Economic Coercion." Presented at the Annual Meeting of the American Political Science Association, 2003, Philadelphia, PA.

Drury, A. Copper and Johann Park. 2004. "MIDs, Economic Sanctions, and Trade: The Effect of Economic Coercion on Military Disputes." Presented at the Annual Meeting of the International Studies Association, 2004, Montreal, Canada.

Ellings, Richard J. 1985. *Embargoes and World Power: Lessons from American Foreign Policy*. Boulder: Westview Press.

Elliott, Kimberly Ann and J. David Richardson. 1997. "Determinants and Effectiveness of 'Aggressively Unilateral' U.S. Trade Actions. In *The Effects of U.S. Trade Protection and Promotion Policies,* ed. Robert C. Feenstra. Chicago: University of Chicago Press, 214-243.

Elliott, Kimberly Ann and Peter P. Uimonen. 1993. "The Effectiveness of Economic Sanctions with Application to the Case of Iraq." *Japan and the World Economy* 5(4): 403-409.

Elliott, Kimberly Ann. 1998. "The Sanctions Glass: Half Full or Completely Empty?" *International Security* 23(1): 50-65.

Emmanuel, Arghiri. 1972. *Unequal Exchange: A Study of the Imperialism of Trade*. New York: Monthly Review Press.

Epstein, Lee, Andrew D. Martin and Matthew M. Schneider. Forthcoming. "On the Effective Communication of the Results of Empirical Studies, Part 1." *Vanderbilt Law Review*.

Faber, J. and R. Weaver. 1984. "Participation in Conferences, Treaties, and Warfare in the European System, 1816-1915." *Journal of Conflict Resolution* 28(4): 522-534.

Ferris, Wayne H. 1973. *The Power Capabilities of Nation-States: International Conflict and War*. Lexington, Mass.: Lexington Books.

Firebaugh, Glenn and Bradley P. Bullock. 1987. "Export Upgrading, Export Concentration, and Economic Growth in Less Developed Countries: A Cross-National Study." *Studies in Comparative International Development* 22: 87-109.

Fordham, Benjamin O. and Timothy J. McKeown. 2003. "Selection and Influence: Interest Groups and Congressional Voting on Trade Policy." *International Organization* 57(3): 519-549.

Frank, Andre Gunder. 1969. *Latin America: Underdevelopment of Revolution?: Essays on the Development of Underdevelopment and the Immediate Enemy*. New York: Monthly Review Press.

Freedom House. 2006. Freedom in the World. <http://www.freedomhouse.org/>.

Freeman, Linton, S.P. Borgatti and D.R. White. 1991. "Centrality in Valued Graphs: A Measure of Betweenness Based on Network Flow." *Social Networks* 13: 141-154.

Freeman, Linton. 1978/1979. "Centrality in Social Networks: Conceptual Clarification." *Social Networks* 1: 215 -239.

Fucks, Wilhelm. 1965. "Formeln zur Macht: Prognosen uber Volker." Wirtschaft Potentiale, Verlags-Anstalt.

Gaddis, John Lewis. 1986. "The Long Peace: Elements of Stability in the Postwar International System." *International Security* 10(4): 99-142.

Gaddis, John Lewis. 1987. *The Long Peace: Inquiries into the History of the Cold War*. New York: Oxford University Press.

Galaskiewicz, Joseph and K. Krohn. 1984. "Positions, Roles, and Dependencies in a Community Interorganization System." *Sociological Quarterly* 25: 527-550.

Galaskiewicz, Joseph. 1979. "The Structure of Community Organizational Networks." *Social Forces* 57(4): 1346-1364.

Galtung, Johan. 1967. "On the Effects of International Economic Sanctions: Examples from the Case of Rhodesia." *World Politics* 19(3): 378-416.

Galtung, Johan. 1971. "A Structural Theory of Imperialism." *Journal of Peace Research* 8(2): 81-117.

Garnham, David. 1976a. "Dyadic International War, 1816-1965: The Role of Power Parity and Geographical Proximity." *Western Political Quarterly* 29(2): 231-242.

Garnham, David. 1976b. "Power Parity and Lethal International Violence, 1969-1973." *Journal of Conflict Resolution* 20(3): 379-394.

Gartzke, Erik and Quan Li. 2003a. "Measure for Measure: Concept Operationalization and the Trade Interdependence-Conflict Debate." Journal of Peace Research 40(5): 553-572.

Gartzke, Erik and Quan Li. 2003b. "All"s Well That Ends Well: A Reply to Oneal, Barbieri & Peters." *Journal of Peace Research* 40(6): 727-732.

Gartzke, Erik, Charles R. Boehmer, Joseph J. Hewitt, and Timothy Nordstrom. 2006. "The Crisis Behavior of International Organizations." Presented at the Annual Meetings of the International Studies Association, 2006, San Diego, CA.

Gartzke, Erik, Quan Li, and Charles Boehmer. 2001. "Investing in the Peace: Economic Interdependence and International Conflict." *International Organization* 55(2): 391-438.

Gartzke, Erik. 1998. "Kant We All Get Along? Opportunity, Willingness, and the Origins of the Democratic Peace." *American Journal of Political Science* 42(1): 1-27.

Gelman A., C. Pasarica, and R. Dodhia. 2002. "Let's Practice What We Preach: Turning Tables into Graphs." *The American Statistician* 56(2): 121-130.

Gelman, Andrew, Cristian Pasarica and Rahul Dodhia. 2002. "Let's Practice What We Preach: Turning Tables into Graphs." *The American Statistician* 56(2): 121–30.

German, F. Clifford. 1960. "A Tentative Evaluation of World Power." *Journal of Conflict Resolution* 4(1): 138-144.

Getis, A. and Ord, J. K. 1992. "The Analysis of Spatial Association by Use of Distance Statistics." *Geographical Analysis* 24: 189-206.

Gibler, Douglas M. and Meredith Reid Sarkees. 2004. "Measuring Alliances: The Correlates of War Formal Interstate Alliance Dataset, 1816–2000." *Journal of Peace Research* 41 (2): 211-222.

Gilpin, Robert. 1981. *War and Change in World Politics.* Cambridge: Cambridge University Press.

Glaser, Charles L. 2003. "The Necessary and Natural Evolution of Structural Realism." In *Realism and the Balancing of Power,* eds. John A. Vasquez and Colin Ellman. Upper Saddle River, NJ: Englewood Cliffs, 266-278.

Gleditsch, Kristian Skrede and Michael D. Ward. 2005. "Visualization in the Study of International Relations." In *New Directions in International Relations*, eds. Alex Mintz and Bruce M. Russett. Lexington, MA: Lexington Books, 65-91.

Gleditsch, Kristian Skrede. 2002. "Expanded Trade and GDP Data." *Journal of Conflict Resolution* 46(5): 712-724.

Gleditsch, Kristian Skrede. 2004. *Expanded Trade and GDP Data*. Version 4.1. <http://dss.ucsd.edu/~kgledits/exptradegdp.html>.

Gochman, Charles S. 1980. "Status, Capabilities, and Major Power Conflict." In *The Correlates of War, II,* ed. J. D. Singer. New York: Free Press.

Gochman, Charles S. and Zeev Maoz. 1984. "Militarized Interstate Disputes, 1816-1976: Procedures, Patterns, and Insights." *Journal of Conflict Resolution* 28(4): 585-616.

Goenner, Cullen F. 2004. "Uncertainty of the Liberal Peace." *Journal of Peace Research* 41(5): 589-605.

Goenner, Cullen F. Forthcoming. "Economic War and Democratic Peace." *Conflict Management and Peace Science.*

Goldstein, Joshua. 1991. "A War-Economy Theory of the Long Wave." In *Business Cycles: Theories, Evidence and Analysis*, eds. N. Thygesen, K. Velupillai, and S. Zambelli. London: Macmillan.

Gordon, Jonathan, Hyung Min Kim, and Timothy J. McKeown. Forthcoming. “U.S. Federal Research & Development Funding: Strategic Trade Policy Tool, By-Product of Military Competition, or Politics as Usual.” *Review of International Political Economy.*

Gould, Roger V. 1989. “Power and Social Structure in Community Elites.” *Social Forces* 68(2): 531-552.

Gould, Roger V. and Roberto M. Fernandez. 1989. “Structures of Mediation: A Formal Approach to Brokerage in Transaction Networks.” *Sociological Methodology* 19: 89-126.

Green, Donald P., Soo Yeon Kim, and David H. Yoon. 2001. “Dirty Pool.” *International Organization* 55(2): 441-468.

Greene, William H. 1981. “Sample Selection Bias as a Specification Error: A Comment.” *Econometrica* 49(3): 795-798.

Greene, William H. 2003. *Econometric Analysis*. 5th Edition. Upper Saddle River, N.J.: Prentice Hall.

Grieco, Joseph M. 2001. “Repetitive Military Challenges and Recurrent International Conflicts, 1918-1944.” *International Studies Quarterly* 45(2): 295-316.

Gulick, Edward Vose. 1955. *Europe's Classical Balance of Power: A Case History of the Theory and Practice of One of the Great Concepts of European Statecraft*. Ithaca: Cornell University Press for the American Historical Association.

Haass, Richard N. 1997. “Sanctioning Madness.” *Foreign Affairs* 76(6): 74-85.

Hafner-Burton, Emilie and Alexander H. Montgomery. 2006. “Power Positions: International Organizations, Social Networks, and Conflict.” *Journal of Conflict Resolution* 50(1): 3-27

Hanneman, Robert A. and Mark Riddle. 2001. *Introduction to Social Network Methods*. Riverside, CA: University of California, Riverside. <http://faculty.ucr.edu/~hanneman/>.

Hart, Jeffrey. 1976. “Three Approaches to the Measurement of Power in International Relations.” *International Organization* 30(2): 289-305.

Hart, Robert A. 2000. “Democracy and the Successful Use of Economic Sanctions.” *Political Research Quarterly* 53(2): 267-284.

Hass, Michael. 1970. “International Subsystems: Stability and Polarity.” *American Political Science Review* 64(1): 98-123.

Heagerty, Patrick J. and Lumley, Thomas. 2000. “Window Subsampling of Estimating Functions with Application to Regression Models.” *Journal of the American Statistical Association* 95: 197-211.

Heagerty, Patrick J., Michael D. Ward, and Kristian Skrede Gleditsch. 2002. “Windows of Opportunity: Window Subseries Empirical Variance Estimator in International Relations.” *Political Analysis* 10: 304-317.

Heckman, James J. 1979. “Sample Selection Bias as a Specification Error.” *Econometrica* 47(1): 153-162.

Heckman, James J. 1990. “Varieties of Selection Bias.” *American Economic Review* 80(2): 313-318.

Herz, John H. 1959. *International Politics in the Atomic Age.* New York: Columbia University Press.

Hitch, Charles J. and Roland N. McKean. 1960. *The Economics of Defense in the Nuclear Age*. New York: Atheneum.

Hosti, K. J. 1964. “The Concept of Power in the Study of International Relations.” *Background* 7(4): 179-194.

Hovi, Jon, Robert Huseby and Detlef F. Sprinz, 2005. “When Do (Imposed) Economic Sanctions Work?” *World Politics* 57(4): 479-499.

Hoyle, R. H. and Panter, A. T. 1995. "Writing About Structural Equation Models." In *Structural Equation Modeling, Concepts, Issues, and Applications*, ed. R. H. Hoyle. Thousand Oaks, CA: Sage Publications, 158-176.

Hu, Li-tze and Peter M. Bentler. 1999. “Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria versus New Alternatives.” *Structural Equation Modeling* 6(1): 1-55.

Hufbauer, Gary Clyde, Jeffrey J. Schott, and Kimberly Ann Elliott. 1990. *Economic Sanctions Reconsidered*. 2nd Edition. Washington, DC: Institute for International Economics.

Huth, Paul K. 1996. *Standing Your Ground: Territorial Disputes and International Conflict.* Ann Arbor: University of Michigan Press.

Huth, Paul K. and Todd L. Allee. 2002. *The Democratic Peace and Territorial Conflict in the Twentieth Century*. Cambridge, New York: Cambridge University Press.

ICB. 2003. *Dyadic-Level Crisis Data*. Version 5.0. <http://www.cidcm.umd.edu/icb/Data/index.html>.

Ireland, Michael J. and Scott Sigmund Gartner. 2001. “Time to Fight: Government Type and Conflict Initiation in Parliamentary Systems.” *Journal of Conflict Resolution* 45(5): 547-568.

ITU. Various Years. *Direction of Traffic: Trading Telecom Minutes*. International Telecommunication Union.

ITU. Various Years. *Yearbook of Statistics*. International Telecommunication Union.

Jarvenpaa, S. L. and G. W. Dickson. 1988. “Graphics and Managerial Decision Making: Research Based Guidelines.” *Communications of the ACM archive* 31(6): 764 – 774.

Jeffreys, Harold, Sir. 1961. *Theory of Probability.* 3rd Edition. Oxford: Clarendon Press.

Jöreskog, Karl G. 1979. *Advances in Factor Analysis and Structural Equation Models.* Cambridge, Mass.: Abt Books.

Judge, George G., R. Carter Hill, William E. Griffiths, Helmut Lutkepohl, and Tsoung-Chao Lee. 1985. *The Theory and Practice of Econometrics*. 2nd Edition. New York: Wiley.

Kadera, Kelly M. 2001. *The Power-Conflict Story: A Dynamic Model of Interstate Rivalry.* Ann Arbor: University of Michigan Press.

Kadera, Kelly M. and Gerald L. Sorokin. 2004. “Measuring National Power.” *International Interactions* 30(3): 211-230.

Kant, Immanuel. 1970. *Perpetual Peace: A Philosophical Sketch*. Reprinted in *Kant's Political Writing*, ed. Hans Reiss. Cambridge: Cambridge University Press. Originally published 1797.

Kaplan, Morton. 1957. *System and Process in International Politics.* New York: Wiley.

Kastellec Jonathan P. and Eduardo Leoni. 2006. "Using Graphs Instead of Tables to Improve the Presentation of Empirical Results in Political Science." Society for Political Methodology Working Paper.

Keohane, Robert O. and Joseph S. Nye. 1977. *Power and Interdependence: World Politics in Transition.* Boston: Little, Brown.

Keshk, O., B. Pollins and R. Reuveny. 2004. "Trade Still Follows the Flag: The Primacy of Politics in a Simultaneous Model of Interdependence and Armed Conflict." *Journal of Politics* 66: 1155 - 1179.

Kim, Hyung Min and David L. Rousseau. 2005. "The Classical Liberals Were Half Right (or Half Wrong): New Tests of the Liberal Peace, 1960-88." *Journal of Peace Research* 42(5): 523-543.

King, Gary and Langche Zeng. 2001a. "Explaining Rare Events in International Relations." *International Organization* 55(3): 693-715.

King, Gary and Langche Zeng. 2001b. "Logistic Regression in Rare Events Data." *Political Analysis* 9(2): 137–163.

King, Gary, Michael Tomz, and Jason Wittenberg. 2000. "Making the Most of Statistical Analyses: Improving Interpretation and Presentation." *American Journal of Political Science* 44(2): 341-355.

King, Gary, Michael Tomz, and Jason Wittenberg. 2003. *CLARIFY: Software for Interpreting and Presenting Statistical Results*. Version: 2.1.

Kinsella, David. 2003. "Changing Structure of the Arms Trade: A Social Network Analysis." Presented at the Annual Meeting of the American Political Science Association, 2003, Philadelphia, PA.

Kinsella, David. 2004. "Mapping the Small Arms Trade: Insights from Social Network Analysis." Presented at the Annual Meeting of the International Studies Association, 2004, Montréal, Canada.

Kinsella, David. 2006. "The Black Market in Small Arms: Examining a Social Network." *Contemporary Security Policy* 27(1): 100-117.

Kirby, Andrew M. and Michael D. Ward. 1987. "The Spatial Analysis of Peace and War." *Comparative Political Studies* 20: 293-313.

Kissinger, Henry. 1964. *Diplomacy.* New York: Simon & Schuster.

Kline, Rex B. 1998. *Principles and Practice of Structural Equation Modeling*. 1st Edition. New York: Guilford Press.

Kline, Rex B. 2005. *Principles and Practice of Structural Equation Modeling*. 2nd Edition. New York: Guilford Press.

Knoke, D. and R. S. Burt. 1983. "Prominence." In *Applied Network Analysis: A Methodological Introduction*, eds. R.S. Burt and M.J. Miner. Beverly Hills, CA: Sage, 195-222.

Knoke, David and Edward O. Laumann. 1982. "The Social Organization of National Policy Domains: An Exploration of Some Structural Hypotheses." In *Social Structure and Network Analysis*, eds. Peter V. Marsden and Nan Lin. Beverly Hills, Calif.: Sage.

Knoke, David and James H. Kuklinski. 1982. *Network Analysis*. Beverly Hills, CA: Sage Publications.

Knorr, Klaus. 1975. *The Power of Nations: The Political Economy of International Relations.* New York: Basic Books.

Krackhardt, David. 1990. "Assessing the Political Landscape: Structure, Cognition, and Power in Organizations." *Administrative Science Quarterly* 35(2): 342-369.

Krackhardt, David. 1994. "Graph Theoretical Dimensions of Informal Organizations. In *Computational Organization Theory*, ed. K.M. Carley and M.J. Prietula. Hillsdale, NJ: Lawrence Erlbaum Associates.

Krause, Keith. 1991. "Military Statecraft: Power and Influence in Soviet and American Arms Transfer Relationships." *International Studies Quarterly* 35(3): 313-336

Kugler, Jacek and Douglas Lemke. 1996. *Parity and War: Evaluations and Extensions of the War Ledger*. Ann Arbor: University of Michigan

Lam, San Ling. 1990. "Economic Sanctions and the Success of Foreign Policy Goals: A Critical Evaluation." *Japan and the World Economy* 2(3): 239-248.

Landes, William M. 1978. "An Economic Study of U.S. Aircraft Hijackings, 1961–1976." *Journal of Law and Economics* 21(1): 1–31.

Lasswell, Harold Dwight and Abraham Kaplan. 1950. *Power and Society: A Framework for Political Inquiry.* New Haven: Yale University Press.

Lektzian, David and Mark Souva. 2003. "The Economic Peace between Democracies: Economic Sanctions and Domestic Institutions." *Journal of Peace Research* 40(6): 641-660.

Lemke, Douglas and William Reed. 2001a. "The Relevance of Politically Relevant Dyads." *Journal of Conflict Resolution* 45(1): 126-144.

Lemke, Douglas and William Reed. 2001b. "War and Rivalry among Great Powers." *American Journal of Political Science* 45(2): 457-469.

Lemke, Douglas. 2002. *Regions of War and Peace*. Cambridge, New York: Cambridge University Press.

Leng, Russell J. and J. David Singer. 1988. "Militarized Interstate Crises: The BCOW Typology and Its Applications." *International Studies Quarterly* 32(2): 155-173.

Levy, Jack S. 1981. "Alliance Formation and War Behavior: An Analysis of the Great Powers, 1495–1975." *Journal of Conflict Resolution* 25(4): 581-613.

Levy, Jack S. 1985. "Theories of General War. *World Politics* 37(3): 344-374.

Leyton-Brown, David. 1987. *The Utility of International Economic Sanctions.* London: Croom Helm.

Li, Quan and Drew Schaub. 2004. "Economic Globalization and Transnational Terrorist Incidents: A Pooled Times Series Cross Section Analysis." *Journal of Conflict Resolution* 48(2): 230-258.

Liang, Kung-Yee and Scott L. Zeger. 1986. "Longitudinal Data Analysis Using Generalized Linear Models." *Biometrika* 73(1): 13-22.

Lincoln, James R. and Jon Miller. 1979. "Work and Friendship Ties in Organizations: A Comparative Analysis of Relation Networks." *Administrative Science Quarterly* 24(2): 181-199.

Lindsay, James M. 1986. "Trade Sanctions as Policy Instruments: A Re-examination." *International Studies Quarterly* 30(2): 153-73.

Lohse, G. L. 1993. "A Cognitive Model for Understanding Graphical Perception." *Human-Computer Interaction* 8: 353-388

Long, J. Scott and Jeremy Freese. 2001. *Regression Models for Categorical Dependent Variables Using Stata.* College Station: Stata Press.

Long, J. Scott. 1997. *Regression Models for Categorical and Limited Dependent Variables.* Thousand Oaks: Sage Publications.

Long, J. Scott and Jeremy Freese. 2005. *Regression Models for Categorical Dependent Variables Using Stata*. 2nd Edition. College Station, TX: Stata Press.

Losman, Donald L. 1979. *International Economic Sanctions: the Cases of Cuba, Israel, and Rhodesia.* Albuquerque: University of New Mexico Press.

Lucier, C. 1974. "Power and the Balance." Ph. D. diss. University of Rochester.

Mackinder, Halford John, Sir. 1919. *Democratic Ideals and Reality: A Study in the Politics of Reconstruction.* London: Constable and Company, ltd.

Mahan, A T. 1893. *The Influence of Sea Power Upon History, 1660–1783*. 4th Edition. Boston: Little, Brown.

Malloy, Michael P. 1990. *Economic Sanctions and U.S. Trade*. Boston: Little, Brown.

Maniruzzaman, Talukder. 1992. "Arms Transfers, Military Coups, and Military Rule in Developing States." *Journal of Conflict Resolution* 36(4): 733-755.

Mansbach, Richard W. and John A. Vasquez. 1981 In *Search of Theory: A New Paradigm for Global Politics*. New York: Columbia University Press.

Mansfield, Edward D. 1994. *Power, Trade, and War*. Princeton, NJ: Princeton University Press.

Mansfield, Edward D. 1995. "International Institutions and Economic Sanctions." *World Politics* 47(4): 575-605.

Mansfield, Edward D. and Brian M. Pollins, eds. 2003. *Economic Interdependence and International Conflict: New Perspectives on an Enduring Debate*. Ann Arbor: University of Michigan Press.

Mansfield, Edward D. and Brian M. Pollins. 2001. "The Study of Interdependence and Conflict: Recent Advances, Open Questions, and New Directions for Future Research." *Journal of Conflict Resolution* 45(6): 834-859.

Maoz, Zeev and Bruce M. Russett. 1993. "Normative and Structural Causes of Democratic Peace, 1946-1986." *The American Political Science Review* 87(3): 624-638.

Maoz, Zeev and Nasrin Abdolali. 1989. "Regime Type and International Conflict." *Journal of Conflict Resolution* 33(1): 3-35.

Maoz, Zeev. 1996. *Domestic Sources of Global Change.* Ann Arbor: University of Michigan Press.

Maoz, Zeev. 2001a. "Democratic Networks: Connecting National, Dyadic, and Systemic Levels of Analysis in the Study of Democracy and War." In *War in a Changing World*, eds. Zeev Maoz and Azar Gat. Ann Arbor, MI: University of Michigan Press, 143-182.

Maoz, Zeev. 2001b. Dyadic Militarized Interstate Disputes Data Set. Version 1.1. <http://spirit.tau.ac.il/poli/faculty/maoz/dyadmid.html>.

Maoz, Zeev. 2006a. "Systemic Polarization, Interdependence, and International Conflict, 1816-2002." *Journal of Peace Research* 43(4): 391-411.

Maoz. Zeev. 2006b. "Untangling the Level of Analysis Puzzle of the Democratic Peace: A Social Network Analysis." Unpublished Manuscript.

Maoz, Zeev., Lesley G. Terris, Ranan D. Kuperman, and Ilan Talmud. 2005. "International Networks and International Politics." In New Directions for International Relations, eds. Alex Mintz and Bruce Russett. Lanham, MD: Lexington Press, 35-64.

Maoz, Zeev., Lesley G. Terris, Ranan D. Kuperman, and Ilan Talmud. 2006. "Structural Equivalence and International Conflict, 1816–2001. A Network Analysis of Affinities and Conflict." *Journal of Conflict Resolution* 50(5): 664-689.

Marinov, Nikolay. 2005. "Do Economic Sanctions Destabilize Country Leaders?" *American Journal of Political Science* 49(4): 241-265.

Marsden, Peter V. 1982. "Brokerage Behavior in Restricted Exchange Networks." In *Social Structure in Network Analysis*, eds. Peter Marsden and Min Lin. Beverly Hills, CA: Sage Publications, 201-219.

Martin, Lisa L. 1992. "Institutions and Cooperation: Sanctions during the Falkland Islands Conflict." *International Security* 16(4): 143-178.

McClelland, Charles A. 1966. *Theory and the International System.* New York: Macmillan.

McMahon, Mary E. "Higher Education in a World Market: An Historical Look at the Global Context of International Study." *Higher Education* 24(2): 465-482.

McMillan, Susan M. 1997. "Interdependence and Conflict." *Mershon International Studies Review* 41(1): 33-58.

Meyer, Joachim, Marcia Meyer, Kuskin Shamo, and Daniel Gopher. 1999. "Information Structure and the Relative Efficacy of Tables and Graphs." *Human Factors* 41(4): 570-587.

Meyer, Joachim, David Shinar, and David Leiser. 1997. "Multiple Factors that Determine Performance with Tables and Graphs." *Human Factors* 39(2): 268-286.

Midlarsky, Manus I. 1988. *The Onset of World War*. Boston: Unwin Hyman.

Miers, Anne C. and T. Clifton Morgan. 2002. "Multilateral Sanctions and Foreign Policy Success: Can Too Many Cooks Spoil the Broth?" *International Interactions* 28(2): 117-136..

Mintz, Beth and Michael Schwartz. 1981. "Interlocking Directorates and Interest Group Formation." *American Sociological Review* 46(6): 851-869.

Mitchell, J. C. 1969. "The Concept and Use of Social Networks." In *Social Networks in Urban Situations*, ed. J.C. Mitchell. Manchester: Manchester University Press, 1-50.

Modelski, George and William R. Thompson. 1987. "Testing Cobweb Models of the Long Cycle." In *Exploring Long Cycles*, ed. George Modelski. Boulder, CO: Lynn Rienner, 85-111.

Modelski, George and William R. Thompson. 1988. *Seapower in Global Politics, 1494-1993*. Seattle, WA: University of Washington Press.

Morgan, Cliff, Navin Bapat, and Valentin Krustev. 2006. Threat and Imposition of Sanctions (TIES). Version 3.5. <http://www.personal.psu.edu/nab12/sanctionspage.htm>.

Morgan, T. Clifton and Valerie L. Schwebach. 1992. "Take Two Democracies and Call Me in the Morning: A Prescription for Peace?" *International Interactions* 19(4): 305-320.

Morgan, T. Clifton and Valerie L. Schwebach. 1997. "Fools Suffer Gladly: The Use of Economic Sanctions in International Crises." *International Studies Quarterly* 41(1): 27-50.

Morgenstern, Oskar, Kauss Knorr and Klaus Heiss. 1973. *Long Term Projections of Political and Military Power*. Cambridge, MA: Ballinger.

Morgenthau, Hans Joachim and Kenneth W. Thompson. 1985. *Politics among Nations: the Struggle for Power and Peace*. 6th Edition. New York: McGraw-Hill.

Morgenthau, Hans Joachim. 1948. *Politics among Nations: the Struggle for Power and Peace*. New York: A. A. Knopf.

Morgenthau, Hans Joachim. 1962. *Politics in the Twentieth Century*. Chicago: University of Chicago Press.

Most, Benjamin A. and Harvey Starr. 1989. *Inquiry, Logic, and International Politics*. Columbia, S.C.: University of South Carolina Press.

Moul, William B. 1988. "Great Power Nondefense Alliances and the Escalation to War of Conflicts Between Unequals, 1815–1939." *International Interactions* 15(1): 25–43.

Mullins, Nicholas C., Lowell L Hargens, Pamela K. Hecht and Edward L. Kick. 1977. "The Group Structure of Cocitation Clusters: A Comparative Study." *American Sociological Review* 42(4): 552-562

Nemeth, Roger and David A. Smith. 1985. "International Trade and World-System Structure: A Multiple Network Analysis." *Review* 8(4): 517-560.

Niou, Emerson and Peter C. Ordeshook. 1990. "Stability in Anarchic International Systems." *American Political Science Review* 84(4): 1207-1234.

Niou, Emerson, Peter C. Ordeshook, and Gregory F. Rose. 1989. *The Balance of Power: Stability in International Systems.* New York, NY: Cambridge University Press.

Nobel Foundation. 2006. Conflict Map <http://nobelprize.org/educational_games/peace/conflictmap/>.

Nogee, Joseph L. 1975. "Polarity: An Ambiguous Concept." *Orbis* 18: 1193-1225.

Nooruddin, Irfan. 2002. "Modeling Selection Bias in Studies of Sanctions Efficacy." *International Interactions* 28(1): 59-75.

O'Loughlin, J., M. D. Ward, C. Lofdahl, D. Cohen, D. Reilly, K. S. Gleditsch and M. Shin. 1998. "The Spatial and Temporal Diffusion of Democracy, 1946-1994." *Annals of the Association American Geographers* 88(4): 545-574.

OECD. Various Years. *International Development Statistics: Geographical Distribution of Financial Flows to Aid Recipients*. Organization for Economic Co-operation and Development.

Oneal, John R. 2003. "Measuring Interdependence and Its Pacific Benefits: A Response to Gartzke & Li." *Journal of Peace Research* 40(6): 721-725.

Oneal, John R. and Bruce M. Russett. 1997. "The Classical Liberals Were Right: Democracy, Interdependence, and Conflict, 1950–1985." *International Studies Quarterly* 41(2): 267-293.

Oneal, John R. and Bruce M. Russett. 1999. "The Kantian Peace: The Pacific Benefits of Democracy, Interdependence, and International Organizations, 1885–1992." *World Politics* 52(1): 1-37.

Oneal, John R. and Bruce M. Russett. 2001. "Clear and Clean: The Fixed Effects of the Liberal Peace." *International Organization* 55(2): 469-485.

Oneal, John R., Bruce M. Russett and Michael L. Berbaum. 2003. "Causes of Peace: Democracy, Interdependence, and International Organizations, 1886–1992." *International Studies Quarterly* 47(3): 371-394.

Oppenheim, Felix E. 1981. *Political Concepts: A Reconstruction.* Chicago: University of Chicago Press.

Ord, J. K. and A. Getis. 1995. "Local Spatial Autocorrelation Statistics: Distributional Issues and an Application." *Geographical Analysis* 27(4): 286-306.

Organski, A. F. K. 1958. *World Politics*. New York: Knopf.

Organski, A. F. K. 1968. *World Politics*. 2nd Edition. New York: Knopf.

Organski, A. F. K. and Jacek Kugler. 1980. *The War Ledger*. Chicago: University of Chicago Press.

Ostrom, Charles W., and Francis W. Hoole. 1978. "Alliances and Wars Revisited: A Research Note." *International Studies Quarterly* 22(2): 215–36.

Pape, Robert A. 1997. "Why Economic Sanctions Do Not Work." *International Security* 22(2): 90-136.

Pape, Robert A. 1998. "Why Economic Sanctions Still Do Not Work." *International Security* 23(1): 66-77.

Peceny, Mark, Caroline C. Beer and Shannon Sanchez-Terry. 2002. “Dictatorial Peace?” *The American Political Science Review* 96(1): 15-26.

Pevehouse, Jon C. 2004. “Interdependence Theory and the Measurement of International Conflict” *Journal of Politics* 66(1): 247-266.

Powell, Robert. 1994. “Anarchy in International Relations Theory: The Neorealist- Neoliberal Debate.” *International Organization* 48(2): 313-344.

Pruitt, Dean G. 1964. “National Power and International Responsiveness.” *Background* 7(4): 165-178.

Puhani, Patrick A. 2000. “The Heckman Correction for Sample Selection and Its Critique? A Short Survey.” *Journal of Economic Surveys* 41(1): 53-68.

Quackenbush, Stephen L. 2006. "Identifying Opportunity for Conflict: Politically Active Dyads." *Conflict Management and Peace Science* 23(1): 37-51.

Raftery, A. E. 1996. “Bayesian Model Selection in Social Research.” In *Sociological Methodology*, ed. P. V. Marsden. Oxford: Basil Blackwell, 111-163.

Rapkin, David P., William R. Thompson, and Jon A. Christopherson. 1979. “Bipolarity and Bipolarization in the Cold War Era: Conceptualization, Measurement, and Validation.” *Journal of Conflict Resolution* 23(2): 261-295.

Rasler, Karen and William R. Thompson. 2001. “Rivalries and the Democratic Peace in the Major Power Subsystem.” *Journal of Peace Research* 38(6): 659-683.

Ray, James Lee and J. David Singer. 1973. “Measuring the Concentration of Power in the International System.” *Sociological Methods and Research* 1(4): 403-437.

Reed, William and David H. Clark. 2000. “War Initiators and War Winners: The Consequences of Linking Theories of Democratic War Success.” *Journal of Conflict Resolution* 44(3): 378-395.

Reed, William. 2000. “A Unified Statistical Model of Conflict Onset and Escalation.” *American Journal of Political Science* 44: 84-93.

Regan, Patrick M. 1995. “U. S. Economic Aid and Political Repression: An Empirical Evaluation of U. S. Foreign Policy.” *Political Research Quarterly* 48(3): 613-628.

Remus, William. 1984. “An Empirical Investigation of the Impact of Graphical and Tabular Data Presentations on Decision Making.” *Management Science* 30(5): 533-542.

Reuveny, Rafael. 2000. “The Trade and Conflict Debate: A Survey of Theory, Evidence and Future Research.” *Peace Economics, Peace Science and Public Policy* 6(1): 23-49.

Richardson, Lewis Fry. 1960. *Arms and Insecurity: A Mathematical Study of the Causes and Origins of War.* Pittsburgh: Boxwood Press.

Robinson, P. 1991. “Globalization, Telecommunications and Trade.” *Futures* 23(8): 801-814.

Roeder, Philip G. 1985. “The Ties that Bind: Aid, Trade, and Political Compliance in Soviet-Third World Relations.” *International Studies Quarterly* 29(2): 191-216.

Rogers, Everett M. and Rekha Agarwala Rogers. 1976. *Communication in Organizations*. New York: Free Press.

Rousseau, David L. 2005. *Democracy and War: Institutions, Norms, and the Evolution of International Conflict*. Stanford, CA: Stanford University Press.

Rousseau, David L., Christopher Gelpi, Dan Reiter and Paul K. Huth. 1996. "Assessing the Dyadic Nature of the Democratic Peace, 1918-88." *American Political Science Review* 90(3): 512-533.

Rousseau, David L. and Hyung Min Kim. 2005. "The Reciprocal Relationship Between Military Conflict and Political Development." Presented at the Annual Meeting of the American Political Science Association, 2005, Washington, DC.

Russett, Bruce M. 1968. *The Yale Political Data Program: Program, Experience, and Prospects*. New Haven, Conn.: Yale University, Political Science Research Library.

Russett, Bruce M. and John R. Oneal. 2001. *Triangulating Peace: Democracy, Interdependence, and International Organizations*. New York, NY: Norton.

Russett, Bruce M., John R. Oneal and David R. Davis. 1998. "The Third Leg of the Kantian Tripod for Peace: International Organizations and Militarized Disputes, 1950–1985." *International Organization* 52(3): 441-467.

Sacko, David H. 2004. "Hegemonic Governance and the Process of Conflict." Ph.D. diss. Pennsylvania State University.

Sandler, Todd, John T. Tschirhart and Jon Cauley. 1983. "A Theoretical Analysis of Transnational Terrorism." *American Political Science Review* 77(1): 36-54.

Sandoval-Bustos, Rosa Eugenia. 2004. "Economic Sanctions and Interdependence." Presented at the Annual Meeting of the Midwest Political Science Association, 2004, Chicago, Illinois.

Sanjian, Gregory S. 1999. "Promoting Stability or Instability? Arms Transfers and Regional Rivalries, 1950–1991." *International Studies Quarterly* 43(4): 641-670.

Schmidt, Carman. 2005. "Japan's Circle of Power: Legitimacy and Integration of a National Elite." *ASIEN* 96: 46-67

Schneider, Gerald, Katherine Barbieri, and Nils Petter Gleditsch, eds. 2003. *Globalization and Armed Conflict*. Lanham, MD: Rowman & Littlefield.

Schroeder, Paul W. 1976. "Alliances, 1815-1945: Weapons of Power and Tools of Management." In *Historical Dimensions of National Security Problems*, ed. Klaus Knorr. Lawrence: University of Kansas Press, 227-262.

Schultz, Kenneth A. 1999. "Do Democratic Institutions Constrain or Inform? Contrasting Two Institutional Perspectives on Democracy and War." *International Organization* 53(2): 233-266.

Schultz, Kenneth A. 2001. *Democracy and Coercive Diplomacy*. Cambridge; New York: Cambridge University Press.

Scott, John. 2000. *Social Network Analysis: A Handbook*. 2nd Edition. London; Thousands Oaks, Calif.: SAGE Publications.

Shaw, M. E. 1954. "Group Structure and the Behavior of Individuals in Small Groups." *Journal of Psychology* 38: 139-149.

Sherman, Frank. 1994. "SHERFACS: A Cross-Paradigm, Hierarchical and Contextually Sensitive Conflict Management Data Set." *International Interactions* 20(1-2): 79-100.

Shimbel, A. 1953. "Structural Parameters of Communication Networks." *Bulletin of Mathematical Biophysics* 15: 501-507.

Singer, J. David and Melvin Small. 1968. "Alliance Aggregation and the Onset of War, 1815-1945." In *Quantitative International Politics*, ed. J. David Singer. New York: Free Press, 247-286.

Singer, J. David and Melvin Small. 1991. *Diplomatic Exchange Data, 1815-1970*. [computer file]. (Study # 5026). ICPSR version. Ann Arbor, MI: University of Michigan, Mental Health Research Institute, Correlates of War Project [producer], 1991. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 1991.

Singer, J. David and Melvin Small. 1991. *Diplomatic Missions Received by Each International System Member, 1817-1970*. [computer file]. (Study #5025). ICPSR version. Ann Arbor, MI: University of Michigan, Mental Health Research Institute, Correlates of War Project [producer], 1991. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 1991.

Singer, J. David, Stuart Bremer, and John Stuckey. 1972. "Capability Distribution, Uncertainty, and Major Power War, 1820-1965." In *Peace, War, and Numbers*, ed. Bruce Russett. Beverly Hills: Sage Publications, 19-48.

Singer, J. David. 1987. "Reconstructing the Correlates of War Dataset on Material Capabilities of States, 1816-1985." *International Interactions* 14: 115-132.

Singer, J. Davis and Melvin Small. 1966. "The Composition and Status Ordering of the International System: 1815-1940." *World Politics* 18(2): 236-282.

SIPRI. Conflict Data Sets <http://www.sipri.org/contents/conflict/conflictdatasets.html>.

SIPRI. Various Years. *The Arms Transfers Database*. Stockholm International Peace Research Institute. <http://www.sipri.org/contents/armstrad/at_data.html>.

Small, Melvin and J. David Singer. 1973. "The Diplomatic Importance of States, 1816-1970: An Extension and Refinement of the Indicator." *World Politics* 25(4): 577-599.

Smith, Alistair. 1996. "The Success and Use of Economic Sanctions." *International Interactions* 21(3): 229-245.

Smith, David A. and Douglas R. White. 1992. "Structure and Dynamics of the Global Economy: Network Analysis of International Trade 1965-1980." *Social Forces* 70(4): 857-893.

Smith, David A. and Roger J. Nemeth. 1988. "An Empirical Analysis of Commodity Exchange in the International Economy: 1965-80." *International Studies Quarterly* 32(2): 227-240.

Snijder, T. A. B. 1981. "The Degree Variance: An Index of Graph Heterogeneity." *Social Networks* 3(3): 163–174.

Snyder, David A. and Edward L. Kick. 1979. “Structural Position in the World System and Economic Growth, 1955-1970: A Multiple-Network Analysis of Transnational Interactions.” *American Journal of Sociology* 84(5): 1096-1126.

Snyder, Glenn H. and Paul Diesing. 1977. *Conflict among Nations: Bargaining, Decision Making, and System Structure in International Crises*. Princeton, N.J.: Princeton University Press.

Souva, Mark. 2005. “Foreign Policy Determinants: Comparing Realist and Domestic-Political Models of Foreign Policy.” *Conflict Management and Peace Science* 22(2): 149-163.

Sparrowe, Ted T. Reymond and Robert C. Liden. 2005. “Two Routes to Influence: Integrating Leader-Member Exchange and Network Perspectives.” *Administrative Science Quarterly* 50(4): 505-535.

Sprout, Harold Hance and Margaret Sprout. 1962. *Foundations of International Politics.* Princeton, N.J.: Van Nostrand.

Sprout, Harold Hance and Margaret Sprout. 1965. *The Ecological Perspective on Human Affairs, with Special Reference to International Politics.* Princeton, N.J.: the Princeton Center of International Studies by Princeton University Press.

Spykman, Nicolas J. 1944. *The Geography of the Peace*. New York: Harcourt, Brace and Company.

Starr, Harvey and Benjamin A. Most. 1976. “The Substance and Study of Borders in International Relations Research.” *International Studies Quarterly* 20(4): 581-620.

Steiber, Steven R. 1979. “The World System and World Trade: An Empirical Exploration of Conceptual Conflicts.” *Sociological Quarterly* 20(1): 23-36.

Stephenson, K. and M. Zelen. 1989. “Rethinking Centrality: Method and Examples.” *Social Networks* 11: 1-37.

Stoll, Richard J. and Michael Champion. 1985. “Capability Concentration, Alliance Bonding, and Conflict among the Major Powers.” In *Polarity and War: The Changing Structure of International Conflict*, ed. A. N. Sabrosky. Boulder, CO: Westview.

Stoll, Richard J. and Michael D. Ward, eds. 1989. *Power in World Politics.* Boulder, Colorado: Lynne Rienner Publishers.

Stolzenberg, Ross M. and Daniel A. Relles. 1997. “Tools for Intuition about Sample Selection Bias and Its Correction.” *American Sociological Review* 62(3): 494-507.

Sullivan, D. G. 1963. “Towards an Inventory of Major Propositions Contained in Contemporary Textbooks in International Relations.” Ph.D. diss. Northwestern University.

Sutton, F. X. 1993. “The World in 1990s.” In *International Investment in Human Capital: Overseas Education for Development*, ed. C. D. Goodwin. New York: Institute of International Education.

Sweeney, Kevin J. 2003a. “A Dyadic Theory of Conflict: Power and Interests in World Politics.” Ph.D. diss. Ohio State University.

Sweeney, Kevin J. 2003b. “The Severity of Interstate Disputes: Are Dyadic Capability Preponderances Really More Pacific?” *Journal of Conflict Resolution* 47(6): 728-750.

Sweeney, Kevin J. 2004. Implementing and Interpreting Sample Selection Models. <http://psweb.sbs.ohio- state.edu/prl/Selection%20Models.pdf>.

Taber, Charles S. 1989. "Power Capability Indexes in the Third World." In *Power in World Politics*, eds. Richard J. Stoll and Michael D. Ward. Boulder, Colorado: Lynne Rienner Publishers.

Tanaka, J. S. 1993. "Multifaceted Conceptions of Fit in Structural Equation Models." In *Testing Structural Equation Models*, eds. Kenneth A Bollen and J. Scott Long. Newbury Park: Sage Publications, 10–39.

Tellis, Ashey J., Janice Bially, Christopher Layne, and Melissa McPherson. 2000. *Measuring National Power in the Postindustrial Age*. Santa Monica, CA: RAND.

Thompson, William R. 1983. "Uneven Economic Growth, Systemic Challenges, and Global Wars." *International Studies Quarterly* 27(3): 341-355.

Tsebelis, George. 1990. "Are Sanctions Effective?: A Game-Theoretic Analysis." *Journal of Conflict Resolution* 34(1): 3-28.

Tufte, Edward R. 1983. *The Visual Display of Quantitative Information*. Cheshire, CT: Graphics Press.

UNESCO. Various Years. *UNESCO Statistical Yearbook*. United Nations Educational, Scientific, and Cultural Organization.

Van Bergeijk, Peter A.G. 1989. "Success and Failure of Economic Sanctions." *Kyklos* 42(3): 385-404.

Vanhanen, Tatu. 2000. "A New Dataset for Measuring Democracy, 1810-1998." *Journal of Peace Research* 37(2): 251-265.

Vasquez, John A. 1993. *The War Puzzle*. Cambridge, New York: Cambridge University Press.

Vella, Francis and Marno Verbeek. 1999. "Two-Step Estimation of Panel Data Models with Censored Endogenous Variables and Selection Bias." *Journal of Econometrics* 90: 239-263.

Vella, Francis. 1992. "Simple Tests for Sample Selection Bias in Censored and Discrete Choice Models." Journal of Applied Econometrics 7(4): 413-421.

ViewConflicts. 2006. Geographic Visualization of Armed Conflicts <http://www.svt.ntnu.no/geo/forskning/konflikt/viewConflicts/>.

Von Amerongen, Otto Wolff. 1980. "Economic Sanctions as a Foreign Policy Tool?" *International Security* 5(2): 159-67.

Wagner, R. Harrison. 1986. "The Theory of Games and the Balance of Power." *World Politics* 38(4): 546-576.

Wallace, Michael D. 1973. "Alliance Polarization, Cross-Cutting, and International War, 1815-1964: A Measurement Procedure and Some Preliminary Evidence." *Journal of Conflict Resolution* 17(4): 575-604.

Wallensteen, Peter. 1981. "Incompatability, Confrontation, and War: Four Models and Three Historical Systems, 1816-1976." *Journal of Peace Research* 18(1): 57-90.

Wallerstein, Immanuel Maurice. 1974. *The Modern World-System*. New York: Academic Press.

Wallerstein, Immanuel Maurice. 1979. *The Capitalist World-Economy: Essays*. Cambridge; New York: Cambridge University Press.

Wallerstein, Immanuel Maurice. 1983. "Three Instances of Hegemony in the History of the Capitalist-World Economy." *International Journal of Comparative Sociology* 24: 100-108.

Waltz, Kenneth Neal. 2003. "Evaluating Theories." *Realism and the Balancing of Power: A New Debate,* eds. John A. Vasquez and Colin Elman. Upper Saddle River, N.J.: Prentice Hall, 49-57.

Waltz, Kenneth Neal. 1979. *Theory of International Politics*. New York: Random House.

Ward, Michael D. and Kristian Skrede Gleditsch. 2002. "Location, Location, Location: An MCMC Approach to Modeling the Spatial Context of War and Peace." *Political Analysis* 10(3): 244-260.

Wasserman, Stanley and Katherine Faust. 1994. *Social Network Analysis: Methods and Applications*. Cambridge; New York: Cambridge University Press.

Wayman, Frank Whelon, J. David Singer, and Gary Goertz. 1983. "Capabilities, Allocations, and Success in Militarized Disputes and Wars, 1816-1976." *International Studies Quarterly* 27(4): 497-515.

Wayman, Frank Whelon and T. Clifton Morgan. 1990. "Measuring Polarity in the International System." In *Measuring the Correlates of War*, eds. J. D. Singer and P. F. Diehl. Ann Arbor: University of Michigan Press.

Wayman, Frank Whelon. 1984. "Bipolarity and War: The Role of Capability Concentration and Alliance Patterns among Major Powers, 1816-1965." *Journal of Peace Research* 21(1): 61-78.

Weede, Erich. 1976. "Overwhelming Preponderance as a Pacifying Condition among Contiguous Asian Dyads, 1950–1969." *Journal of Conflict Resolution* 20(3): 395-411.

Wellman, B. 1988. "Structural Analysis: From Method and Metaphor to Theory and Substance." In *Social Structures: A Network Approach*, eds. B. Wellman and S. D. Berkowitz. Cambridge, England: Cambridge University Press, 81-107.

Winship, Christopher and Robert D. Mare. 1992. "Models for Sample Selection Bias." *Annual Review of Sociology* 18: 327-350.

Wohlforth, William C. 1999. "The Stability of a Unipolar World." *International Security* 24(1): 5-41.

Wolfers, Arnold. 1962. *Discord and Collaboration; Essays on International Politics*. Baltimore: Johns Hopkins Press.

Wright, Quincy. 1965. *A Study of War*. 2nd Edition. Chicago: University of Chicago Press.