International Trade and Political Conflict/Cooperation:

Simultaneous Equations Models and Empirical Tests

by

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ABSTRACT

The relationship between bilateral trade and political conflict/cooperation is highly debated in the international political economy literature as to whether political relations drive trade flows or trade flows drive political relations. Even among those who advocate that trade flows drive political relations, some state that trade causes bilateral cooperation, others argue that it causes bilateral conflict, and a third group claims that trade may cause either bilateral conflict or cooperation.

This dissertation investigates the causality between each of 10 categories of disaggregated bilateral trade as well as total trade, and conflict/cooperation in 16 dyads for the time period from the early 1960s to the early 1990s. The evidence shows that Granger causality runs both ways. The dissertation then develops a micro-founded simultaneous equations model of bilateral trade and conflict/cooperation. Consumers and producers are assumed to distinguish between products, among other factors, according to bilateral relations, and governments are assumed to choose conflict/cooperation according to a tit for tat strategy while taking bilateral trade into account.

Both economic and political data are used in the empirical tests of the model. Political relations data are based on splicing the two events data sets of COPDAB and WEIS which are widely used in the literature. Trade and other economic data are from the United Nations, the International Monetary Fund, and the European Commission for total trade and five categories of disaggregated goods. All trading pairs formed among the U.S., China, the (former) Soviet Union, Japan, and (West) Germany are investigated separately on each dyad and for each good as well as for total trade.

The results demonstrate that bilateral political relations and international trade are indeed highly interdependent. Bilateral cooperation causes a rise in bilateral trade demand and supply volumes. No specific directions are found, however, for the effects of cooperation on bilateral trade values or those of bilateral trade on political relations. From trade flows for specific goods, the volumes of trade in high technology goods and fuels are found to increase with cooperation. A rise in the volume or price of these goods generally causes conflict sent from the importer to the exporter.

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CHAPTER 1: INTRODUCTION

International trade requires a peaceful environment. Yet, political conflicts among nations are pervasive. Recently, trade has been increasingly used as a foreign policy tool. Some countries encounter frequent disputes on trade and others face occasional impositions of trade sanctions. Yet, pure economic models attempt to explain international trade ignoring altogether bilateral political conflict/cooperation (CC). In this literature, conflicts are viewed as irrational or anomalous, and therefore, not worthy of formal analysis as criticized by Bergeijk (1994:chapter 5). While trade among countries tends to have inertia and often takes place regardless of nations' political rivalry, the effect of political variables on trade patterns is at times large and crucial, especially as exports and imports become increasingly important for every country. The political science literature has been more attentive to the relationship between international trade and CC.

For countries in peace, politics affects bilateral trade (BT) through protectionism and political pressure groups. For countries in a hostile environment, politics sometimes stops trade, though even very hostile countries sometimes continue to have economic relations. For example, hostile trading pairs or dyads, such as United States-(former) Soviet Union, United States-China, India-Pakistan, and Greece-Turkey, continue to trade, albeit on a different scale and using different types of goods.

The interaction between international political and economic variables has been a major topic for classical economists (e.g., Smith, 1776; Ricardo, 1817; Mill, 1840), Marxists (e.g., Lenin, 1916; Kondratieff, 1935), Keynesians (e.g., Keynes, 1919, 1936; and numerous others), and political economists (e.g., Hobson, 1902; Hirschman, 1945; Schumpeter, 1954; Tinbergen, 1962; Kindleberger, 1970). In a few studies that employ trade gravity model which includes political variables, as in Aitken (1973), Sapir (1981), and Brada and Mendez

(1985), trade is assumed to depend on bilateral politics.[1]

The idea that free trade is a fundamental cause of peace originates in the nineteenth century. David Hume believed that "free trade is the vital principle by which the nations of the earth are to become united in one harmonious whole" (Burton, 1946: 521). Similarly, Smith (1776) and Ricardo (1817) stressed the link between trade, based on absolute or comparative advantage, and international harmony. Countries that engage in trade will be peaceful, according to Angell (1911), because trading partners do not want to face a potential reduction, due to a political conflict, of welfare gains from international trade. Montesquieu (1900:316) succinctly states that "peace is the natural effect of trade," because trade is motivated by national essentials and creates mutual gains to both partners.

There is also a literature that proposes that trade increases the level of political conflict. Lenin (1916) and Choucri and North (1975) are two such examples. The reason for conflict stems from the fact that trading nations compete over limited markets and scarce resources. Furthermore, trade may generate opportunities to exercise political power by potential foes, as exemplified by Hirschman (1945) for Nazi Germany.

The link between BT and CC is at the center of the recent international political economics literature. Since Polachek's (1978) seminal paper, the debate on the relationship between trade and conflict is mostly empirical. Researchers like Polachek (1978, 1980, 1992, 1995), Gasiorowski and Polachek (1982), Gasiorowski (1986), Sayrs (1988, 1989, 1990), Vries (1990), Pollins (1989a, 1989b), and Bergeijk (1994) pool data of many dyads and estimate models that include CC and BT.[2] While some studies use BT as the dependent variable, others instead use CC as the dependent variable. The choice of the dependent variable is, however, made arbitrarily, simply by assuming so.

The literature has well established that BT and CC are *related*. What has not been clearly established, however, is whether it is BT that diminishes or increases CC or is it CC that inhibits or encourages BT. Authors like Polachek (1980:65), Gasiorowski and Polachek (1982:721) and Pollins (1989a:751) repeatedly admit that causality has not been properly established in their models but rather assumed. Many researchers have expressed the need for a formal causality test between trade and CC. Sayrs (1990:19) summarizes well: "some important results have emerged but many issues remained unresolved. Perhaps most important are the causal linkages between trade and conflict."

Moreover, most of the studies on BT and CC have pooled trade and political data of many dyads so as to increase the sample size, implicitly assuming that the relationship between CC and trade is similar for all dyads. While some writers have criticized the use of such pooled data and called for individual dyadic studies, whether or not the relationship is indeed similar among dyads has not yet been fully investigated.[3]

Empirical studies of trade and CC have mostly dealt with the relationship between CC and total BT. While one study (Gasiorowski and Polachek, 1982) has partially dealt with sectoral trade, only one dyad was looked at and the authors warn that their results "remain primarily speculative" (1982:724). Perhaps the strongest statement for a need to study disaggregated trade is made by Polachek (1980), who hypothesizes, but without testing it, that trade in strategic commodities will diminish conflict more than other commodities. Polachek (1992:97) concedes that commodity by commodity trade flows are needed to study the relationship between BT and CC but such data are not readily available to him. Hence, the relationship between sectoral BT and CC is not yet established.

This study is based on the premise that the relationship between BT and political relations or CC depends on *both* economic and political variables. Specifically, our objective is to formally model and empirically investigate the relationship between BT and CC within a framework that allows for a two way causation. In such a model, BT and CC affect each other. Our model applies to all dyads. While in some dyads the association of BT and CC may be weak, we believe that pure economic trade models can not fully explain BT of dyads that experience fluctuations in bilateral relations. Moreover, since economies differ, the relationship between BT and CC may vary across economic sectors or traded goods and dyads. Hence, the practical importance of the BT and CC nexus is an empirical issue.[4]

By drawing from economics and political science, we develop a formal trade and CC simultaneous equation model (SEM), estimate the model, and interpret the results. The term, CC, is used throughout to denote that there is no unique measure of conflict and cooperation. As estimating this SEM requires hard-to-obtain BT price (index) data, we derive a SEM for which price data are not necessary, albeit with some loss of information.

1.1 Organization of the Dissertation

The dissertation is organized as follows. Chapter 2 reviews the literature. In chapter 3, we discuss the CC data. Chapter 4 investigates the causality between total BT and CC. In chapter 5, we investigate the causality between disaggregated BT and CC. In chapter 6, we develop a formal and micro founded BT and CC SEM. In chapter 7, we estimate the trade flow version of our SEM, using total trade values, and interpret the results. In chapter 8, we estimate the SEM from total trade volumes and interpret the results. In chapter 9, we estimate the SEM from disaggregated trade volumes and interpret the results. In the last chapter, we summarize our investigations, outline our contribution to the literature, and highlight possible avenues of future research. Detailed estimation results are presented in Appendices 1, 3, 4 and 5. The algebraic development of the model is presented in Appendix

2. The following discussion summarizes each chapter.

1.2 Summary of Findings

The literature is reviewed in chapter 2. We start by summarizing the realist and liberal paradigms of trade and discussing models of BT which do not include CC as a variable and models of CC which do include BT as a variable. The main body of this chapter reviews BT and CC theories and empirical studies along three competing arguments: BT brings peace, BT brings conflict; and politics is a determinant of BT. It is found that the direction of BT and CC causality is highly debated in the literature. Reviewing the small emprical literature on the link between disaggregated BT and CC, we find that while authors recognize that the BT and CC relationship may vary along goods, but the issue is mostly not investigated. We conclude chapter 2 by reviewing the literature on BT and CC causality. Researchers admit that the causality is not verified by their models. The possibility of BT and CC simultaneity is entertained but not investigated.

Chapter 3 deals with the measurement of CC. In this study, CC are measured from large data sets of daily international events. In particular, we use two such data sets: Conflict and Peace Data Bank (COPDAB) and World Events Interaction Survey (WEIS). We begin this chapter by reviewing studies on the highly debated compatibility of COPDAB and WEIS. The COPDAB data from 1948 to 1978 and the WEIS data since 1966 are most widely used in the literature. Whether or not the two series are compatible is debated in the literature. We investigate the compatibility between the two series by using several statistical tests and time series analysis. We find that COPDAB and WEIS are compatible and thus could be combined, through a splicing method, to generate long time series of CC.

In Chapter 4, Granger causality between total BT and CC is investigated. The hypotheses are that either BT causes CC, CC causes BT, BT and CC cause each other, or BT and CC are not related. To this end, Granger causality is formally tested. Trade data are from the International Monetary Fund (IMF). A total of 16 dyads are investigated individually by assuming that the direction and the strength of CC and BT causality may differ from one dyad to another. It is found that Granger causality between BT and CC, which is dyad dependent, is reciprocal.

In chapter 5, Granger causality between disaggregated BT and CC is investigated. Trade data are from the United Nations (UN). Ten Standard International Trade Classification (SITC) one-digit commodity groups are analyzed separately. Granger causality between BT and CC is found to be reciprocal, dyad dependent, but independent of the size of trade in particular commodities and of whether or not two countries are political rivals.

From the results of reciprocal causality in total and disaggregated BT, a model in which BT and CC are simultaneously determined is called for. A formal and micro founded BT and CC SEM is developed in chapter 6. The BT equations of the model are formulated for a multi-country system. The CC equations are formulated for a dyad which is a widely used unit of analysis in the quantitative literature on foreign policy interaction.

The empirical model to be estimated is derived under the assumption that BT and CC flows of a dyad can be analyzed separately from those of other dyads, or in partial equilibrium. This assumption is common in international economics, political science, and in the trade and conflict literature. The latter literature, however, does not estimate models in which BT and CC simultaneously determine each other. Similarly, the international economic literature on bilateral trade does not include bilateral relations as a continuous variable, and the quantitative political science literature on foreign policy interaction, with few exceptions which are disscused in chapter 2, does not include bilateral trade as a variable.

In the theoretical model, consumers and producers are assumed to differentiate among countries according to bilateral CC. Governments are assumed to choose bilateral CC according to a tit for tat strategy while taking BT into account. The optimization problems facing consumers and producers are solved to obtain demand and supply functions. The SEM from total trade volumes per dyad includes two demand equations, two supply equations, and two CC equations. The BT part of this SEM is solved analytically under certain simplifying partial equilibrium assumptions to obtain a model in which BT values are given by a dyadic trade gravity like equation.

The testable implications of the model are that the demand for import depends on bilateral prices, multilateral import expenditures, tariffs, exchange rate, and CC. The supply of export depends on bilateral prices, multilateral export expenditure, and CC. In particular, bilateral demand and supply are expected to increase with cooperation. The effect of cooperation (or conflict) on the value of BT is, however, theoretically ambiguous. Hence, empirically we expect to find that trade value may either increase or decrease with CC. Similarly, the theoretical effect of BT on CC are also ambiguous. That is, empirically BT may cause either conflict or cooperation.

In Chapter 7, I estimate the SEM from trade values and interpret the results. CC data are generated by splicing COPDAB and WEIS time series. Trade and economic data are mostly from the IMF or the UN. The sample includes all dyads formed among the United States, China, the (former) Soviet Union, Japan, and (West) Germany. Data from 1948 to 1992 are used. To test the sensitivity of the model to the way CC indices are formed, we employ both the sum of weighted conflict and cooperation (net conflict) and separate sums of conflict and cooperation. Using both CC measures we find that CC significantly explains BT and BT significantly explains CC for most dyads. While the signs of variables conform, mostly, to our expectations, certain regularities regarding the sign of the effect of BT on CC are identified.

Total bilateral and multilateral trade price, value, and volume data from the European Commission are used to estimate the SEM from demand and supply equations in chapter 8. All dyads formed among the United States, (West) Germany, Japan, and the (former) Soviet Union are included. Data from 1963 to 1992 are used. The results from this analysis reveal, in most cases, correct slopes of demand and supply with respect to price and multilateral trade expenditures. The effect of CC on demand and supply is statistically significant and positive. The effect of BT on CC is statistically siginificant, yet its sign is ambiguous.

In chapter 9, disaggregated bilateral and multilateral trade price, value, and volume data from the European Commission are used to estimate the SEM from demand and supply equations for five goods: (1) agriculture and fishery; (2) fuels and power; (3) minerals and chemicals; (4) machines, transport equipment, and electronics; and (5) food, clothing, paper, plastics, rubber, and miscellaneous. All dyads formed among the United States, (West) Germany, and Japan are included. Data from 1963 to 1992 are used. The estimation mostly reveals correctly sloped demand and supply. The effect of CC on BT is mostly statistically significant and positive. The effect of BT on CC is statistically siginificant in many cases but its sign reveals certain tendencies.

The dissertation's findings are summarized in chapter 10. The performance and the contribution of the model to the literature are evaluated. Future research avenues are highlighted. In a nut shell, CC is found to affect BT and BT is found to affect CC. The relationship between BT and CC, however, is found to vary across dyads and goods. As world politics are constantly in flux and states continually re-evaluate friends and foes, economic variables do not fully explain trade patterns and political variables do not fully

explain bilateral relations. In short, BT and CC are interdependent. The effect of conflict on BT volume is found to be mostly negative but the effect of conflict on BT value is found to be ambiguous. BT, however, can generate either conflict or cooperation.

ENDNOTES

1. International politics is captured, however, only by dummy variables to indicate whether or not trading partners belong to the same political and/or economic blocks such as EEC, NATO or CMEA.

2. Studies that focus on the link between total trade and various international political variables (though without quantity measures of CC) also include Arad and Hirsch (1981), Summary (1989), Dixon and Moon (1993), and Gowa (1994). These studies use the trade gravity model augmented by political variables. Domke (1988) and Mansfield (1994) study the link between international trade and the onset of wars, arguing that traders fight less.

3. For a general criticism of cross sectional studies, see Achen (1986) and Ward (1987). Bremer (1992) criticizes this approach in war studies. Sayrs (1989b, 1990) discusses the limitations of pooled analysis for trade and conflict.

4. We do not intend to explain the causes of wars and crises, or extreme forms of cooperation such as political unification. That is, governments have their own reasons to start bilateral conflict or cooperation which we consider as exogenous. However, we argue that after CC starts, BT and CC are endogenously and simultaneously determined.

CHAPTER 2: LITERATURE REVIEW AND IMPLICATIONS

In the spirit of an interdisciplinary study, we follow literatures from both economics and political science, in particular those developed by students of international political economy (IPE), international relations (IR), and applied trade analysis. Our literature review is presented in seven parts. We begin by outlining the realist and liberal paradigms of trade. The second part of the review summarizes empirical BT studies that do not include political determinants and empirical CC studies which do not include BT as a determinant. The third part reviews studies which argue that BT brings peace. The fourth part presents studies which claim that trade brings conflict. The fifth part discusses studies in which CC is a determinant of BT. The sixth part re-states the BT-CC debate in terms of the direction of causality, discusses BT and CC pooled analysis, and evaluates the need to study the relationship between dissaggregated BT and CC. Finally, we discuss the implications of the literature review for our project.

2.1 The Liberal and Realist Paradigms of International Trade

Liberal scholars assume that the individual is society's basic unit and is a rational welfare maximizer.[1] Economic liberalism became the main paradigm of neoclassical economics. At center stage is the notion that free markets will converge to an efficient equilibrium in which supply equals demand. Economic exchange increases society's wealth since it maximizes efficiency by rewarding individuals according to productivity. A basic harmony of interests underlies market based societies. A market economy will resolve internal conflicts of interests as individuals will bargain to harmonize interests. Strictly speaking, liberals argue for the practice of laissez-faire economic policies.

Liberals assume that under free trade, open market economies will converge to an efficient equilibrium in which some goods are traded. Producing and trading goods according to comparative advantage generates absolute gains to all traders. States' relative gains depend on their terms of trade to be determined in bargaining, however, the risk of loosing gains from trade will ensure agreements. While leaders may seek to maximize political power, masses will force them toward policies that increase welfare. Free markets and trade create economic growth. Individuals will resist war because it diminishes welfare; people are "too busy growing rich to have time for war" (Blainey, 1973:10). Further, "it is a logical fallacy and an optical illusion in Europe to regard a nation as increasing its wealth when it increases its territory" (Angell, 1913:34). As trade benefits all parties while conflict inhibits trade and since trading states are not expansionary, trade brings peace.

According to liberals, as international economic ties expand, interdependence increases and brings peace through the following channels. First, interdependent nations take other states' interests into account when calculating their own policies. This diminishes the consequences of a conflict of interests. Second, as national economies become intertwined they are more affected by conflicts. However, since interdependence increases the costs of war it also reduces the risk of wars. Third, interdependence increases international contacts to handle common matters and harmonizes states' interests. Last, interdependence creates groups with vested interests in cooperation. As governments are tuned to interest groups, war between states with interdependent economies is not likely.

For realists[2], the important feature of IR is the absence of a world government (anarchy) which makes world politics a self-help system. Realists assume that states are rational unitary actors who maximize security by strengthening capabilities. As one nation's search for security may cause others to feel insecure, states face a security dilemma. Security is determined by military power; economic capabilities are important to the extent that they enhance national security. States' actions in world politics are primarily a response to external, rather than domestic, forces; the domestic and international systems are assumed to be dichotomized.

In contrast to liberals, realists argue that states seek to maximize relative gains from economic exchange to enhance their political power. Therefore, states should be self-sufficient in critical resources. Trade is a liability since it increases dependence on external sources. As the benefits from trade increase, they may become addictive and may be used as a tool of coercion by potential enemies. Further, trading states encounter more possibilities to disagree on issues of mutual interest. Hence, the likelihood of bilateral conflict increases with trade. Interdependence may bring conflict as national policies may collide. Since leaders' political fate depends on economic performance, they may attempt to generate gains at the expense of other states. In the extreme, such conflicts may escalate to wars. Since interdependence increases states' vulnerability, it increases the likelihood of political blackmail by potential enemies.

Modern realists argue that national economic policies affect long term national security. In particular, strategic trade and industrial policies may generate long-run economic growth and change the systemic distribution of power. Since economic power contributes to national security, states pursue relative gains from economic exchange. In anarchy, states can not trust others to not use relative gains from trade in future conflicts, hence, international cooperation is a zero sum game.

2.2 Investigating BT and CC Separately

The majority of the economic literature on international trade does not include political variables. Similarly, there are many empirical/quantitative studies of conflict/cooperation in the literature on international relations which do not include economic variables. As we integrate both those literatures, we review in the following those studies which are most relevant for our purpose. We focus on studies employing empirical/statistical techniques in both areas of study.

Empirical BT Studies in Economics

We identify four approaches in modeling BT in pure economic terms: (1) Differentiation of traded goods based on their origin and/or destination; (2) The trade gravity equation; (3) Specification and estimation of demand and supply equations under alternative assumptions; (4) computed general equilibrium (CGE) models.

The origin/destination differentiation approach to modeling BT, pioneered by Armington (1969), studies import demand for goods that are differentiated by the country of origin while assuming an infinitely elastic export supply. Armington (1969a) assumes that consumers consider goods produced in different countries imperfect substitutes. That is, they differentiate goods according to country of origin. For instance, "French machinery, Japanese machinery, French chemicals, and Japanese chemicals might be four different products distinguished in the model" (Armington, 1969a:159). Accordingly, each consumer's utility function is assumed to have the following properties: (1) The marginal rate of substitution between any two goods of the same kind from different origins, referred to as products, does not depend on the quantity consumed of other goods (buyers' preferences for a good do not depend on quantities of other goods). (2) The elasticity of substitution between any two products is constant and is equal to the elasticity of substitution between any other two products.[3] These assumptions imply (and are implied by) weakly separable preferences. Hence, we can think of consumers making a two stage decision. In the first stage total goods' quantities are determined. In the second stage the total quantity of each good is allocated among products. Armington further assumes that the representative consumer has a constant elasticity of substitution (CES) utility function.

The assumption of equal elasticities of substitution among products, while simplifying the analysis, may be restrictive (Kohli, 1991). Still, as discussed in Walley (1985) and Cox and Harris (1985, 1986), it streamlines the presentation of bilateral import models and makes empirical work feasible, in particular in CGE trade models.[4]

Italianer (1986), like Barten (1971) before him, assumes that consumers follow a three stage decision process. In the first stage, consumers allocate their income between goods; In the second stage, they allocate total expenditures on each good between imported and domestic goods. In the third stage, they allocate foreign goods among different products (i.e. different suppliers). Only the third stage is estimated, however, by Italianer (1986). Similarly, Brenton (1989) uses the "almost ideal" utility function to study allocation of U.K. imports of manufactures across suppliers.

Some researchers (e.g., Linnemann, 1966; Hufbauer, 1970) argue that non economic goods' national characteristics such as cultural distance, human skills, and historical links, affect BT patterns. Kohli and Morey (1988) employ this method in a model of import demand by adding goods' characteristics to consumers' utility, such as exporter's economic size, population, product availability, and exporter's reputation.

Other studies develop import demand and export supply equations assuming that importers distinguish among imported goods according to their country of origin, and exporters distinguish among exported goods according to their country of destination (e.g. Geraci and Preow, 1982; De Melo and Robinson, 1985, 1989; Bergstrand 1985, 1989, Marquez, 1992, 1992, Gould, 1994). Two approaches are used to differentiate exports according to destination: pricing among markets according to the stability of exchange rates (Knetter, 1989, 1992; and Marquez, 1991, 1992) and using a constant elasticity of transformation production technology (Powell and Gruen, 1968; Geraci and Preow, 1982; De Melo and Robinson, 1985, 1989).

The trade gravity approach to modeling BT, employs the gravity model in each good or for total trade. The name gravity alludes to the similarity of trade gravity models to gravity force equation in physics. Namely, BT flow increases with partners' gross national product (GNP) and decreases with trade resistance (Taplin, 1967). Tinbergen (1962), Poyhonen (1963a, 1963b), and Pulliainen (1963) are the first to use the gravity model to explain BT based on exporter's and importer's GNP.[5] The model became popular because it is tractable, flexible, and empirically useful (Leamer and Levinson, 1994). Trade resistance is a compounded term that encompasses geographical distance, membership in economic unions, transportation and insurance costs, protectionism, and trade agreements.[6] A common finding is that BT values depend on the economic size of partners and the "distance" between them (Linnemann (1966). Mostly cross sectional, these studies use geographical distance as a proxy for "distance," trade barriers, and the cost of insurance and freight. Sapir (1981), Brada and Mendez (1985), and Eichengreen and Irwin (1995), for instance, utilize the trade gravity model to investigate the effect of economic blocks and economic integration on BT using dummies to mark membership in a block.

Several authors (e.g. Linneman, 1966; Leamer and Stern, 1970; Anderson, 1979; Sapir, 1981; Helpman and Krugman, 1985; Biker, 1987; Bergstrand, 1985, 1989) argue that the gravity equation is a reduced form of a model which equates import demand to export supply. Critics argue that gravity models lack micro-foundations (Anderson, 1979:106; Leamer and Stern, 1970:158). Other authors develop a trade gravity equation based on microeconomic foundations (Linnemann 1966; Anderson 1979; Helpman and Krugman 1985; Bergstrand 1985, 1989; and Biker, 1987). While these studies are conceptually similar, different gravity equations are derived depending on the assumed functional forms of consumption, production, and market structure.

Bergstrand (1989) adds intra-industry trade to the gravity model by assuming that consumers' utility depends on two goods, manufactures and non manufactures, differentiated by country of origin and firm. Using two inputs, firms differentiate among destinations.[7] An equation similar to the trade gravity model is derived and is estimated from an annual cross section of OECD for SITC one digit trade data.[8]

Other studies derive a traditional reduced form equation of BT flows from various assumed specific forms of demand and supply functions. See Bond (1985), Haynes, Hutchison and Mikesell (1986), and Italianer and d'Alcantara (1986), for examples. Italianer and d'Alcantara note that "disaggregating BT flows crucially binges on data availability" (1986:4), where only data for OECD declaring countries are available. Estimating their reduced form under the assumption of constant transportation and insurance costs over the sample period, they use their equations to simulate the effect of shocks in exogenous variables (1986:22).

The demand/supply specification approach to modeling BT, specifies bilateral import demand and export supply equations while assuming that importers differentiate goods according to origin and exporters according to destination. Most authors use time series data and assume a logarithmic linear form. The specification is dynamic using adaptive expectations, or a partial adjustment model, or an autoregressive lag structure where the number of lags is determined empirically (see Stern, Francis, and Shumacher, 1976). Only a small part of the studies treat trade prices as endogenous and use a simultaneous estimation technique (Marquez, 1992: 18:24). Recent empirical studies dealing with the estimation of BT demand and supply functions include Ranuzzi (1981,1982), Geraci and Preow (1982), Haynes, Hutchison and Mikesell (1986), and Marquez (1991).

Ranuzzi (1981,1982) uses BT price data assembled by the European Commission to estimate import demand and export supply equations separately for food, minerals, basic materials, and manufactures from 1963-1980 data for France, Germany, Italy, and the U.K. He finds that demand tends (but not always) to be inversely related to price. For supply, Ranuzzi points that "no acceptable resutls were obtained" (1982:27), both when OLS or two stage least squares estimates were used.

Geraci and Preow (1982) construct total BT price indicies for five countries from 1958 to 1974. While they assume that importers differentiate goods according to origin and exporters according to destination, in estimation they pool the data assuming similar bilateral demand and supply functions for a country with all trade partners. Ignoring simultaneous equations bias, they use linear least squares and find statistically significant negatively sloped demand curves for two out of five countries. In supply, they find price elasticities which are "highly erratic and insignificant" (p 439). They explain these results by criticizing their bilateral price data and call for use of disaggregated trade data.

Haynes, Hutchison and Mikesell (1986) study U.S.-Japan BT using multilateral trade unit values in manufacturing to proxy BT prices. These authors include contemporaneous prices and lagged moving averages of prices. Signs of price variables are mostly negative for Japan's demand and partially positive for U.S. demand. In supply, the coefficients of bilateral price variables are either not statistically significant, or negative and statistically significant.

Harigan (1993) assumes monopolistic competition, and identical preferences, technology, and factor endowments across countries. He argues that casual observations reject Helpman and Krugman's (1985) model which predicts that the volume of bilateral import in good i is given by its share in total world spending times the output of good i produced by the exporter. Using bilateral import of a good divided by GNP as the dependent variable, and exporter output of that good, tariffs, transportation costs, and non-tariff trade barriers as independent variables, he estimates the model by using 1983 trade data for 28 separate manufactured goods traded among OECD members.

Surveying 102 BT studies written between 1941 and 1991, Marquez (1992:17) finds that three quarters ignore simultaneity bias, 95 percent assume an ad-hoc logarithmic formulation, and most use multilateral trade prices to proxy BT prices. He uses bilateral total trade prices obtained from the European Commission to estimate bilateral demand and supply equations in a simoultaneous system and finds that his results, from a model in which utility follows the Rotterdam form and supply behaves according to the pricing-to-market hypothesis, are different from others. Three issues are found to be important in estimation of bilateral import demand and export supply functions: using BT prices, demand and supply simultaneity, and using micro founded models.[9]

The CGE approach to modeling BT, employs CGE models to study BT. In such studies the focus is on BT simulation rather than estimation of BT models. Researchers employ elasticities and other numerical parameters published in existing studies and use the model to simulate reaction to various policy shocks. In CGE models the economy is characterized by a set of prices and quantities in each sector such that all markets clear simultaneously. In such models consumers maximize utility and producers maximize profits. What makes them computable is the assumption of specific utility function for a representative consumer, specific market structure, and specific production technology for a representative firm. Typically, a weakly separable form is assumed for both utility and production functions (Shoven and Whalley, 1984). In contrast to Heckscher (1919) and Ohlin's (1933) who assume similar technology and tastes across countries and attribute trade to differences in factor endowments, a "further characteristic common to most of the multi country and single country [CGE] models is the use of the so-called Armington assumption" (Shoven and Whalley, 1984:1034).

"The major constraints on the selection of demand and production functions in all the applied models is that they be both consistent with the theoretical approach and analytically tractable" (Shoven and Whalley, 1984:1017). In consumption, Cobb-Douglas or CES utility functions are common. In production, linear, CES, Cobb Douglas, or Constant Elasticity of Transformation (CET) functions are used.[10] Many CGE models assume that markets are perfectly competitive (e.g., Deardorf and Stern, 1986). Such models may involve non linear equations in prices and quantities. While the number of endogenous variables equals the number of equations, analytical solution is usually not possible. Therefore, researchers solve the model numerically.

Empirical CC Studies in International Relations

Following Wilkenfeld, Hopple, Rossa and Andriole (1980), we identify two approaches to the study of foreign policy: (1) Foreign policy decision making; (2) Foreign policy behaviour.

The decision making approach to foreign policy analysis, studies the process of foreign policy decision making. Scholars (i.e. Snyder, Bruck and Sapin, 1962; Allison, 1971; Maoz, 1985) determine key actors and focus on the process of arriving at foreign policy decisions. The majority of decision making studies tend to be descriptive or qualitative.

These studies further sub-divide according to their perception of government as (1) a unitary rational actor with defined goals; (2) an organization of bureaucrats that follows standard operating procedures, guided by inertia, and practices incrementalism; (3) a group of agents with certain psychological qualities, beliefs, and personal experience; (4) an organization of groups representing competing interests that bargain with each other. In such an organization "where you sit determines where you stand" (Allison, 1971:134).

The foreign policy behavior (interaction) approach to foreign policy analysis, focuses on foreign policy behavioral outputs (response) which are generated by foreign policy inputs (stimulus). Scholars (i.e. Boulding 1962; Rosenau, 1966,1968; Phillips, 1978; Ward, 1981,1982,1985; Dixon, 1986; Rajmaira and Ward, 1992) treat the decision making process as a black box whose internal components are not fully identified. This approach is macro oriented, that is it does not model the specifics of the decision making process.

In the basic interaction model, bilateral cooperation and conflict are investigated separately. Contemporaneous cooperation (conflict) emanating from an actor to a target depends on a constant term, cooperation (conflict) sent by the actor in the previous period, and contemporaneous cooperation (conflict) emanating from the target. Theoretical justification of these assertions may be found in many studies (i.e. Boulding, 1962; Phillips, 1978; Ward, 1985; Dixon, 1986; Smith, 1987). Various extensions are made. The effect of domestic politics and national factors is examined by several scholars (i.e. Wilkenfeld et al., 1980; Bremmer, 1977,1980). Ashley (1980) investigates the effect of systemic factors. In many models coefficients are assumed fixed (Ward, 1981, 1982; Azar, Bennett, and Sloan, 1974, Dixon, 1986). Boulding (1962), Azar, Bennet, and Sloan (1974), and Ward and Rajmaira (1992) argue that coefficients may change over time. Sayrs (1987, 1989) adds a measure of BT to the basic model. She deals only with one government. In Smith (1987), the coefficient of the target's conflict or cooperation (reactivity) depends on BT, multilateral trade, and political climate. The resulting non-linear model is linearized and estimated by restricting the components of reactivity to sum to the constant reactivity of the basic model.

It seems to us that the two approaches to the analysis of foreign policy are interrelated. Interaction equations could be considered as structural equations of the underlying decision making process. As specifying analytically the micro-foundations of foreign policy is hard, some scholars specify the structural equations in a direct, but nevertheless theoretical, manner. The analogue on the economic side is the specification of a trade gravity equation or modeling aggregate demand and supply without emphasizing individual decisions.

2.3 Trade Brings Peace

Free trade, interdependence, and democracy have long been associated with peace and international cooperation (i.e. Smith, 1776; Ricardo, 1817; Kant, 1795; Angell, 1911). As detailed in Polachek (1978), Blainey (1973) and Read (1967) argue that the long peace in Europe starting in 1815 is a result of the increase in the level of free trade. These authors claim that the view that more trade will bring peace was shared by British politicians and philosophers since the end of the 18th century.[11] Modern literature in this vein includes Polachek (1978,1980,1992,1995), Gasiorowksi and Polachek (1982), Arad and Hirsch (1981,1983), Gasiorowski (1986), and Sayrs (1987,1989).

Studies Using Total Trade Data

Polachek (1978, 1980) provides a formal theoretical justification why trade should bring peace. Polachek's partial equilibrium model portrays a nation state as a rational actor whose welfare depends positively on consumption and hostility. Further, he assumes that hostility toward a trading partner decreases the price a country gets for its exports and increases the price a country pays for its imports. The problem facing a nation state is how to maximize welfare by choosing a level of hostility, for a given level of consumption. Accordingly, Polachek argues that political leaders will be averse to conflict with their trade partners.

Polachek (1978,1980,1992) uses COPDAB to specify net conflict as the dependent variable.[12] Independent variables include the value of bilateral export or import. In addition, he includes 14 country attributes (i.e. population density, secondary school enrollments per 1000 people, growth national product (GNP) growth rate). The model is estimated from 1958 to 1967 for 31 countries in a pooled time series research design. Gasiorowski and Polachek (1982) deal with the U.S.-Warsaw Pact dyad. They specify several bivariate models of trade and conflict in which yearly net conflict is the dependent variable and the total trade value is the independent variable. Both Polachek (1978,1980,1992) and Gasiorowski and Polachek (1982) find that trade diminishes conflict.

Sayrs (1987, 1989) pools time series for 172 dyads from 1950 to 1975. She specifies separate annual sums of the number of COPDAB based events as dependent variable. The BT measure combines export, import, and GDP of both partners. Sayrs finds that trade is associated with less conflict. The relationship between cooperation and trade is vague and depends on whether a country is a high/low volume trader and whether the U.S. appears in the sample. For low volume traders, trade is associated with more cooperation. For high volume traders, trade and cooperation are not associated. With the U.S. in the sample, trade is associated with less cooperation. Without the U.S., trade and cooperation were not associated. Sayrs concludes that "trade does not provide an economic incentive to cooperate even though it may serve to diminish the overall level of conflict" (1989:155). Sayrs (1989:159) argues that trade in strategic resources does not seem to follow Polachek's "trade brings peace" assertion. However, she does not elaborate on this issue.

Studies Using Disaggregated Trade Data

Polachek (1980:67) argues that "conflict should be most sensitive to trade of commodities particularly strategic to an economy." Small amounts of trade in such goods produce large welfare gains. However, measurement of welfare gains requires a knowledge about supply and demand curves, data which were not available to him. Therefore, his empirical test is indirect. In his 1958-1967 period, Polachek (1980) finds that oil importers tend to be friendly to oil exporters which he attributes to the strategic nature of oil.

Gasiorowksi and Polachek (1982:725) hypothesize that "the *economic structure* of different countries will affect their benefits from trade in certain types of goods, and hence also the strength of incentives associated with these goods to reduce conflict." [italics in original]. When an economic sector is strong, indicative of comparative advantage, trade will induce cooperation and vice versa. The authors compute correlations between U.S. trade with the entire Warsaw Pact and net conflict between the U.S. and each Warsaw Pact member using annual data from 1967 to 1978. They find higher correlations for U.S. exports of capital goods and imports of raw materials. Correlation for capital goods increases when a member is more industrialized. Correlation for agriculture decreases when the share of agriculture in its national products becomes larger. The authors acknowledge, however, that the "aggregated data may partially blur the effects of trade with particular countries," and warn that the "evidence [presented] is not conclusive and the results of this section [refers to the paper] remain primarily speculative" (Gasiorowski and Polachek, 1982:725,726).

The dependent variable in Polachek and McDonald (1992) is net conflict and the independent variables are BT values, actor's GDP, actor and target GDP difference, and bilateral import price elasticity. Polachek and McDonald (1992:277) hypothesize that "the more inelastic (elastic) an actor country's import demand and export supply to a target country, the smaller (larger) the amount of actor-to-target conflict." Bilateral import elasticities from the IMF world trade model are used. Based on the cross section of 14 OECD importers in 1973, the authors find that conflict increases with bilateral import price elasticity. The study has several limitations, however. Only the single year of 1973 is analyzed, the elasticities of substitution among goods from different origins are set to one for all goods and dyads; only manufactures and raw material data are investigated; the model does not include bilateral price elasticities for raw materials; and only bilateral import demand is being investigated. The authors, in fact, label their analysis preliminary and call for further research.

Arad and Hirsch (1981) and Arad, Hirsch and Tovias (1983) extend Hirschman's (1945) framework, arriving, however, at different conclusions. These authors deal with the question of whether former enemies that recently signed a peace agreement can achieve stable trade relations. Trade is beneficial to both partners. If political conflict leads to trade cessation, both sides lose. When deciding on the composition of trade with a former enemy, leaders are guided by their subjective probability of future trade disruptions and their expected cost. However, trade diminishes the propensity of former enemies to be hostile toward each other. Focusing on the Israeli-Egyptian case, the authors argue that since the cost of trade disruption may vary across goods, analyzing BT of (former) adversaries has to be per traded good. The empirical analysis, however, is purely economic, without considering CC. Trade value of each good is modeled separately in terms of GNP of countries A and B, the multilateral exports and imports of that good, geographical distance, and difference in per capita GNP. The model is estimated using 1971 data of 58 sectors from a cross section of Organization for Economic Cooperation and Development (OECD) countries.

2.4 Trade Brings Conflict

The hypothesis that trade causes conflict is advanced by Choucri and North (1975), Park, Abolfathi, and Ward (1976), Feld (1979), and Ashley (1980). International trade can increase the level of international conflict by raising frictions. Trade increases political tension also by enhancing outward expansion, according to Sayrs (1988). This argument is mostly made in terms of trade in certain national security enhancing important goods.

The basic assumption in these studies is that international traders compete for scarce economic resources (production inputs and markets for final products). With limited resources, as the competition for depleting resources intensifies, state power is used to guarantee national access to production resources and markets. As the level of state intervention increases, one is more likely to observe an increase in protectionism, trade wars, economic penetration, colonial expansion, intervention in local conflicts; and hence an overall decrease in international cooperation. In the extreme, combined with long waves in world prices and economic growths, such dynamics may lead to hegemonic wars (Conybeare, 1985; Goldstein, 1985).

Park, Abolfathi, and Ward (1976) investigate Middle Eastern oil exporters from 1947 to 1974 by constructing an event data set which focuses on oil. As oil exports grow, exporters become nationalistic, attempt to restructure relations with importers, and use oil as a foreign policy tool. Similarly, Polachek (1980) finds that oil exporters are hostile toward oil importers.

Bennet, Rosenblatt, and Wang (1992) investigate the link between BT and CC for the U.S.-Japan dyad from 1948 to 1978. They visually inspect trade-related COPDAB events and find that periods of conflict are followed by cooperation, and textile, steel, agriculture, and electronics are more prone to trade disputes. The link between arms trade and client-patron relations is reviewed by Krause (1991). Conflict may increase with the value of arms trade when a client state attempts to decrease its vulnerability.

Tyson (1992) and Thurow (1992) connect controlling shares of world trade in leading sectors to sustained economic growth. Competition over world markets for manufactures and minerals leads to disputes since, argues Sen (1984:7), "most of these industries are also of strategic significance for the production of military goods." The state intervenes in the production of metals, steel, chemicals, machinery, and transport equipment to ensure its military power. Similarly, as high technology manufactured goods create large spill-over effects into the production of weaponry, competition over trade shares in leading sectors intensifies international political conflict, according to Borrus and Zysman (1992) and Vogel (1992).

Finally, several scholars investigate the link from BT to CC assuming that states pursue relative gains from trade. In anarchic system, states concern for relative gains apply both for national security and economic matters (Gowa, 1989, 1994; Grieco, 1989, 1994; Mastanduno, 1991). States measure their national capabilities relative to that of their potential enemies. Since economic status is a component of political power, states compare their performance to others (Borrus and Zysman, 1992). Therefore, states exploit relative gains from economic transactions through trade, financial, and industrial policies. When states are interdependent, the pursuit of relative gains from trade induces conflict and may be manifested in attempts to coerce other states to change their goals.

2.5 Politics Determines Trade

We categorize the body of work which argues that politics determines trade along two approaches. The first approach advocates that the trade policy is a manifestation of foreign policy and studies economic interdependence and influence. The second approach argues that political as well as economic variables affect bilateral trade flows. Scholars study empirically the effect of CC on BT by combining economic and political variables. In the former approach, the actor is portrayed as a political decision maker guided by considerations of power and security. In the latter approach, the actor is portrayed as an economic agent who is affected by bilateral politics as well as economics.

Interdependence and Influence

The ideas of the first approach to analyzing the effect of politics on trade date back to the 18th century at which time mercantilists examined the use of international economics as an instrument in the service of the state's larger foreign policy interests. In the 20th century these ideas were embraced by economic realists and nationalists. Two issues are dealt with, interdependence, and the use of economic sanctions.

Rosecrance and Stein (1973) discuss three definitions of interdependence: (1) a relationship of economic and/or political interests among countries; (Morse and Young, 1969; Morse, 1972); (2) a term suggesting sensitivity of one country to economic policies of another (Tollison and Willett, 1973; Cooper, 1968); (3) a relationship that involves power and implies a connection that would be costly to break--dependence; a situation that increases national vulnerability (Hirschman, 1945; Waltz, 1970). The following disscusion dwells on the latter interpretation of interdependence.

For Hirschman (1945), dependence implies an asymmetric need, where asymmetry refers to a situation in which one trade partner needs the benefits of trade more than the other. Dependence is a continuum; on one side there is complete dependence; on the other, symmetric interdependence. Hirschman reverses the story told by Ricardo (1817); instead of discussing the gains from trade he considers countries suddenly faced with the necessity of doing without it. Since both counties gain from trade, both lose when trade is interrupted. However, the partner that values gains from trade more is prone to political blackmail.

Hirschman (1945) measures dependence by computing the percentage of BT out of a nation's total trade with the world. He claims that during the 1930s Germany's trade policy was set to achieve political domination of Eastern European countries. According to his data, 60.3% of Bulgaria's import and 54% of its export, 48.2% of Hungary's export and 44.2% of its import, and 42.1% of Rumania's import and 33.2% of its export were with Nazi Germany. For Germany these numbers were much smaller. This leads Hirschman to hypothesize that these countries supported Nazi Germany because they were economically dependent on Germany. These ideas are extended by Baldwin (1979) who argues that dependence implies actors' ability to influence others by cutting their supply of a critical resource. Hence, a weaker actor that controls a vital resource can still exercise economic power to influence stronger parties.

Richardson (1976, 1978), Richardson and Kegely (1980), Armstrong (1981) and Ray (1981) argue that foreign policy of economically weak states conforms to economically dominant countries' policies. Weak states anticipate that future policies of dominant states will reward and punish them in proportion to their compliance. In turn, dominant nations' trade and aid policies are set according to weak states' level of compliance. Thus, in a dyad characterized by such relations economic dependence explains the foreign behavior of both sides.

Richardson (1976,1978), Richardson and Kegely (1980), and Roeder (1985) use United Nations (UN) general assembly votes to measure political compliance of economically dominated states. Richardson et al. find that voting patterns of small countries follow their economic ties with the U.S.; the more dependent a country is on these ties, the more foreign policy conforms to U.S. foreign policy. Roeder (1985) finds similar results regarding the dependence (in form of trade and economic/military assistance) of Third World countries on the Soviet Union from 1954 to 1981. In contrast, Moon (1983,1985) argues that the ability of dominant states to affect foreign policy of smaller states should be understood within a North-South dependency framework. Using similar empirical measures of political compliance he finds that dominant Northern states are able to influence Southern countries only if they have managed to build a support base of Southern elites.

For Knorr (1975), interdependence is the mutual effect of countries' actions on each other. The cost of exercising military power rises the more symmetric is states' interdependence. "Power arises from an asymmetric interdependence" (1977:102). To enhance national security states should be self sustained or should limit their trade (Knorr, 1973). Waltz deals mostly with major powers. He argues that "if interdependence grows at a pace that exceeds the development of central control, then interdependence hastens the occasion for war" (Waltz, 1979:138).

Keohane and Nye (1977) argue that conflicts do not disappear when interdependence prevails. However, they may take new forms. While interdependence increase conflicts' cost and may reduce the use of military power, costly economic relations may be taken by actors in pursue of their political agenda. For Buzan (1984), interdependence makes states vulnerable since they are no longer able to steer their domestic economic policies independently of other states' economic goals. Consequently, conflicts may arise precisely because of interdependence.

The empirical relationship between interdependence, conflict and cooperation is ambiguous, argue Gasiorowski (1986) and Vries (1990). Gasiorowski's (1986) cross sectional study uses COPDAB data for 44 countries. He focuses on the relationship between the average weighted net conflict that a country directs to the world and several measures of interdependence (i.e. import/export partner concentrations, long/short term capital flows, mean total trade as percentage of GDP). He finds that large export/import concentration and short term capital flows are associated with conflict. However, large trade volumes (beneficial effect of interdependence) increase cooperation when he controls for the costly effects of interdependence.

Vries (1990) uses trade flows of 48 nations from 1950 to 1960 and checks their correlation to Conflict and Peace Data Bank (COPDAB) based measure of conflict and cooperation. He finds that high levels of interdependence increase both conflict and cooperation. Explaining his results, Vries argues that interdependence intensifies the interaction of nations by generating issues for debate. Asymmetric interdependence further increases the likelihood of conflict as one side may attempt to exploit it and the other to diminish it.

Paarlberg (1978, 1980) illustrates how trade in food and oil are used to coerce other countries. He concludes that petrol-power is a more potent source (than agriculture) of diplomatic leverage. Baldwin (1985) discusses the effectiveness of trade as a foreign policy tool by using the concept of *strategic goods* (1985:214), which are defined as goods for which there are no readily available substitutes. Trade of such goods can be used to exercise leverage on other countries. However, "the *strategic* quality of a good [italics are original]" is also a function of the situation, states Baldwin (1985:215).

In contrast to Paarlberg and Baldwin, Hufbauer, Schott, and Elliott's (1990) empirical investigation concludes that economic statecraft policies, in particular trade sanctions, are typically not effective. Attempts to coerce another government into a particular avenue of response through the use of trade and financial sanctions have long been part of international diplomacy and was already prevalent in ancient Greece (Thucydides, 1972:54). Hufbauer, Scott, and Elliott (1990) list 116 cases of using economic sanctions for political purpose. The use of sanctions assumes the willingness of the imposing country to intervene in the decision making process of another government. An issue related to the effectiveness of sanctions is international cooperation with the sending country; the more coordinated the sanctions are the more they achieve their political goal (Martin, 1992).

Empirical Models Combining Economic and Political Variables

The second approach to analyzing the effect of politics on trade combines economic as well as political variables and studies this relationship empirically. Roemer (1977) investigates the extent to which trade of 43 manufactured goods follows the patterns of political influence generated by the U.S., Japan, U.K., Germany, and Canada. Trade intensities, measured by the ratio of the share of country A's import from country B and the share of country A's imports from the world in each good, are used to reveal the preference of A towards B's export. Using trade data in a single year of 1971 for 14 regions, Roemer (1977) finds that the sectoral pattern of trade in manufacturing goods is biased as countries sell disproportionately more out of their weak sectors toward the region of their political sphere of influence.

Savage and Deutsch (1960) argue that trade flows proxy political relations. No causal mechanism is offered, though. The difference between actual trade and that to be expected if countries' shares of world trade were equally distributed (assuming neutral preferences) indicates bilateral preference. Kunimoto (1977) and Nagy (1983) further develop this idea by suggesting that nations with cooperative bilateral relations engage in more trade while conflictive nations trade less. Pollins (1989a, 1989b) and Bergejik (1994) empirically test these assertions.[13]

The story told by Pollins and Bergejik deals with the relationship between total bilateral import and cooperation.[14] While his model is not formal, he assumes utility maximizing agents (be it private individuals, firms, interest groups, elites, or governments) who trade because it increases their welfare. Agents wish to minimize the risk from disrupted trade flows. Therefore, in addition to other variables, they take into account information about the bilateral political relations between their country and trade partners. As opposed to Polachek's actor who chooses hostility while constrained by economic considerations, Pollins' agent makes economic decisions while being constrained by politics. Thus, Pollins expects that total import of a country will decline (increase) as bilateral relations become less (more) cooperative. In empirical test, Pollins (1989a) and Bergejik (1994) hypothesize that BT value will be positively correlated with cooperation.[15]

The studies of Pollins, as those of Bergeijk, do not include formal models. Instead, cooperation measures are added to final results of various trade models. Though the original hypotheses is specified in terms of specific goods (fuels, high technology, agriculture, and food), Pollins only uses total trade data. Pollins (1989a) uses Bergstrand's (1985) results and specifies a trade gravity equation that include price terms.[16] Cooperation is treated as an additional term of trade resistance. The model is estimated by pooling data of all dyadic combinations of 25 countries for the period 1960 to 1975. Pollins (1989b) uses Leamer and Stern's (1970) empirical model in which total import demand depends on world and domestic prices and importer's GNP. A variable is added to capture the effect of cooperation on total import demand. The model is estimated by pooling data of 6 importers and 25 exporters for the 1955-1978 period. The results of Pollins point out that BT value is positively associated with cooperation.[17]

Gowa (1989, 1994) predicts trade flows based on the patterns of states' alliances. Since trade allows countries to efficiently allocate resources of production, it may enhance their military capabilities. States, argues Gowa, pay attention to relative gains from trade. Therefore, countries are more likely to trade with allies than with neutrals or enemies. She tests this hypothesis for major powers trade using a trade gravity equation enhanced by a dummy variable to indicate alliances. Similarly, Hoffmann (1963) and Waltz (1979) argue that regional integration is more likely within a military alliance. Gravity models augmented by other political variables, such as arms transfers, regime similarity, and regional economic blocks are used, for instance, in Summary (1989), Dixon and Moon (1993), and Aitken (1973), Sapir (1981) and Brada and Mendez (1985), respectively.[18]

2.6 BT and CC Causality, Pooled Analysis, and Disaggregation

We have demonstrated that trade and conflict models produce different predictions. Given their assumptions, the contesting models seem logically correct. Hence, the issue at hand is the validity of the assumptions and the debate can be resolved only empirically. Since the seminal paper of Polachek (1978) the main trust of the debate has become an empirical issue. The results of empirical BT and CC studies, however, are contradictory, mainly because the models specified are fundamentally different. There are contrasting models, each assuming a different trade and conflict causality. In the models specified by Polachek (1978,1980,1992), Gasiorowski and Polachek (1982), Gasiorowski (1986) and Sayrs (1987,1989), for instance, CC is the independent variable and trade is the dependent variable. In the models specified by Pollins (1989a, 1989b), Bergeijk (1994), Summary (1989), Dixon and Moon (1993), and Gowa (1989, 1994), for instance, BT is the dependent variable and CC (or a comparable measure of bilateral politics) is the independent variable.

Most BT-CC empirical studies in the literature follow a similar structure. Researchers pool time series data of total trade and of CC of many dyads over up to 30 years implicitly assuming that the trade and conflict relationship is similar across dyads. Annual BT data are from the International Monetary Fund (IMF) and CC data are from COPDAB. Given that COPDAB's events collection ended in 1978, authors do not test their models beyond 1978. Pooling dyads to study BT-CC relationship, however, is criticized in this literature.

Finally, most empirical studies in the trade and conflict literature use total trade values data. While the theoretical importance of the types of goods traded for the relationship between BT and CC is disscused by several authors, most of the empirical analysis does not use disaggregated trade data. Those studies which emphasize the importance of investigating the link between disaggregated BT and CC are reviewed in this section.

Trade and Conflict Causality

The disagreements on the direction of BT and CC causality are at the center of this literature. Indeed, the need to study the causality between trade and conflict is clearly stated in the literature. Polachek (1980:63) states that the exact relationship between trade and CC could not be inferred from his study: "Thus from these tables [tables showing impact of trade on CC], it cannot be ascertained whether trade diminishes conflict, or whether in fact the reverse is true, and it is really conflict that reduces trade". He then considers the method of using appropriately lagged trade data in his model in order to resolve the causality, but does not implement it because the sample size is too small: "Generally, as has been shown, trade is fairly stable over short intervals (Russett, 1967:144-157). Thus a problem arises with the relatively small number of years in the sample" (Polachek, 1980:65).

Pollins (1989a:742) argues against Polachek's (1978, 1980) and Arad and Hirsch's (1981, 1983) specification and claims their "insistence" that trade influences CC but CC does not influence trade contradicts the main assumption of their models. He argues that rational agents dislike conflict because they are aware that conflict diminishes trade. To resolve the issue of causality he mentions a possibility of conducting a formal Granger test, but then he admits that he did not implement it because he did not have enough data.

> More sophisticated statistical tests for the direction of causality (such as Granger-Sims procedures) are of doubtful value here because I am limited to 16 annual observations (Pollins, 1989a:751).

Sayrs (1990), acknowledging that all the empirical studies of international trade and CC use basically the same approach, argues that the most important point is missing from those studies; namely, the causality relationships between trade and CC have never been verified, and in principle, these linkages are still not fully understood.[19]

Gasiorowski and Polachek (1982) are perhaps most explicit on the causality issue by stating that they doubt the results of the linear regression models that use a measure of CC as the dependent variable and a measure of trade as an independent variable, because such models may simply be misspecified, and therefore their results may be an artifact.

> An important issue that must be addressed here is the direction of causality in trade/conflict relationship embodied in equations 1 through 3 [equations specifying conflict as a function of trade]...Ascertaining the direction of causality in these equations is also important because the regression results shown in Table 1 are strictly valid only if trade is thought to "cause" conflict (quotation marks are in the original, Gasiorowski and Polachek, 1982:721).

Gasiorowski (1986:31) simply "claims" that CC is the appropriate dependent variable, but does not report any formal tests to show it: "Since it was beyond the scope of this study to replicate these elaborate tests [the tests that verified the direction of causality], conflict is merely *assumed* to be the appropriate dependent variable here" (emphasis is original).

To our best knowledge, Gasiorowski and Polachek (1982) are the only researchers who have formally tested the causality, yet only for the U.S. and the Warsaw Pact dyad by using quarterly BT and net conflict data from 1967 to 1978.[20] The total real dollar value of trade (imports + exports) of this dyad was used for trade data and quarterly weighted net conflict from COPDAB was used for CC. A linear time trend was included in the regression. The hypothesis that trade does not Granger cause CC was rejected at the 5% significance level when 1 to 6 lags of dependent and independent variables were used. The hypothesis that CC does not Granger cause trade was, however, rejected when 4 to 6 such lags were used. The authors then concluded that causality runs from trade to CC, and therefore their model specifying CC as a function of trade is correctly specified for the U.S.-Warsaw Pact dyad.

> This indicates that Granger causality for short lag periods runs overwhelmingly from trade to conflict, and strongly suggests that <u>causation runs in the direction implied in equations 1 through 3</u> [the equations that specify trade as a function of CC] (emphasis is original, Gasiorowksi and Polachek, 1982:723).

However, their causality test invites several comments and criticisms. First, they used a limited sample period (1967-1978) for only one dyad. Looney (1991) points out that a causality test is sample size sensitive and that using a large sample size increases the confidence in the test results. Second, quarterly total trade data, after controlling for inflation, are known to contain seasonal fluctuations, which were not controlled for. Therefore, their equations may have been misspecified, a factor that is known to affect causality results. Third, the limitations of real dollar values of exports and imports were mentioned by the authors themselves. This measure is also influenced by exchange rate fluctuations, which was again not controlled for. Finally, by assuming that the political and economic integration of the Warsaw Pact countries created a bloc rather than nation specific linkages, they used aggregated trade and CC data of the entire Warsaw Pact rather than those of its individual members. But, the causality direction, certainly its strength, may be different from dyad to dyad. At any rate, causality tests between trade and CC are best conducted for each dyad, at least until we have evidence of common factors across dyads.

Finally, scholars such as Mansfield (1994), Oneal et al. (1996), and Barbieri (1996) seek to explain the link between *military conflict* and/or wars and trade. Military conflict, modeled as a dichotomous variable, is assumed in these studies to be the dependent variable, and data of many dyads are pooled in the empirical analysis. In contrast, the studies we have reviewed seek to investigate the relationship between trade and the wider phenomenon of political conflict and cooperation. The above three recent studies make two *a priori* assumptions on the direction of trade and conflict causality: BT Granger causes CC, and the BT-CC relationship is similar across dyads. The common finding is that the the incidence of interstate military disputes, including wars, declines as BT rises. Clearly, if the assumed trade and conflict causality in those studies is not supported by empirical data, those recent results in the literature need to be re-evaluated.

Pooled Analysis

Studies on trade and conflict have typically pooled many dyads together and performed a time-series-cross-section analysis, presumably, to gain efficiency in the estimation by raising degrees of freedom. However, since the pooling forces the coefficients of regression models to be the same across dyads "there may be important, patterned variation across dyads that this design cannot pick up," as stated by Pollins (1989a:757). Furthermore, Gasiorowski (1986) and Sayrs (1988, 1989) report some empirical evidence which supports that trade and conflict parameters vary across dyads. Holsti (1986) also criticizes the approach in which the relationship between political and economic variables are assumed to be similar across countries, because tradeoffs governments make between power and plenty may differ across dyads and issues. Empirically, Ashley (1980), Ward (1981, 1982), Goldstein and Freeman (1990), and Rajmaira and Ward (1990) find that coefficients in their regression analyses of CC interactions vary across dyads.

Since the limitations of this approach are known, I refer only to those that bear on the study of trade and conflict. Sayrs (1989b:15) points out the problem in pooling data: "[D]iscerning different causal relationships is somewhat more perplexing than it sounds because it could easily call into question the original justification for grouping independent cross-sections (aggregating) as an aspect of the research design". Achen (1986) surveys the various limitations of aggregating cross sections in a regression.

Perhaps the strongest criticism against pooling countries comes from Ward (1987:76): "[C]omparing China or Taiwan, for example, in the same regression analysis may well have the same effect on your regression coefficients as weighing your analysis by including three Indias, two Benins, and a half dozen Japans. Regression coefficients ... are only meaningful if the data base contains observations on comparable units". Hence, Ward argues that the process underlying what seems to be similar economic and political phenomena in different countries might actually be different. In such cases, pooling data might give misleading results. Gasiorowski and Polachek (1982) argue that different economic structures of countries affect their gains from trade in certain goods and, as a result, affect their CC behavior. These arguments apply also to our causality investigation. Since the importance of trade may differ among countries, dyadic causal directions and dynamic relations between trade and CC may vary as well.

Gasiorowski and Polachek (1982) show a significant negative relationship, albeit not a causal relationship, between trade and conflict in their U.S.-Warsaw Pact study. Gasiorowski (1986) repeats the analysis for 130 dyads in which the U.S. is an actor to find that his results only partially agree with Gasiorowski and Polachek (1982): the significant inverse relationship between trade and conflict holds up in only 20 out of 130 regressions; in 102 cases no significant relationship is found, and eight regressions give a significant positive relationship. Hence, although the U.S. is an actor in all his dyads, the results differ across dyads. For dyads with different actor and target countries, the discrepancy might be even larger.

Sayrs (1990) notes that studying trade and conflict using pooled analysis is not optimal. Sayrs (1990) and Pollins (in personal communication with Sayrs) are aware that the pooled analysis has basic limitations when applied to the trade and conflict debate. According to Sayrs (1990), Pollins claims that dynamic non-recursive models of trade and conflict are not tractable for pooled samples. "A different research design, perhaps a single time series for one trading pair might be an acceptable alternative" (1990:34).

In the literature on international economics, Marquez and McNeilly (1988) evaluate pure BT empirical studies. They argue that too much aggregation is applied in this literature, both across countries and goods. Aggregation of countries or of goods, or using pooled time series cross section data, is useful only if those countries indeed have similar trade elasticities with respect to income and price across goods. However, this is "an empirical question that has been neglected by previous studies" (1998:307).

The Importance of Studying Disaggregated BT

The literature on the importance of certain commodities to national security originates in the nineteenth century. Stressing the important link between manufactured goods and national security, List (1856:268) argues: "Trade with manufacturing nations is subject to interruption by war." Therefore, a country should be self-reliant in the supply of such goods. Several modern analysts have adopted this line of thought. In his evaluation of the reasons for the alleged U.S. economic decline, Gilpin (1984) stresses the importance of not being dependent on foreign machinery and petroleum. Similarly, the Cold War spawned an extensive debate on controlling East-West trade particularly in high technologies, energy sources, power generating equipments, and industrial machineries as in Knorr (1975), Deese (1984), Mastanduno (1992), and Crowford (1993). Recently, these arguments were adopted by Borrus and Zysman (1992) and Vogel (1992) to formulate a linkage between trade theory and national security.

Empirical studies of BT and CC since Polachek's (1978) paper deal mostly with total trade. The need to study the link between CC and BT in *various goods* is stated, implicitly or explicitly, by many authors like Polachek (1980, 1992), Gasiorowski and Polachek (1982), Arad, Hirsch, and Tovias (1983), Gasiorowski (1986), Domke (1988), Pollins (1989a, 1989b), and Sayrs (1989, 1990). For instance, discussing limitations of his own study, Pollins (1989a:757) admits that his model "is specified at a very high level of aggregation." Along similar lines, Pollins (1989b:479) notes:

> different importers have different preferences regarding the goods they wish to purchase (e.g., some will be more interested in petroleum, while others will be particularly interested in high-tech manufactured goods), ...

However, while he calls for a study for the link among CC, commercial policy, certain traded goods, and particular domestic interest groups, his data refer only to total trade.

Similarly to Hirschman's (1945) trade partner concentration index designed to measure trade dependence and interdependence, Gasiorowski (1986:33) wants to measure "the commodity concentration of exports." Countries that trade in a small number of certain goods, adds Gasiorowski (1986), are expected to be more vulnerable to trade disruption and political influence. Unfortunately, however, his statistical analysis of the relationship between conflict and interdependence does not make use of disaggregated trade data.

Domke (1988) analyzes the relationship between trade export and the onset of war. Explaining why he uses total trade export data, Domke (1988:119-120) writes:

> It may be, therefore, that mass publics of economies that import a great deal of consumer goods would favor cooperative foreign policies in order to protect their supply of such goods. To answer such a question, not only would data on imports be required, but they would need to be separated according to the quantity of imports of *various types of goods*. Because of this difficulty, as well as the ones noted above, imports will not be included in the analyses here [italics are added].

In her review of the trade and conflict literature, the basic assumption underlying this literature, summarizes Sayrs (1990), is that the gains from trade are similar to all traders. Trade will diminish conflict as all traders' welfare decreases when trade is disrupted. However, the literature on trade and conflict does not consider cases in which the gains from trade may not be equal because of, writes Sayrs (1990:22), "the commodities traded or some aspect of the trader itself." That is, the composition of trade is an important factor which has so far been omitted from the empirical analysis of trade and conflict.

Perhaps the strongest statement for a need to study disaggregated trade is made by Polachek (1980), who hypothesizes, but without testing it, that trade in strategic commodities will diminish conflict more than other commodities. Polachek (1992:97) concedes that

> ideally dyadic *commodity by commodity* trade flows are needed. Unfortunately, such data was not available on an annual basis in each year for which conflict data exist. On the other hand, aggregate import and export data collected on a country by country directional basis are available [italics are added].

Moreover, Polachek (1992:113) argues that "unduly extensive aggregation" of trade data may imply a biased estimate of the ability of BT to diminish political conflict. Factors which are important in finding the true effect of trade on conflict include, continues Polachek (1992:113), "the degree of competition in the international market for ***the goods in question***, the domestic production possibilities for ***these goods***, the availability of ***substitute commodities***, as well as other factors [italics are added]." However, Polachek's analysis focuses only on total trade flows.

2.7 The Implications of the Literature Review

We have reviewed several literatures from economics and political science on the topics of modeling BT, modeling CC, and the link between BT and CC. We have found that there are several theoretical and empirical debates in the literature. The following summarizes the implications of those debates for our project.

First, Polachek and Pollins make different assumptions. Polachek's actor, a government, chooses conflict while BT diminishes his propensity to be hostile. Pollins's actor, a consumer, chooses import level while conflict diminishes his propensity to trade. However, Pollins (1989a:742) argues that "ultimately, the causal relationship between international politics and commerce should be traced as reciprocal". Similarly, Polachek (1992:14) argues that "one cannot ascertain whether trade diminishes conflict, or whether the reverse is true," and adds that his "paper argues that both are true". Still, neither Pollins nor Polachek modeled a reciprocal trade and conflict relationship. If the true model is one in which BT and CC are simultaneously determined, the parameters estimated by Pollins and Polachek are biased. Hence, we need to model the BT and CC nexus as a reciprocal relationship, provided that BT and CC causality tests (see below) may point us in this direction.

Second, except Polachek, authors do not present formal models. While Pollins and

Sayrs discuss fundamental assumptions and profess intention to build a formal model of trade and CC (Pollins, 1989b:477; Sayrs, 1989:156) their empirical models are not formally derived from micro economic foundations. Further, researchers consider the behavior of only one country and some specified empirical models do not directly follow theoretical reasoning (for example, see in Polachek, 1980). Pollins (1989b) is the only one to estimate the bilateral demand for import in the presence of CC. Since both supply and demand influence price and quantity in equilibrium, simultaneous equations estimation methods need to be used to avoid biased results. However, Pollins estimates import demand without simultaneously accounting for export supply. Hence, his results may be biased due to a simultaneous equations bias. Accordingly, we intend to develop a micro founded model and estimate its parameters. We need to model both bilateral demand and supply effects and both countries political and economic behaviors need to be accounted for.

Third, the empirical relationship between CC and BT in different goods is almost not studied in the literature. Authors argue that this relationship may vary across goods and dyads. Consequently, we intend to systematically study the relationship between CC and BT in different commodities and dyads.

Fourth, authors are aware that pooling dyads to study trade and CC is problematic (Pollins, 1989b). As countries trade in different goods, have different economic structures, and may approach bilateral politics from a diverse historical and cultural setup, the relationship between trade and CC may vary among dyads. We intend to investigate BT and CC with as few restrictions as possible. Causality direction and model estimation need to be, therefore, investigated for each dyad and for each good *individually* by assuming that causality between BT and CC may be different across commodity groups as well as across dyads.

Fifth, most of the empirical studies, by using similar approaches, find that trade and

CC are associated. Typically, statistical models with BT and CC variables are analyzed using annual data of many dyads over a time period of (up to) 30 years in a pooled cross-section analysis, where many dyads are analyzed together by assuming that the relationship in one dyad is exactly the same as that in another dyad. As demonstrated, there are two competing models: Polachek (1978, 1980) and others estimate models in which bilateral CC is the dependent variable and BT is an independent variable. On the other hand, Pollins (1989a, 1989b) and others estimates models in which the total import is the dependent variable and CC is an independent variable. Most of the researchers, however, admit that the causality direction between BT and CC has not been verified by their models. In order to resolve the trade and conflict debate, the causality between BT and CC has to be addressed first as these results may point out the type of BT and CC model needed.

Sixth, the literature on international political economy of trade and conflict has repeatedly called for an investigation of the causality between disaggregated BT and CC. Accordingly we may investigate these causality issues and the following questions about the dynamic relationship between CC and BT. (1) Does causality between BT and CC for a certain dyad vary across goods? (2) Does causality between BT and CC for a certain commodity differ across dyads? (3) Does CC systematically cause BT in some goods? (4) Does BT systematically cause CC in some goods? (5) Are causality results from disaggregated trade data similar to those from total trade data? (6) Is the size of BT in a commodity out of a country's total trade a factor affecting BT and CC dynamic relationship? Finally, (7) how sensitive are empirical results to trade data source (UN versus IMF) and to data frequency (quarterly versus yearly)?

Seventh, empirical dynamic studies of trade and conflict employ events data to measure CC as this is the only currently available way to measure CC as a continuum.

Existing empirical studies of trade and conflict have used COPDAB for that purpose. Any attempt to enlarge the time period covered beyond 1978 requires to use other events data. As we pointed out, for practical purposes WEIS is the only events data which are systematically being collected for many countries and a wide range of cases. As testing for Granger causality and/or estimating trade and conflict SEMs requires large samples, we need to look into the issue of WEIS - COPDAB compatibility. Such compatibility, if verified, will allow us to create long time series of conflict and cooperation by splicing WEIS and COPDAB events data time series.

Finally, if causality results will point the need to model BT as a dependent variable as in Pollins' work, or model BT as a part of simultaneous model of trade and conflict , we chose one two practical methods to do so. The first approach is to use the trade gravity approach. The second approach is to model demand and supply functions of BT in the presence of trade. If the later option is chosen, one may need to collect data on BT prices, estimate both supply and demand equations in a simultaneous system to avoid simultaneity bias, and use a micro-founded optimization approach.

ENDNOTES

1. See in Smith (1776), Kant (1795), Ricardo (1817), Angell (1911), Willson (1918), Keohane and Nye (1972,1977,1987), Polachek (1978,1980,1992,1995), Doyle (1986), and Rosencrance (1986).

2. The realist argument is rooted in mercantilism (i.e., Hamilton, 1791; List, 1841; Schmoller, 1895) and neo-mercantilists (i.e., Magaziner and Patinkin, 1990; Cohen and Zysman, 1987; Mastanduno, 1991; Vogel, 1992; Borrus and Zysman, 1992; Tyson, 1992; Thurow, 1992; Batra, 1993). On the pursuit of security and relative gains see Carr (1939,1966), Morgenthau (1973), Waltz(1979), and Grieco (1989, 1994). On trade and foreign policy see Hirschman (1945), Waltz (1970), Cooper (1968,1985), Knorr (1975), Baldwin (1985), and Busch and Milner (1994).

3. Since we are dealing with a multi good case, the elasticity of substitution between good i from countries m and l, in country k, is given by the Allen-Uzawa partial elasticity, where X_{imk} (X_{ilk}) is good i produced in country m (l) and consumed in country k, and P_{imk} (P_{ilk}) is its price.

$$\sigma_{imlk} = -\frac{\partial(X_{imk}/X_{ilk})}{\partial(P_{imk}/P_{ilk})} \cdot \frac{P_{imk}/P_{ilk}}{X_{imk}/X_{ilk}}$$

4. Some authors assume that the elasticity of substitution among imports is the same but differs from the one between imports and domestic goods; cf. Markusen (1986) and Bergstrand (1989).

5. Some researchers (i.e., Linnemann, 1966; Aitken 1973; Sattinger 1978; Sapir 1981) use a version of gravity equation that includes exporter and importer population and their income per capita.

6. For surveys of the use of the trade gravity model see Leamer and Stern (1970), Deardorf (1984), Leamer (1992), and Leamer and Levinson (1994).

7. Additional assumptions made are: (1) market structure is monopolistic competition; (2) there are scale economies in production; (3) identical technology of production across countries; (4) the same prices are charged by all firms in an industry; and (5) partial equilibrium market clearing per good.

8. Bergstrand's (1989) test deviates, however, from his model. Only the reduced form is estimated and the same independent variables are used for all goods (regardless of the model's predictions).

9. Using the Rotterdam and the Almost Ideal utilities Marquez (1991) finds different results.

10. CET function is introduced by Powell and Gruen (1968) to model multiple output production processes and is further developed by Hasenkamp (1976). It's form is identical to a CES function ,however, it is concave (while CES is convex). The partial elasticity of transformation measures the effect of a change marginal rate of transformation of two variables on their ratio along CET curve. CET function is used in various trade studies (i.e. Dixon, Parmenter, Sutton and Vincent, 1982; Geraci and Preow, 1982; De Melo and Robinson 1985,1989; Robinson 1988; and Bergstrand, 1989).

11. For example, during the 19th century the British Prime Minister William Gladstone, the politician Sir Robert Peel, and the classical economist John Stuart Mill, believed that trade brings peace.

12. Polachek (1978,1980,1992) uses the sum of conflict and cooperation weighted events, and the yearly difference between the number of cooperative and conflictual events.

13. Spero (1985) and Parrott (1985) analyze East-West trade relations from the 1950s to the early-1980s and find that it follows the pattern of East-West political and military conflict.

14. Pollins' (1989a, 1989b) uses the ratio of squared cooperation to net conflict to measure bilateral relations. Thus, his measure (and results) may be biased in favor of cooperation.

15. Pollins (1989b) estimates demand for imports As supply is not modeled, his study is subject to a simultaneity bias. While the model requires BT prices, Pollins construct prices using multilateral trade prices. Therefore, his results are also subject to measurement error (see Marquez, 1991, 1992).

16. While Bergstrand's (1985) model uses the partners' domestic and multilateral export/import prices, Pollins (1989a) uses the ratio between multilateral export and import prices.

17. Considering only bilateral import demand, Pollins and Brecke (1987) use elasticities of substitution computed in studies surveyed in Stern, Francis and Schumacher's (1976) work which do not involve bilateral political relations as a variable.

18. Summary (1989) studies a cross section of U.S. BT. Cooperation is approximated by arms transfers, a measure of political freedom, and the number of partner's agents registered in the U.S. Dixon and Moon (1993) investigate the effect of political regime and foreign policy orientation on U.S. bilateral export, using pool fo 76 importers from 1966 to 1983. Aitken (1973), Sapir (1981), and Brada and Mendez (1985) investigate the effect of regional economic blocks (i.e., EEC, CMEA) on BT. These studies do not distinguish, however, between cooperative and conflictual dyads.

19. Sayrs summarizes the issue of BT and CC causality: "Since the model [of trade and conflict] has been specified, some important results have emerged but many issues remained unresolved. Perhaps most important are the casual linkages between trade and conflict (i.e., does trade diminish conflict or does the absences of conflict encourage trade" (1990:19). She continues: "There is no systematic evidence that establishes trade as causally prior to lowered levels of conflict" (1990:25).

20. Some researchers have used ad hoc test methods for trade and conflict causality. Pollins (1989a) estimates a model in which the total annual import is the dependent variable, while lagged values of his CC measure are independent variables. He reports that the lagged CC coefficients are statistically significant. Polachek (1980) assumes that the trade CC relationship is reciprocal and uses a two-stage least squares estimation for the equations in which CC is a function of imports and CC is a function of exports. He then concludes that causality runs from trade to CC.

CHAPTER 3: CONFLICT AND COOPERATION MEASURES

As our project uses concepts from both economics and political science, our data include both political conflict and cooperation data and bilateral trade data and other related economic variables. In this chapter of the dissertation, we present the data and measures of CC. CC data are from COPDAB and WEIS data sets. As these events data sets cover different time periods, we investigate their compatibility, intending to combine them into one long time series.

Past research on the compatibility of COPDAB and WEIS is inconclusive: some authors claim that COPDAB and WEIS are compatible, while others claim that they are not. We find that, in general, dyadic series of CC from COPDAB and WEIS are compatible and we splice them to obtain a longer time series of CC to be used in the investigations conducted in this dissertation. A simple method is proposed to combine (or splice) COPDAB and WEIS events time series so as to create a single spliced time series. Long time series from 1948 to 1992 so generated are then used to test Granger causality between international trade and bilateral CC, in chapters 4 and 5, and to estimate the model developed, in chapters 7 through 9. COPDAB and WEIS compatibility results are presented here for six dyads. Additional results are presented in Appendix 1.

3.1 Conflict and Cooperation Events Data Sets

We view bilateral conflict and cooperation as a continuum of actions. Accordingly, our conflict and cooperation data are based on events data sets which are the only source available for bilateral relations that are measured as a continuous variable. Events data are used extensively in the quantitative study of international relations. COPDAB, covering the period from 1948 to 1978, and WEIS, covering the period since 1966, are the most widely used events data sets. Both COPDAB and WEIS report dyadic CC events as published by daily newspapers. The CC events are then sorted by a group of social scientists according to predefined categories and coded into data sets.

Azar's (1972) COPDAB series covers daily political and economic interactions among 135 nations, international organizations and non-governmental agencies. The events were collected from approximately 70 public sources around the world. Azar (1972) decided that multiple sources were necessary to reduce the bias in the data collection. Still, Azar and Havener (1976:232) note: "we cannot say that all the biases of newsmen press agencies and ministers of information have been eliminated ... we do not underestimate the existence of filters in the perception, prosecution and interpretation of international politics". Attempts to aggregate the daily events into wider categories were begun by Azar and Sloan (1975) and finalized by Azar and Havener (1976). This categorization differentiates daily events in terms of the degree of hostility and friendliness they entail by ordering them according to their intensity from the most peaceful event to the most war like one. The data collection of the COPDAB project ended in 1978.

McClelland's (1971) WEIS, on the other hand, covers 243 nations, international organizations and non-governmental agencies. It was, according to Goldstein (1992:370), "constructed within a conceptual framework that explicitly denies the possibility of reducing data to one dimension of conflict-cooperation". The presence of specific "verbs" describing a daily interaction of different states was searched in the data collection for WEIS from the daily reports of its only source, the New York Times. McClelland (1968:G16) argued that several sources might add information if they agreed, but usually these sources did not agree with each other: "our investigation of the matter had resulted, tentatively, in the judgment that the reports do not agree very closely, cross-nationally". Thus, the use of several sources might create noise in the data set. While the selection of the New York Times as the only source may add an "American bias," the New York Times is an "exceptionally rich source of reports of international political events", which would lower the likelihood of biased news reports. Unlike COPDAB in which events are organized in an increasing order of intensity, events in WEIS are coded into nominal categories.

To be sure, there are other events data sets such as Behavioral Correlates of War (BCOW), Kansas Event Data System (KEDS), Program for the Analysis of Nonviolent Direct Action (PANDA), the Global Event Data System (GEDS), and the data set developed by Sherman, 1994 and Farris, Alker, Carley and Sherman, 1980 (SHERFACS). But, they either cover short time periods or deal with a narrow range of cases or both. Two major approaches are utilized in studies that deal with quantitative measurements of international political interactions. Some researchers limit the boundary of their inquiries by focusing on events related to specific disputes or international and domestic incidents of conflicts. Other researchers choose to deal with the overall bilateral political relations -- both conflict and cooperation -- of many dyads over long periods of time, but without focusing on specific episodes of political conflict or cooperation.

SHERFACS and BCOW are two typical examples of "episodic data sets" (Davies and McDaniel, 1994:59). SHERFACS was started by Hass (1968), continued by Farris, Alker, Carley and Sherman (1980), and recently surveyed by Sherman (1994). This events data set measures the dynamics of approximately 700 specific international political conflict episodes, and 1,000 specific domestic disputes in different countries from 1945 to 1985. Leng and Singer's (1988) BCOW emphasizes the need to distinguish between verbal and actual activity of bilateral state interactions. Events records in BCOW contain relatively detailed information and include quotes from news sources. However, BCOW contains a much smaller set of cases, especially, in comparison to the number of cases included in COPDAB or WEIS.

The second category of events data sets includes -- besides COPDAB and WEIS -- the KEDS, PANDA, and GEDS research programs. Schrodt and Gerner (1994) describe the KEDS project and compare its results to WEIS. The KEDS project codes events into WEIS's categories. However, there are two main differences between WEIS and KEDS. First, KEDS is automatically coded by a computer program that reads news texts and sorts them into WEIS categories. WEIS is manually coded. Second, WEIS is based on the New York Times, while KEDS is based on Reuters' News Service wire story leads, available as online data from NEXIS data service starting in 1979. Schrodt and Gerner (1994) report that currently the KEDS data set, from 1982 to 1992, includes daily interactions of seven actors: six Middle Eastern actors (Egypt, Jordan, Syria, Israel, Lebanon, and the Palestinians) and the United States. The authors compared their machine coded events with manually coded WEIS events over the same time periods and for the same actors, and reported that for half of the dyads tested, the correlation for the number of reported conflictual events and net cooperation were statistically significant. The correlations were computed for each year from 1982 to 1989 and ranged from 0.59 to 0.99. The differences between WEIS and KEDS are attributed by the authors to the different density of events reported by the New York Times and the Reuters news agency.

The PANDA project is run by the Center of Nonviolent Sanctions at Harvard University. The main focus of PANDA is nonviolent sanctions, an activity which is not the main emphasis of other event data sets (e.g. COPDAB and WEIS). Although PANDA has not yet been published in regular journals, Schrodt and Gerner (1994) report that the PANDA data set uses the KEDS computer program to code Reuters' News Service wire leads into WEIS-like categories. These categories are augmented by additional codes and verbal descriptions as needed by the particular focus of the PANDA project. Recently, we have learned that the PANDA project has released a global data set covering the years from 1984 to 1994.

The status of the GEDS project has recently been described by Davies and McDaniel (1994). This events data set is not ready yet for public use. It uses the Reuters news agency and other news sources to code events starting initially from 1990. Once this goal is met, the research program intends to go back and code events from 1979, after which time the program will enter events on an almost real time base in a partially automated scheme. Davies and McDaniel (1994:57) summarize the intent of GEDS: "the GEDS project is oriented toward generating a record of daily event reports, rather than a record of "real" events as such" (quotations in original). Therefore, each GEDS event record includes direct quotes from the news source, in addition to some analytical comments. However, "further analysis or interpretation of the report using various coding schemes is left primarily to GEDS users" (1994:57).

Therefore, it seems to us that WEIS is, for practical purposes, currently the only data set of conflict and cooperation events that is systematically being collected for many countries and over a wide range of cases. As a result, as also pointed out by Goldstein (1992), many researchers rely on WEIS events data in their studies on the dynamics of conflict and cooperation in international relations. WEIS starts in 1966, but COPDAB is available from 1948 to 1978. The differences in the way the raw data are collected and categorized, and the different sources used to construct the two data sets raise a legitimate question: Are the COPDAB and WEIS data sets compatible so that they can be spliced into one long time series starting from 1948? This question is investigated in this chapter. The literature on COPDAB and WEIS compatibility is reviewed next.

3.2 The Literature on COPDAB and WEIS Compatibility

The body of literature on events data is by now extensive. A large part of it deals with theoretical issues related to the pros and cons of different approaches of constructing such data sets and to their usefulness in studying international relations in general.[1] Our focus is not on the merits of events data sets themselves or on possible ways to improve them, but rather on actual practical utilization of the existing resources.[2]

In using events data sets, several issues seem to be important: events data scaling, events data aggregation over time, COPDAB/WEIS compatibility, and subsequently combining COPDAB and WEIS series into one time series. The use of scales, or weights, arises due to the relative importance of events. Also important is how to aggregate daily events over time. Daily time series are typically noisy and variables with which COPDAB and WEIS are to be related, such as international trade data, are often monthly and quarterly data. Therefore, some procedures for aggregating events over time are needed. The issue of COPDAB/WEIS compatibility has been repeatedly raised in the literature to check whether they can be used interchangeably for certain hypothesis tests. The purpose of our investigation in chapter 3 is not particularly to discuss whether COPDAB and WEIS are interchangeable, but rather to find ways to splice COPDAB and WEIS time series in their overlapping time periods and still use the original series (or a simple transformation of the those series) in non-overlapping time periods. Our literature review focuses on the COPDAB/WEIS compatibility and possible methods to combine them into one series.

The issue of COPDAB/WEIS compatibility is still being debated in the literature. While the basic information in COPDAB and WEIS is similar, the two data sets are measured differently: they are coded by different people using different procedures. WEIS and COPDAB were compared by Vincent (1983), Howell (1983), and Goldstein and Freeman

(1990). They all used the 1966-1978 COPDAB/WEIS overlapping period as the basis for the comparison, but reached different results. Howell (1983:157) concluded: "Some further explanation of the circumstances under which the two data sets may be used needs to be provided, however, since it seems clear that they [WEIS and COPDAB] are not interchangeable". Vincent (1983:166) opposed this conclusion and claimed: "there is a reasonably good fit between the data sets between 1968 and 1978, except for the years 1971, 1972 and 1975".[3] On the other hand, McClelland (1983) alerted researchers to the basic theoretical differences between COPDAB and WEIS. Recently, Goldstein and Freeman (1990:39) argued: "in all, the degree of correlation is high enough to show that the different series are addressing the same reality".

Howell (1983) investigated COPDAB/WEIS compatibility for the U.S.-U.S.S.R. dyad by aggregating the number of cooperative events and separately the number of conflictual events (frequencies) into annual series and presented graphs of the yearly frequencies versus time from 1966 to 1978. In addition, he generated monthly frequencies (the number of events in a month) for both data sets and correlated them to obtain correlation coefficients between 0.55 and 0.97, and concluded that COPDAB and WEIS were not interchangeable. Then, he checked if tests of six specific hypotheses yielded the same results from alternative uses of COPDAB or WEIS, and reported that the use of COPDAB and WEIS for testing the same hypothesis might lead to different conclusions.

We have several comments on the Howell's work. First, the choice of frequencies of conflictual and cooperative events as the basis for the COPDAB/WEIS comparison is not appropriate. A measure related to the weighted conflict and cooperation scale should be the variable to use, because this is what these data sets were designed to quantify. Moreover, Howell compressed the conflict and cooperation continuum into two discrete levels, which might have caused misrepresentation of the reality due to the loss of resolution. Second, the frequency of occurrence is most likely to differ between data sets that use a different number of newspapers as sources. Third, Howell investigated only one dyad. It is hard to generalize from a study of one dyad. Finally, the interpretation of Howell's results would depend on their intended use. For the purpose of splicing COPDAB and WEIS series, his correlation coefficients in the range 0.55 to 0.97 do not seem to be unreasonably small.

Vincent (1983) compared WEIS and COPDAB for a sample of 128 dyads from 1966 to 1978 by generating annual COPDAB and WEIS aggregates of weighted net conflict per dyad using the Azar and Havener's (1976) weights for COPDAB and the Vincent's (1979) weights for WEIS. He performed three tests for the yearly data. The first test checked yearly correlation between COPDAB and WEIS using all dyads. The correlation coefficients were around 0.8, except for the years 1971, 1972, and 1975 in which the correlations were 0.47, 0.14, and 0.36, respectively. In the second test, Vincent generated a standardized annual net conflict score, and compared COPDAB and WEIS by checking the number of dyads in which this score differed by more than 0.2. He concluded that COPDAB under-reports events related to major powers, European, and Asian states; while WEIS under-reports events related to Middle Eastern, African, and Latin American states. The third test compared systemic properties of COPDAB and WEIS (the overall world level of CC). The weighted yearly reports were summed across all dyads for each year. The match between the yearly increase or decrease of this measure was then used to compare COPDAB and WEIS. Only in four out of 13 years checked, the change of world systemic net conflict from COPDAB matched that from WEIS.

Vincent concluded that in general WEIS and COPDAB can be regarded as similar except for systemic purposes, because the global level of conflict and cooperation expressed by COPDAB and WEIS did not seem to match. It is expected, however, that the basic differences between the two data sets will be most pronounced at a high level of aggregation due to the different number of news sources used by COPDAB and WEIS. In addition, Vincent pooled 128 dyads together and thus his results would not generally apply to WEIS and COPDAB compatibility for specific dyads.

McClelland (1983) reviewed the results of Howell (1983) and Vincent (1983) and argued that WEIS is not fundamentally suitable for analysis of conflict or cooperation. Still, he acknowledged the possibility that users might treat WEIS as if it was created to reflect conflict and cooperation. Thus, for practical purposes, he left the door open to the possibility of splicing WEIS and COPDAB. While he alerted the user for potential difficulties in an interchangeable use of WEIS and COPDAB, he did not completely rule out the compatibility between the two series.

Goldstein and Freeman (1990) studied the relations among the U.S.S.R., the U.S., and China using WEIS, COPDAB and ASHLEY (an events data set dedicated to the U.S.-China-U.S.S.R. relations from 1950 to 1972) to show that their results did not depend on the particular data set used. They first aggregated WEIS and COPDAB into the sums of monthly and quarterly conflict and cooperation using the Azar and Havener's (1976) weights for COPDAB and the Vincent's (1979) weights for WEIS. They then correlated COPDAB and WEIS for each of the six dyads formed by their three countries, each country being once a target (a country the conflict or cooperation action was directed at) and once an actor (a country that generated the conflict or cooperation action). The correlation coefficients were around 0.74 for cooperation and between 0.36 to 0.89 for conflict. They concluded that there was a fairly high degree of match between the two data sets. More importantly, Goldstein and Freeman contradicted Howell's (1983) third test results: While the latter argued that one should not use COPDAB and WEIS to test the same hypothesis, the former did exactly that and obtained consistent results.

Ward and Rajmaira (1992) combined WEIS and COPDAB into one series starting in 1948. They manually re-coded post 1978 WEIS events into COPDAB categories. In cases where the textual descriptions of WEIS were inadequate they looked at the original reports of the New York Times. Ward and Rajmaira weighted the re-coded and the original data using the Azar and Havener's (1976) weights, and then aggregated them into one series for cooperation and another for conflict. This method has, however, several disadvantages. A coder who is also an investigator can inadvertently create data in such a way that will later influence the analysis. At the same time, the method treats the period starting in 1979 differently from the 1948-1978 time period. While 1948-1978 COPDAB events were interpreted by one group of coders, the events after 1978 were coded by a mixed group of the WEIS original coders and Ward and Rajmaira themselves. The fact that the post 1979 events are filtered twice increases the likelihood of events misclassifications or coding errors. Moreover, the method is time consuming and requires skilled coders. Thus, it is not suitable for a study with many dyads over long time periods. A statistical, automated approach would be more cost effective.

3.3 Investigating COPDAB and WEIS Compatibility

WEIS and COPDAB are two data sets between which compatibility is investigated here. However, the methods and statistical techniques we describe below can, in principle, be used to check the compatibility of any events data sets, provided that they include some overlapping time period during which they cover the same dyads. In this sense the methodology developed here is general and does not apply only to WEIS and COPDAB.

We assume that both WEIS and COPDAB are designed to measure, or record, the same political information. Hence, the question of the compatibility between WEIS and COPDAB becomes "to what extent do COPDAB and WEIS record the real world in the same manner?" Note that the question is not whether "the two events data sets truly record the real world," which can perhaps never be answered. In our compatibility study, unlike in McClelland (1983), WEIS and COPDAB are viewed as two measures for the same political phenomenon.

COPDAB and WEIS may indeed be compatible for several reasons. First, both data sets record the same type of information. For instance, an event which COPDAB classifies as "# 11" and another event which WEIS classifies as "yield" may simply be different units of measurement of the same real world phenomenon.[4] Second, the fact that WEIS and COPDAB coders use different coding procedures is viewed as different mechanisms of measuring the same real world phenomenon. Third, the source of COPDAB and WEIS is basically similar, being news reports in public newspapers. Since many modern newspapers receive their news from the same news agencies, we expect a great deal of overlap and commonality. Finally, errors are generally expected in both COPDAB and WEIS. Those errors may come from coder's misclassification of events, coder's misinterpretation of events, or misrepresentation in newspapers themselves. The errors in both COPDAB and WEIS can be -- to a great extent -- purely random, however.

Consequently, it is important to find ways to extract similar signals from the noisy information contained in both COPDAB and WEIS. To this end, we identify three guidelines in our COPDAB and WEIS compatibility investigation. Certainly, the most important guideline should be to choose dyads in which both COPDAB and WEIS had reports in their overlapping period. The second guideline is to compare WEIS and COPDAB on a per dyad basis. Previous works in the literature have shown that when compared in the aggregate, across many dyads, WEIS and COPDAB do not match very well. The compatibility may depend on dyads and its strength may differ from one dyad to another. The third guideline is to look for statistical criteria of COPDAB/WEIS compatibility because any events data sets inherently contain some random components.

An appropriate set of statistical tests is therefore required to check if WEIS and COPDAB are compatible in a given dyad, and if any differences between their measurements across time are purely random.

3.4 Methodology

The following steps are taken here to investigate the compatibility of COPDAB and WEIS:

(1) Create unweighted daily COPDAB and WEIS series for each dyad.[5]

(2) Decide on a particular weights for CC and how to weigh the daily events.[6]

(3) Choose a dyadic measure (or measures) of CC.[7]

(4) Aggregate the chosen dyadic measure(s) over some time period. The length of the time period will depend on the need of the particular application. In general, the shorter the time period of aggregation is (say, monthly rather than quarterly aggregation), the easier it is to discern the dynamics of political processes, but at the same time the political data usually become noisier.

(5) Deal with COPDAB and WEIS missing reports.

(6) Create dyadic COPDAB and WEIS series of the chosen index for the COPDAB/WEIS overlapping time period from 1966 to 1978.

(7) Present graphs of the chosen index of CC for each dyad for the overlapping time period.

(8) Apply statistical techniques to check the compatibility of WEIS and COPDAB, per dyad.

(9) If the plots and the tests show that COPDAB and WEIS are compatible, splice them, per dyad.

Since WEIS and COPDAB are known to under or over report for some geographical regions, as discussed earlier, it is possible that WEIS and COPDAB may not be compatible for some dyads. Six dyads are investigated. At the same time, since several ways of generating measures of conflict and cooperation from the raw data are mentioned in the literature, the compatibility will be tested by using six different indices of conflict and cooperation that are commonly used.

Choice of Dyads

Six dyads are chosen for this study: India-Pakistan, Turkey-Greece, the United Kingdom-Argentina, Jordan-Syria, Honduras-El Salvador, and Egypt-Libya. All six dyads have experienced large fluctuations in their bilateral conflict and cooperation over time. If WEIS and COPDAB are compatible in these dyads, then the two time series are more likely to be compatible in other dyads with less fluctuations. With large fluctuations, there is generally more room for disagreement and discrepancy in the way conflict and cooperation are classified and coded. Dyads are also chosen from different geographical regions in order to address Vincent's (1983) regional effects on WEIS and COPDAB. The number of dyads studied, being only six, is by no means large. However, in order to pay close attention to different conflict/cooperation measures and various statistical procedures, we had to limit ourselves to a manageable number of dyads. Further study is needed to investigate the same issue for a large number of dyads.

Choice of Conflict and Cooperation Measures

The first question to be resolved is whether conflict and cooperation are indeed two separate variables or they can be regarded as two sides of the same variable. Lebovic (1985) claims that conflict and cooperation should be combined into one scale. King (1989) argues that the error from aggregating conflict and cooperation events into one index is smaller than the error from aggregating them into two separate conflict and cooperation indices. Ward (1981, 1982), Havener and Peterson (1975), and Vasquez and Mansbach (1984) argue that conflict and cooperation should be analyzed separately. No answer seems to exist for the choice of appropriate measures. To this end, the following practice is suggested. Most importantly, one should decide which indicator of conflict and cooperation best suits the particular application in question. If it is not clear which indicator would be preferred, several indicators should be investigated in the same model to find out which indicator best explains the data.

Treatment of Missing Reports

Both COPDAB and WEIS contain periods without reports, the extent of which differs from dyad to dyad, especially depending on geographical regions. When a particular study includes dyads from different geographical regions, and especially when a short period of aggregation is used, the likelihood of getting time periods with missing reports will be higher. Sayrs (1987) argues that missing reports are one of more disturbing aspects of both COPDAB and WEIS since the user cannot distinguish possible coding errors from the true absence of news events. Many methods exist to deal with missing data but, in principle, all involve different levels of data manipulation. In the following we discuss two methods that are practical and tractable.

In one popular method, periods of no reports are assumed to signal that nothing interesting actually happened. That is, if nothing was reported, then there had been nothing to report so that missing data are equated with a neutral event with a weight of zero.[8] Thus, in this method missing reports do not add to the aggregation of CC.[9] In the second method, if nothing is reported it is assumed to mean that the last reported news still holds true. In effect, equating no reports to old events amounts to some degree of data smoothing. Since there is no clear choice between the two methods for missing data treatment, both methods are followed in our statistical analysis. For the results reported here, missing reports have been treated as neutral events. Parallel exercises by treating missing reports as being the same as old reports yield similar results.

3.5 Statistical Analysis of WEIS and COPDAB Compatibility

Following Howell (1983) and Ball and Mankiw (1993) who prescribe that the first stage of any time series study should be to plot the data and visually inspect it because a phenomenon that cannot be detected visually will not be significant in most statistical analysis, we generated plots of six COPDAB and WEIS indices of conflict and cooperation for each dyad from 1966 to 1978. Figures 3-1 through 3-6 plot of quarterly net weighted conflict, separate sum of weighted conflict, separate sum of weighted cooperation, maximum cooperation, maximum conflict, and average weighted net conflict, in each of the six dyads.

The net weighted conflict, NET, is the sum of weighted conflict and cooperation events generated by country A toward country B, over the time period T, either a quarter of a year, over which daily events are accumulated.

$$NET = \sum_{t=1}^{T} (W_{CN}(CN_t) + W_{CO}(CO_t)) \quad (1)$$

In (1), W_{CN} is a vector of weights. Each element of W_{CN} corresponds to a particular conflictual event (CN_t) at time t. Similarly, W_{CO} and CO_t are the weights and events of cooperation, respectively.

The aggregated conflict or aggregated cooperation, SUMCN and SUMCP, are the sums of weighted events separately for conflict or cooperation events, respectively.

$$SUMCN = \sum_{t=1}^{T} (W_{CN}(CN_t) \quad (2)$$

$$SUMCP = \sum_{t=1}^{T} (W_{CO}(CO_t) \quad (3)$$

The maximum cooperation, SMX, is the most cooperative weighted event within the time period.

$$SMX = maximum(W_{CO}(CO_1), \ldots, W_{CO}(CO_T)) \quad (4)$$

The maximum conflict, SMI, is the most conflictual weighted event within the same time period, where the minimum operator is used since the weights of conflictual events are negative by definition.

$$SMI = minimum(W_{CN}(CN_1), \ldots, W_{CN}(CN_T)) \quad (5)$$

The sixth measure, the average net weighted conflict, is obtained by dividing the net weighted conflict by the number of events in the given time period which is denoted here as N_T.

$$WS = \frac{NET}{N_T} \quad (6)$$

Figures 3-1 through 3-6, in their order, relate to the pairs Pakistan-India, Turkey-

Greece, the United Kingdom-Argentina, Jordan-Syria, Egypt-Libya, and Honduras-El Salvador. For each dyad, Figure (a) is for net conflict, (b) is for aggregated conflict, (c) is for aggregated cooperation, (d) is for maximum cooperation, (e) is for maximum conflict, and Figure (f) is for average net conflict.

[Insert Figures 3-1 through 3-6 here]

Figures 3-1 through 3-6 suggest that COPDAB and WEIS for those dyads exhibit similar dynamic patterns for conflict and cooperation. The similarity is greater for the net conflict/cooperation index as in Figure (a) than for the separate aggregated conflict or aggregated cooperation indices as in Figure (b) or (c). This is expected, because as the level of data disaggregation increases, the less WEIS and COPDAB will look alike due to the stronger effect of the noise in each series. Yet, we cannot ignore the presence of substantial differences between WEIS and COPDAB even for the net conflict in some cases. The extent of COPDAB/WEIS compatibility for different indices of conflict and cooperation and for different time periods or dyads, according to these figures, appears to be an empirical matter.

A series of statistical tests are performed next.[10] First, I checked whether or not COPDAB and WEIS series include unit roots for each dyad. When a time series, y_t, is correlated with the lagged series of y_{t-1}, then the correlation between y_t and y_{t-1} is called either the first order serial correlation or autocorrelation. Likewise, the correlation between y_t and y_{t-4}, for instance, is called the fourth order autocorrelation. When the correlation between y_t and y_{t-1} is so large to be unity so that dependence of y_t on y_{t-1} is extremely large (or series y_t is very persistent), then the series y_t is said to contain a unit root, or is said to be nonstationary. On the other hand, a series that does not have a unit root is said to be stationary. The difference between y_t and y_{t-1} of a nonstationary series usually becomes stationary. Whether a time series is stationary or nonstationary is important as it shows a degree of persistence in the series and, more importantly, because the distinction between the two situations dictates different statistical analysis to be applied. When a time series has zero autocorrelations for any lags, then it is said to be a white noise series.

Second, the cross correlations between the two data sets are computed. The correlation coefficient is between -1 and 1. Two series are unrelated, or independent, if they are not correlated with each other.

Third, a series of autocorrelations at different lags for each dyadic WEIS and COPDAB series are computed, plotted, and visually inspected. If two stationary time series have similar autocorrelations at different lags, then they can be viewed as compatible.

Fourth, if dyadic COPDAB and WEIS series do not have unit roots, WEIS is regressed on COPDAB, the regression coefficients that are obtained are statistically meaningful, and the significance levels of the coefficients and the properties of the error term -- namely, autocorrelation and heteroskedasticity -- are investigated.

Fifth, if dyadic COPDAB and WEIS series have unit roots, the original series is differenced to make them stationary before conducting the tests listed above. If COPDAB and WEIS are nonstationary, regressing one time series on the other will in general give spurious results. Yet, if the regression error term in this situation is still stationary, the presence of cointegration is indicated.[11] Cointegration occurs when a (particular) linear combination of two nonstationary series becomes stationary. Two nonstationary series should be statistically related differently depending on whether they are cointegrated or not. If they are not cointegrated, then both series have to be differenced before they are meaningfully related. If two nonstationary series are cointegrated, however, an error correction model is then required to relate the two series.

Two alternative methods were used for unit root tests: the augmented Dickey and

Fuller test (ADF) as formulated by Dickey and Fuller (1979, 1981), and the Durbin Watson test (DW) from a linear regression of a series in question on a constant. The results are presented in Table 3-1.[12]

[Insert Table 3-1 here: Unit Roots Tests for Weighted Net Conflict]

The null hypothesis tested is that the series has a unit root. The null hypothesis is rejected at the 5% significance level from ADF in all cases except for Egypt-Libya. Egypt-Libya has the values of -2.35 and -3.07 for ADF, which is larger than the critical value of -3.17. The same null hypothesis is rejected in all cases from DW as all the values of DW are greater than the critical value of 0.39 at the 5% significance level. Our results thus show that both COPDAB and WEIS dyadic weighted net conflict time series are generally stationary.[13]

Correlations between different quarterly measures of conflict and cooperation of COPDAB and WEIS are reported in Table 3-2. The notations of the CC measures used in equations (1) through (6) above are also adopted below. Table 3-2 summarizes the correlations for the 1966-1978 COPDAB/WEIS overlapping time period for the six measures of conflict and cooperation. The country listed above is the actor and the country listed underneath is the target.

[Insert Table 3-2 here: Correlations Between COPDAB and WEIS]

The correlation coefficient is asymptotically, normally distributed with mean zero and variance 1/NOB, where NOB is the number of observations. In rough figures, correlations in the range of ± two standard deviations are not statistically significant at the 5% significance level. When NOB is 52 (quarterly data for 13 years), correlations that lie outside the range ± 0.277 are significant at the 5% significance level. Except for SMX and SUMCP in Honduras-El Salvador, SMX in Jordan-Syria, and every measure in the United Kingdom-Argentina, the correlations in Table 3-2 are significant at the 5% significance level. That is, the weighted COPDAB and WEIS series are linearly related for most of the dyads we tested. In the United Kingdom-Argentina dyad, COPDAB and WEIS exhibit low correlations (ranging from 0.07 to 0.21) for every measure of conflict and cooperation suggesting that they are not compatible. Both COPDAB and WEIS, however, have many missing reports in this dyad during the 1966-1978 overlapping period, and the missing data do not occur exactly at the same time period. On the other hand, Pakistan-India has large correlations, ranging from 0.49 to 0.99. In general, the weighted net conflict (NET) has the highest correlation among the six measures. It is also interesting to note that the COPDAB/WEIS correlations for conflict events of SMI (or SUMCN) are generally higher than those for cooperation events of SMX (or SUMCP). Perhaps, this result is because there had been some severe conflicts or wars in all of our dyads in the sample period.[14]

Finally, a series of autocorrelations at different lags were computed and displayed for quarterly weighted net conflict for each dyad. As already mentioned, autocorrelations are important because they characterize the time series behavior of any stationary time series. Since both COPDAB and WEIS quarterly weighted net conflict series are stationary, they can be viewed as compatible when their correlograms (a plot of autocorrelations) look similar. Figures 3-7(a) through 3-7(f) are correlograms of the net conflict for the six dyads. In general, the COPDAB and WEIS correlograms of all dyads look similar.

[Insert Figure 3-7 here: Autocorrelation]

As before, autocorrelations that lie in the range of $\pm$ 0.277 are generally not significant at the 5% level. For example, Figure 3-7(b) shows that the autocorrelations for Turkey-Greece of both COPDAB and WEIS are statistically zero, from the very first lag. Figure 3-7(d) indicates that a similar pattern exists for Jordan-Syria, except for a significant (at the 5% level) autocorrelation at the fourth lag of COPDAB. Similar observations can be made for the other dyads. The fact that autocorrelations are generally not significant from the first lag points out that a nation's actions toward another nation have a short memory without much persistence. The similarity of the correlograms also implies that COPDAB and WEIS weighted net conflict series for these six dyads are sufficiently compatible to justify splicing.

3.6 Splicing COPDAB and WEIS

Since various statistical tests performed support the COPDAB/WEIS compatibility for each dyad, dyadic COPDAB and WEIS series are spliced to create one long time series of conflict and cooperation from 1948 to 1993. The following linear regression equation is estimated for quarterly conflict and cooperation indices:

$$WEIS_t = C_0 + C_1 COPDAB_t + e_t \tag{7}$$

where C_0 is the intercept term, C_1 is the slope coefficient, and e_t is the regression error or residual term. In (7), WEIS and COPDAB stand for all the conflict and cooperation indices used in Table 3-2. Using the regression coefficients estimated for the quarterly weighted net conflict, WEIS-like COPDAB indices were computed. Events in COPDAB during 1948-1966 are thus transformed to conform to WEIS.[15] Similar regression equations were separately estimated for the quarterly sums of weighted conflict and weighted cooperation.

The adoption of a regression method for splicing has several advantages. It uses the information only in the original COPDAB and WEIS data sets and thus minimizes jumps in the transition period (1966 or 1978) from one series to the other, as the regression estimation finds the coefficients that minimize the squared deviations of one series from the other. The method is also relatively simple and does not increase the likelihood of additional coding errors. The method computes different regression coefficients for each dyad. I therefore do not impose a stronger constraint that the same coefficients should prevail in all the dyads.

Whether or not to include an intercept in (1) depends on two competing considerations. If a linear regression does not include an intercept, then the mean of the residual will not be zero in general; and if it does include it, then the model transforms a neutral event in the original COPDAB series into a non-neutral event in the transformed WEIS-like COPDAB series. If missing reports are treated as neutral events, the inclusion of the intercept also means that missing reports in COPDAB are transformed into non-neutral events, and therefore the 1948-1966 period in the transformed COPDAB will not have, strictly speaking, periods of no reports or neutral events at all. Yet, if the intercept term is numerically small, these considerations do not matter. At any rate, the intercept terms are included in our regressions.[16]

The results of the regressions are summarized in Table 3-3 for each dyad, where R^2's in Panel A are from net conflict (NET), sum of cooperation (SUMCP), and sum of conflict (SUMCN) indices. Next to R^2, in Panel B, the values of C_0 and C_1 coefficients for net conflict with their corresponding standard errors and significance levels (from t-statistics) are also presented. For instance, C_1 for Pakistan-India is 2.244 with the standard error of 0.042. The implied t-statistic is 53.43 (2.244/0.042), which has a "p" value, or a significance level, of 0.000. That is, the coefficient is significant at any conventional significance level. The Durbin Watson statistic, the significance level from Box-Pierce Q statistics, and the White test statistic are also listed in Panel C. The White's (1980) test statistic is distributed as χ^2, and checks for the presence of heteroskedasticity in the regression error term (values greater than 7.81 imply heteroskedastic error term).[17] Only Pakistan-India has White's statistic greater than 7.81 with the value of 13.01 indicating a potential heteroskedasticity. The Durbin Watson and the Q statistics check for the presence of the first and higher order autocorrelations in the error term. A value of Durbin Watson statistics around 2 and Q significance levels larger than 0.05 imply no autocorrelations indicating the residuals are white noise series.

Table 3-3 thus shows that, except for the United Kingdom-Argentina which we discussed earlier, C_t is significantly different from zero and C_0 is not significantly different from zero at any conventional significance level. (As mentioned above, we nevertheless decided to keep C_0 in the regression.) The regression error term does not exhibit autocorrelations of the first and of higher order, and, except for Pakistan-India, it is also homoskedastic. The fact that the error term is mostly white noise suggests that the difference between COPDAB and WEIS can be inferred to be purely random. In other words, there is no statistical difference between COPDAB and WEIS net conflict measures.[18] As we have already mentioned, the United Kingdom-Argentina had mostly missing data from 1966 to 1978, for which the regression splicing method, and for that matter any statistical method, will not work. In sum, the regression method has successfully spliced COPDAB and WEIS for five out of the six dyads.

3.7 Concluding Remarks

The splicing method developed in this chapter is used to generate time series of CC for the dyads investigated in chapters 4-5 and 7-9. In general, these results support the part of the literature which advocates that WEIS and COPDAB are compatible.

ENDNOTES

1. The advantages and disadvantages of events data are discussed by Azar and Ben-Dak (1975), Achen (1987), Andirole and Hopple (1984), and Gaddis (1987). Hermann (1988) and Alker (1988) suggest constructing different types of events data sets and Schrodt (1988), Schrodt and Donald (1990), and Schrodt and Gerner (1994) looking into automating the process of events data collection.

2. There are some researchers who are against the use of any events data sets at all.

3. His sample period was from 1966 to 1978 throughout his paper. Yet, he used 1968 rather than 1966 in this statement.

4. We cannot overemphasize the importance of applying similar weighting scales to the discrete categories of COPDAB and WEIS before comparing them or using them together. The latest paper dealing with the issue of scaling WEIS was written by Goldstein (1992), which shows, to our best knowledge, the only full weighting scheme of WEIS. As for COPDAB, the weighting scheme of Azar and Havener (1976) is used by most researchers.

5. Both COPDAB and WEIS data sets include several fields of data for each event. Important information for our purpose is the conflict and cooperation scale per dyad, which is the value from 1 to 15 in COPDAB and an abbreviated verb describing the particular event in WEIS. For detailed descriptions for COPDAB, see Azar (1982, 1984); and for those for WEIS, see World Event Interaction Survey, Coding Manual (1993).

6. Several such weighting schemes exist for both COPDAB and WEIS. Goldstein (1992) summarizes this literature and presents a new set of weights for all of the 63 events in WEIS. In this study we use the Azar and Havener's (1976) weights for COPDAB and Goldstein's (1992) weights for WEIS. These weight schemes are widely used in the literature.

7. The choice of conflict and cooperation index is important and can affect empirical results. The particular choice should depend on the application at hand. Several types of indices are mentioned in the literature: Polachek (1978, 1980) uses unweighted net conflict; Thompson and Rapkin (1982), Gasiorowski and Polachek (1982), Gasiorowski (1986) and Pollins (1989a, 1989b) use weighted net conflict; Gasiorowski (1986) uses average weighted net conflict; Sayrs (1987), Ward and Rajmaira (1992), and Ward (1981, 1982) use separate weighted conflict and cooperation indices; and Ashley (1980) mentions the possibility of using the extreme values of conflict and cooperation.

8. Sayrs (1987) argues that treating missing reports as neutral events may create too much variation of conflict and cooperation across time, and therefore may introduce spuriousness into the data. She decides to drop dyads with many periods of missing reports from the analysis. However, I do not follow her approach because it is still interesting to study COPDAB/WEIS compatibility under the same treatment of missing reports in all dyads.

9. This approach was adopted by Sayrs (1987) and Goldstein and Freeman (1990). Pollins (1989a, 1989b), Gasiorowski and Polachek (1982), Gasiorowski (1986), Polachek (1978, 1980) and Ward and Rajmaira (1992) do not explicitly report how they treated missing

reports.

10. All the statistical analyses are conducted by using RATS version 4.0.

11. For the full treatment of spurious regressions when using nonstationary time series in linear regression, see Granger and Newbold (1974) and Phillips (1986). The use of error correction models for cointegrated variables is summarized by Banerjee et al. (1993).

12. The results in Table 3-1 are for the quarterly weighted net conflict index. Other indices of conflict and cooperation were also checked and they did not have unit roots either. Time series from COPDAB from 1948 to 1978 and WEIS from 1966 to 1993 are analyzed separately for unit roots.

13. Though similar tests were conducted for other measures of conflict/cooperation, they are not reported. The results were qualitatively the same as those reported here.

14. We also used monthly data for three dyads to check if there was any significant difference. The results showed that the use of monthly data did not make any qualitative difference in the correlation between COPDAB and WEIS.

15. Alternatively, WEIS can be transformed to behave like COPDAB. We decide to convert COPDAB into WEIS-like numbers because WEIS is still being updated. Professor Tomlinson at the Naval Academy in Maryland, the current manager of the WEIS project, has informed us that WEIS will continue to be updated in the foreseeable future.

16. In Table 3-2, the largest intercept term equals 27.221 for Pakistan-India, which should still be considered to be small, because Figures 3-1 (a) through 3-6 (a) show that the quarterly net conflict indicator is in general, though dyad dependent, in the range of $\pm$ several hundreds.

17. The White test regresses the regression residuals on the independent variables and their squares.

18. Our splicing method assumes that the coefficients derived from COPDAB/WEIS overlapping time period remain the same outside of the sample period. Unfortunately, the 1966-1978 period is the only period in which we have both COPDAB and WEIS. A test for structural change was developed by Chow (1960). We performed a predictive failure Chow test for structural stability within the sample period. Possible causes for structural instability may be a change in coding procedures, a change in sources, or a change in event data collection. Our Chow test results show that our COPDAB/WEIS transformation is indeed stable.

Table 3-1. Unit Roots Tests for Weighted Net Conflict.

	COPDAB			WEIS		
Dyad	ADF	DW	NOB	ADF	DW	NOB
Pakistan-India	-4.46	1.57	113	-4.41	1.92	111
Turkey-Greece	-4.00	1.41	112	-5.95	2.34	101
U. K.-Argentina	-3.77	2.08	113	-4.20	2.01	90
Jordan-Syria	-3.18	1.26	113	-3.81	1.89	100
Egypt-Libya	-2.35	0.77	122	-3.07	1.32	97
Honduras-El Salvador	-4.98	1.80	119	-5.57	1.68	88

Notes: ADF is augmented Dickey-Fuller statistic, DW is Durbin-Watson statistic, and NOB is the number of observations. At the 5% significance level for the sample size of 100, the critical value for ADF is -3.17, so that there are no unit roots except for Egypt-Libya. The critical value is from Greene (1993:565). At the 5% significance level for the sample size of 100, the relevant critical value for DW is 0.39, so that there are no unit roots. The critical value is from Engle and Yoo (1991:128).

Table 3-2. Correlations between COPDAB and WEIS.

Conflict/Cooperation Measures	Pakistan-India	Turkey-Greece	U. K.-Argentina	Jordan-Syria	Egypt-Libya	Honduras-El Salvador
	Dyads					
NET (net conflict)	0.99	0.49	0.14	0.71	0.50	0.91
SUMCP (sum of cooperation)	0.83	0.56	0.07	0.35	0.30	-0.047
SUMCN (sum of conflict)	0.97	0.55	0.19	0.81	0.83	0.92
SMX (maximum score or most cooperative event)	0.51	0.29	0.12	0.15	0.43	0.042
SMI (minimum score or most conflictual event)	0.50	0.55	0.21	0.72	0.71	0.83
WS (weighted net conflict)	0.49	0.25	0.20	0.39	0.59	0.60
Number of observations	52	52	41	51	38	39

Note: The number of observations differs from one dyad to another depending on the reporting periods in WEIS and/or COPDAB.

Table 3-3. COPDAB and WEIS Compatibility Tests.

Dyads:	Pakistan-India	Turkey-Greece	U. K.-Argentina	Jordan-Syria	Egypt-Libya	Honduras-El Salvador
Panel A: R^2 from the regression of WEIS on COPDAB.						
NET (net conflict)	0.982	0.236	0.000	0.499	0.627	0.801
SUMCP (sum of cooperation)	0.692	0.325	0.065	0.123	0.215	0.001
SUMCN (sum of conflict)	0.984	0.318	n/a	0.664	0.759	0.860
Panel B: Regressions of $WEIS_t = C_0 + C_1\,COPDAB_t + e_t$ for the net conflict.						
C_0	27.221	-6.560	3.951	-8.348	3.580	-10.374
C_1	2.244	0.795	-0.001	0.584	0.496	0.716
$Se(C_0)$	24.165	8.828	2.168	8.509	9.822	7.764
$Se(C_1)$	0.042	0.202	0.129	0.083	0.063	0.058
$Sg(C_0)$	0.265	0.460	0.075	0.331	0.717	0.189
$Sg(C_1)$	0.000	0.000	0.993	0.000	0.000	0.000
Panel C: First and higher order of autocorrelations of the residual from Panel B.						
DW	1.835	2.166	1.776	2.194	1.683	1.601
Sg(Q)	0.461	0.406	0.981	0.426	0.872	0.284
White	13.01	4.12	0.09	0.64	6.54	6.12

Notes: n/a indicates that there are no conflict events. Se(.) is standard error and Sg(.) indicates the significance level. For significance, values less than 0.10 (0.01) imply a significance at the 10% (1%) level. DW is Durbin Watson statistic; Sg(Q) is the significance level for Box-Pierce Q statistics, and White is White statistic for heteroskedasticity. All statistics in Panel C show that residuals in Panel B are white noise. The number of observations for each dyad is listed in Table 3-2.

Figure 3-1: Pakistan to India

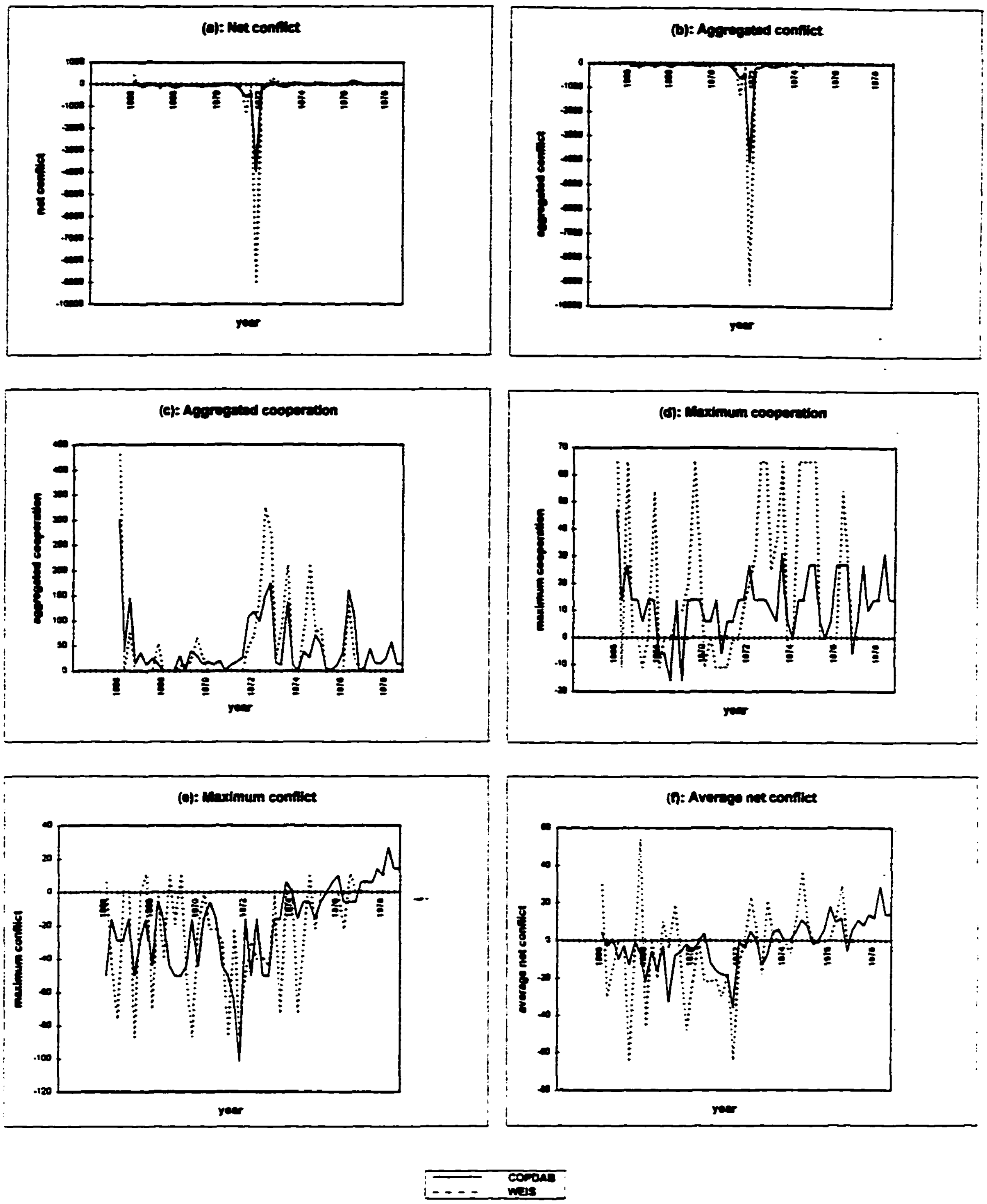


Figure 3-2: Turkey to Greece

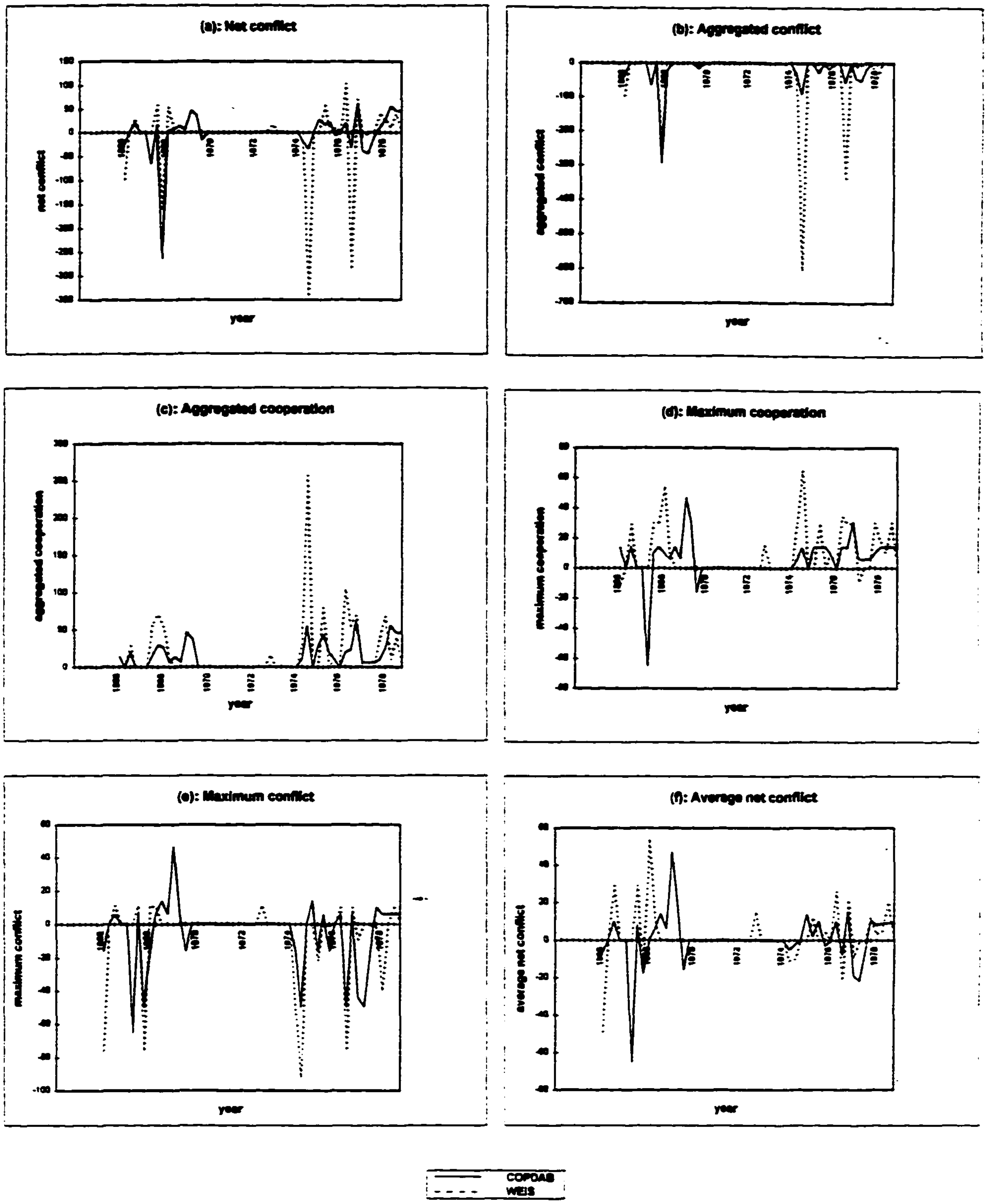


Figure 3-3: U.K. to Argentina

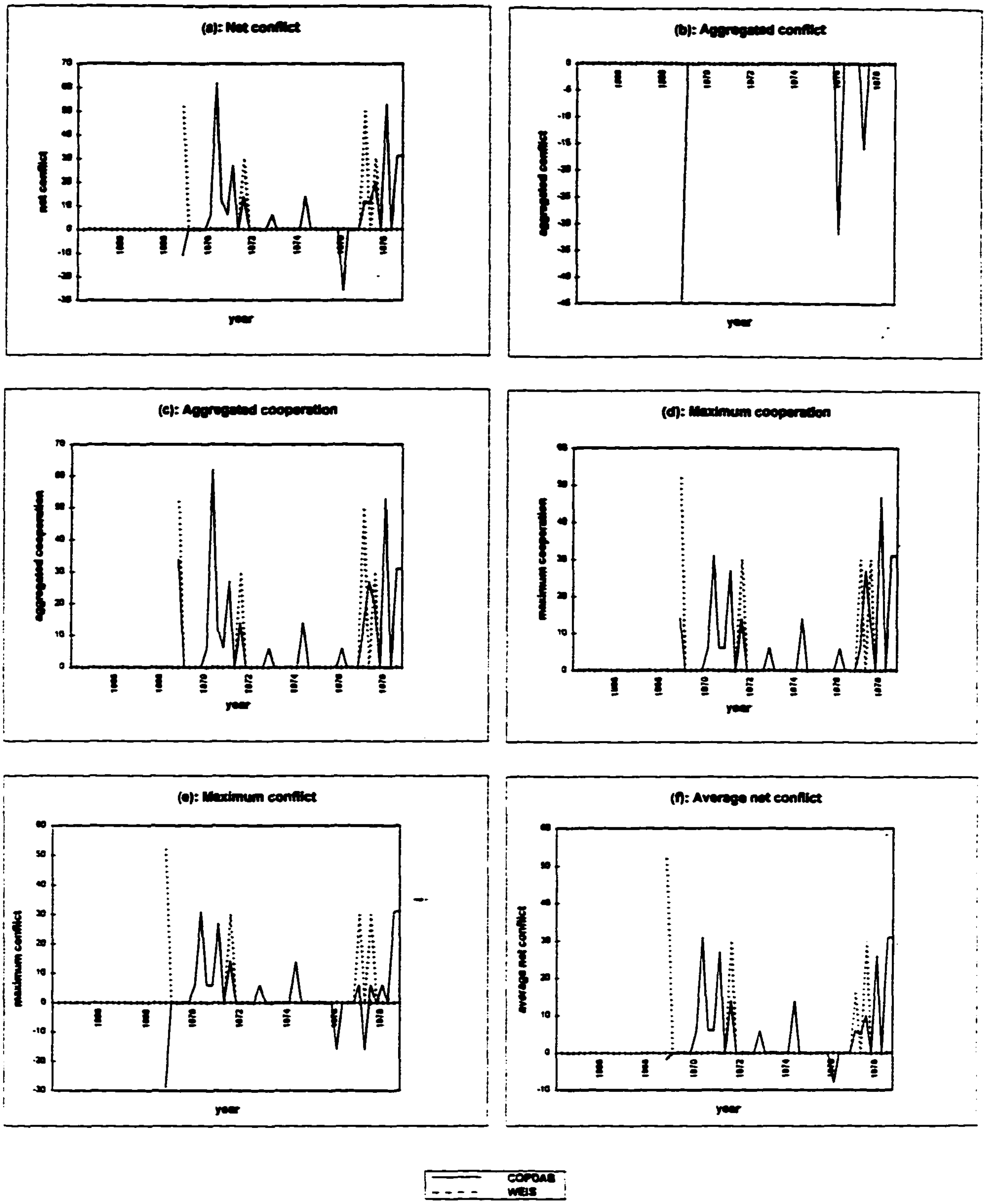


Figure 3-4: Jordan to Syria

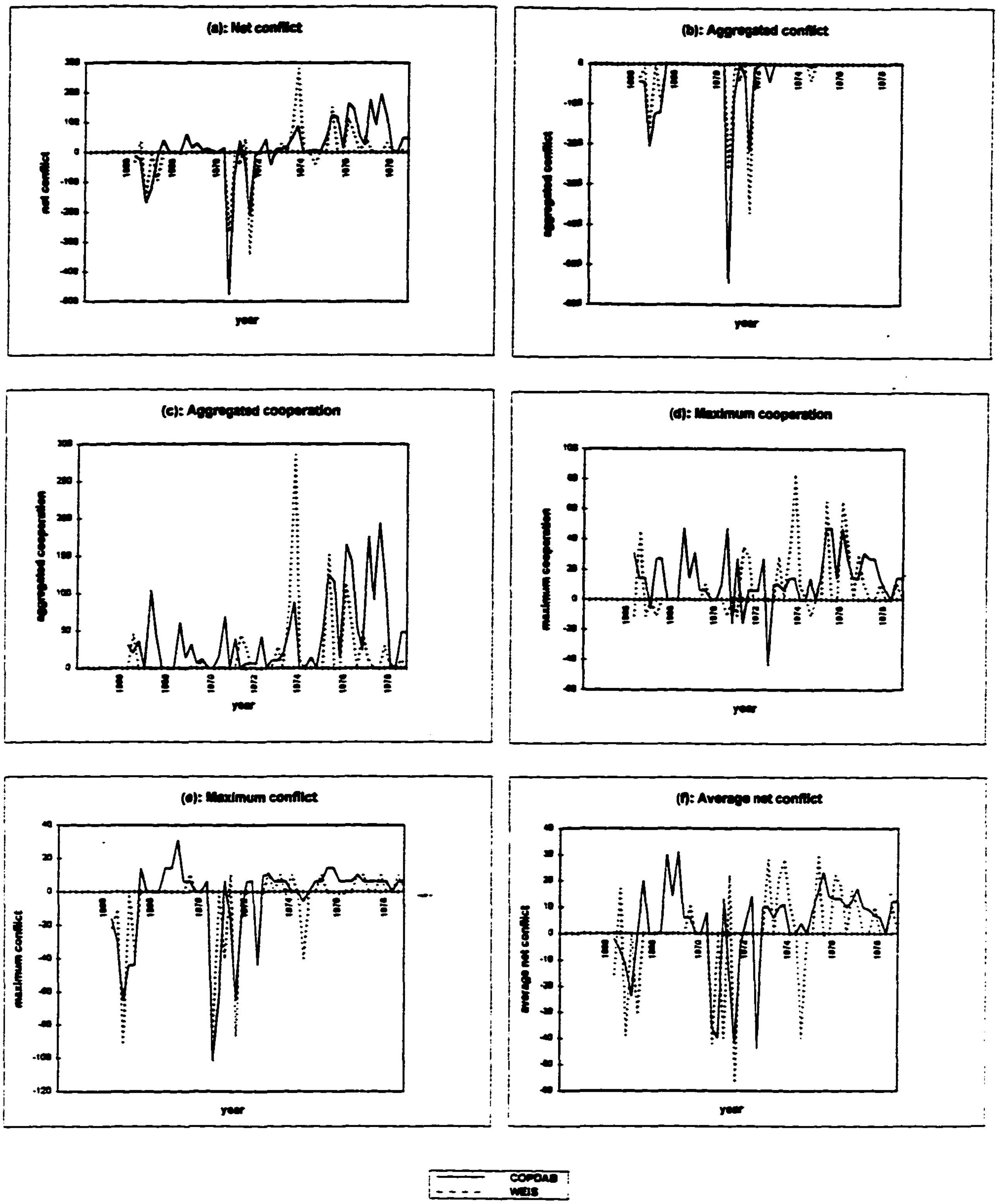


Figure 3-5: Egypt to Libya

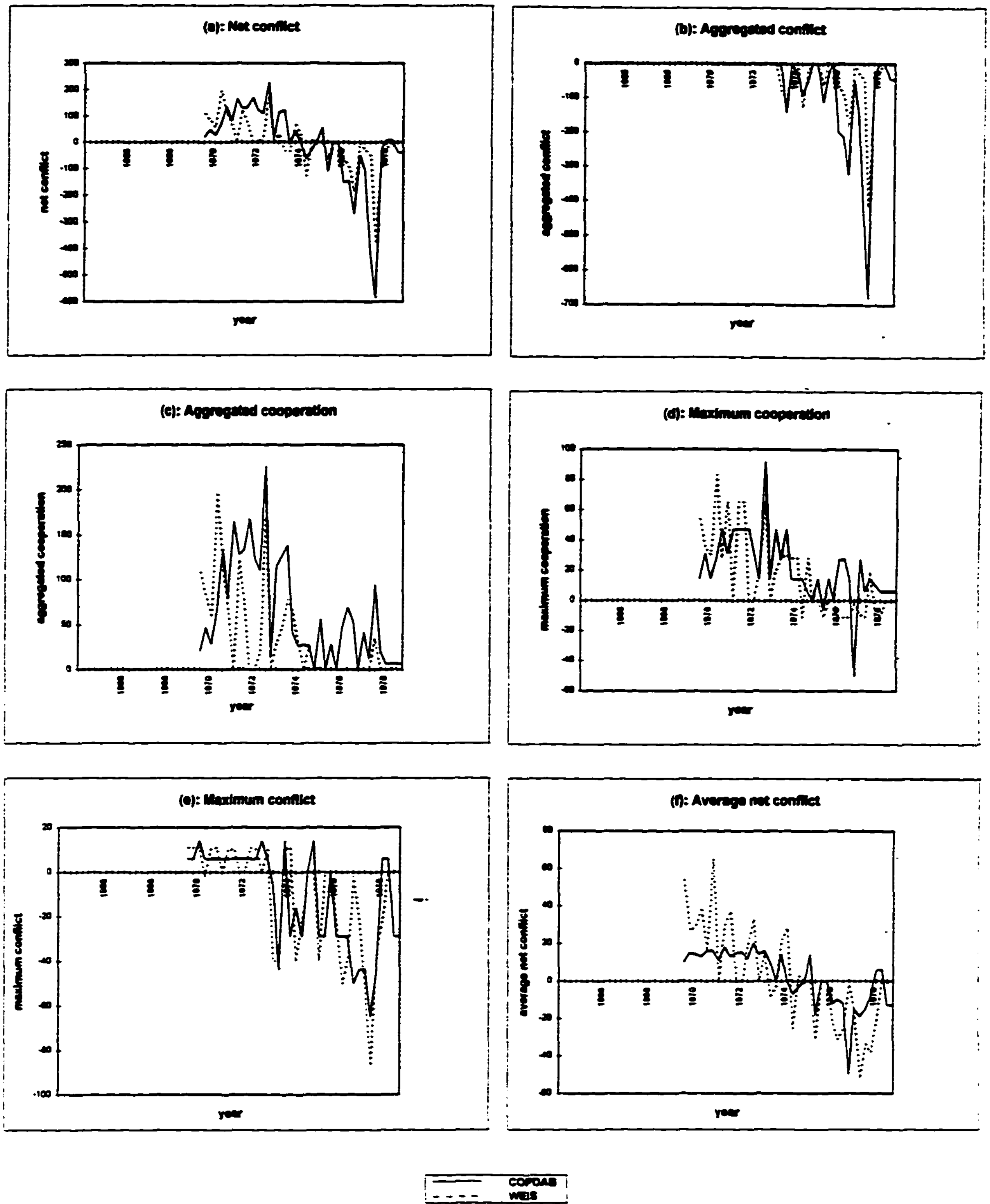


Figure 3-6: Honduras to El Salvador

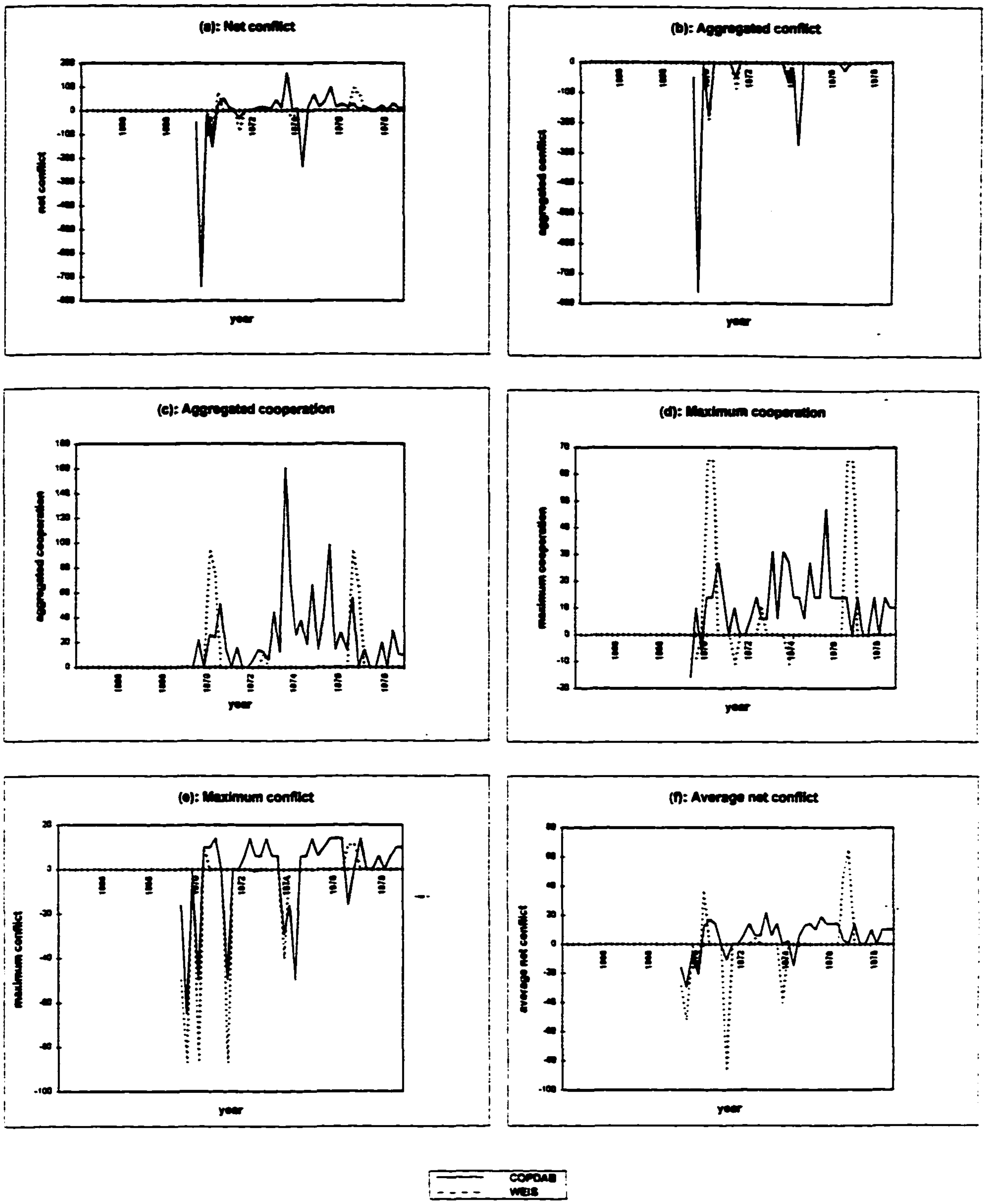
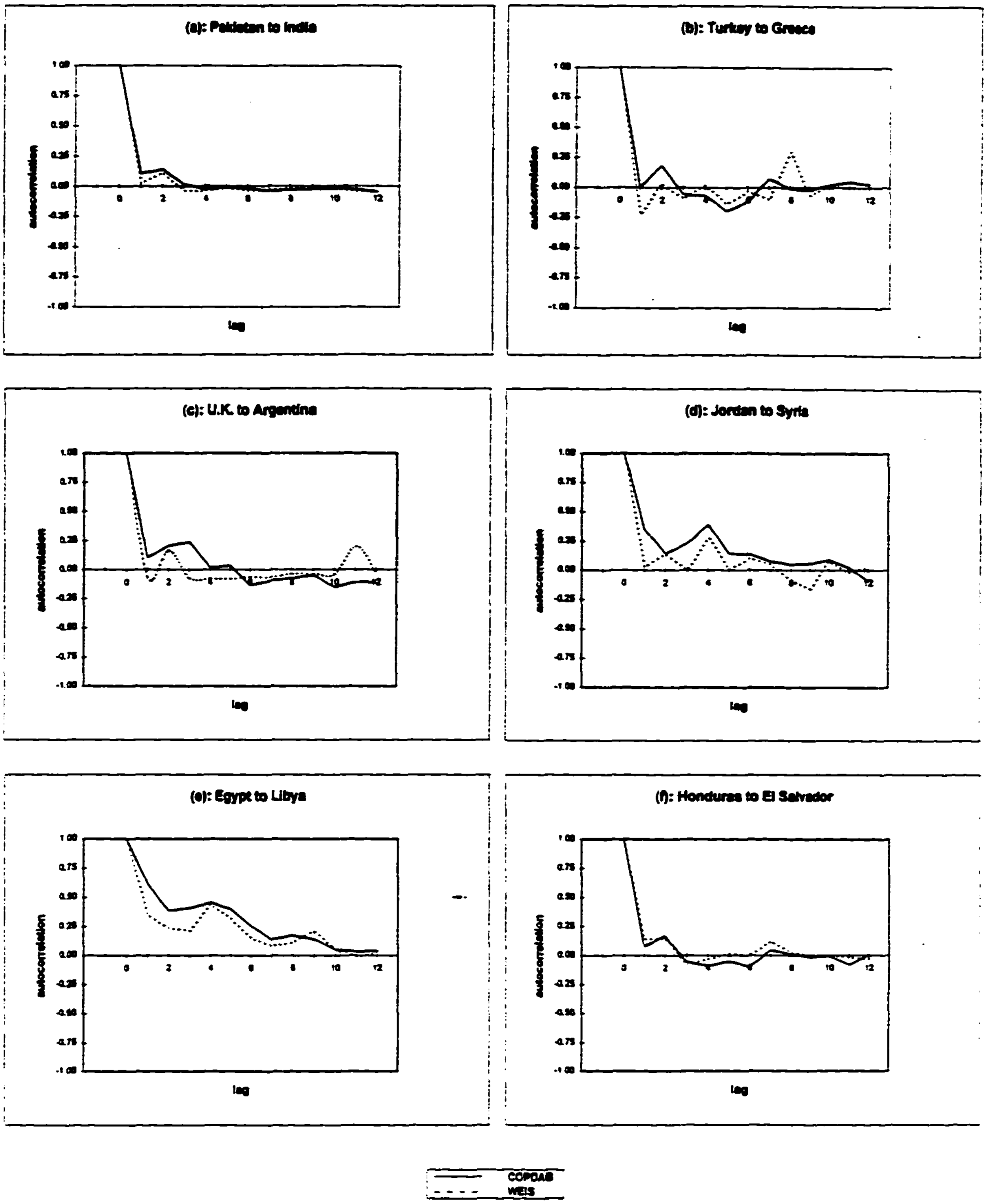


Figure 3-7: Autocorrelation



CHAPTER 4: TOTAL BT AND CC CAUSALITY

The need for a total and disaggregated trade and conflict causality study is clearly established in the literature. This chapter investigates the causality between total BT flows and CC. The next chapter investigates the causality between disaggregated BT flows and CC.

4.1 Granger Causality Test Procedure

Pierce (1977:12) summarizes the definition of Granger causality, originally given by Granger (1969), as "Granger's definition is in terms of predictability: a variable X causes another variable Y, with respect to a given universe or information set that includes X and Y; if present Y can be better predicted by using past values of X than by not doing so, all other information available (including past values of Y) being used in either case."

Since Sims' (1972) seminal study on Granger causality between money and income, many papers have investigated the causality for various time series. To be sure, there have also been papers written on the shortcomings of Granger's approach. Guilkey and Salemi (1982), Geweke (1984), and Kang (1985) have shown that the Granger test results are sensitive to distributed lag length choice. Nelson and Kang (1981, 1984) have shown that detrending a series with unit roots generally changes its dynamic properties. Moreover, Kang (1985) has shown that detrending nonstationary series will, in general, lead to different causality conclusions. Another difficulty arises from missing variables, as was also pointed out by Granger himself (1980): the inclusion of a third variable in a bilateral Granger causality test may change the test's results.

Limitations notwithstanding, Granger causality tests have been widely performed because they can reject theories that incorrectly assume certain causal relationships. Furthermore, a causality study can also serve as a heuristic statistical description of the relationship between variables which can be exploited in a subsequent model building process.

The discussion is organized along the following subsections. First, we discuss our research design. Second, we describe the dyads, data, and trade and conflict measures used in the investigation. Third, we present the causality regressions. Last, we discuss our results presented in several Tables.

4.2 Research Design

A causality relationship can be viewed as a prerequisite to a formal model building. Moreover, this is an important step toward understanding trade and CC dynamics. All the studies so far in the literature have used pooled data. The advantages of this approach are clear: gaining estimation efficiency and overcoming insufficient data for some dyads. Such a research design implicitly assumes that the coefficients of the estimated models are the same in all dyads. However, the trade and conflict literature does not support such an approach.

Hirschman (1945) distinguishes economically small and dependent countries from large and powerful countries. Keohane and Nye (1977) hypothesize that the economic and political behavior of interdependent countries is different from that of dependent or non-dependent countries. Polachek (1980) distinguishes between large countries (e.g., the U.S. or the U.K.) and small countries (e.g., Lebanon or Israel). Gasiorowski and Polachek (1982) focus on the dyad U.S. - Warsaw Pact, implicitly arguing that the behavior of this dyad is expected to be different from other dyads. Arad and Hirsch (1983) distinguish the behavior of previous enemies from that of other countries. Gasiorowski (1986) finds that the trade and conflict behavior of the U.S. toward one country is different from that toward another country. Sayrs (1989a) finds that countries with a large total trade volume behave differently from countries with a low volume. Polachek (1995) distinguishes between the behavior of democracies and nondemocracies. It is also reasonable to argue that economic relations among countries should generally be represented at the same level of analysis as conflict and cooperation because the two activities are interrelated. Causality should therefore be investigated for each dyad individually, as it is done here.

Since previous studies indicate that Granger tests are sensitive to many factors, we take a conservative approach to reduce the risk of obtaining false results. The presence of unit roots is checked to find a suitable data transformation and causality is tested by using different numbers of lags. We also construct our bilateral BT measures properly.

4.3 Data and Measures of Trade and Conflict

In this section we discuss the dyads in the sample and the measures of BT and CC constructed for the causality investigation. Our measures are then compared to those used by other studies in the trade and conflict literature.

Dyads

The choice of our 16 dyads is based on several considerations. The availability of BT and CC data plays an important role. Not all countries report their trade data to international organizations, and some countries do not appear in events data sets for certain time periods. Annual total trade data are generally available since 1948 and quarterly data only since 1960. Conflict and cooperation events data are available since 1948. For a dynamic analysis of dyadic trade and CC, dyads have to show a considerable degree of variations in their trade and conflict/cooperation data over time. Diverse dyads are to be selected from different geographical regions and with a whole conflict/cooperation spectrum. Our sample, accordingly, includes countries that fought a long war and signed a peace agreement, countries that fought a short war and reached a settlement, countries that did not fight a war but still experienced political tension of different levels of intensity, and countries classified as enduring rivalries by Gochman and Maoz (1984). Our 16 dyads thus include countries of different sizes and of different types of political and economic regimes by containing superpowers, regional powers, democracies, planned economies, medium sized countries, and small countries.

Table 4-1 summarizes several characteristics of the 16 dyads.[1] Sample periods depend on the availability of the data. Generally, the sample period ends at the last quarter when WEIS has a non-missing reports. Adopting Azar's (1982) terminology, *target* stands for the country toward which the political activities were directed, and *actor* stands for the country that originated the political activities toward target. The column titled *enduring rivalry* presents the Gochman and Maoz (1984) classification for the time period 1816 to 1976. In the column titled *war*, a yes/no answer is listed to the question if there was a war between the two countries within the time span of our sample. In cases of yes, the years in which the war took place are listed. The entry *ET* indicates a situation of extreme tension, which is listed along with the years of the extreme dyadic political tension.

[Insert Table 4-1 here: Dyads in the Sample.]

Conflict/Cooperation and Trade Data

The trade data are from the International Monetary Fund (IMF) data base[2] which contains annual data since 1948, and quarterly and monthly data since 1960. The data in this study include the following quarterly time series for each dyad, each reported by country A in nominal dollars: (1) total exports from country A to country B, (2) total imports of country A from country B, (3) total exports of country A to the rest of the world, and (4) total imports of country A from the rest of the world.

Quarterly trade data are used in this study. The Granger causality test needs a large amount of data since its statistical model includes distributed lags of both dependent and independent variables. Although annual trade data have less cases of no reports and are probably more consistent across countries than monthly and quarterly data, the investigation of the dynamics of BT and conflict/cooperation may require data with a higher frequency than annual data. This is because, though not tested, the reaction time for firms, private agents, and policy makers in response to political changes may probably be shorter than a year. In fact, certain BT and conflict/cooperation relationships show drastic economic and political changes within a few months and even a few weeks. On the other hand, monthly export and import data tend to be noisy with many periods of no reports. Hence, quarterly data are used here.

As in most of the previous empirical studies on trade and conflict/cooperation, COPDAB is chosen, because, to our best knowledge, this is the only source that consistently covers world wide dyads over a long time period. COPDAB's 1948-1978 coverage is augmented by WEIS, which covers events since 1966. In chapter 3 I have shown that COPDAB and WEIS are generally compatible so that the two data sets can be spliced together. Accordingly, I use a regression method, as in Chapter 3, to splice COPDAB and WEIS series into a single time series.

Construction of Trade and Conflict/Cooperation Measures

No exact rules exist for the correct choice of conflict/cooperation and trade measures. In order to make our causality study comparable to earlier studies, measures that have widely been used in the literature are chosen here. Polachek (1978, 1980) uses exports, imports, and net conflict; Pollins (1989a, 1989b) uses imports and cooperation weighted by net conflict; Gasiorowski (1986) uses several measures of economic interdependence and average net conflict; and Sayrs (1987, 1989a) uses exports and imports both normalized either by gross domestic products or by the total trade with the world, and separate sums of conflict and cooperation. The variables in this chapter are chosen in order to capture an "overall" phenomenon of bilateral political climate and international trade.

Conflict/Cooperation Measure. Daily weighted conflict/cooperation reports are aggregated into a quarterly index of net conflict. As in Polachek (1978, 1980), Gasiorowski and Polachek (1982), Gasiorowski (1986), Thompson and Rapkin (1982), Dixon (1983), and Pollins (1989a, 1989b); conflict and cooperation are not considered as two separate variables. They are instead treated as having opposite signs of the same variable. It is further assumed that the "general" bilateral political climate, as opposed to separate indices of conflict and of cooperation, is important for the causality. The decision making process by firms, private agents, and political leaders is thus assumed to depend on the aggregation of the full spectrum of political relations.[3]

The net conflict measure was generated as in chapter 3. First, separate conflict and cooperation daily series were constructed for WEIS by using the Goldstein's (1992) weights and for COPDAB by using Azar and Havener's (1976) weights.[4] The daily measures are from actor toward target countries. Second, the daily measures were summed to produce quarterly cooperation and conflict measures, both for WEIS and for COPDAB. Finally, net conflict indices were obtained by adding the quarterly conflict and cooperation measures.

N_t denotes net conflict generated by actor A toward target B in period t, the "observations period" (a quarter), over which daily events are summed. Missing daily reports were assumed to be equivalent to neutral events.[5] The splicing of COPDAB and WEIS follows chapter 3. A time series of WEIS net conflict was regressed on a similar COPDAB time series and a constant term over the overlapping period of 1966-1978. Regression coefficients, estimated by ordinary least squares for each dyad were used to linearly transform quarterly net conflict COPDAB time series into WEIS-like series, starting in 1948 and ending in 1966. Finally, one long series is obtained from 1948 to the early 1990s by using the original WEIS series starting from 1966 up to the quarter of the last reports in WEIS. In two cases where WEIS and COPDAB showed no compatibility in the overlapping period, two separate data periods were adopted one using COPDAB and the other using WEIS.[6]

Trade Measure. Nominal dollar figures reflect the effects of inflation, changes in exchange rates, economic business cycles, economic growths, and commodity price changes. To isolate the relationship between conflict/cooperation and BT, the IMF trade data were normalized. Hirschman (1945) is the first researcher to suggest the use of a normalized index, which he calls the trade partner concentration ratio. This ratio can measure both the importance of the BT to a country and the country's dependence on its trade partner.

Gasiorowski and Polachek (1982) claim that a bilateral version of Hirschman's index (the percentage of a country's trade with a given partner) is a proper variable to use in studies of trade and conflict. However, they do not use that variable because "[u]nfortunately, the necessary data to compute this measure were not available to us for quarterly time periods." (1982:715). Consequently, they use the real dollar value of total trade, export, and import the limitations of which have been mentioned above. Fortunately, we have located the data needed to compute the bilateral version of Hirschman's index. The quarterly dyadic trade ratio, BT_{t}, is computed as follows:

$$BT_t = \frac{EXP_{ABt} + IMP_{ABt}}{EXP_{AWt} + IMP_{AWt}}, \tag{1}$$

where subscripts A and B denote countries A and B and W indicates the world. In (1), IMP (EXP) is the value of import (export) in nominal dollars. Thus, EXP_{ABt} is the value of total export of country A to country B in period t, and IMP_{ABt} is the value of total import of country A from country B in period t. All the data are reported by country A, and EXP_{AWt} and IMP_{AWt} are, respectively, the total export and the import of country A to and from the world, in period t.[7] Under the assumption that inflations, exchange rates, and business cycles similarly affect trade with the world and BT, their influence on the trade ratio will be negligible. Moreover, if the world trade environment is assumed to be perfectly competitive, commodity price fluctuations will not substantially affect the trade ratio.

More About Our Measures.

The current stage of the trade and conflict debate can be characterized as the "Polachek-Pollins debate." We thus focus on the differences and similarities between our trade and conflict/cooperation measures and those employed by Polachek (1978, 1980) and by Pollins (1989a, 1989b). Polachek uses two types of conflict and cooperation measures: one is the difference between the number of yearly cooperative and conflictive events (net frequency) and the other is weighted net conflict (using the Azar and Havener's (1976) weights). His trade measure is the nominal dollar value of exports and imports of each country. Pollins (1989a, 1989b), on the other hand, uses the nominal level of imports from country A to country B, and combines dyadic conflict and cooperation into a single measure. His measure uses a nonlinear transformation of weighted cooperation sent from country A to country B as a portion of weighted net conflict (cooperation + conflict) sent from country A to country B.

Our trade and conflict measures are thus a synthesis of Polachek's and Pollins' measures. As in Polachek, both exports and imports are focused; and as in Polachek and Pollins, weighted conflict and cooperation are combined into one index. In the study of an overall phenomenon of trade and conflict/cooperation, net conflict and trade ratio seem to better capture the political economy.[8]

Finally, our trade measure is a ratio between 0 and 1. As Gasiorowski and Polachek (1982) point out, the trade ratio measure captures, in addition to describing BT flows, a notion of state power that might be exercised by one nation over another. As such, our analysis can be interpreted in terms of a concept like dependence as in Hirschman (1945) or vulnerability as in Keohane and Nye (1977). In sum, our trade ratio contains more information than the nominal level of imports and exports in that it also reflects how important the trade between countries A and B is to country A.

4.4 Causality Tests

Granger (1969) suggests an F test from (2) and (3) below,[9] provided that the error terms u_t and v_t are white noise:[10]

$$BT_t = BT_0 + \sum_{j=1}^{L_T} (\alpha_j BT_{t-j}) + \sum_{j=1}^{L_N} (\beta_j N_{t-j}) + \sum_{j=1}^{3} (\lambda_j Q_j) + \gamma t + u_t \quad (2)$$

$$N_t = N_0 + \sum_{j=1}^{L_T'} (\alpha_j' BT_{t-j}) + \sum_{j=1}^{L_N'} (\beta_j' N_{t-j}) + \sum_{j=1}^{3} (\lambda_j' Q_j) + \gamma' t + v_t \quad (3)$$

In (2) and (3), BT_t is the BT ratio at t, BT_{t-j} is that ratio in j quarters ago. N_t is the bilateral weighted net conflict at time t, and N_{t-j} is the same measure in j quarters ago. BT_0 and N_0 are the intercepts, t is linear time trend, and Q_j's (j=1, 2, 3) are seasonal dummy variables.

Finally, L_T (L'_T) and L_N (L'_N) are the number of quarterly lags of trade ratio and net conflict, respectively, and all the greek symbols represent parameters.[11]

If β_i in (2) are significantly different from zero, the inclusion of the past values of conflict/cooperation (along with the past history of trade) will yield better forecasts of future trade than the use of past trade alone; hence net conflict Granger causes trade. The roles of conflict/cooperation and trade are then reversed in (3) to test if trade Granger causes net conflict by testing if α'_i are significantly different from zero. If both β_i and α'_i are significantly different from zero, the causality between net conflict and trade is reciprocal or is said to be bi-directional.

The specifications in equations (2) and (3) are similar to those in Gasiorowski and Polachek (1982) except for a few differences. Quarterly dummy variables are included here to account for seasonal effects in trade. Different trade and conflict/cooperation measures, over a much longer time period, are used here. In addition, whether or not the trade and conflict/cooperation measures are stationary time series is investigated. Finally, contemporaneous effects of BT on net conflict or those of net conflict on BT are not included here in order to test the Granger causality proper.

It is possible, as Hoole and Huang (1989) point out in their causality study of the global conflict, that our causality tests miss some relevant exogenous variables. As it is standard to any such investigation, our analysis is strictly correct under the assumption "that all other things are equal" (Hoole and Huang, 1989:147). To this end, the error terms--or residual terms--of u_t and v_t are checked to make sure that they are indeed white noise.

Several researchers have debated on the appropriate procedure of selecting the proper number of lags in the test of Granger causality. As detailed by Kang (1985, 1989), L_T and L_N are usually set to be equal to each other and lags of 4, 6, 8, or 12 are used most often with quarterly data. Kang (1989) concludes that the final prediction error criterion used in Hsiao (1979) to determine the lag lengths in causality tests is not adequate and suggests an alternative procedure. However, the procedure suggested by Kang (1989) involves transfer function analysis and is not easy to implement. Instead, we decided to follow a more conservative approach used also by other researchers[12] and used different (but statistically acceptable) lag structures. Under proper lag structures, the error terms of u_t and v_t should become white noise.[13]

All the variables should be stationary time series in order to make the Granger test statistic truly an F distribution. Several unit root tests are advanced in the literature, out of which the most widely used are those suggested by Dickey and Fuller (1979, 1981), Phillips (1987), and Phillips and Perron (1988). Another popular method is to check the Durbin Watson statistic from a regression of a time series in question on a constant.

4.5 Results

Following the convention in the literature, several tests were conducted to detect the presence of unit roots. For each dyad, augmented Dickey Fuller (ADF) tests, augmented Phillips Perron (APP) tests, and a test using the Durbin Watson statistic were performed.[14] The ADF and APP tests have yet two versions: one using the "t" statistic and the other using the product of the sample size and $(1-\rho)^{1/2}$, where ρ is the first order autocorrelation of the series in question. Since unit roots test results depend on the number of lags used, several different lags for each dyad were tried in order to make sure that our conclusions are robust. Altogether, over two dozen unit roots test results (not reported here) were obtained for each time series of trade ratio and net conflict. Except for four trade ratios out of 16, where the majority of the tests identified the presence of a unit root; the data series were in general stationary. It is fair to conclude that our time series are mostly stationary without unit roots. Most series needed detrending with a linear time trend instead of differencing.

As we mentioned above, different lag lengths were tried to make sure that the equations were parsimonious in a simple structure and that the residual series became white noise. For instance, a lag length of one quarter was tried to see whether residuals became white noise. Next, both first and second lags were used, and so on, up to twelve lags. Out of many trials, the best two cases obtained are reported in Table 4-2. Under the column, "best F," the significance level of F that yielded the lowest significance level is given. This is followed by the "next best F," in which the second lowest significance level is achieved. One reason for reporting both is to check the sensitivity of the causality result to the lag length, which is also important here due to the presence of many no reports. In each case, the corresponding lag lengths which provide the best and the next best F are also listed.

[Insert Table 4-2 here: Conflict Causes Trade, Significance Level.]

The results generally show that Granger causality tends to disappear in most dyads when the distributed lag structure is too long. That is, as more terms are included in the equation, the regression coefficients become, jointly, less significant. Table 4-2 is used to test the null hypothesis that conflict does not Granger cause trade.[15] Low significance level indicates that the hypothesis is rejected. In particular, those values less than 0.05 imply that the null hypothesis is rejected at the 5% significance level so that conflict/cooperation causes trade. The results for the other null hypothesis that trade does not Granger cause conflict/cooperation are provided in Table 4-3, of which layout is the same as that of Table 4-2.

[Insert Table 4-3 here: Trade Causes Conflict, Significance Level.]

According to Tables 4-2 and 4-3, significant causality is present in eleven out of 16 dyads. Out of those eleven dyads, the hypothesis that net conflict does not Granger cause trade is rejected in four dyads at the 10% significance level and in two dyads at the 5% significance level (from the best lag structure).[16] The hypothesis that trade does not cause net conflict, on the other hand, is rejected in three dyads at the 10% significance level and in two dyads at the 5% significance level (again from the best lag structure). In four dyads, the causal relationship between trade and net conflict is reciprocal or bi-directional at the 10% significance level, and in two dyads at the 5% level. Whether or not a dyad is an enduring rivalry does not seem to affect the direction of causality, however. It should be noted that causality results are not uniform across dyads.[17] The values of many lag lengths in Tables 4-2 and 4-3 range from one to four quarters. These lag lengths partially justify the use of quarterly data, because annual data might not reveal such lead/lag relationship between BT and CC.

The significance levels given in Tables 4-2 and 4-3 only inform us of the direction of the causality. They do not show whether, for instance, conflict "positively" or "negatively" causes trade. In order to answer such an important inquiry, some of the coefficients in the Granger equations (2) and (3) are reported. Table 4-4 lists the values, with their lag lengths in parentheses, of the lag coefficients of net conflict in (2) that are most significant from the best "F" lag structure. Likewise, Table 4-5 lists those of trade from (3). In Tables 4-4 and 4-5, NS is used to indicate those cases in which none of the coefficients are significant at the 10% significance level.

[Insert Table 4-4 here: Coefficients of Conflict in a Regression When Trade is the Dependent Variable]

[Insert Table 4-5 here: Coefficients of Trade in a Regression When Conflict is the Dependent Variable]

The sign of the significant lag coefficients of net conflict is positive in 17 out of 20 coefficients in Table 4-4 implying that when the bilateral net conflict goes up to be more cooperative, in general, the level of the BT increases. Moreover, even in those dyads where the hypothesis that net conflict does not cause BT is not rejected at the 10% significance level, more cooperation in the past is still associated with increased level of BT. The pattern of the signs of lag coefficients is mixed in Table 4-5, however. An increase in the past BT is associated with more cooperation in 15 out of 25 significant coefficients at the 10% significance level, whereas 10 coefficients show opposite directions. Hence, more trade may bring either increased levels of conflict or cooperation.

It is interesting to note that, the number of lags of net conflict that appeared (statistically) significantly is relatively short, being from 1 to 4 quarters. This suggests that the use of annual data by may be inadequate and that when it comes to profit making opportunities, agents in our dyads are guided by rather a short term memory justifying our use of quarterly data. Still, in some cases to be studied quarterly trade data are not available for the duration required, for example for countries like the USSR or China. Further, some BT data, such as bilateral prices or quantities, are available only as yearly data. In these cases, yearly data need to be used.

4.6 Concluding Remarks

While some stylized facts about conflict/cooperation and trade have been uncovered in this chapter further investigations are suggested by our findings. First, the situations of no report can be differently and, perhaps, better treated. Although the assumption of "no news equals a neutral event" in conflict/cooperation seems reasonable, unreported trade data can be retrieved from additional sources. Most, if not all, of the empirical studies on trade and conflict/cooperation in the literature have used IMF trade data (and COPDAB conflict/cooperation data). However, the United Nations (UN) also maintains and provides bilateral and multilateral trade data. Since the original data sources are different between UN and IMF data, tests similar to this chapter would be worthwhile to undertake by using the UN trade data. That may also reveal the robustness of our results.[18] Yet, the frequency of no reports data is not the same across the UN and IMF data sets. This suggests a possible strategy of filling unreported data in one from the other source.

Second, our causality study in this chapter does not include those dyads in which political relations did not experience large fluctuations over time. Our results tend to point out, however, that those dyads which are more peaceful yield a weaker Granger causality from conflict/cooperation to trade. For instance, the causality from conflict/cooperation to trade for U.S.-U.S.S.R. seems to be weaker in the entire period than in the period before 1978, and that for UK-Argentina is weaker in the COPDAB period than in the WEIS period. More dyads should be investigated. An enlarged sample should include more dyads that did not witness large fluctuations in their political relations.

Third, the causality may also depend on the kind of commodities or services traded. The importance of different commodities to countries may also be dyad dependent. Moreover, transaction costs due to the disruption of BT, what Arad and Hirsch (1983) call the "cost of dissociation," may differ from commodity to commodity and may also affect the patterns of causality. We believe that the use of disaggregated trade data may be a useful way to uncover more detailed patterns of international trade and conflict causality. We return to this issue in the next chapter.

Finally, our causality findings suggest new directions for a theoretical development in the area of trade and conflict/cooperation. A fully micro-founded theory of international trade and conflict/cooperation should, therefore, be dyadic and should account for the effect of politics on both imports and exports as well as the effect of trade on conflict and cooperation. Hence, trade should be modeled as determined by both trade variables and conflict/cooperation, and conflict/cooperation should be determined by trade and other variables. A simultaneous equations model is thus called for, and will be developed in chapter 6, to reflect the reciprocity between international trade and political conflict/cooperation.

ENDNOTES

1. Some countries appear more than once. The United States, Chile, Egypt, and Argentina appear twice in the sample, but with different trading partners. The sample period for most dyads was from the first quarter of 1960 to the early 1990s. A few dyads had a smaller amount of available data. Egypt and Israel reported trade starting only from 1979. Ethiopia and Somalia reported trade only up to 1984. For Bolivia-Chile, Indonesia-Malaysia, Peru-Ecuador, and Venezuela-Guyana, we used only 1960-1978 COPDAB data. The U.S. and China reported trade starting from the third quarter of 1971. We analyzed US-USSR twice: first using the entire period from 1960 to 1991:4 and second using COPDAB data from 1960 to 1978 to focus on more political turbulent time periods. For UK-Argentina and Chile-Argentina, data periods were divided into two, one using COPDAB and the other using WEIS, because COPDAB and WEIS could not be spliced into one. Otherwise specified, COPDAB periods prior to 1978 are discussed in the text.

2. The trade data are well documented in IMF Direction of Trade Statistics (1992).

3. Some researchers regard conflict and cooperation as two separate variables. Ward (1981, 1982), Ward and Rajmaira (1992), and Sayrs (1987, 1989a) aggregate COPDAB events into two separate annual indicators; one for conflict and the other for cooperation.

4. Weighted daily COPDAB or WEIS numbers were generated by replacing events by their appropriate weights. See Azar (1982), Goldstein (1992), and WEIS (1993) for detailed descriptions. Weights are positive for cooperation and negative for conflict. In case of more than one daily event, weighted events are aggregated, separately for conflict and for cooperation, to generate a daily number.

5. Alternatively, one may argue that "no reports were the same as old reports." Treating missing reports as neutral events, however, is common in the literature. Indeed, I find that treating days with no reports as previous daily events generally alters the original dynamics of CC series, especially in cases with consecutive missing reports, which happens in some of our dyads.

6. For Bolivia-Chile, Indonesia-Malaysia, Peru-Ecuador, and Venezuela-Guyana; only COPDAB data were used, because WEIS contained mostly no reports. As reported by Vincent (1983), we have indeed found that WEIS tends to under report events for countries in the periphery.

7. When quarterly trade data are not reported, annual data are used to supplement the data, as follows: (1) When one quarter is not reported, the annual data and the other quarterly data are used to compute the unreported value. (2) When more than one quarterly data are not reported, the annual data are divided into quarters according to the previous year's ratio between quarterly and annual data. (3) When quarterly data are consecutively not reported in more than one year, the annual data are equally divided across quarters. The percentage of dyadic trade data that are supplemented, out of 16 dyads (using the COPDAB period prior to 1978 for US-USSR), is as follows. It was less than 1.5% in six dyads, between 10% and 20% in six, between 20% and 30% in three, and it was about 50% in one dyad. Finally, when both quarterly and annual data are not reported, they are excluded from the analysis, the

extent of which is indicated by the number of observations in Table 4-1.

8. Some drawbacks of using the net frequency measure of conflict and cooperation as in Polachek (1978, 1980) were already pointed out by Gasiorowski (1986).

9. The original regression in Granger (1969) does not include the linear time trend or quarterly dummies. Kang (1985) shows that a failure to detrend a series, when needed, tends to introduce or enhance causal relationships; whereas detrending, when not needed, tends to remove or weaken causal relationships. Our series needed detrending, but not differencing.

10. We also tried Sims' (1972) formulation for the causality test. This formulation requires pre-filtering of the data to purge autocorrelations from the error term. Since the test becomes sensitive to particular pre-filters used and since it is difficult to find a theoretical justification for the use of such pre-filters, the Granger's direct approach is used here.

11. All the statistical analyses are conducted by using RATS version 4.0.

12. Sargent (1976) and Sims (1972) use a fixed, but arbitrary, lag length. Mehra (1977) and Huang and Kracaw (1984) report results for the different lag lengths they use.

13. Lags from 1 to 12 were tried.

14. In our augmented Dickey-Fuller test, the first difference of a time series is regressed on an intercept term, the first lag of the time series, a linear trend term, and a distributed lag structure of the first difference of the same time series.

15. We followed Joerding (1986) and verified our lag structures on the basis of a partial autocorrelation analysis of both trade and net conflict variables. In most cases, the number of lags, with which the null hypothesis of no Granger causality is rejected in the clearest way, was close to the number of lags that yielded a white noise error term in the partial autocorrelation analysis. In the causality tests, two equations are modeled and estimated separately, in contrast to a vector autoregressive regression (VAR) analysis. Error terms are thus neither checked for possible cross-correlations nor decomposed by using a variance decomposition technique.

16. With the full sample period for US-USSR; conflict/cooperation causes trade in four dyads, trade causes conflict/cooperation in three dyads, and the causality is reciprocal in three dyads.

17. For one dyad and at the 5% significance level, Gasiorowski and Polachek (1982) showed that trade Granger causes net conflict when 1 to 6 distributed lags are used, whereas net conflict Granger causes trade when 4 to 6 lags are used. They nevertheless concluded that trade Granger causes net conflict. It is not entirely clear how they come to this conclusion, because their results are more consistent with an interpretation that the causality between trade and net conflict is rather reciprocal.

18. This methodology was implemented by Goldstein and Freeman (1990). They repeated their tests using both COPDAB and WEIS data to show that their results did not depend on a particular data set.

Table 4-1. Dyads in the Sample.

Dyad	Rival	War	Date	Data Start/End	Obs.
Egypt-Libya	No	Yes	1977	1960:1-1992:2	130
Jordan-Syria	No	Yes	1970	1960:1-1988:3	115
Turkey-Greece	Yes	Yes	1974	1960:1-1991:3	127
Pakistan-India	Yes	Yes	1965,1971	1960:1-1992:1	129
UK-Argentina^{C}	No	No	n/a	1960:1-1978:4	76
UK-Argentina^{W}	No	Yes	1982	1971:3-1991:4	82
Honduras-El Salvador	No	Yes	1969	1960:1-1990:4	124
Bolivia-Chile	No	No	n/a	1960:1-1978:4	76
Chile-Argentina^{C}	Yes	ET	1972,1978	1960:1-1978:4	76
Chile-Argentina^{W}	Yes	ET	1972,1978	1966:3-1991:3	101
Egypt-Israel	Yes	No	n/a	1979:1-1991:3	51
Ethiopia-Somalia	Yes	Yes	1977-1978	1960:1-1984:4	100
Indonesia-Malaysia	No	ET	1963-1965	1960:1-1977:3	71
Morocco-Algeria	No	ET	1975	1960:1-1988:2	114
Peru-Ecuador	Yes	ET	1978	1960:1-1978:4	76
US-China	No*	No	n/a	1971:3-1992:2	84
US-USSR^{f}	No*	ET	1962,1973,1978,1979	1960:1-1991:4	128
US-USSR^{C}	No*	ET	1962,1973,1978	1960:1-1978:4	76
Venezuela-Guyana	No	No	n/a	1962:3-1978:4	66

Notes: The first country in each dyad listed is an actor and the second country is a target. For the superscripts, "C" indicates COPDAB period, "W" WEIS period, and "f" indicates full data period. The entry n/a stands for not applicable. The column, rival, specifies whether or not the dyad is classified as enduring rivalry in the literature. The column, war, similarly shows the status of war or extreme tension (ET) during the sample period and the date of such conflict is specified under the column, date. (The classification of enduring rivalries is not consensus. For instance, Goertz and Diehl (1993) and Geller (1993) classify the US-USSR and US-China dyads as enduring rivalries as well.) The column, data start/end, specifies the earliest and latest date for which both conflict/cooperation and trade data were available for this study. The column, obs., shows the number of observations used in the statistical analysis. The number often differs from the span indicated by the start/end due to missing trade data.

Table 4-2. Conflict Causes Trade, Significance Level.

Dyad	Sig (Best F)	Lags	Sig (Next best F)	Lags
Egypt-Libya	0.017	4	0.028	2
Jordan-Syria	0.088	12	0.181	9
Turkey-Greece	0.209	12	0.263	11
Pakistan-India	0.053	1	0.070	2
UK-Argentina[C]	0.258	4	0.271	1
UK-Argentina[W]	0.044	3	0.109	4
Honduras-El Salvador	0.000	3	0.000	4
Bolivia-Chile	0.294	1	0.503	4
Chile-Argentina[C]	0.305	6	0.560	7
Chile-Argentina[W]	0.899	5	0.922	6
Egypt-Israel	0.087	9	0.116	8
Ethiopia-Somalia	0.869	1	0.925	2
Indonesia-Malaysia	0.012	1	0.018	2
Morocco-Algeria	0.377	11	0.434	10
Peru-Ecuador	0.112	2	0.264	1
US-China	0.223	8	0.226	7
US-USSR[f]	0.136	1	0.444	3
US-USSR[C]	0.031	1	0.106	10
Venezuela-Guyana	0.449	2	0.556	8

Notes: Values in the column, sig, are the significance of F statistics for lag lengths under the column, lags. For the superscripts, "C" indicates COPDAB period, "W" WEIS, and "f" indicates full period.

Table 4-3. Trade Causes Conflict, Significance Level.

Dyad	Sig (Best F)	Lags	Sig (Next best F)	Lags
Egypt-Libya	0.285	10	0.312	12
Jordan-Syria	0.408	1	0.525	10
Turkey-Greece	0.029	1	0.036	2
Pakistan-India	0.165	3	0.171	4
UK-Argentina[C]	0.195	2	0.223	9
UK-Argentina[W]	0.671	1	0.694	12
Honduras-El Salvador	0.000	5	0.000	4
Bolivia-Chile	0.144	3	0.267	4
Chile-Argentina[C]	0.421	1	0.558	3
Chile-Argentina[W]	0.533	2	0.724	1
Egypt-Israel	0.015	1	0.108	2
Ethiopia-Somalia	0.420	3	0.555	11
Indonesia-Malaysia	0.000	7	0.001	8
Morocco-Algeria	0.002	10	0.002	11
Peru-Ecuador	0.231	3	0.453	4
US-China	0.398	2	0.463	3
US-USSR[f]	0.113	7	0.197	8
US-USSR[C]	0.064	4	0.065	2
Venezuela-Guyana	0.093	1	0.121	2

Notes: Values in the column, sig, are the significance of F statistics for lag lengths under the column, lags. For the superscripts, "C" indicates COPDAB period, "W" WEIS, and "f" indicates full period.

Table 4-4. Conflict Coefficients when Trade is the Dependent Variable.

Dyad	Coefficients (Lags)
Egypt-Libya	0.819** (2)
Jordan-Syria	0.447* (1); 0.386* (6); -0.673** (12)
Turkey-Greece	0.131** (4); 0.123** (9)
Pakistan-India	0.0126* (1)
UK-Argentina[C]	0.326** (4)
UK-Argentina[W]	0.003** (1)
Honduras-El Salvador	0.645** (2); 0.531** (3)
Bolivia-Chile	NS
Chile-Argentina[C]	1.460** (6)
Chile-Argentina[W]	NS
Egypt-Israel	-0.650* (3); 0.685** (4); 0.595** (6); -0.786** (7)
Ethiopia-Somalia	NS
Indonesia-Malaysia	0.272** (1)
Morocco-Algeria	NS
Peru-Ecuador	0.450* (2)
US-China	0.0316* (2)
US-USSR[f]	NS
US-USSR[C]	0.0411** (1)
Venezuela-Guyana	NS

Notes: Coefficients are divided by 10,000. Values in parentheses are lags. * (**)=significant at the 10% (5%). NS=not significant at 10%. "C" indicates COPDAB, "W" WEIS, and "f" full period.

Table 4-5. Trade Coefficients when Conflict is the Dependent Variable.

Dyad	Coefficients (Lags)
Egypt-Libya	0.490* (1); 0.815** (6); -0.608* (10)
Jordan-Syria	NS
Turkey-Greece	-0.325** (1)
Pakistan-India	-3.428** (2)
UK-Argentina[C]	0.194* (2)
UK-Argentina[W]	NS
Honduras-El-Salvador	0.261** (1); 0.263** (2); -0.241** (3); -0.156** (4); -0.136** (5)
Bolivia-Chile	0.191** (3)
Chile-Argentina[C]	NS
Chile-Argentina[W]	NS
Egypt-Israel	-0.221** (1)
Ethiopia-Somalia	NS
Indonesia-Malaysia	-0.486** (1); 0.736** (2); -0.328* (3); -0.407** (6)
Morocco-Algeria	-0.954** (1); 0.704* (2); 0.994** (3); -0.494** (7); -0.388** (8)
Peru-Ecuador	NS
US-China	NS
US-USSR[f]	NS
US-USSR[C]	-1.562** (1); -1.478** (4)
Venezuela-Guyana	2.110* (1)

Notes: Coefficients are divided by 10,000. Values in parentheses are lags. * (**) = significant at the 10% (5%). NS=not significant at the 10%. "C" indicates COPDAB, "W" WEIS, and "f" full period.

CHAPTER 5: DISAGGREGATED BT AND CC CAUSALITY

Through the investigation of 16 trading dyads individually, we have found in chapter 4 that Granger causality between CC and *total* BT is dyad dependent and, more importantly, tends to be reciprocal. That is, BT causes CC and CC causes BT at the same time. This chapter investigates Granger causality between *disaggregated* BT and CC. To our best knowledge, this is the first attempt to systematically study the causal link between BT in various commodity groups and CC, over a large number of dyads and for a long data period.

Granger causality between CC and BT is investigated separately for each of ten SITC (Standard International Trade Classification) one-digit categories as well as for the total trade. Data on disaggregated BT are from the UN. CC data are from COPDAB and WEIS as described in chapter 3. When available, both yearly and quarterly data are used. Data period is generally between the early 1960s to the early 1990s. Following the research design in chapter 4, and as we discussed in the section on the implications of our literature review for our project, causality will be investigated here for each dyad and for each good *individually* by assuming that causality between BT and CC may be different across commodity groups as well as across dyads.

5.1 Data and Measures

We use the same 16 dyads as in chapter 4. The use of the same dyads will enable us to compare the results.[1] Table 5-1 summarizes the characteristics of dyads. Both quarterly and yearly BT and CC data are employed. Disaggregated quarterly BT data are available for four dyads, while yearly data are available for all dyads. Sample periods are restricted by the availability of both BT and CC data. Typically, the beginning period of the sample is constrained by the availability of BT data while the ending period is constrained by the availability of CC data. In all cases data frequency is dictated by the availability of BT data, because CC data are given daily. As in Azar (1982), *target* refers to a country toward which political actions are directed and *actor* refers to a country generating activities toward the target. The classification of dyads as political rivalries follows chapter 4. A yes/no answer to the question if there was a war or extreme tension (ET) in the sample period used is listed along with the date of such events.

[Insert Table 5-1 here: Dyads in the Sample.]

Disaggregated Trade Data

Leamer (1990) states that the main goal in disaggregation of trade data should be to enhance understanding and communication. In order to explain the sources of comparative advantage, Leamer (1984, 1990), Firebaugh and Bullock (1986), and Smith and Nemeth (1988) use a cross section of post World War II trade data to identify bundles of goods whose production requires similar inputs or level of processing. However, they arrive at different bundles of goods. This study, however, as in Bergstrand (1989) and others, disaggregates total trade along SITC one-digit categories. The description of SITC one-digit categories is given in Table 5-8 at the end of this chapter.

Measures

The time series of CC measure used in this chapter are identical to the net conflict measure used in chapter 4. Trade data in this chapter are from the United Nations (UN), whereas those in chapter 4 are from the International Monetary Fund (IMF). Yearly UN disaggregated BT values are available since 1962 and quarterly data only since the early 1970s.[2] Yet, some countries report to the UN only yearly disaggregated trade data and only yearly data are naturally used here for those countries. Periods with no reports in a certain category are assumed to indicate that those goods were not traded at all or the value of trade is negligible so that no reports are assumed to imply zero BT.

As in chapter 4, the ratio is computed between country A's BT with country B and country A's multilateral trade, in a certain commodity group, all reported by country A. This measure captures country A's dependence on country B. As both export and import may affect trade dependence, BT in good i in time t is computed as:

$$BT_{ti} = \frac{EXP_{ABt_i} + IMP_{ABt_i}}{EXP_{AWt_i} + IMP_{AWt_i}}, \tag{1}$$

where subscripts A and B denote countries A and B and W indicates the world. In (1), IMP (EXP) is the value of import (export) in nominal dollars. Thus, EXP_{ABti} is the value of export of country A to country B in period t, and IMP_{ABti} is the value of import of country A from country B in period t, both in good i. Similarly, EXP_{AWti} and IMP_{AWti} are the trade values with the world in good i. As in chapter 4, the effects of inflation, exchange rate fluctuations, business cycles, and commodities price fluctuations on BT_{ti} are assumed to be negligible.

5.2 Causality Tests

Granger (1969) suggests a statistical test based on F statistics from equations (2) and (3) below, provided that error terms of u_t and v_t are white noise. Equations (2) and (3) are estimated separately for each good per trading dyad. When quarterly BT in various goods are available and used, equations (2) and (3) include additional three dummy variables to control for possible seasonalities in trade data.

$$BT_{it} = BT_{i0} + \sum_{j=1}^{L_T} (\alpha_{ji} BT_{i_{t-j}}) + \sum_{j=1}^{L_N} (\beta_{ji} N_{t-j}) + \gamma_i t + u_t, \quad (2)$$

$$N_t = N_{i0} + \sum_{j=1}^{L'_T} (\delta_{ji} BT_{i_{t-j}}) + \sum_{j=1}^{L'_N} (\theta_{ji} N_{t-j}) + \psi_i t + v_t. \quad (3)$$

In (2) and (3), BT_{it} denotes the BT ratio in good i at time t, BT_{it-j} denotes that ratio j periods ago, N_t denotes bilateral CC (measured as net conflict) at time t, and N_{t-j} denotes that value j periods ago. In addition, L_T and L_N in (2), and L'_T and L'_N in (3), are the numbers of lags of BT and N, respectively, used in the analysis. All greek symbols represent parameters to be estimated, and the time trend, t, controls for the presence of possible deterministic trend.[3] The subscripts to denote countries A and B are suppressed in (2) and (3) for brevity.

Equation (2) investigates if CC Granger causes BT in good i. If the coefficients β_j ($j=1,\ldots,L_N$) are significantly different from zero, including past values of CC in a regression that includes past values of BT yields better forecast of BT than when using lagged BT alone, or BT is Granger caused by CC. Equation (3) investigates whether or not BT of good i Granger causes CC. If the coefficients δ_{ji} ($j=1,\ldots,L'_T$) are significantly different from zero, CC is Granger caused by BT. If both β_{ji} ($j=1,\ldots,L_N$) and δ_{ji} ($j=1,\ldots,L'_T$) are significantly different from zero, the causality between CC and BT is reciprocal. Contemporaneous BT and CC are not included in (2) and (3) to test the Granger causality proper.

It should be noted that our bivariate investigation of Granger causality may conclude wrong causal relationship if there are some other relevant variables excluded in the investigation. Following Hoole and Huang (1989:147) and similar to chapter 4, we assume that "all other things are equal," in the test. To this end, the residual terms of u_t and v_t in (2) and (3) are checked to make sure that they are white noise without containing any systematic information. Accordingly, we report causality results only when error terms are white noise series.

The appropriate procedure of choosing lag length for Granger test is debated in the literature. In this study we follow the conservative approach we used in chapter 4 by systematically investigating Granger causality using various lag lengths and examining results across different lags. With quarterly (annual) data we use up to 12 (4) lags.

Tests of Granger causality between any two series using the F statistics require that series will be stationary with no unit roots. In chapter 4 I tested the presence of unit roots in time series of *total* BT and CC, and concluded that both series do not have a unit root and that series need de-trending with a linear time trend instead of differencing. The CC series used in this chapter are similar to those used in chapter 4 and therefore should not have unit roots.

Since total BT ratio computed from the UN data generally matches that from the IMF data, we may simply assume that the total BT used here do not have unit roots. Unit root tests for disaggregated BT ratio series are deemed unnecessary because of three reasons. First, disaggregated BT will likely follow the total BT in their time series behavior. Second, results show that regressions (2) and (3) do not exhibit the combination of high R^2 and low Durbin Watson statistics which typically shows that some variables are nonstationary with unit roots. In regressions (2) and (3) the Durbin Watson statistic is between 1.6 to 2.4, while R^2 is between 0.2 and 0.8. Third, since error terms in (2) and (3) are made sure that they are white noise and since CC is shown to be stationary, it is likely (as pointed out by Hamilton, 1994:561), but not conclusively though, that BT ratios of all goods are stationary without a unit root. Hamilton (1994:562) adds that when values of lagged dependent and independent variables are included in the regression, as in our case, many of "the problems associated with spurious regressions can be avoided".

5.3 Results

Trade data source in this study is the UN and not the IMF of the previous chapter. We first investigate the extent to which different trade data sources may affect causality results. Total BT from the UN data is computed by aggregating bilateral trade data in commodities. UN quarterly trade data are available for four out of 16 dyads used in chapter 4, starting in early 1970s. The comparison of the causality results for those four dyads shows that causality directions and lag lengths are in general similar[4] regardless of the data sources.

Different lag lengths are tried for each dyad and for each commodity group while making sure that the error terms in (2) and (3) are white noise. A large number of causality results with different significance levels of F statistic are obtained. We only report, for space limitations, the best significance level and its lag length obtained for each good.[5]

Table 5-2 reports causality results from quarterly data and Tables 5-3 and 5-4 from yearly data. For each dyad, eleven (best) F statistic significance levels are reported, one for the total trade and ten for SITC one-digit commodities. Table 5-3 and the upper part of Table 5-2 are used to test the null hypothesis that CC does not Granger cause BT. Low significance level indicates that the null hypothesis is rejected. Values in **bold** indicate that the null hypothesis is rejected at the 10% significance level, and therefore CC causes BT. Table 5-4 and the bottom part of Table 5-2, on the other hand, report results of testing the null hypothesis that BT does not Granger cause CC.

[Insert Table 5-2 here: BT and CC Causality Using Quarterly Data.]

[Insert Table 5-3 here: CC Causes BT (Yearly Data): Significance Level and Lag Length.]

[Insert Table 5-4 here: BT Causes CC (Yearly Data): Significance Level and Lag Length.]

The causality between BT and CC, in general, tends to be reciprocal. This overall causal direction agrees with the result in chapter 4 for the total trade. Hence, for dyads used here, the models in the literature that assume a certain unidirectional causality, regardless of its direction, are not supported. Instead, the results suggest that models of BT and CC should probably be specified as a simultaneous equations model in which both BT and CC are interdependent.

From quarterly data in Table 5-2, BT mostly causes CC for Turkey-Greece (TRGR) and causality is mostly reciprocal for US-USSR (USSU), whereas no significant causality is detected for US-China (USCH) and Egypt-Israel (EGIS). For USSU, CC causes BT in six goods and BT causes CC in six goods, four of which show a reciprocal causality. For TRGR, CC causes BT in three goods and BT causes CC in nine goods, three of which show a reciprocal causality. Causality is much weaker for the USCH and EGIS dyads. Only two goods show CC to BT causality, only one shows BT to CC causality for USCH, and none of which shows a reciprocal causality. In the case of EGIS, one commodity group shows CC to BT causality, two groups show BT to CC causality, and one of which shows a reciprocal relationship.

Several additional points should be noted from the yearly data. First, there is a statistically significant BT and CC causality (in either direction) for some goods in all dyads in Tables 5-3 and 5-4. The smallest number of goods that exhibit a significant causality is three in the case of Egypt-Israel (EGIS). In the other extreme, for US-USSR (USSU), nine goods show a significant causality, from CC to BT. Further, in cases where total BT does not exhibit a causal relationship with CC, disaggregated trade does exhibit causality, in some goods. Hence, for dyads tested here, models of disaggregated BT or of CC that presume a certain unidirectional causality appear to be misspecified.

Second, as hypothesized by several researchers without testing it, the use of the total BT in studies of trade and conflict may contain some aggregation bias as commodities appear to be heterogenous in their relationships with CC. The relationship between disaggregated BT and CC may differ across goods (even for the same dyad) and may not agree with that between total BT and CC. Moreover, the practice of pooling dyads for the study of BT and CC should be used with care. Our results show that BT and CC causality may also differ across dyads for the same good.

Third, whether or not a dyad is classified as an enduring rivalry in the international relations literature seems to have only a marginal effect on the causal direction. When all the political rivalries in the sample are grouped together, the number of goods in which BT is caused by CC equals 33, while the number of goods in which CC is caused by BT equals 27.[6] Hence, political rivalries tend to have a more pronounced CC to BT causality than BT to CC causality, but only marginally so.

Finally, among political rivalries, causality from CC to BT is most pronounced for US-USSR (nine goods exhibit statistically significant causality from CC to BT and four goods exhibit causality from BT to CC), whereas causality from BT to CC is most pronounced in Turkey-Greece (six commodities exhibit significant causality from BT to CC while two commodities exhibit causality in the opposite direction). Our results for US-USSR therefore do not agree with Gasiorowski and Polachek's (1982) conclusion that for the US-Warsaw Pact causality runs from trade to conflict (which is interpreted by them as evidence which supports their claim that trade brings peace.) However, our analysis differs from their, other than the difference between USSR and the Warsaw Pact. They investigate the *total* trade from 1967 to 1978, a period which covers mostly US-USSR detente years; whereas we analyze *disaggregated trade* from 1962 to 1991.

Based on results from yearly data, Table 5-5 reports the number of dyads per each good in which CC Granger causes BT (C-->T); BT Granger causes CC (T-->C); and BT and CC Granger cause each other (C<-->T). Significant results are reported using the 10% significance level as a threshold.[7] For dyads which appear twice in Tables 5-3 and 5-4 (USSU, CIAR, and UKAR), we report results from both large and small sample periods based on separate COPDAB and WEIS data.

[Insert Table 5-5 here: BT and CC Causality Per Commodity Groups, Across Dyads.]

Table 5-5 shows that BT and CC causality tends to be reciprocal for a large number of commodity groups. There is a statistically significant BT and CC relationship in five goods in more than 60% of dyads and in all goods, except for SITC 9, in more than 50% of dyads tested. Moreover, the number of dyads that exhibit C-->T, for a certain good, is larger than the number of dyads that exhibit T-->C. Causality from CC to BT tends to be more pronounced in basic manufactures, iron, and steel (SITC 6), and in crude materials and ferrous metals (SITC 2). For SITC 6, causality runs from CC to BT in six dyads, from BT to CC in one dyad, and it is reciprocal in five dyads. For SITC 2, causality runs from CC to BT in five dyads, from BT to CC in one dyad, and reciprocal in three dyads. Other goods which demonstrate C-->T tendency are fuels (SITC 3), fat/oil/processed animals (SITC 4), and miscellaneous manufactures (SITC 8). For beverages and tobacco (SITC 1) and industrial machinery (SITC 7), causality from BT to CC is more frequent.[8]

Goods often identified as strategic in the literature are metals, certain manufactures, and fuels. These goods tend to exhibit a clearer causality from CC to BT. Although, as pointed out by Baldwin (1985), it is hard to quantify how strategic a good is, such goods may now be viewed as strategic as their trade is more responsive to politics. For food, beverages, and industrial machinery, causality is slightly greater in the BT to CC direction. Such goods may be thus viewed as less strategic.

The results reported in Tables 5-2 through 5 are only for the direction of causality from F tests, not for the sign of the effects between CC and BT. Needless to say, the signs of (significant) coefficients are important.[9] To save space, only two dyads of US-USSR and US-China are discussed. The number of coefficients that are statistically significant in (2) and (3), across goods, is provided in Table 5-6. Table 5-6 shows that the effect of CC on BT in both dyads is generally positive, meaning that better political cooperations lead to a larger trade. The effect of BT on CC is ambiguous, however. Coefficients are positive in roughly half of cases and they are negative in the other half. That is, larger trade may bring better cooperations or, equally well, it may lead to more conflicts.

[Insert Table 5-6 here: Signs of Significant Coefficients for US-USSR and US-China]

Finally, causality may also depend on the amount of the share of BT out of a country's total trade in that good. When a country trades a lot in a certain commodity group, it may become more strategic by influencing more producers and consumers. Gains and losses from trade are generally larger as the volume of trade gets larger mobilizing more intense interest groups. Table 5-7 reports the number of dyads in which causality runs in a certain direction for goods in which the BT ratio is the first, second, and third largest for each reporting country.[10] The effect of the size of BT on the causal direction is ambiguous, as the size does not appear to affect the causality. The pattern of causal direction in Table 5-7 is about the same as that in earlier tables for other goods.

[Insert Table 5-7 here: Causality and Size of BT Ratio.]

5.4 Concluding Remarks

In this chapter we have investigated the causal relationship between disaggregated BT and political CC. For total trade, results seem to be robust; similar causal relations hold regardless of the source of trade data (IMF versus UN) and regardless of data frequency (quarterly versus yearly). The following summarize additional stylized facts on the causal relationship between disaggregated BT and CC uncovered in this chapter.

First, causality between disaggregated BT and CC, which is dyad dependent, tends to be reciprocal. In all dyads investigated here there is a significant reciprocal causality between BT and CC in some goods indicating that the international trade of goods and political actions appear to be interdependent. As we argue in chapter 4, empirical models that arbitrarily assume a unidirectional BT and CC causality, in particular, those specified by Polachek (1978, 1980, 1992) and by Pollins (1989a, 1989b), are equally supported or equally rejected. Hence, a better model of BT and CC may be obtained by combining those two models into one in a simultaneous equations model.

Second, certain goods show a tendency toward a unidirectional BT and CC causality. In metals, petroleum, basic manufactures, and high technologies causality from CC to BT is more pronounced, whereas in food, beverages, and miscellaneous manufactures causality from BT to CC is more frequent. The relationship between BT and CC varies across traded goods. That is, disaggregated BT and CC should be explored through a simultaneous equations model which, at the same time, does not constraint parameters to be similar across goods and/or dyads.

Third, whether or not a dyad is classified as an enduring rivalry has only a marginal effect on the causal direction. While in some rivalries causality runs from CC to BT, in other rivalries the opposite results occur. More dyads need to be investigated to clarify the rivalry effect on the BT and CC causality.

Fourth, for the US-USSR and US-China dyads, there is a tendency for BT to increase in some goods when political relations improve. However, the effect of an increase of BT on CC is ambiguous. Similarly, the effect of the size of BT across goods, in all the dyads investigated, on causality is not clear.

Finally, similar to chapter 4, the analysis in this chapter points out that the methodology of pooled time-series-cross-section analysis, used in virtually all the studies in the trade and conflict literature, needs to be re-evaluated. This conclusion is all the more important when disaggregated trade data are used. A dynamic model of BT and CC, in its lag lengths and coefficients, varies across dyads and should not be constrained to have exactly the same coefficients across dyads.

Several limitations of the analyses in chapters 4 and 5 are: First, as in chapter 4 the sample used in this chapter does not include dyads that experience very peaceful relations throughout the sample period. Second, BT and CC relationship may further depend on other variables which were not controlled for in our study as Granger's analysis is bivariate.

Perhaps most importantly, the investigation of the Granger causality between BT and CC is only the first stage toward the specification of a full model. The next stage should be to *formally* specify and empirically test a micro-founded model of BT and CC. Our results strongly suggest that a model of BT and CC should be a simultaneous one. A model of BT and CC needs to integrate economic and political factors from the behavior of consumers, producers, and governments. Thus CGE models of trade, reviewed in chapter 2, seem an attractive starting point. I devote chapter 6 to the development of such a model. Regardless of the approach chosen in chapter 6, however, one point comes across clearly: in many goods and dyads, neither pure economic models of BT, nor pure political models of CC, fully explain the trade and political relationship between countries, or BT and CC appear to be truly interdependent.

ENDNOTES

1. The sample includes countries of different sizes, government types, economic systems, and from different regions. Moreover, the sample includes superpowers, middle powers, minor powers, dyads that fought a war, dyads that did not fight a war, and political rivalries.

2. Quarterly total BT data from the IMF are available since 1960 and yearly data since 1948.

3. All statistical analyses are conducted by using statistical package RATS, version 4.0.

4. In the case of Egypt-Israel, results are slightly different between the two sources probably because of a 1987 fourth quarter spike in trade ratio from the UN data, which is caused by a report of low Egyptian trade with the world that is reported in the IMF data.

5. In chapter 4 we also report the second best significance level in order to check the sensitivity of results to lag length. For space reasons, only the best levels are reported here.

6. The fact that some causal directions are reciprocal is ignored here.

7. In general, the use of 5% significance level in Tables 5-2 through 5-4 retains the main thrust of the results.

8. In Table 5-8, the list of SITC two digits goods is provided as well as each SITC one digit category.

9. It should be noted that the standard errors of coefficients may not be reliable due to potential multicollinearity in equations with long lags.

10. Average trade ratios over the sample period are used for the BT sizes. The lowest BT ratio is 0.0024 for Ethiopia-Somalia and the highest is 0.2073 for Chile-Argentina in the WEIS period. The average is 0.0679 for the largest BT ratios. For countries that fought a war the average is 0.0321.

Table 5-1. Dyads in the Sample.

Dyad	Rival	War	Date	Yearly	Quarterly	Obs.	Symbol
Egypt-Libya	No	Yes	77	65-92	n/a	28	EGLI
Jordan-Syria	No	Yes	70	64-88	n/a	25	JOSY
Turkey-Greece	Yes	Yes	74	62-91	72:4-93:3	30 (77)	TRGR
Pakistan-India	Yes	Yes	65,71	62-92	n/a	31	PKIN
UK-Argentina[c]	No	No	n/a	62-78	n/a	17	UKAR[c]
UK-Argentina[w]	No	Yes	82	71-91	n/a	21	UKAR[w]
Honduras-El Salvador	No	Yes	69	63-90	n/a	28	HUSA
Bolivia-Chile	No	No	n/a	62-78	n/a	17	BOCI
Chile-Argentina[c]	Yes	ET	72,78	62-78	n/a	17	CIAR[c]
Chile-Argentina[w]	Yes	ET	72,78	66-91	n/a	26	CIAR[w]
Egypt-Israel	Yes	No	n/a	80-91	80:1-91:3	12 (47)	EGIS
Ethiopia-Somalia	Yes	Yes	77-78	62-91	n/a	30	ETSO
Indonesia-Malaysia	No	ET	n/a	67-77	n/a	11	IDMA
Morocco-Algeria	No	ET	75	62-88	n/a	27	MOAL
Peru-Ecuador	Yes	ET	78	62-78	n/a	17	PEEC
US-China	No*	No	n/a	71-92	71:1-92:2	22 (86)	UCCH
US-USSR[f]	No*	ET	62,73,78,79	62-91	70:1-91:4	30 (88)	USSU[f]
US-USSR[c]	No*	ET	62,73,78	62-78	n/a	17	USSU[c]
Venezuela-Guyana	No	No	n/a	62-78	n/a	17	VNGU

Notes: The first country in each dyad listed is an actor and the second country is a target. For the superscripts, "C" indicates COPDAB period, "W" indicates WEIS period, and "f" indicates full period. The entry n/a means not applicable. The column, rival, specifies whether the dyad is classified as a rivalry in the literature. The column, war, shows the status of war or extreme tension (ET) during the sample period. The date of such conflict is specified under the column, date. The classification of rivalries is not consensus. For instance, Goertz and Diehl (1993) and Geller (1993) classify the US-USSR and US-China dyads as rivalries as well. The columns of yearly and quarterly specify the earliest and latest date for which both CC and disaggregated trade data are available. The column, observations, shows the number of yearly data points and that of quarterly data points in parentheses. The column, symbol, indicates the shorthand name of that dyad used in other tables.

Table 5-2. BT and CC Causality Using Quarterly Data.

CC Causes BT: Significance Level and Lag Length (below)

Dyad	T	S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
USSU	0.64	0.20	0.14	**0.05**	**0.00**	**0.00**	**0.06**	**0.03**	**0.10**	0.66	0.66
	2	1	3	9	4	9	10	10	8	11	1
USCH	0.39	0.48	0.56	**0.01**	**0.02**	0.42	0.20	0.50	0.13	0.49	0.39
	12	9	3	3	8	11	2	9	12	12	8
TRGR	**0.02**	0.89	0.49	0.36	0.17	0.45	**0.00**	**0.01**	**0.05**	0.29	0.57
	12	3	6	2	11	9	11	1	7	2	5
EGIS	0.40	0.42	0.31	0.26	0.30	**0.04**	0.12	0.41	0.31	0.11	0.49
	5	12	12	12	5	10	11	12	1	6	11

BT Causes CC: Significance Level and Lag Length (below)

Dyad	T	S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
USSU	**0.04**	0.13	0.15	0.28	**0.05**	**0.01**	**0.01**	**0.10**	0.38	**0.01**	**0.00**
	7	7	12	1	1	9	10	1	7	1	1
USCH	0.35	0.65	0.209	0.84	0.18	0.32	0.54	0.19	**0.06**	0.20	0.54
	4	1	4	7	2	1	12	2	6	4	1
TRGR	**0.00**	**0.04**	**0.05**	**0.00**	**0.04**	**0.00**	**0.01**	**0.00**	**0.00**	**0.00**	0.61
	7	7	7	6	7	7	3	7	2	7	5
EGIS	0.11	0.12	**0.09**	0.22	0.21	**0.08**	0.18	0.13	0.18	0.46	0.74
	6	1	1	1	1	1	3	1	1	11	11

Notes: T stands for total trade and S0, S1, ..., and S9 stand for one-digit SITC commodity groups. Dyad symbols are listed in Table 5-1. Values are the significance levels of F statistics and the corresponding lag lengths are given below. The first country in each dyad is the reporter of trade data and is also the actor. Values significant at the 10% significance level are shown in **bold**.

Table 5-3. CC Causes BT (Yearly Data): Significance Level and Lag Length.

Dyad	T	S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
EGLI	**0.01**	**0.05**	0.32	**0.06**	**0.02**	0.31	0.20	**0.02**	0.11	**0.05**	**0.01**
	1	2	1	4	1	1	1	1	1	4	1
JOSY	0.50	0.24	**0.03**	0.17	**0.06**	0.23	0.38	0.19	**0.10**	**0.03**	0.31
	2	4	4	4	2	3	2	3	1	2	2
TRGR	0.17	0.80	0.61	0.31	**0.07**	0.31	0.41	**0.01**	0.49	0.51	0.84
	1	1	1	4	1	1	2	1	1	1	3
PKIN	**0.01**	**0.09**	0.58	0.11	**0.01**	0.17	0.16	0.15	**0.09**	**0.00**	0.24
	1	2	2	4	1	2	1	1	1	1	1
UKAR[c]	0.49	**0.01**	**0.03**	0.63	0.28	**0.04**	**0.03**	**0.01**	0.53	**0.02**	0.14
	3	4	1	4	4	4	4	3	1	4	1
UKAR[w]	0.15	0.23	0.26	0.44	**0.07**	0.33	0.12	0.18	0.30	0.40	0.24
	1	1	2	1	1	1	1	1	1	1	1
HUSA	**0.00**	**0.00**	**0.00**	**0.05**	0.11	0.22	**0.02**	**0.00**	**0.02**	**0.00**	**0.04**
	1	3	4	1	1	3	4	1	1	1	4
BOCI	0.85	0.71	0.12	**0.07**	0.32	**0.01**	0.94	**0.02**	**0.07**	**0.05**	**0.09**
	1	2	2	1	3	1	2	1	2	2	1
CIAR[c]	0.41	0.25	0.25	0.25	0.11	0.35	0.80	0.19	**0.06**	0.79	**0.06**
	3	3	3	3	3	1	4	3	2	1	1
CIAR[w]	0.42	0.36	0.96	0.71	0.56	0.14	0.43	0.14	0.91	0.71	0.71
	1	1	1	1	1	1	1	3	1	2	1
EGIS	0.71	**0.00**	0.80	0.78	0.56	**0.02**	**0.06**	0.18	0.36	0.74	0.49
	1	2	2	1	1	1	2	2	1	2	2
ETSO	0.24	0.16	**0.00**	**0.00**	0.66	n/a	**0.02**	**0.02**	0.48	0.46	0.52
	4	2	4	4	1	n/a	4	4	1	1	1
IDMA	0.61	0.44	0.28	0.12	0.92	**0.01**	0.38	**0.09**	0.40	**0.04**	0.82
	1	1	1	1	1	1	1	1	1	1	1
MOAL	0.31	**0.03**	0.12	**0.03**	**0.04**	**0.00**	0.36	0.21	0.64	**0.02**	0.26
	3	2	4	3	2	2	2	1	2	3	1
PEEC	**0.08**	**0.03**	**0.04**	**0.02**	**0.07**	**0.04**	0.20	**0.02**	0.19	0.11	0.73
	1	1	1	2	1	1	1	3	2	3	1
USCH	0.25	0.65	0.69	**0.01**	**0.04**	0.14	0.72	0.25	**0.07**	0.25	0.54
	4	1	2	2	1	3	1	4	4	4	4
USSU[f]	0.17	**0.10**	**0.00**	**0.04**	0.20	**0.10**	**0.04**	**0.02**	**0.02**	**0.02**	**0.05**
	3	3	3	4	1	2	1	3	2	3	4
USSU[c]	0.51	0.94	**0.10**	**0.00**	**0.00**	0.65	0.20	**0.00**	**0.02**	**0.10**	**0.02**
	1	3	1	1	2	4	4	3	1	3	3
VNGU	**0.00**	0.89	n/a	0.11	**0.00**	n/a	**0.00**	**0.08**	0.22	0.25	0.97
	2	2	n/a	1	2	n/a	2	4	3	2	1

Notes: See notes in Table 5-2 and n/a stands for not applicable due to zero trade.

Table 5-4. BT Causes CC (Yearly Data): Significance Level and Lag Length

Dyad	T	S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
EGLI	0.19	0.21	0.71	**0.02**	0.66	0.29	0.16	0.17	0.21	0.90	0.29
	3	4	1	2	2	3	4	3	4	1	3
JOSY	0.21	**0.10**	0.72	0.14	**0.03**	**0.03**	0.90	0.30	**0.01**	0.17	0.78
	1	1	4	1	2	2	1	2	3	4	1
TRGR	**0.05**	**0.01**	**0.00**	0.49	**0.00**	0.51	**0.04**	**0.03**	**0.03**	0.16	0.47
	2	3	3	1	2	1	2	2	2	4	1
PKIN	0.50	**0.09**	0.80	0.70	0.42	**0.01**	**0.08**	0.87	0.58	0.15	0.12
	2	2	1	3	1	2	2	1	1	3	1
UKAR[c]	**0.00**	**0.00**	0.61	0.15	0.55	0.36	0.43	0.29	**0.05**	**0.07**	**0.00**
	2	2	1	1	4	2	1	4	2	4	2
UKAR[w]	0.43	0.81	**0.10**	**0.01**	**0.00**	0.11	0.25	0.73	**0.09**	**0.06**	0.74
	1	2	1	4	1	4	2	1	1	2	1
HUSA	**0.00**	**0.00**	**0.00**	0.32	**0.00**	**0.00**	**0.00**	0.12	**0.00**	**0.03**	**0.00**
	4	4	4	2	4	4	4	1	2	4	4
BOCI	0.21	0.18	**0.01**	**0.06**	**0.10**	0.36	0.52	**0.08**	0.28	**0.00**	**0.04**
	4	2	2	4	3	2	1	1	2	2	2
CIAR[c]	**0.00**	**0.01**	0.54	0.76	**0.08**	0.62	0.19	0.14	**0.00**	0.36	0.25
	1	1	4	3	1	1	4	2	1	3	1
CIAR[w]	0.44	0.45	0.77	0.51	0.73	0.17	0.51	0.58	0.79	0.28	0.84
	4	1	2	1	1	4	1	1	3	4	2
EGIS	0.28	0.15	0.34	0.87	0.14	0.47	0.33	0.11	0.14	0.81	0.31
	1	1	2	2	1	1	1	1	1	1	2
ETSO	**0.02**	0.60	**0.06**	**0.00**	**0.00**	n/a	**0.00**	**0.00**	0.54	**0.00**	**0.00**
	4	4	2	4	2	n/a	4	4	3	2	2
IDMA	0.17	0.61	0.47	0.47	0.30	0.55	**0.10**	0.16	**0.07**	0.24	0.32
	2	2	2	2	2	1	1	2	2	1	1
MOAL	**0.00**	**0.00**	**0.09**	0.29	**0.00**	**0.00**	0.81	**0.00**	**0.00**	0.21	**0.00**
	2	1	1	4	4	1	1	2	3	1	1
PEEC	0.14	**0.02**	0.23	0.37	0.11	0.19	0.22	0.62	0.23	0.21	0.59
	4	1	1	1	2	4	4	4	1	4	4
USCH	0.12	0.48	**0.05**	0.42	0.60	0.28	0.39	0.13	**0.01**	**0.06**	0.24
	2	1	2	4	4	4	1	2	2	2	4
USSU[f]	**0.06**	**0.06**	0.39	0.25	0.28	0.17	**0.04**	0.16	0.22	**0.08**	**0.06**
	1	1	1	1	2	1	2	2	1	1	4
USSU[c]	0.38	0.34	**0.00**	0.24	0.26	0.63	0.19	0.17	0.23	0.16	0.25
	2	2	3	1	4	1	2	3	4	4	3
VNGU	**0.02**	0.35	n/a	0.17	0.18	n/a	0.52	**0.02**	0.12	0.52	0.45
	3	4	n/a	4	4	n/a	4	3	3	4	2

Notes: See notes in Table 5-3.

Table 5-5. BT and CC Causality Per Commodity Groups, Across Dyads.

SITC	Description	C-->T	T-->C	T<-->C	N.C.
T	Total trade	3	4 (5)	2	7 (6)
S0	Food /Live animals	2	2	5 (6)	7 (6)
S1	Beverages/Tobacco	3 (4)	5 (4)	2 (3)	6 (5)
S2	Crude materials/Metalliferous	5	1	3	7
S3	Mineral Fuels/Lubricants	5	3	4	4
S4	Fat /Oil /Processed animals	5	3	1	7
S5	Chemicals	2 (3)	3	3 (2)	8
S6	Basic Manufactures/Steel/Iron	6	1	5 (6)	4 (3)
S7	Machinery/Electronics	3	4	3 (4)	6 (5)
S8	Manufactured Goods	5 (6)	3 (2)	3	5
S9	Goods not classified	1 (2)	2	3	10 (9)

Notes: C-->T refers to the number of dyads in which causality from CC to BT is significant at the 10 % level. T-->C refers to the number of dyads in which significant causality is from BT to CC and T<-->C shows that in which significant causality is reciprocal. N.C. indicates the number of dyads in which there is no significant causal relationship. The counts in parentheses are from the COPDAB periods for the dyads of UK-Argentina, US-USSR, and Chile-Argentina.

Table 5-6. Signs of Significant Coefficients for US-USSR and US-China.

Dyad	[C-->T]$_Q$	[C-->T]$_Y$	[T-->C]$_Q$	[T-->C]$_Y$
USSU positive	6	7	5	3
USSU negative	7	2	5	5
USCH positive	12	3	4	5
USCH negative	2	4	2	3
Total positive	18	10	9	8
Total negative	9	6	7	8

Mote: USSU stands for US-USSR and USCH stands for US-China. Positive and negative refers to the signs of significant coefficients. Subscript Q indicates quarterly data and subscript Y yearly data.

Table 5-7. Causality and Size of BT Ratio.

Causality	Largest	Second Largest	Third Largest
C-->T	2	6 (8)	3 (2)
T-->C	3	2	4
T<-->C	5 (6)	1	2
No causality	6 (5)	7 (5)	7 (8)

Notes: Significant causality at the 10% in the three largest sizes of BT. The counts in parentheses are from the COPDAB periods for the dyads of UK-Argentina, US-USSR, and Chile-Argentina.

Table 5-8. SITC-1 and SITC-2 Levels, Revision 2.

SITC-1	description	SITC-2	description
0	Food and live animals	01	meat and preparations
		02	Dairy products,birds eggs
		03	Fish and preparations
		04	Cereals and preparations
		05	Vegetables and Fruits
		06	Sugar and preps, honey
		07	Coffee,Tea,Cocoa,Spices
		08	Feedings for animals
		09	Misc edible products
1	Beverages and tobacco	11	Beverages
		12	Tobacco and Manufactures
2	Crude materials,inedible except fuel	21	Hides,skins,furs,undressed
		22	Oil seed,oleaginous fruits
		23	Crude rubber including synthetic
		24	Cork and wood, Lumber
		25	Pulp, waste paper
		26	Textile,fibers and waste
		27	Crude Fertilizers,minerals
		28	Metalliferous,ores scrap
		29	Crude animal and vegetable material
3	Mineral fuels, lubricant	32	Coal,coke and briquettes
		33	Petroleum and products
		34	Gas,natural and manufactured
		35	Electrical current
4	Animal,Vegetable oil,Fat	41	Animals, oils and fats
		42	Fixed vegetable oils,fat
		43	Processed animal,vegetable oil and fat
5	Chemical related products	51	Organic Chemicals
		52	Inorganic Chemicals
		53	Dyes,tanning,coloring products
		54	Medical and pharmaceutical products
		55	Perfume,cleaning materials,oils
		56	Fertilizers manufactures
		57	Explosives,pyrotechnics
		58	Plastics, Resins, cellulose, ethers
		59	Chemical materials and products
6	Basic manufac. classified chiefly by material	61	Leather,dressed furskins
		62	Rubber manufactures
		63	Wood,cork manuf. excluding furniture
		64	Paper,Paperboard prod.
		65	Textile,yarn,fabrics
		66	Nonmetallic mineral manufactures
		67	Iron and steel
		68	Non-ferrous metals
		69	Manufactures of metals
7	Machines transport equip	71	Power generating equip
		72	Machines specialized for industries
		73	Metalworking machinery
		74	General industrial machinery and parts
		75	Office machines,auto. data processing
		76	Telecommunication, sound equipment
		77	Electric machinery,appliances,parts
		78	Road vehicles and parts
		79	Other transportation equipment
8	Misc manufactured goods	81	Sanitary,heating,lighting
		82	Furniture,parts thereof
		83	Travel goods, handbags
		84	Clothing, apparel and accessories
		85	Footwear
		87	Prof.,scientific,control instruments
		88	Photographic equip. and optical goods
		89	Misc. manufactured goods
9	Goods not classified	91	Postal, mail
		93	Special transactions
		94	Zoo, animals, pets
		95	War,army equip.,firearms,ammunition
		96	Coin,not gold,not legal tender
		97	Gold, platinum,jewels, monetary

CHAPTER 6: MODEL DEVELOPMENT

In this chapter we develop a simultaneous equation model, or SEM, of BT and CC. Three principles drive the development of this model. First, we model the behavior of each dyad separately. Second, following the causality investigations in chapters 4 and 5, I model the relationship between BT and CC as interactive.[1] Last, while previous BT and CC studies in the literature investigate the interaction between BT and CC of *one* unitary actor trade partner, I model the interaction between *both* trade partners' BT and CC flows, and distinguish among consumers, producers, and governments in each country. To streamline the presentation, in this chapter we present the main steps of the model development. Appendix 2 presents the algebraic steps required to derive the formulas shown here.

6.1 Brief Overview of the Model

Each nation in the model produces goods for both foreign and domestic markets, and consumes domestic and imported goods. The rational actors in the model are consumers, producers, and governments. Across nations, consumers are assumed to have the same type of utility function and producers the same type of production technology; the numerical parameters of the functions, however, may differ from country to country. Actors' valuation of bilateral political relations also varies across countries. As indicated in chapter 2, the term good refers to a certain type of traded commodities, where the term *product* refers to a location specific traded good.[2]

The literature has recognized that consumers and producers may differentiate goods according to their origin or destination, respectively. Following Armington (1969), we assume that consumers take into account not only quality and relative prices but also the country of origin of the product. While this assumption is used in many studies, researchers do not explicitly model why consumers differentiate among products. Armington (1969) and Parker (1979) argue that such a behavior may be related to historical and cultural ties among trade partners. Hickman (1973) attributes it to delivery times and capacity utilization. De Melo and Robinson (1989) claim that such an assumption is needed since models do not disaggregate products sufficiently. A different approach, explicitly modeled here, is that products are distinguished according to bilateral political relations.

Producers are assumed to differentiate goods according to their country of destination as in Geraci and Preow (1982), Dixon, Parmenter, Sutton and Vincent (1982), De Melo and Robinson (1985, 1989), and Bergstrand (1985,1989). Researchers do not explicitly model why producers differentiate products, however. Dixon, Parmenter, Sutton and Vincent (1982) argue that products are differentiated by producers since firms engage in joint production for various countries using a finite resource pool. De Melo and Robinson (1989) use the same reasoning they use for the import side (see above). According to Knetter (1992), firms distinguish among destinations in response to exchange rate stability. We assume that goods are differentiated by destination according to bilateral political relations of trade partners.[3]

As in Barten (1971) and Italianer (1986), consumers are assumed to implement a three stage decision process. In the first stage, consumers allocate income to broad categories. In the second stage, they allocate expenditure on each category to imported and home produced goods. In the third stage, they allocate the expenditure on imports among foreign suppliers. As in Geraci and Preow (1982) and Italianer and d'Alcantara (1986), producers are assumed to first decide on the level of production of each good. In the second stage, they allocate this level to domestic and foreign markets. Finally, they allocate the export of each category among destinations. Following Deardorf and Stern (1986), Bergstrand (1985), and De Melo and Robinson (1989), private agents are assumed to be price takers.[4] While products are imperfect substitutes, goods are assumed to be homogenous within each sector.

As in Pollins (1989a, 1989b), private economic agents are assumed to regard political relations as exogenous, or as given. When bilateral relations deteriorate (improve), bilateral import is assumed to contribute less (more) to consumers' welfare and producers are assumed to devote less (more) resources to production for that destination.[5]

There are several reasons why bilateral relations may affect economic agents. First, consumers or producers may wish to penalize foes. Second, as bilateral relations deteriorate, the expected cost of trade disruption increases, and consumers may substitute products from a foe and producers may allocate exports to alternative destinations. Third, as bilateral relations deteriorate, traders may require additional insurance, and exporters may invest more resources in marketing due to bias against unfriendly countries. Fourth, as governments may restrict trade with potential foes, traders or agents with vested interests in trade may invest more in lobbying for free trade.

In contrast to Polachek (1980, 1992) who assumes that all governments derive a positive utility from bilateral conflict, we assume that the utility or disutility that governments derive from bilateral CC may change across dyads, traded products, and over time. To simplify, governments are assumed to not consume, produce, or intervene in markets, other than to impose tariffs. Following the interaction approach to foreign policy, we assume that governments' choice of bilateral CC depends on their own previous CC (inertia) and on CC directed at them (reciprocity). However, other factors, such as the value or the volume and price of bilateral export and import, may also affect governments' foreign policy interaction.

6.2 Demand and Supply

The demand of the product in the model is a modification of Armington's (1969) and

Barten's (1971) studies, while the supply part modifies Geraci and Preow's (1982) and Bergstrand's (1985) work. The primary features introduced here are endogenous bilateral conflict and cooperation terms in demand and supply. In the end, a testable model of bilateral sectoral trade, which turns out to be a trade gravity like model (but with some differences) is developed.

There are N nations and n goods in the model. The index j denotes producing nations with $j=1,2,...,N$; and the index k indicates consuming nations, with $k=1,2,...,N$. The index i ($i=1,2,...,n$) denotes goods. The quantity and price of good i produced in country j and consumed in country k (which we defined as a *product*) are given, respectively, by Q_{ijk} and P_{ijk}. A vector of products, Q_k, is consumed in country k, following Armington (1969).

Consumers in country k maximize utility by choosing Q_k given their income. Modeling and solving the real world consumer's problem is hard as the number of goods which are consumed is very large. "It is thus important to find ways in which the problem can be simplified, either by aggregation, so that whole categories can be dealt with as single units, or by separation, so that the problem can be dealt with in smaller, more manageable units" (Deaton and Muellbauer, 1980). To simplify, we follow Solow (1955), Strotz (1957), Armington (1969), Hickman and Lau (1973), and most CGE models in assuming that consumers' preferences are weakly separable. This assumption reduces the scope of the problem. We also assume that goods can be aggregated into groups, thus reducing the information requirements in empirical analysis. Similarly, following Geraci and Preow (1982), Dixon, Parmenter, Sutton and Vincent (1982), De Melo and Robinson (1989), and Bergstrand (1985, 1989) we assume that production technology is also weakly separable.

Aggregation implies that the solution of the consumer's problem can utilize quantity and price indices of baskets' of goods. Separability implies that goods or products can be divided into groups that hold commodities of the same kind such that preferences how to allocate expenditure among goods within a group can be considered independent of goods in other groups. Hence, utility can be divided to components (sub-utilities), each depending on goods within a particular group. This implies the existence of consumers' decision making tree.

Under separability, two decision making trees are most widely used in the empirical bilateral trade literature. Some authors follow Armington (1969) and assume a two stage decision process, as shown in Figure 6-1. In the first stage consumers decide on the amount of each good to be consumed from both domestic and foreign suppliers. In the second stage they allocate the good's quantity among different products (e.g., Geraci and Preow, 1982; Bergstrand,1985; Marquez, 1991, 1992).

[Insert Figure 6-1 here: Two Stage Decision Making Tree]

Hickman (1973) and Hickman and Lau (1973) further simplify Armington's (1969) approach by assuming that in the eyes of consumers domestic products are not substitutes of imports, or alternatively, there is no domestic production of imported products. Equivalently, other researchers note that under weakly separable utility further sub division of groups into sub groups is theoretically possible (Barten, 1971; Deaton and Muellbauer, 1980). Accordingly, many studies assume a three stage decision process as shown in Figure 6-2.

[Insert Figure 6-2 here: Three Stage Decision Making Tree]

As bilateral trade data are not readily classified according to the categories of national production data, the three stage decision making process assumption greatly simplifies empirical work focusing on disaggregated bilateral trade. Ranuzzi (1981, 1982), Italianer (1986), and Italianer and d'Alcantara (1986), for instance, apply this assumption in studying disaggregated trade. Pollins (1989b), Kohli and Morey (1988), and De Crombrugghe (1995), for example, apply this assumption in studying total trade.[6]

Under separability of preferences, it can be shown that the consumers' problem which is solved in several stages and the one which is solved directly are equivalent (Deaton and Muellbauer, 1980). That is, in both solutions the same quantities are purchased given similar prices. Out of the several decision stages the more problematic is the first as in this stage consumers allocate income to broad groups while utilizing groups' quantity and price indices which depend on the choice of products in other stages. As discussed in Deaton and Muellbauer (1980), the theoretical equivalence of the two formulations breaks down unless consumer's preferences are both homothetic and linearly homogenous, or they have a particular functional form identified by Gorman (1959). Yet, if we drop the assumption of separability the estimation of bilateral trade models, in particular those dealing with disaggregated trade, becomes impractical (Italianer, 1986).

I shall adopt the three stage decision process both in consumption and in production. Utilizing weekly separable functional form for consumers' utility function we assume that the consumers' problem may be solved in three stages as in Barten (1971), Italianer (1986) and others. We also assume that when consumers allocate income over categories (stage one), and when allocating each category over imported and domestic goods (stage two), they do not consider bilateral CC. We solve only the allocation of k's expenditures on multilateral sectoral imports (M_{ik}) among foreign suppliers. This solution approach is similar to the one used in Hickman (1973), Hickman and Lau (1973), Ranuzzi (1982), Italianer and D'alcantara (1986), De Crombrugghe (1995) and others.

Incorporating CC into bilateral trade theory is not straightforward as current trade theory does not consider the role of bilateral political relations. We find that two approaches may be used. In the first approach, we may treat conflict, cooperation (and various other political factors) as an additional trade resistance in a trade gravity equation. Such approach was taken by Sapir (1981), Brada and Mendez (1985), Summary (1989), Pollins (1989a), Dixon and Moon (1993), and Gowa (1989, 1994). This approach, however, is not based on microeconomic foundations. Another possibility, implemented here, is to use the characteristic approach.

Some researchers (i.e. Bhagwati, 1964; Lancaster, 1966; Linnemann, 1966; Hufbauer, 1970; Gruber and Vernon, 1970) argue that goods' characteristics like cultural distance, human skills, and membership in international economic or political organizations affect consumption, in general, and BT patterns, in particular. Kohli and Morey (1988) hypothesize that differences in bilateral import flows across exporters are due to different characteristics of supplied goods. Accordingly, they add a linear transformation of those characteristics to consumers' utility (modeled as CES function). Solving the consumer's optimization problem, their bilateral import demand includes various exogenous characteristics (i.e. exporter's GNP, population, product availability, exporter's reputation, products' content of minerals).

In our study, noneconomic factors are introduced into the allocation of imports based on the characteristics of goods. In particular, we attach attributes, or goods' characteristics, to products based on bilateral CC with the country of origin. Consumers are assumed to have access to the same political information. Agents in countries j and k, however, may value bilateral CC differently. Bilateral conflict and cooperation, CC, as viewed by consumers of Q_{ijk} is modeled as a variable b_{ijk}; $b_{ijk} = \exp(\gamma_{ik}CC^{jk})$, where γ_{ik} is positive.[7] This monotonic transformation is chosen so that the logarithm transformation of b_{ijk} will produce the full spectrum of CC values, from $-\infty$ to ∞. Positive CC values imply cooperation while negative CC values imply conflict. Hence, b_{ijk} approaches zero for extremely high conflict levels and infinity for extremely high cooperation levels.

Next, I will solve the third stage of the decision process implemented by consumers and producers. The third stage consumers' sub-utility from import of good i, U_{ik}, is given by (1). The constant elasticity of substitution (CES) among products in country *k* is given by σ_{ik} ($0 \leq \sigma_{ik} \leq \infty$).[8]

$$U_{ik} = \sum_{j=1}^{N-1} (b_{ijk} Q_{ijk}^{\frac{\sigma_{ik}-1}{\sigma_{ik}}})^{\frac{\sigma_{ik}}{\sigma_{ik}-1}} \tag{1}$$

In (1), consumers' utility from Q_{ijk} increases, other things being equal, when the bilateral relations improve.

The price of product Q_{ijk}, P^*_{ijk}, is modeled next. P_{ijk} denotes the free-on-board (f.o.b.) price of Q_{ijk}, denoted in the producer's currency. The ratio of good i's price including the cost of transportation and insurance (c.i.f) to its f.o.b. price is denoted as C_{ijk} so that $C_{ijk} \geq 1$. $TR_{ijk} = (1+t_{ijk})$, where t_{ijk} is ad-valorem tariff imposed by k on good i from j, and E_{jk} is the spot value of k's currency in terms of j's currency.[9]

$$P^*_{ijk} = \frac{P_{ijk} C_{ijk} TR_{ijk}}{E_{jk}} \tag{2}$$

Consumers in k maximize U_{ik} by choosing Q_{ijk} subject to the expenditure allocated to good i's imports (M_{ik}). Following the standard procedure, the first order conditions of this problem yield N(N-1) Armington like import demand functions shown in (3). The sum of weighted prices in the denominator of (3) is referred here to as k's sectoral import price level.

$$Q_{ijk}^{D} = \frac{b_{ijk}^{\sigma_{ik}} P^{*}_{ijk}{}^{-\sigma_{ik}} M_{ik}}{\sum_{j=1}^{N-1} (b_{ijk}^{\sigma_{ik}} P^{*}_{ijk}{}^{1-\sigma_{ik}})} \tag{3}$$

In (3), as political relations improve so that b_{ijk} increases, other things being equal, the quantity demanded by k's consumers increases.

Assume a single factor of production (say, labor) which is internationally immobile.[10] The amount of factor of production available for production of exports of good i in country j is denoted by R_{ij}. Producers allocate the factor of production according to a constant elasticity of transformation (CET) production frontier in (4), where the elasticity of transformation among products is given by τ_{ij} ($0 \leq \tau_{ij} \leq \infty$).[11] Similar to the demand side, the bilateral relations as viewed by Q_{ijk}'s exporters are modeled with a variable a_{ijk}, $a_{ijk} = \exp(-\delta_{ij}CC^{jk})$, where δ_{ij} is positive. Hence, a_{ijk} approaches infinity for extremely high levels of conflict and zero for extremely high levels of cooperation.

$$R_{ij}=\sum_{k=1}^{N-1}\left(a_{ijk}Q_{ijk}^{\frac{1+\tau_{ij}}{\tau_{ij}}}\right)^{\frac{\tau_{ij}}{1+\tau_{ij}}} \tag{4}$$

In (4), as bilateral relations deteriorate additional resources are required to produce Q_{ijk}.

The maximization of profits from producing good i by choosing Q_{ijk} subject to R_{ij} generates the supply function of Q_{ijk}. The sum of weighted prices in the denominator of equation (7) is referred here to as j's sectoral export price level. Multilateral export value of good i in country j is X_{ij}, where $X_{ij} = W_{ij}R_{ij}$, and W_{ij} is sector i's wage. See Bergstrand (1985) and Appendix 2 for details.

$$Q_{ijk}^{S}=\frac{P_{ijk}^{\tau_{ij}}X_{ij}}{a_{ijk}^{\tau_{ij}+1}\sum_{k=1}^{N-1}a_{ijk}^{-\tau_{ij}}P_{ijk}^{\tau_{ij}+1}} \tag{5}$$

In (5), as bilateral relations deteriorate, other things being equal, the quantity supplied decreases.

Assuming that all markets clear, $Q^{D}_{ijk} = Q^{S}_{ijk}$ holds for every sector. The complete general equilibrium system of (N-1)N non-linear demand and supply equations can be solved, in principle, to obtain bilateral quantities and prices in terms of the exogenous variables R_{ij}, a_{ijk}, b_{ijk}, t_{ijk}, σ_{ik}, and τ_{ij} and the endogenous C^{*}. The estimation of such a system requires, however, hard to obtain BT prices and has not yet been done in the literature.

The model can be modified into a dyadic one by assuming that bilateral sectoral trade flows are small relative to multilateral sectoral trade flows, and bilateral CC flows do not depend on CC flows between other countries. Dyadic or bilateral empirical models are widely used in economics, political science, and in the trade and conflict literature. See Bergstrand (1985, 1989), Gould (1994) and actually all purely economic trade gravity models for examples of dyadic models which do not involve CC. See Ward (1982), Rajmaira and Ward (1990), and most other action-reaction or interaction models of CC for examples of dyadic models which do not involve BT. See Polachek (1978, 1980, 1992) and Sayrs (1987, 1989) for examples of dyadic models in which CC depends on BT. See Pollins (1989a, 1989b), Bergeijk (1994), Gowa (1989, 1994) and other applications of a trade gravity model augmented by political variables for examples of dyadic models in the trade and conflict literature.

It follows that the effect of changes in bilateral quantities and prices on other markets is small, so that sectoral export and import price levels and expenditures may be assumed exogenous. Under the above assumptions each trading dyad may be analyzed separately from other dyads, or in partial equilibrium. Two versions of the model may be estimated under these assumptions. In one version, bilateral demand and supply equations are estimated using bilateral prices data. In a second version, bilateral trade value equations are estimated from a model which does not require bilateral trade prices. This second version of the model is derived next.

Under the small markets assumption, we can obtain analytical expressions of bilateral price, quantity, and value per dyad. From (3), (5) and the market clearing condition, (6) is obtained for P_{ijk}, where ETC_{ijk} denotes the term $E_{jk}/(TR_{ijk}C_{ijk})$, PT_{ij} is the denominator of (5), and PS_{ik} is the denominator of (3).

$$P_{ijk} = (M_{ik} X_{ij}^{-1} a_{ijk}^{\tau_{ij}+1} b_{ijk}^{\sigma_{ik}} PT_{ij} PS_{ik}^{-1} ETC_{ijk}^{\sigma_{ik}})^{\frac{1}{\tau_{ij}+\sigma_{ik}}} \quad (6)$$

In (6), as bilateral relations perceived by k's importers improve (b_{ijk} increases), consumers pay more for Q_{ijk}. Similarly, as bilateral relations perceived by exporters improve (a_{ijk} decreases), producers charge a lower price for Q_{ijk}.

The solution for Q_{ijk} is derived by substituting P_{ijk} from (6) into (3), or alternatively into (5):

$$Q_{ijk} = M_{ik}^{\frac{\tau_{ij}}{\tau_{ij}+\sigma_{ik}}} X_{ij}^{\frac{\sigma_{ik}}{\tau_{ij}+\sigma_{ik}}} a_{ijk}^{\frac{-\sigma_{ik}(\tau_{ij}+1)}{\tau_{ij}+\sigma_{ik}}} b_{ijk}^{\frac{\sigma_{ik}\tau_{ij}}{\tau_{ij}+\sigma_{ik}}} PT_{ij}^{-\frac{\sigma_{ik}}{\tau_{ij}+\sigma_{ik}}} PS_{ik}^{-\frac{\tau_{ij}}{\tau_{ij}+\sigma_{ik}}} ETC_{ijk}^{\frac{\tau_{ij}\sigma_{ik}}{\tau_{ij}+\sigma_{ik}}} . \quad (7)$$

As the bilateral relations perceived by importers improve, BT volume increases, other things being equal. Similarly, as bilateral relations perceived by exporters deteriorate, BT volume decreases.

The sectoral BT value expressed in the exporter local currency is derived by multiplying Q_{ijk} in (7) by P_{ijk} in (6). The result, T_{ijk}, is given by (8), where $RM_{ik} = (M_{ik}/PS_{ik})$ and $RX_{ij} = (S_{ij}/PT_{ij})$, for further notational simplification.

$$T_{ijk} = (RM_{ik})^{\frac{\tau_{ij}+1}{\tau_{ij}+\sigma_{ik}}} (RX_{ij})^{\frac{\sigma_{ik}-1}{\tau_{ij}+\sigma_{ik}}} a_{ijk}^{\frac{(\tau_{ij}+1)(1-\sigma_{ik})}{\tau_{ij}+\sigma_{ik}}} b_{ijk}^{\frac{(\tau_{ij}+1)(\sigma_{ik})}{\tau_{ij}+\sigma_{ik}}} ETC_{ijk}^{\frac{(\tau_{ij}+1)(\sigma_{ik})}{\tau_{ij}+\sigma_{ik}}} \quad (8)$$

In the above, PS_{ik} and PT_{ij} are sums of weighted prices of bilateral imports and exports, respectively. In the empirical work in chapters 7 through 9 they are approximated by using multilateral sectoral import and export price indices, respectively, or by using multilateral unit values if price indices are not available.[12] Hence, the terms RM_{ik} and RX_{ij}

may be approximately interpreted as *real* multilateral import and export, respectively.

Expression (8) resembles the widely used trade gravity model with the following differences: (1) it includes *real* multilateral import and export values in contrast to nominal GNP of both trade partners in the typical gravity model; (2) it is specified in terms of individual goods; and (3) it includes the bilateral political relations as a determinant of BT value which do not appear in the original trade gravity model.

Equation (6) resembles, but only partially, the CC model used by Polachek. Similarly, equation (8) resembles, but only partially, the BT model used by Pollins. Polachek assumes that "hostility raises the price that must be paid for imports and lowers the prices at which exports can be sold (1992:93)." In equation (6), however, it is possible that the bilateral price will actually rise with cooperation and fall with conflict. This is the opposite result to that assumed by Polachek. This result may be obtained when the cooperation induced bilateral demand rise is higher than the induced bilateral supply rise effect. In Pollins' work, trade values are unambiguously expected to increase with cooperation (Pollins, 1989a). In equation (8), however, it is possible that trade value will fall with cooperation or rise with conflict. This result may be obtained, for instance, if a cooperation induced fall in prices is larger than the induced rise in quantity.

The above disscusion is clearly illustrated in Figure 6-3 below.

[Insert Figure 6-3 here: Bilateral Demand, Supply, and Cooperation]

Figure 6-3 presents an illustration of shifts in bilateral demand and supply as a result of a rise in bilateral CC. The economy starts in equilibrium at point A, with bilateral demand D_1 and bilateral supply S_1. As the bilateral CC rises, bilateral demand rises or D_1 moves to D_2, and bilateral supply rises or S_1 moves to S_2. The economy moves to the new equilibrium at point B. In point B, the bilateral trade volume (Q_{ijk}) unambiguously rises relative to point A. The bilateral trade price (P_{ijk}) in point B may rise, fall, or remain unchanged relative to point A, depending on the magnitudes of the shifts of demand and supply. If demand moves up more than supply moves down, P_{ijk} rises, and vice verse. The bilateral trade value is given by P_{ijk} x Q_{ijk}. Whether or not the bilateral trade value rises with cooperation depends on how P_{ijk} changes with cooperation.

The source of the differences between my results and those obtained in the trade and conflict literature is the fact that the scope of my model is wider than the scope of either Polachek's or Pollins' models or, for that matter, all models in this literature. Since I distinguish between the behavior of exporters and importers, the price and value of BT may rise or fall as a result of more cooperation or conflict, the effect being determined by the relative strength of the demand and supply effects. These results contrast also with the trade gravity model based studies of Bergeijk (1992, 1994), Gowa (1989, 1994), Summary (1989), and Dixon and Moon (1993) or again, for that matter, with all trade gravity based models which assume that CC changes the trade resistance term. That is, assuming implicitly that CC (measured in different ways) is but another trade friction, these authors conclude that trade values unambiguously increase with cooperation, a result not obtained here.

6.3 Conflict/Cooperation

Our CC model modifies Dixon's (1986) adaptation of the general partial adjustment model to bilateral foreign policy interaction. We assume that j's *desired* CC toward k, CC^*_{jk}, depends on k's *actual* CC toward j, C_{kj}, but with a random shock e_{jk} from j toward k; namely,

$$CC^*_{jk_t}=\lambda_0+\lambda_1 CC_{kj_t}+e_{jk_t}, \tag{9}$$

where, if $\lambda_1 = 1$, country j employs a tit-for-tat strategy to match k's actions. If $\lambda_1 > 1$ or

$0 < \lambda_1 < 1$, j reciprocates k in kind but with a stronger or weaker magnitude, respectively. If $\lambda_1 < 0$, j employs a contrarian strategy; that is, j attempts to appease k's hostility or extends hostility in return for k's cooperation. An equation similar to (9) is written for k's desired CC action toward j in time t, CC^*_{kj}:

$$CC^*_{kj_t} = \lambda'_0 + \lambda'_1 CC_{jk_t} + e_{kj_t}. \tag{10}$$

The actual change in CC in time t from the previous time period is assumed to be proportional to the desired change in CC:

$$CC_{jk_t} = CC_{jk_{t-1}} + \gamma\,(CC^*_{jk_t} - CC_{jk_{t-1}})\,, \tag{11}$$

where, if $\gamma = 1$, CC approaches CC^* instantaneously. If $0 < \gamma < 1$, CC approaches CC^* steadily as t approaches ∞. If $1 < \gamma < 2$, CC approaches CC^* in a dampened wave pattern. If $\gamma = 2$, CC alternates around CC^*. If γ is outside the range 0 to 2, CC diverges from CC^* as t grows. The basic interaction model is obtained in (12) by substituting (9) into (11):

$$CC_{jk_t} = \gamma\lambda_0 + \gamma\lambda_1 CC_{kj_t} + (1-\gamma)\,CC_{jk_{t-1}} + \gamma\,e_{jk_t}. \tag{12}$$

Governments' choice of bilateral CC is assumed to be affected by BT as in the studies of Ashley (1980) and Sayrs (1989). Equations (13) and (14) are specified by adding BT to equation (12) and to its counterpart equation for CC_{kj}. The importance of BT in different sectors to governments may vary, however, within and across countries. Accordingly, the coefficients of BT in the CC equations are assumed to be sector specific. As discussed in Sayrs (1990) and in chapter 2 and demonstrated in chapters 4 and 5, the sign of the effect of sectoral BT on bilateral CC is ambiguous. That is, BT may cause either conflict or cooperation. Finally, a linear functional form is chosen to model the effect of BT on CC to simplify empirical work.

$$CC_{jkt}=\gamma\lambda_0+\gamma\lambda_1 CC_{kj_t}+(1-\gamma)\,CC_{jk_{t-1}}+\sum_{i=1}^{n}\beta_i T_{ijk_t}+\sum_{i=1}^{n}\delta_i T_{ikj_t}+\gamma e_{jk_t} \tag{13}$$

$$CC_{kjt}=\gamma'\lambda_0'+\gamma'\lambda_1' CC_{jk_t}+(1-\gamma')\,CC_{kj_{t-1}}+\sum_{i=1}^{n}\beta_i' T_{ikj_t}+\sum_{i=1}^{n}\delta_i' T_{ijk_t}+\gamma' e_{kj_t}. \tag{14}$$

In (13) and (14), T_{ijkt} (T_{ikjt}) is sector's i trade from j to k (k to j), CC_{jkt} (CC_{kjt}) is CC emanating from actor j to target k (actor k to target j), t denotes time, n is the number of traded goods, and greek letters are parameters to be estimated. In particular, $\gamma\lambda_0$ and $\gamma'\lambda'_0$ are constant terms, β_i, β_i', δ_i and δ_i' are the effects of sectoral BT on CC, $\gamma\lambda_1$ and $\gamma'\lambda'_1$ measure the reciprocity to CC, and $(1-\gamma)$ and $(1-\gamma')$ are the inertia effects of CC. The error terms, e_{jkt} and e_{kjt}, are assumed to be white noise.

Dixon (1986) assumes $0<\gamma\leq 1$. This assumption results in positive or zero inertia terms in (13) and (14). Ward (1982) and Ward and Rajmaira (1992) postulate equations like (13) and (14), but without BT variables. They argue that the signs of $(1-\gamma)$ and $(1-\gamma')$ are ambiguous. As in Phillips (1978) and Maoz (1985), we interpret γ as bureaucratic inertia and/or institutional constraints which prevent decision makers from arriving at CC^* instantaneously. We assume, however, that while decision makers are rational in the sense that their actions agree with their goal or CC^*, they may overreact. It is therefore assumed $0<\gamma<2$.

Though the sign of CC reciprocity is theoretically ambiguous, there may be positive reciprocity in many dyads as conjectured by Boulding (1962) and Phillips (1978). Many empirical studies in the literature find that at least for major powers reciprocity is mostly positive as summarized by Goldstein and Freeman (1990) and Patchen (1990). Accordingly, and since the actors in our sample are all major countries, we assume that reciprocity will be positive.

6.4 Hypotheses

This section lists testable hypotheses which follow directly from the model. These hypotheses will then be tested in the empirical analysis conducted in chapters 7 through 9.

(1) The effect of bilateral cooperation or conflict on the BT volume (quantity) demanded and supplied will be positive or negative, respectively. That is, as cooperation increases we expect that more traded goods will demanded and more traded goods will be supplied.

(2) The effect of cooperation or conflict on BT value (in money terms) is ambiguous. As the equilibrium price may rise or fall with CC, BT value may rise or fall as well. Whether trade value increases with CC depends on the importer's and the exporter's elasticities of substitution among products and the relative strengths of the effects of CC on demand and supply.

(3) BT volume demanded will decrease when the bilateral trade price increases. The bilateral trade volume supplied will increase when bilateral trade price increases.

(4) The effect of the real multilateral import or export expenditures on bilateral trade volume demanded or supplied, respectively, is unambiguous. The larger those expenditures are, the larger the bilateral demand and supply quantities will be.

(5) The larger is the real multilateral total import value, the larger will the BT value be. The effect of the real multilateral total export value on the BT value is ambiguous or it depends on whether σ_{ik} is larger or smaller than one.

(6) BT value and the demanded BT volume are expected to increase when tariffs decrease or when the exporter's currency depreciates in terms of the importer's. The model, however, does not distinguish among these two effects.

(7) The effect of the BT terms on bilateral CC is ambiguous. In some dyads BT may

increase cooperation and in others, it may generate tension. However, the coefficients in the model should all be statistically significant.

(8) The sign of the CC reciprocity is expected to be positive. Inertia may be positive or negative, but γ is expected to be between 0 and 2.

6.5 Revisiting the Liberal and Realist Trade Paradigms

Grounded in a liberal paradigm, standard trade theory ignores the role of political relations. Since BT is beneficial to both partners, it is assumed that nations will bargain to divide the gains from trade. Hence, trade generates cooperation. In contrast, realists assume that nations seek to maximize security and acquire power. Since unequal gains from BT may translate to a loss of security, states are assumed to maximize relative gains from trade. As nations argue about the division of these gains, trade generates conflict.

In modeling the behavior of individuals I followed the liberal trade paradigm and assumed that economic agents are rational maximizers of absolute gains and that economic outcomes result from the actions of individuals. However, the behavior of individuals in the model combines elements from the realist paradigm as individuals take bilateral relations into account. While I did not assume maximization of relative gains, we augmented the liberal view with elements from political realism.

In the model, governments care about bilateral trade. However, their preferences depend on their adherence to the realist or liberal paradigms. While a model in the spirit of Polachek supports the notion that trade diminishes the propensity to be hostile, a model in the spirit of Ashely or Hirschman will generate the opposite result.

6.6 Concluding Remarks

The BT and CC model in this chapter is different from other models in the literature in several ways. First, while a particular direction of causality among BT and CC has been simply assumed in past studies, our model is truly simultaneous. We have introduced bilateral CC to traditional trade theory. As world politics are constantly in flux and states continually re-evaluate friends and foes, economic variables alone will not fully explain bilateral trade patterns. At the same time, bilateral CC is endogenously determined with BT.

Second, while previous studies of BT and CC model the behavior of one trade partner as a unitary actor, we model the behavior of both trade partners, exporters and importers, symmetrically and simultaneously. In contrast to previous studies in the literature, our theoretical BT and CC model also recognizes distinct dyads, goods, governments, consumers, and producers.

We may now identify some directions for our research in the following chapters. First, the SEM model which utilizes trade values may be estimated for dyads in which information on bilateral trade prices and quantities is hard to obtain. This is done in chapter 7. Second, using bilateral price and quantity data available for OECD countries, bilateral demand and supply functions can be estimated per dyad, deriving clearer implications on the effect of CC on BT volumes. This is done in chapters 8 for total trade and 9 for disaggregated trade.

ENDNOTES

1. Both Pollins (1989a:742) and Polachek (1992:14) agree that the causal relationship between international bilateral trade and politics may be reciprocal.

2. Studies of trade and CC do not distinguish among consumers, producers, and/or governments. Assuming the existence of a representative agent is common in international trade models (Deardorf and Stern, 1986).

3. Several studies find deviations from purchasing power parity (PPP) which support the assumption of export and import differentiation. For instance, Kravis and Lipsey (1984) argue that PPP does not exist as the norm in international trade.

4. Other international trade studies which assume that producers are price takers include Whalley (1984), Shoven and Whalley (1984), and Diewert and Morrison (1988).

5. Although Pollins acknowledges the importance of the export-CC link, he does not have an explicit model for export.

6. Hickman's (1973) and Hickman and Lau's (1973) assumption of no domestic production of imported products is equivalent to assuming a three stage decision making tree as in both cases consumers allocate the expenditure on total imports over trade origins.

7. CC^{jk} denotes bilateral political relations between j and k. CC_{jk}, to be used later, denotes conflict and cooperation actions sent from j to k.

8. The CES utility function is widely used in theoretical and empirical BT studies. For instance, see Armington (1969), Hickman and Lau (1973), Italianer (1986), and Kohli and Morey (1988). For $\sigma_{ik}=1$, the CES utility function becomes the Cob Douglas function.

9. We follow Bergstrand (1985, 1989), Marquez (1991, 1992), Gould (1994), and others and assume that protectionism is manifested only through tariffs. The literature, however, did not resolve the question of how to combine tariffs and non tariff barriers into one measure. See, for example, Walter (1972), Balassa (1978), Olechowski and Sampson (1980), Bhagwati (1988), and Grilli (1990).

10. See Mussa (1974), Dixon, Parmenter, Sutton and Vincent (1982), Bergstrand (1985), and Gould (1994) for a similar assumption.

11. See Geraci and Preow (1982), Dixon, Parmenter, Sutton, and Vincent (1982), De Melo and Robinson (1989), Bergstrand (1985, 1989), and Gould (1994) for a similar modeling approach. For $\tau_{ij} = 0$, the CET transformation function becomes a technology fixed output mix. See Powel and Gruen (1968) for details.

12. See Geraci and Preow (1982), Ranuzzi (1982), Bergstrand (1985, 1989), and Italianer (1986) for a similar approach.

Figure 6-1. Two Stage Decision Making Tree

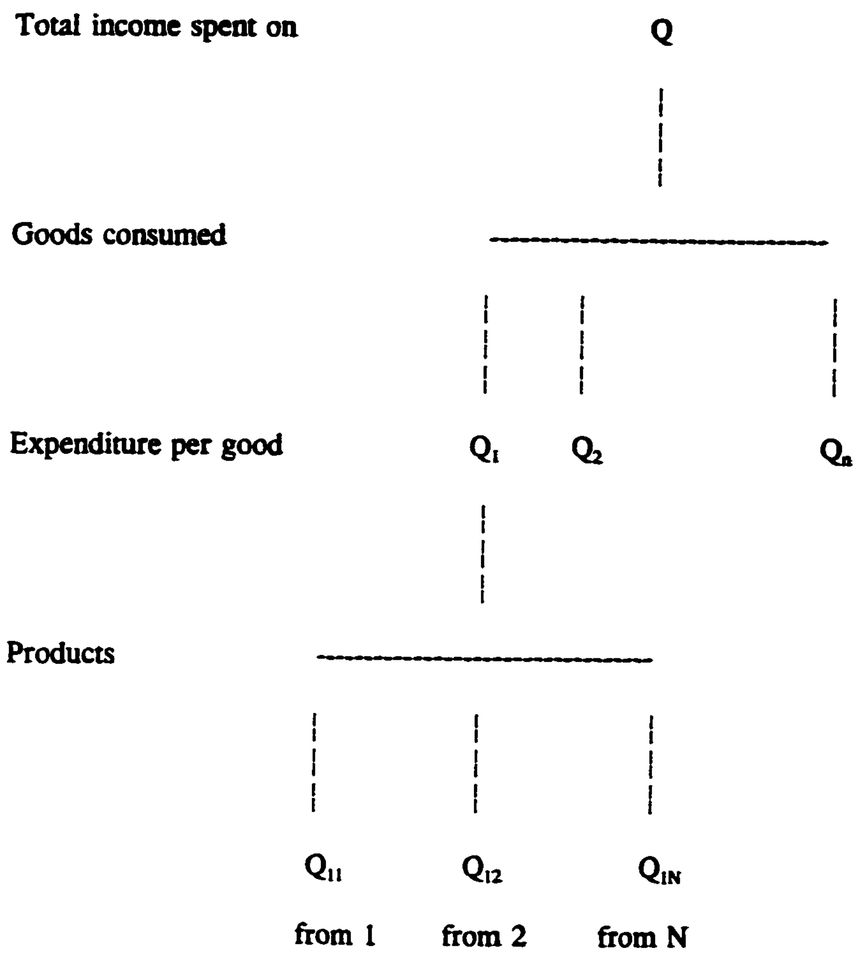


Figure 6-2. Three Stage Decision Making Tree

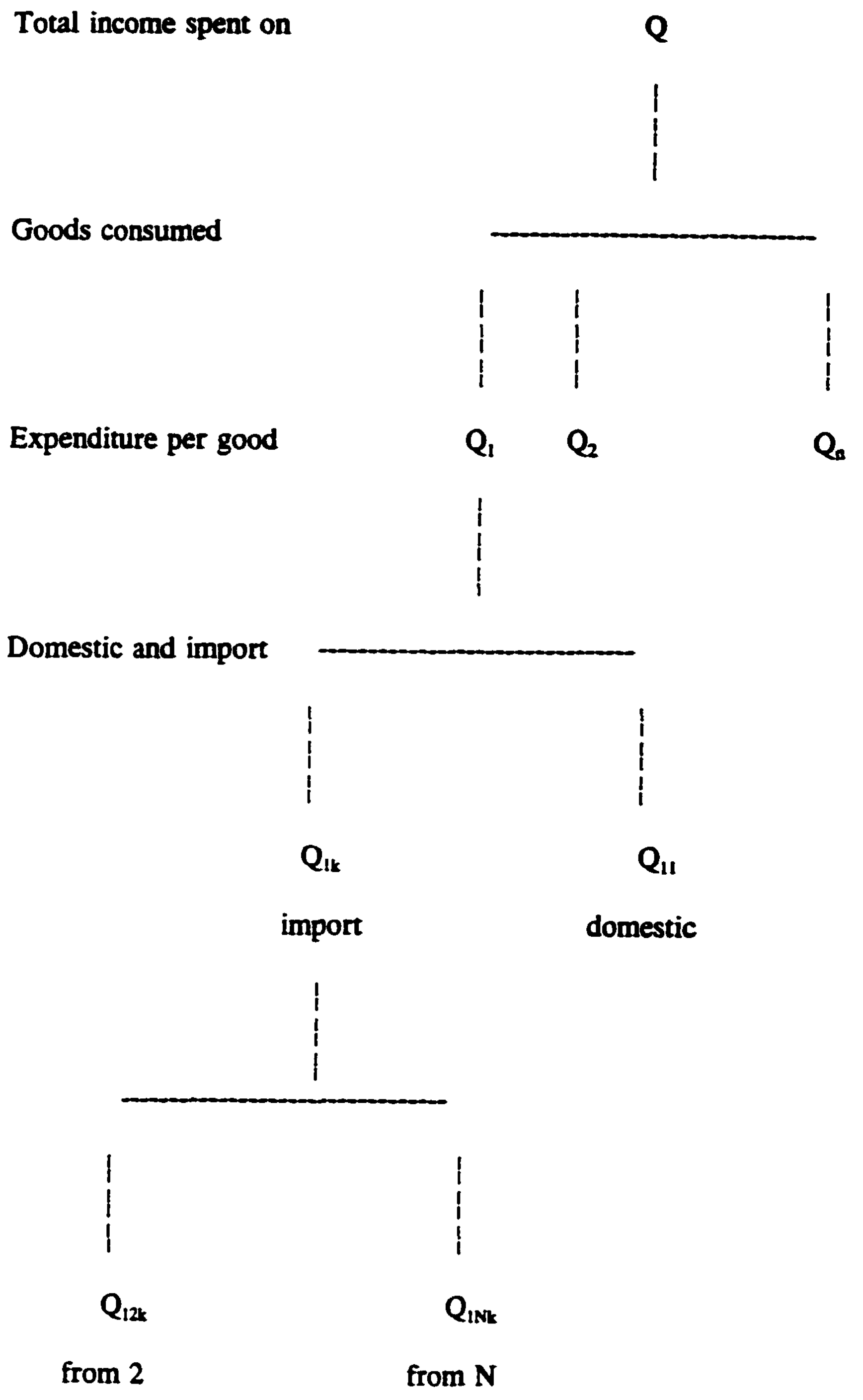
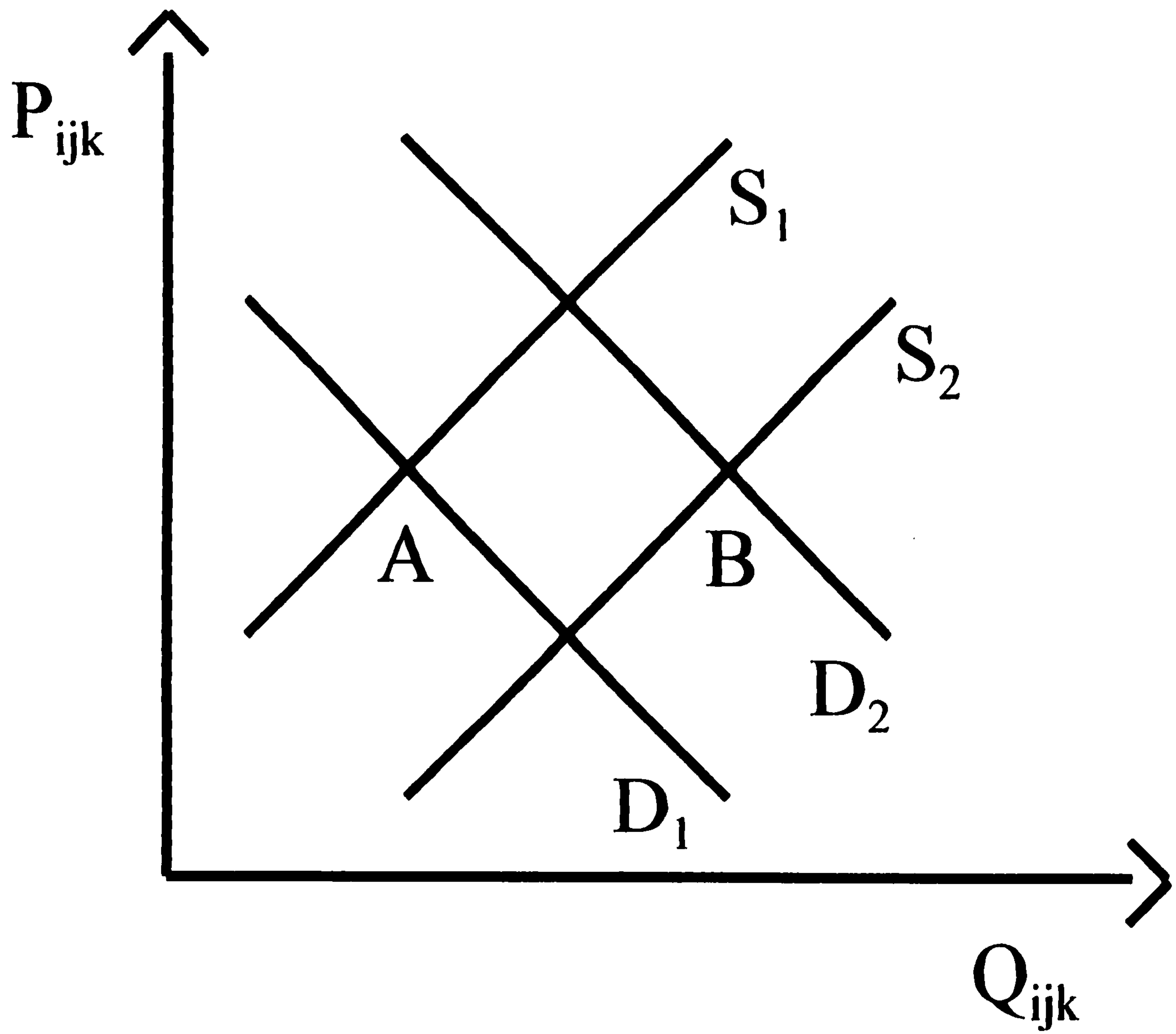


Figure 6-3. Bilateral Demand, Supply, and Cooperation



CHAPTER 7: SEM ESTIMATION FROM TOTAL TRADE VALUES

In this chapter we follow many studies in the literature and assume that there is only one traded good, *total trade*. Under this assumption, the summation over goods in the CC equations (13) and (14) in chapter 6 collapses to one term. Similarly, the index i (denoting the traded good) in the trade value equation (8) in chapter 6 may be dropped. All dyads formed among the US, the (former) USSR, China, (West) Germany, and Japan are included in the estimation.

The model in chapter 6 can be estimated using equations (3) and (5) for bilateral demand and supply, respectively, or using equation (8) for bilateral trade values. In chapter 8, I estimate the demand and supply version of the model. In what follows here, I discuss the estimation of a SEM of BT and CC from total trade *value* data, the sample of dyads we use, the data sources, and the preparation of the empirical measures of the economic and the CC variables in the theoretical model.

The empirical model here is based on equations (8) for BT value, and (13) and (14) for CC flows, presented in chapter 6. Unless specified differently, the term BT in this chapter denotes total BT *values*. Such a model of BT and CC can be applied to most countries in the world as trade value data are not hard to locate. Estimating the demand and supply version of my model, however, requires harder to get bilateral price and quantity data. Such data are available only for some OECD countries and few of their trade partners, as will be further discussed in chapter 8.

7.1 Simultaneous Equations Model to be Estimated

For empirical analysis, the model is simplified in several ways. First, the model is written in a linear form by taking the logarithmic transformation of (8) in chapter 6. Second, the price terms of PT_j and PS_k are approximated by multilateral trade unit value indices, as in Ranuzzi (1982), Italianer (1986), Bergstrand (1985, 1989) and others. It should be noted that ETC enters the model as a single variable. The parameters should thus be restricted accordingly. The imposition of the restrictions will increase the efficiency of the estimates. It is different from Bergstrand (1985, 1989), Pollins (1989a,1989b), and Gould (1994), who estimate their models without imposing the implied theoretical restrictions.[1] Last, in the studies of cross sectional BT, transportation cost is typically approximated by geographical distance. In our time series analysis, we assume that transportation cost does not change over time and therefore it does not appear in the empirical model, similarly to Italianer and d'Alcantara (1986), Bergstrand (1986, 1987), Marquez (1991, 1992), and Onitsuka (1994).[2]

Under the assumption that economic agents in both countries access similar information on bilateral political relations, our theoretical model is operationalized in two different ways. First, conflict and cooperation are regarded as separate variables so that there are four equations for CC, two each from (13) and (14) in chapter 6 to produce two conflict equations and two cooperation equations. Yet, economic agents in this case are assumed to be sensitive to overall bilateral conflict and overall bilateral cooperation. Second, conflict and cooperation are regarded as the same variable so that there are two equations, one each from (13) and (14). Economic agents, in this case, are assumed to be sensitive to both directional CC flows, namely CC_{jk} and CC_{kj}. The first method gives rise to a six-equation SEM and the second method leads to a four-equation SEM.

After taking the logarithmic transformation of (8), CC appears in the model as it is but BT appears as log (BT). In order to make the model linear, BT terms in (13) and (14) are replaced by log (BT) terms. The values of BT are in the exporter's currency and multilateral trade values are in its own currency. The base year for all price indices is 1990.

The model is estimated separately for each trading dyad.

While many models in foreign policy interaction studies are based on (12) in chapter 6, their exact specification varies among authors. Ward (1982), Dixon (1986), Rajmaira and Ward (1990), and Ward and Rajmaira (1992), for example, include current and one lagged actor's CC, as in (12) in chapter 6. Sayrs (1989), Goldstein and Freeman (1990), Goldstein (1991), and Moore (1995), however, include several lagged terms of both actor's and target's CC. The number of lags, however, varies from one study to another.

Although the model developed here is based on the condition of economic equilibrium, it is possible that markets may be in disequilibrium. Comparative static economic analysis assumes that prices and quantities of traded goods adjust instantaneously to shocks in exogenous variables. In practice, the economic adjustment process toward equilibrium takes time due to such factors as existing inventories levels, formation of producers' and consumers' habits, goods' delivery lags, consumers' informational lags, lags due to uncertainty regarding future price, etc. (Magee, 1975; Grossman, 1982).

Several methods utilized in the literature to account for demand and supply dynamics are summarized by Stern, Francis, and Schumacher (1976): (1) directly introducing lags of explanatory variables; (2) a stock adjustment framework assumed similar to all variables; (3) a geometrically declining lag structure (often referred to as Koyck lag). As we have described in chapter 2, the method of handling lags is not uniform across studies in the literature. Yet, "the point to be made about handling response lags is that there is no unambiguous way to choose a lag pattern on *a priori* grounds. The choice is essentially an empirical one" (Stern et al.1976:7).

Price and Thornblade (1972), Magge (1975), Geraci and Preow (1982), Grossman (1982), Haynes, Hutchinson, and Mikesell (1986), and Bergstrand (1986, 1987) model BT with time lags in order to accommodate some changes in the economic environment. Gasiorowski and Polachek (1982) and the analysis in chapters 4 and 5 find that lags of BT in CC equations are in general different from zero. The dynamic version of (8) therefore includes the lags of all the independent variables in the model. Existing theories, including my model, do not specify the exact number of lags. Since yearly data are used here, lags will not be very large and also cannot be very large for the reasons of the efficiency, or lack of efficiency to be precise, of the estimation. It is well known that estimation results are biased if some relevant variables are omitted from the specification, whereas the inclusion of irrelevant variables leads to inefficient estimation.

Given the large number of equations, variables, and dyads in the sample, intensively experimenting with different lags for each variable is not practical. Accordingly, we use the same number of lags for all variables, but without imposing similar coefficients for the lags of some variables as in Price and Thornblade (1972) or Geraci and Preow (1982). After some experimentation, two lags of each variable in equations (8), (13), and (14) are added.[3] The four-equation SEM is presented in Appendix 3, while the six-equation SEM is presented here as below.

Trade flow from j to k:

$$TJK_t = a_0 + \sum_{s=0}^{2} (a_{1s}RMK_{t-s} + a_{2s}RXJ_{t-s} + a_{3s}SCN_{t-s} + a_{4s}SCP_{t-s} + a_{5s}ETJ_{t-s}) + a_6 t + u \tag{1}$$

Trade flow from k to j:

$$TKJ_t=b_0+\sum_{S=0}^{2}(b_{1s}RMJ_{t-s}+b_{2s}RXK_{t-s}+b_{3s}SCN_{t-s}+b_{4s}SCP_{t-s}+b_{5s}ETK_{t-s})+b_6t+u \quad (2)$$

Conflict flow from j to k:

$$CNJK_t=c_0+\sum_{S=0}^{2}(c_{1s}TJK_{t-s}+c_{2s}TKJ_{t-s}+c_{3s}CNKJ_{t-s})+\sum_{S=1}^{3}(c_{4s}CNJK_{t-s})+u_{3t} \quad (3)$$

Conflict flow by from k to j:

$$CNKJ_t=d_0+\sum_{S=0}^{2}(d_{1s}TJK_{t-s}+d_{2s}TKJ_{t-s}+d_{3s}CNJK_{t-s})+\sum_{S=1}^{3}(d_{4s}CNKJ_{t-s})+u_{4t} \quad (4)$$

Cooperation flow from j to k:

$$CPJK_t=e_0+\sum_{S=0}^{2}(e_{1s}TJK_{t-s}+e_{2s}TKJ_{t-s}+e_{3s}CNKJ_{t-s})+\sum_{S=1}^{3}(e_{4s}CPJK_{t-s})+u_{5t} \quad (5)$$

Cooperation flow from k to j:

$$CPKJ_t=f_0+\sum_{S=0}^{2}(f_{1s}TJK_{t-s}+f_{2s}TKJ_{t-s}+f_{3s}CPJK_{t-s})+\sum_{S=1}^{3}(f_{4s}CNKJ_{t-s})+u_{6t}, \quad (6)$$

where u's are structural disturbance terms.

In the above equations (1) through (6), the definitions of variables are listed below:

TJK = logarithm of the value of trade from j to k in j's currency (j's export or k's import),
TKJ = logarithm of the value of trade from k to j in k's currency (k's export or j's import),
RXJ = logarithm of real multilateral export expenditure of j in j's currency,
RMJ = logarithm of real multilateral import expenditure of j in j's currency,
RMK = logarithm of real multilateral import expenditure of k's in k's currency,
RXK = logarithm of real multilateral export expenditure of k's in k's currency,
CNJK = level of sum of conflict from j to k,
CNKJ = level of sum of conflict from k to j,
CPJK = level of sum of cooperation from j to k,
CPKJ = level of sum of cooperation from k to j,
ETJ = logarithm of the combined terms of the tariffs that k imposes on j and the value of k's currency in terms of j's currency,

ETK	=	logarithm of the combined terms of the tariffs that j imposes on k and the value of j's currency in terms of k's currency,
SCN	=	sum of the overall bilateral political conflict, which is CNJK + CNKJ,
SCP	=	sum of the overall bilateral political cooperation, which is CPJK + CPKJ.

7.2 Dyads and Data

We study five major countries from the yearly data from 1948 to 1992. As already mentioned, all dyads formed among the US, the (former) USSR, China, (West) Germany, and Japan are included in the estimation. There are ten dyads and a total of 20 flows of BT and CC in the empirical analysis, as we distinguish between the actor and the target countries. As already mentioned, those ten dyads are all the possible combinations out of the five countries in the sample.

In general, the choice of dyads should be based on several considerations. The yearly BT and daily CC data are available starting from 1948. Some countries do not appear in CC data sets for certain time periods, and not all countries report their economic data to international organizations.[4] Diverse dyads are to be selected from different regions and with a whole CC spectrum. At the same time, it is interesting to focus on countries whose political and economic relations are extensively investigated.

The CC measures used are based on data from two events data sets widely used in the study of international relations, which were described in chapter 3, COPDAB and WEIS. Using the method developed in chapter 3, COPDAB and WEIS daily conflict and cooperation events for the countries in the sample were extracted and processed through splicing to obtain annual measures of CC from 1948 to the early 1990s. The frequency of the CC data used follows the availability of the trade and other economic data. Annual CC data, however, are widely used in many studies of foreign policy interaction (e.g. Ward, 1982; Dixon, 1986; McGinnis and Williams, 1989).[5]

Bilateral and multilateral total trade values are mostly from the IMF's (International Monetary Fund) Direction of Trade Statistics. Multilateral trade prices and exchange rates for the OECD members are from the IMF's International Financial Statistics. For China, multilateral trade values and exchange rates are from China's Statistical Yearbook, and multilateral trade price data are from the World Bank's World Tables and Pollins (1989a). For the USSR, multilateral trade values are from the United Nations' (UN) Yearbook of International Trade and Pollins (1989a), and multilateral trade price data are computed from multilateral trade quantity index data from the UN's Yearbook of International Trade.[6]

Time series data on bilateral sectoral tariffs are not readily available. Tariffs are approximated, as in Geraci and Preow (1977), Thompson and Vescera (1992), Marquez (1991, 1992) and others, by the ratio of custom revenues to multilateral imports.[7] Custom revenues for the United States are from the United States Historical Statistics and Statistical Abstract. For Japan and Germany, they are from Mitchell (1992, 1995). For China and the USSR, however, no tariffs are included in the estimation.

7.3 CC Measures

Our BT data are available on yearly base. To match with BT data, daily CC events are aggregated over time by using weights to produce a CC measure. CC measures are prepared using the method developed in chapter 3. Summarizing, we apply the following procedure. Days without reports are replaced by a neutral event. Weights most widely used in the literature (developed by Goldstein, 1992 for WEIS, and by Azar and Havener, 1976 for COPDAB) are used to convert discrete CC events into numbers from a CC continuum. Weighted events are aggregated into a quarterly series of CC. To splice COPDAB and WEIS, the weighted quarterly WEIS series are regressed on COPDAB in their 1966-1978 overlapping period. The regression coefficients are used to convert COPDAB into WEIS like series for years before 1966. From 1966, WEIS is used as it is. Annual values of CC are obtained by summing quarterly values.

Several CC measures are possible. As we have mentioned in chapter 2, conflict and cooperation are treated as the same variable, so-called *net conflict*, but with the opposite signs in Polachek (1980, 1992), Gasiorowski and Polachek (1982), Dixon (1986), Gasiorowski (1986), Pollins (1989a, 1989b), Goldstein and Freeman (1990, 1991), and Goldstein (1991). Alternatively, one indicator for conflict (the sum of conflictual events) and another for cooperation (the sum of cooperative events) are used in Ward (1982), Sayrs (1989), Rajmaira and Ward (1990), Ward and Rajmaira (1992), and Bergeijk (1994). In order to check the robustness of our empirical results, both net conflict and separate sums of conflict and of cooperation are used here. The positive value of net conflict indicates friendliness while negative value means hostility. Likewise, sum conflict is negative and sum cooperation is positive.

7.4 Results

The model in equations (1) through (6) is estimated by using two stage least squares (2SLS) method, which is a standard method of estimation as in Goldstein and Khan (1978), Ashley (1980), Grossman (1982), Ranuzzi (1982), Dixon (1986), Onitsuka (1994) and others. A statistical software package RATS, version 4.0, has been used. Consistent standard errors or robust errors are obtained by using the method of Newey and West (1987). The Newey and West's method is widely used in the literature including, Barsky and Miron (1989), Bergstrand (1989), Attfield (1991), Ward and Rajmaira (1992), Shea (1993), and Nelson (1995).[8]

The following general hypotheses are then tested. First, individual coefficients in each equation are tested for statistical significance (t test). Second, the lag coefficients of each variable are tested if they are jointly statistically different from zero (F test). Last, the sum of the lag coefficients of each variable is tested to be statistically different from zero (t test).[9]

In the tables that follow, US denotes the United States, JA Japan, SU Soviet Union or the USSR, CH China, and GE denotes (West) Germany. These notations are also used in the discussion. Dyads for BT or CC flows are indicated by country j followed by country k. Thus, US-JA, for instance, indicates BT or CC flow from the United States (j) to Japan (k). There are 20 flows for CC and 20 for BT flows for all the possible directions among the five countries. It should be noted that equations (3) and (4) are each estimated nine times, because there were insufficient data points for Japan-Germany conflicts. Here, I only fully discuss results from the six-equation SEM. Results from the four-equation SEM, presented and discussed in Appendix 3, are basically similar to those for the six-equation SEM. As will be detailed below, the coefficient of determination, R^2, of the BT equations is typically above 0.9, that of the conflict equations is mostly above 0.6, while that of the cooperation equations is mostly above 0.75. A statistical significance level of 10 percent is used throughout the discussion, unless otherwise specified.[10]

Results from the Trade Flow Equations

The coefficients of the BT equations are generally significant as shown in Tables 7-1 and 7-2; at least one lag of RMK and RMJ is statistically significant in 18 (out of 20) cases, at least one lag of RXJ, SCN, and SCP is significant in 20 cases, and at least one lag of ETJ and ETK is significant in 19 cases.

[Insert Table 7-1 here: Coefficients of Equation (1), Trade Flow from j to k]

[Insert Table 7-2 here: Coefficients of Equation (2), Trade Flow from k to j]

For the US-SU dyad, for instance, four out of six coefficients of multilateral real import (RMK and RMJ) are positive whereas those of multilateral real export (RXK and RXJ) have mixed signs, both of which are as expected. The effect of conflict and cooperation on BT as reflected by the coefficients of SCN and SCP does not show a clear tendency, as expected.

Overall, out of 43 significant coefficients of RMK and RMJ, 23 are positive. Out of 49 statistically significant coefficients of RXJ and RXK, 29 are positive. Out of 40 significant coefficients of ETJ and ETK, 26 are positive. Out of 37 (45) significant coefficients of lags of SCN (SCP), 15 (30) are positive. For the contemporaneous lags of economic variables whose theoretical effect is unambiguous according to our model, out of 15 significant coefficients of RMK and RMJ, 11 are positive, while 9 out of 14 significant coefficients of ETJ and ETK are positive.[11]

Tests on the joint significance of coefficients and significance of sums of coefficients in the BT equations are reported in Table 7-3. Panel A is for equation (1) and Panel B is for equation (2). The majority of lag coefficients in Table 7-3 are jointly statistically different from zero. Moreover, the hypothesis that lags of CC are jointly zero is rejected. When statistically significant results are counted, 7 lag coefficients of RMK, 8 of RMJ, 9 of RXJ, 8 of RXK, 10 of ETJ, and 8 lag coefficients of ETK are jointly different from zero. Comparable figures are 13 (out of 18) of SCN and 18 (out of 20) lag coefficients of SCP for CC. In every dyad, at least one group of lag coefficients of SCN or of SCP is statistically significant different from zero. That is, in every case out of the total 20 BT flows, politics matters for trade.

[Insert Table 7-3 here: Joint Significance and Sums fo Lags in Equations (1) and (2).]

For the US-SU dyad, in particular, the sum of coefficients of RMK and that of RMJ are both positive as expected, while those for RXJ and RXK are mixed. The sign of the sums of SCN and SCP does not reveal a clear tendency either.

The signs of the majority of significant sums of coefficients of variables in Table 7-3 conform our expectations. In 12 out of 18 significant cases, the sign of sums of lag coefficients of ETJ and ETK is positive, as expected. Similarly, out of 15 statistically significant cases, 10 sums of lag coefficients of RMK and RMJ are positive. Hence, a reduction in tariffs, a depreciation of exporter's currency, or an increase in importer's multilateral expenditure on import would yield an increase in BT. The signs of sums of lag coefficients of RXJ, RXK, SCN, and SCP have no specific tendency, as expected.

Results from the CC Equations

The coefficients in the CC equations are presented in Tables 7-4 and 7-5 for conflict, and in Tables 7-6 and 7-7 for cooperation. In Tables 7-4 and 7-5, at least one coefficient of conflict inertia is significant in 11 out of 18 cases, while at least one coefficient of conflict reciprocity is significant in 17 out of 18 cases. At least one lag coefficient of BT is significant in 13 out of 18 conflict flows. In Tables 7-6 and 7-7 at least one coefficient of cooperation inertia is significant in 16 cases, at least one coefficient of cooperation reciprocity is significant in all 20 cases, while at least one coefficient of BT is significant in 16 cases. Conflict or cooperation does not persist over time, as the sign of the coefficients of CC inertia reveals no clear tendency. Reciprocity, however, is overwhelmingly positive for both conflict and cooperation. Countries do respond their political reactions in kind: conflict with conflict and cooperation with cooperation. An increase in export is found to cause less conflict from exporter to importer, while an increase in import causes more conflict from importer to exporter.

[Insert Tables 7-4 here: Coefficients of Equation (3), Conflict Flow from j to k.]

[Insert Tables 7-5 here: Coefficients of Equation (4), Conflict Flow from k to j.]

[Insert Tables 7-6 here: Coefficients in Equation (5), Cooperation Flow from j to k.]

[Insert Tables 7-7 here: Coefficients in Equation (6), Cooperation Flow from k to j.]

For the US-SU dyad, in particular, the coefficients of conflict reciprocity are all significant and positive. For cooperation, the significant reciprocity coefficients do not reveal a clear sign. The significant conflict inertia coefficients are negative so that there is a tendency to reduce conflict relative to previous period, while those of cooperation are positive so that cooperation tends to persist. The effect of BT values on CC is theoretically ambiguous in our model. However, in our sample, exports decrease conflict sent from exporter to importer, whereas imports increase conflict from importer to exporter. The coefficients of BT in the cooperation equations are mostly not significant, however.

Test results on the joint significance of lag coefficients and sums of coefficients in the conflict and cooperation equations are presented, respectively, in Tables 7-8 and 7-9.[12] More dyads yield statistically significant results for groups of lag coefficients of CC than for lag coefficients of BT. A statistically significant link from BT to CC exists, however, in the majority of cases; slightly more so for cooperation than for conflict, when the number of significant cases is counted.

[Insert Table 7-8 here: Joint Significance and Sums of Lags in Equations (3) and (4).]

[Insert Table 7-9 here: Joint Significance and Sums of Lags in Equations (5) and (6).]

For the US-SU dyad, for instance, the sums of inertia coefficients are significant for both conflict and cooperation. The sum of the inertia coefficients of conflict is negative while that of cooperation is positive. The sum of the reciprocity coefficients is positive for both conflict and cooperation. The sums of the export coefficients are positive and significant and those of import are negative and significant. Hence, export causes less conflict from exporter to importer while import causes more conflict from importer to exporter. The sums of BT coefficients in the cooperation equations are not significant, however.

CC inertia only weakly explains contemporaneous CC. Out of 18 conflict flows, the sums of inertia coefficients of conflict in Tables 7-8 and 7-9, seven are statistically different from zero. Similarly, out of 20 cooperation flows, the sums of coefficients of cooperation inertia are statistically different from zero in ten cases. Many significant sums of coefficients of CC inertia lags are negative. Hence, CC inertia acts as a negative feedback. The sums of reciprocity terms, however, are significantly different from zero and are all positive. Out of 18 conflict flows, 11 sums of reciprocity terms are statistically different from zero. Out of 20 cooperation flows, all 20 sums of reciprocity terms are statistically different from zero.

In Tables 7-8 and 7-9, BT exerts a statistically significant effect on conflict in 10 out of 18 cases, and on cooperation in 11 out of 20 cases. In the conflict equations, out of 8 significant sums of coefficients of export lags, 6 are positive. Yet, out of 10 significant sums of coefficients of import lags, 8 are negative. Such effects, less pronounced though, are also present in the cooperation equations. Thus, as before, a country's export causes less conflict and more cooperation toward its trade partner. On the other hand, a country's import causes more conflict and less cooperation toward its trade partner. A possible explanation of that tendency may be that import affects domestic competing industries who seek refuge from the state. Exporters, on the other hand, have vested interest in bilateral cooperation.

Results from the Four-Equation SEM

In general, results from the four-equation SEM are similar to those from the six-equation SEM. In the BT equations, the majority of groups of coefficients are statistically different from zero. Importantly, the hypothesis that lags of net conflict are jointly zero is rejected. The signs of the majority of significant sums of coefficients conform our expectations. A reduction in tariffs, an appreciation of exporter currency, and an increase in multilateral import are associated with an increase in BT. The signs of other variables are ambiguous, as expected.

In the CC equations, net conflict inertia weakly explains contemporaneous levels of net conflict. The majority of the statistically significant sums of lag coefficients of net conflict inertia are negative. Most of the reciprocity terms are statistically significantly different from zero and are positive. BT exerts a statistically significant effect on net conflict in 10 out of 20 dyads. Finally, an increase in bilateral export causes less conflict and more cooperation toward a trade partner, where an increase in bilateral import causes more conflict and less cooperation.

7.5 Concluding Remarks

The investigation in chapter 7 has identified several regularities on the relationship between total BT values and CC. (1) A statistically significant effect of CC on BT is apparent in all the trade flows examined. Hence, CC is a determinant of BT in our dyads. (2) The effect of BT on CC is apparent in more than half of the cases examined. Hence, in the majority of cases BT is a determinant of foreign policy. (3) The interaction of BT and CC is driven by both trade partners (see below). (4) The signs of the relationship between BT value and CC are ambiguous and may change across dyads. No clear tendency is revealed from the signs of the sums of lag coefficients and individual lag coefficients of BT in the CC equations, or of CC in the BT equations. (5) CC reciprocity is present in the majority of CC flows, and is mostly positive. CC inertia, however, is statistically significant in fewer cases and is mostly negative. (6) Bilateral total import value seems to cause conflict toward a trade partner. Bilateral export value, however, seems to cause cooperation toward a trade partner. As the effect of BT variables on CC is theoretically ambiguous in our model, we further investigate this last result in chapters 8 and 9.

The estimation of the model by using equations (3) for demand and equation (5) for supply may yield clearer tendencies as the effect of CC on quantities demanded and supplied is theoretically unambiguous: as political relations improve, the quantities demanded and supplied increase. However, such estimation requires BT price data, which are hard to obtain. Disaggregating total trade along sectors may also reveal BT and CC tendencies unique to that particular sector. The aggregation of the total BT investigated here might have mixed those individual tendencies. These issues are further investigated in chapters 8 and 9.

Most empirical BT studies deal with OECD countries. Our investigations add the (former) Soviet Union and China to this set. Our results show that a link among CC and BT is not confined only to non-OECD dyads or to political rivals. Though it is hard to obtain their data, China and the (former) Soviet Union are major countries in the period analyzed here and need to be investigated more in the trade literature. Investigating BT pattern for other non-OECD large countries, such as Russia, India, Brazil, or large oil producing countries, is as important.

The results presented in this chapter show that the coefficients of SEM models are statistically significant in the majority of dyads. The finding that the test results are, in general, similar across the two SEM models considered in this chapter and in Appendix 3 (six and four equations) can be regarded as sign of robustness and strength of the BT and CC link in our model.

The above claim that BT and CC are determined by *both* trade partners' economic *and* political behavior is supported by the data, as in many dyads both directions of BT and CC flows are statistically significant. Moreover, the result that coefficients differ across dyads suggests that pooling dyads to study BT and CC may not be appropriate. Though we have not thoroughly tested the hypothesis that coefficients are the same across dyads, our results do not seem to support it.

We may now identify possible future research. Following our theoretical model, future investigations need to estimate demand and supply equations in the presence of CC, possibly deriving clearer implications on the effect of CC on BT volumes. Second, disaggregating the BT value, volume, and price data is required as the relationship between trade and CC may vary across goods. Using BT price data, available for OECD countries and some of their trade partners, BT demand and supply functions for total trade and for various goods can be estimated from SEM. To these ends we estimate the demand and supply SEM version of model from total or disaggregated BT volumes and prices in chapters 8 and 9, respectively.

ENDNOTES

1. Further, Pollins' (1989a, 1989b) trade price measures are not bilateral (as required in Pollins, 1989b) or multilateral (as required in Pollins, 1989a) which may have contaminated his results due to measurement error.

2. The IMF reports f.o.b. to c.i.f. ratios from multilateral trade but not from BT. In general, the changes in this ratio over time are smaller than 10 percent for Japan and 5 percent for the U.S. and Germany. For China, the reported ratio is constant and for the USSR, no data are reported.

3. In a few dyads we tried from zero up to four lags. The use of two lags appears to be the best over all, with lowest significance levels for coefficients and good R^2 values.

4. Annual bilateral and multilateral total trade values, multilateral trade prices, custom revenues, exchange rates, and daily CC, are available since 1948. The coverage of quarterly data is, in general, much shorter. For the USSR and China, only annual data are available.

5. The frequency of CC data to be used in empirical studies is debated in the literature on foreign policy interaction models. See Freeman (1990) and Rajmaira and Ward (1990).

6. Trade data for China and the USSR in 1948 and 1949 are from Pollins (1989a). As in Bergeijk (1994), zero trade values are replaced by $100,000, which is the smallest possible entry. The $100,000 value is also used in European Commission trade data. Some studies treat zero trade flows as missing observations. This method may discard relevant information as countries may stop trade due to hostility as argued by Bergeijk (1994) and Eichengreen and Irwin (1995). In our sample, the zero trade value treatment applies mostly to the US-China and USSR-China dyads.

7. This amounts to assuming that multilateral tariffs equal bilateral tariffs, as in Marquez (1991, 1992) and others.

8. Robust errors are computed because it is found that the instruments and the residuals are not correlated while Q tests find that serial correlation may be present in ten percent of the equations. Six lags in the form of moving average terms in the residuals are used. Other lags were also tried for few dyads. The computed correlogram of the residuals supports the adequacy of this assumption.

9. Grossman (1982), Haynes, Hutchinson, and Mikesell (1986), Bergstrand (1986, 1987), and Onitsuka (1994), for instance, report sums of coefficients from BT models without CC. The sums of lags coefficients can be interpreted as the long term multiplier of a sustained shock for the duration of the number of lags used in the model. See Gujarati (1995:568).

10. The majority of cases are also statistically different from zero at the 5 percent significance level.

11. Still, as in other BT studies, our model does not predict signs of coefficients of specific lags of variables in the model.

12. The investigation of reciprocity and inertia from sums of lags of CC terms is used in Goldstein and Freeman (1990, 1991), Goldstein (1991), Moore (1995) and others.

Table 7-1. Coefficients of Equation (1), Trade Flow From j to k.

Dyad	RMK	RXJ	SCN	SCP	ETJ	a_0 / R^2
US-JA	0.172	1.152**	-2.807**	-1.487*	-0.144	-12.273**
	-0.609**	0.951**	-3.662**	0.332	-0.129	
	-0.032	-0.145	-1.520*	-0.168	-0.243**	0.993
US-SU	5.317**	5.148**	0.830**	-0.630*	-1.438	-202.234*
	6.232**	-3.683**	0.211	-1.800**	-1.541*	
	-2.895**	1.726*	-0.801**	1.613**	-1.669	0.962
US-CH	2.665**	3.222**	6.237**	11.401**	7.113**	-201.248*
	3.086**	-4.29**	9.944**	6.638**	6.361**	
	-1.434**	7.891**	-1.131	5.502**	-8.702**	0.945
US-GE	0.716**	-1.401**	0.847**	-0.172	1.353**	36.670**
	0.157	0.737**	-2.059**	0.868**	0.884**	
	-0.219**	-0.635**	-0.743*	-0.201	0.436**	0.980
JA-SU	4.499**	2.823**	-4.443	12.315**	1.041	-182.895**
	0.060	1.427	-1.545	-2.470	-5.080**	
	6.838**	-2.224**	-2.087	6.535**	-2.458	0.935
JA-CH	0.469	1.789*	-12.817**	-5.100**	0.691*	17.448
	-0.380	0.707	-4.560	4.177	-0.980**	
	-0.058	-2.679**	2.536	9.034**	1.565**	0.909
JA-GE	-0357	0.681**	NA	-10.030**	0.530**	1.777**
	0.504**	-0.377**		11.474**	0.491**	
	-0.518**	0.434**		6.976**	0.039	0.997
GE-SU	1.176	-0.145	-4.895**	-4.652*	-1.718	-42.808**
	0.509	1.782**	-3.798**	-2.280**	-2.312	
	-1.206	1.310	-1,128	-1.248	-2.162	0.867
GE-CH	0.468**	-0.017	-23.350**	41.246**	-6.530**	32.795**
	0.763**	-5.617**	-28.716**	18.346**	8.033**	
	0.358**	3.577**	-1.086	25.840**	2.824**	0.772
CH-SU	-0.498**	1.392**	2.022**	2.446**	0.080	-25.873*
	0.619	0.524**	3.937**	1.329*	-0.632	
	1.512**	-1.009**	2.697**	3.263**	2.461**	0.961

Notes: Column headings match variable names in the equation. In each group of three numbers, the top is for lag 0, followed by lag 1 and lag 2. The constant term at the top and R^2 below are given in the last column, a_0 / R^2. NA denotes not applicable because there are no events of that kind. Coefficients significant at the 5% (10%) are indicated by ** (*). The coefficients of SCP and SCN are multiplied by 10,000.

Table 7-2. Coefficients of Equation (2), Trade Flow From k to j.

Dyad	RMJ	RXK	SCN	SCP	ETK	b_0 / R^2
US-JA	0.421**	0.691**	2.737**	1.660**	0.389**	7.073**
	-0.268	-0124	-0.496	-0.980**	-0.640**	
	-0.756**	0.745**	-1.145	0.349	0.366**	0.995
US-SU	3.523**	-1.068**	-1.270**	-0.424**	-2.468**	-42.102*
	1.294**	-1.093**	-0.190**	1.025**	-2.582**	
	-1.823**	2.039**	0.378**	0.314**	-2.925**	0.970
US-CH	-1.772	2.875**	14.110**	2.923	2.996**	710.767*
	-11.740**	-7.357**	14.328**	0.862	0.160	
	-9.516**	-10.584**	-1.437	21.869**	19.824**	0.775
US-GE	0.245**	0.997**	-5.855**	-0.195	-0.612*	1.651
	0.608**	-0.775**	-3.026**	-0.864**	0.251	
	-0.657*	0.519**	-4.309**	-0.750*	0.095	0.990
JA-SU	-1.468**	5.555**	3.477	12.481**	-3.855**	-158.276**
	-1.462**	6.383**	-10.770*	-3.502**	3.672**	
	-2.067**	6.556**	-0.576	3.479**	6.506**	0.957
JA-CH	-1.356**	0.392	-4.251	2.813**	-0.244	28.115**
	0.781	0.613*	11.907**	6.736**	0.086	
	0.106	-0.900**	-1.788	3.063**	0.577**	0.964
JA-GE	0.941**	0.077	NA	4.870	-0.655**	-2.420
	-0.234**	1.018*		-2.042	0.763**	
	-0.769**	0.132		-17.866**	0.312	0.989
GE-SU	0.884**	-2.654**	-2.225**	0.482	5.837**	47.610**
	0.382	-3.562**	-5.087**	-3.710**	-4.913**	
	3.266**	0.408	0.211	1.325**	10.556**	0.943
GE-CH	-1.083**	0.490**	-13.928**	7.599**	1.287**	33.070**
	0.364**	0.423**	-12.511**	10.524**	-0.873**	
	-0.320**	-0.453**	-7.676**	16.104**	0.232*	0.974
CH-SU	0.548**	-2.023**	0.818**	-1.111**	0.902**	43.249**
	0.252**	0.789**	4.128**	4.525**	-1.487**	
	-0.345**	-0.585**	2.238**	-0.562	0.252**	0.987

Notes: Column headings match variable names in the equation. In each group of three numbers, the top is for lag 0, followed by lag 1 and lag 2. The constant term at the top and R^2 below are given in the last column, b_0 / R^2. NA denotes not applicable because there are no events of that kind. Coefficients significant at the 5% (10%) are indicated by ** (*). The coefficients of SCP and SCN are multiplied by 10,000.

Table 7-3. Joint Significance and Sums of Lags in Equations (1) and (2).

Panel A: Equation 1 (Trade Flow from J to K)

Dyad	RMK	RXJ	SCN	SCP	ETJ
US-JA	0.000	0.000	0.000	0.000	0.000
	-0.469**	1.958**	-7.989**	-1.323*	-0.518**
US-SU	0.000	0.000	0.010	0.000	0.000
	8.654**	3.191**	0.240	-0.816**	-4.648**
US-CH	0.000	0.000	0.000	0.000	0.000
	4.317**	6.813**	15.051**	23.541**	4.773**
US-GE	0.000	0.000	0.001	0.000	0.000
	0.654**	-1.300**	-1.955**	0.495	2.676**
JA-SU	0.000	0.000	0.249	0.000	0.000
	11.395**	2.026*	-8.075	16.380**	-6.498**
JA-CH	0.202	0.000	0.040	0.001	0.000
	0.031	-0.183	-14.840*	8.111	1.277**
JA-GE	0.000	0.000	NA	0.000	0.000
	-0.050	0.738**		8.420*	1.060**
GE-SU	0.606	0.002	0.000	0.144	0.000
	0.479	2.947**	-9.822**	-8.181**	-6.192**
GE-CH	0.000	0.000	0.000	0.000	0.000
	1.590**	-2.057**	-53.153**	85.430**	4.326**
CH-SU	0.000	0.000	0.000	0.000	0.000
	1.633**	0.907**	8.657**	7.039**	1.910**

Panel B: Equation 2 (Trade Flow from K to J)

Dyad	RMJ	RXK	SCN	SCP	ETK
US-JA	0.000	0.000	0.000	0.000	0.000
	-0.603**	1.314**	1.095	1.030*	0.116
US-SU	0.000	0.007	0.000	0.000	0.000
	2.994**	-0.122	-1.081**	0.914**	-7.975**
US-CH	0.000	0.000	0.000	0.000	0.000
	-23.039**	-15.065**	27.000**	25.654**	22.980**
US-GE	0.000	0.000	0.000	0.000	0.079
	0.195**	0.741**	-13.190**	-1.809**	-0.265
JA-SU	0.000	0.000	0.000	0.000	0.000
	-4.996**	18.494**	-7.869	12.458**	6.323*
JA-CH	0.000	0.049	0.000	0.000	0.000
	-0.468	0.105	5.868	12.612**	0.418*
JA-GE	0.000	0.000	NA	0.000	0.000
	-0.062	1.228**		-15.038**	0.419**
GE-SU	0.000	0.000	0.000	0.000	0.000
	4.533**	-5.807**	-7.548**	-2.869**	11.480**
GE-CH	0.000	0.000	0.000	0.000	0.000
	-1.039**	0.460**	-34.116**	34.238**	0.645**
CH-SU	0.000	0.000	0.000	0.000	0.000
	0.456**	-1.819**	7.148**	2.851**	-0.333**

Notes: See notes to Table 7-1. The top value is the joint significance level and the bottom figure is the value of the sum of coefficients of all lags.

Table 7-4. Coefficients of Equation (3), Conflict Flow from j to k.

Dyad	CNJK	CNKJ	TJK	TKJ	c_0 / R^2
US-JA	-0.092	0.089	-154.154*	5.794	75.392
	0.236	0.133	128.777	55.318	
	-0.081	0.173*	91.432**	-116.453	0.385
US-SU	-0.355**	0.770*	216.233*	-351.982**	18336.961**
	-0.182	0.327*	-41.617	-629.050 **	
	0.032	0.347*	308.589**	-469.622**	0.908
US-CH	0.004	0.096**	17.078**	-12.151	157.181
	0.076	-0.015	-16.716*	-6.509	
	-0.457**	-0.021	22.518**	-18.398**	0.637
US-GE	-0.215	0.019	33.201	-53.891	-211.117
	-0.182	-0.036*	15.202	-5.121	
	-0.230	-0.012	-13.252	30.624	0.224
JA-SU	0.173	0.594	-36.340	166.501	-76.450
	-0.268	-0.375**	19.274	-133.130*	
	0.183	-0.076	-64.367	69.958	0.486
JA-CH	-0.126	0.005	2.407	-13.637	-14.386
	-0.097	0.093*	-2.582	-3.042	
	-0.144	0.085	3.775	12.315	0.183
JA-GE	NA	NA	NA	NA	NA
GE-SU	0.001	0.756**	59.180	-188.063**	1519.525**
	-0.088	0.073	-29.055	13.075	
	0.0831*	0.087	18.976	51.930	0.782
GE-CH	-0.334**	0.082**	-0.168	-0.531	-29.843**
	0.023	0.029**	2.146*	3.313	
	-0.109**	-0.011	-3.122**	-0.273	0.887
CH-SU	0.314**	1.278**	25.425	29.769	-277.200
	-0.155*	-0.601**	186.420	-72.600	
	0.118*	0.048	-288.139**	133.321	0.933

Notes: Column headings match variable names in the equation. In each group of three numbers, the top is for lag 0, followed by lag 1 and lag 2, except for the coefficients of CNJK, which are for lags 1-3. The constant term at the top and R^2 below are given in the last column, c_0 / R^2. NA denotes not applicable because there are no events of that kind. Coefficients significant at the 5% (10%) are indicated by ** (*).

Table 7-5. Coefficients of Equation (4), Conflict Flow from k to j.

Dyad	CNKJ	CNJK	TKJ	TJK	d_0 / R^2
US-JA	0.021	0.117	-115.808	200.765*	-843.954**
	-0.300	0.058	79.834	-74.290	
	-0.089	0.467**	-142.794	126.433	0.530
US-SU	-0.239	1.035*	409.843*	-109.731	-19971.165**
	-0.256	0.379*	697.667*	-108.065*	
	-0.126**	0.142*	453.208	-306.597**	0.887
US-CH	0.473**	1.296*	47.179	51.108	-878.656**
	0.193	-1.897**	-199.701	13.787	
	-0.160	-0.867	104.993	8.465	0.758
US-GE	0.188**	0.337	-254.135	86.962	753.924
	0.024	-0.778**	234.058**	259.538	
	-0.079	0.391	-7.687	-361.308*	0.360
JA-SU	0.182	0.374**	25.201	-26.649	41.611
	0.154	0.004	3.699	-6.963	
	-0.372**	-0.266**	25.075	-13.558	0.400
JA-CH	0.270	-0.013	-16.770	8.665	-287.647**
	-0.075	-0.001	36.510	-21.587	
	-0.136	0.167	23.527	-14.069	0.334
JA-GE	NA	NA	NA	NA	NA
GE-SU	-0.230**	0.992*	326.592**	-107.406	-2744.593**
	-0.056	0.184*	-17.885	94.068	
	-0.131**	0.094	-106.145	-58.950*	0.847
GE-CH	-0.208	10.122**	-4.697	2.966	248.82**
	0.224*	2.491	-33.215	-17.126	
	0.091**	-1.617	13.957	26.619**	0.846
CH-SU	0.045	0.559**	-0.262	95.340	-617.148
	-0.078	-0.023	-5.971	-216.865	
	-0.006	0.231*	-13.571	169.991**	0.929

Notes: Column headings match variable names in the equation. In each group of three numbers, the top is for lag 0, followed by lag 1 and lag 2, except for the group of coefficients of CNKJ, which are for lags 1-3. The constant term at the top and R^2 below are given in the last column, d_0 / R^2. NA denotes not applicable because there are no events of that kind. Coefficients significant at the 5% (10%) are indicated by ** (*).

Table 7-6. Coefficients in Equation (5), Cooperation Flow from j to k.

Dyad	CPJK	CPKJ	TJK	TKJ	e_0 / R^2
US-JA	0.118	0.920**	0.654	25.533	592.547**
	0.096	0.016	330.856*	91.148	
	0.017	-0.152	-166.185	-271.591**	0.801
US-SU	0.564*	0.847**	25.785	194.550	-1220.834
	0.045	-0.468**	-46.352	-123.597	
	-0.070	-0.087	27.131	1.467	0.941
US-CH	0.170	0.900**	25.089**	-10.399	-160.936*
	-0.261*	-0.078	-12.557	24.764	
	-0.072	0.098	20.651**	-32.341*	0.883
US-GE	-0.068	0.453**	-121.806	-182.502	3394.433**
	-0.020	0.027	-130.697	-115.469	
	-0.216**	0.010	152.248*	263.054**	0.719
JA-SU	-0.227*	0.907**	4.883	21.620	-70.482
	0.116	0.217*	-9.083	-10.682	
	-0.019	-0.056	1.195	-3.029	0.889
JA-CH	0.002	0.743**	24.660**	-32.093	-19.216
	-0.494**	0.001	-12.650	8.670	
	-0.041	0.369**	0.805	10.560	0.939
JA-GE	-0.081	0.934**	-9.849	17.387*	-12.749
	-0.073	0.076	18.071	-18.819**	
	-0.333**	0.152	-22.569**	19.748**	0.810
GE-SU	-0.206*	0.818**	-22.826	15.837	-44.022
	-0.313*	0.140***	-72.928**	39.399**	
	0.018	0.337**	15.529	34.109*	0.867
GE-CH	-0.381**	0.884**	8.232	-17.236	-157.092**
	-0.265**	0.304*	11.904	11.432	
	-0.052	0.184	-19.482**	12.503	0.894
CH-SU	0.145	0.777**	52.492	-58.999*	-236.218*
	0.094	0.075	-23.417	35.753	
	0.034	-0.394**	-57.379*	68.011*	0.837

Notes: Column headings match variable names in the equation. In each group of three numbers, the top is for lag 0, followed by lag 1 and lag 2, except for the group of coefficients of CPJK, which are from lags 1-3. The constant term at the top and R^2 below are given in the last column, e_0 / R^2. Coefficients significant at the 5% (10%) are indicated by ** (*).

Table 7-7. Coefficients in Equation (6), Cooperation Flow from k to j.

Dyad	CPKJ	CPJK	TKJ	TJK	f_0 / R^2
US-JA	0.288**	0.704**	-74.946	-0.659	-362.091*
	-0.045	-0.113	47.257	-312.023**	
	0.001	-0.029	196.941*	121.843	0.530
US-SU	0.411**	1.027**	-157.696	-22.848	1984.734
	0.028	-0.445*	88.144	54.968	
	0.072	0.008	-51.925	-26.135	0.922
US-CH	0.125	0.874**	17.808	-17.917	117.608
	-0.082	-0.175*	-31.726	25.774*	
	0.006	0.229	35.079	-37.842**	0.862
US-GE	0.206**	0.951**	405.203**	15.584	-2663.445**
	-0.160**	-0.164	68.057	101.794	
	0.076	0.221	-373.660	-106.324	0.610
JA-SU	-0.232	0.974**	-13.098	-7.405	98.243
	0.042	0.272	4.505	10.106	
	0.010	-0.104	8.807	-6.550	0.891
JA-CH	-0.033	1.185*	63.283*	-37.110**	67.250
	-0.311**	0.011	-23.973	22.447**	
	0.014	0.421**	-35.134	7.337	0.937
JA-GE	-0.194	0.722*	-16.357**	6.927	31.091
	0.066	0.212	19.244**	-29.160	
	0.226**	-0.004	-14.057**	30.297**	0.781
GE-SU	-0.065	1.106**	-19.008	34.524	62.490
	-0.431**	0.134	-52.834*	78.324**	
	-0.002	0.420**	-30.161	-21.319	0.934
GE-CH	-0.368*	0.899*	16.548	-6.203	63.410
	-0.192	0.306*	-8.262	-8.771	
	-0.036	0.167*	-12.390	16.392**	0.867
CH-SU	-0.058	0.924**	64.007**	-37.628	200.593
	0.354**	-0.051	-41.656	5.198	
	-0.063	-0.095	-47.470	45.989	0.789

Notes: Column headings match variable names in the equation. In each group of three numbers, the top is for lag 0, followed by lag 1 and lag 2, except for the group of coefficients of CPKJ, which are from lags 1-3. The constant term at the top and R^2 below are given in the last column, f_0 / R^2. Coefficient significant at the 5% (10%) are indicated by ** (*).

Table 7-8. Joint Significance and Sums of Lags in Equations (3) and (4).

Panel A: Equation 3 (Conflict Flow from J to K)

Dyad	CNJK	CNKJ	TJK	TKJ
US-JA	0.146	0.202	0.017	0.566
	0.063	0.395**	66.055	-55.342
US-SU	0.001	0.000	0.000	0.000
	-0.505**	1.444**	483.205**	-1450.654**
US-CH	0.000	0.141	0.001	0.054
	-0.377	0.059	22.881**	-37.057**
US-GE	0.385	0.098	0.037	0.221
	-0.626*	-0.029	35.151	-28.388
JA-SU	0.077	0.008	0.089	0.160
	0.087	0.143	-81.432	103.330
JA-CH	0.158	0.001	0.892	0.494
	-0.368*	0.183**	3.600	-4.365
JA-GE	NA	NA	NA	NA
GE-SU	0.289	0.000	0.162	0.056
	-0.004	0.916**	49.101*	-123.059**
GE-CH	0.000	0.000	0.000	0.003
	-0.421	0.100**	-1.143**	2.508**
CH-SU	0.002	0.000	0.313	0.530
	0.276*	0.724**	-76.293	90.489

Panel B: Equation 4 (Conflict Flow From K to J)

Dyad	CNKJ	CNJK	TKJ	TJK
US-JA	0.063	0.000	0.000	0.000
	-0.368	0.642**	-178.767**	252.908**
US-SU	0.001	0.000	0.000	0.000
	-0.621**	1.556**	1560.719**	-524.393**
US-CH	0.000	0.000	0.424	0.236
	0.507**	-1.468	-47.527	73.361
US-GE	0.209	0.007	0.168	0.276
	0.133	-0.050	-27.764	-14.807
JA-SU	0.000	0.000	0.080	0.127
	-0.036	0.112	53.975	-47.171*
JA-CH	0.152	0.586	0.026	0.060
	0.058	0.152	43.266**	-26.992**
JA-GE	NA	NA	NA	NA
GE-SU	0.006	0.000	0.000	0.190
	-0.418**	1.272**	202.561**	-72.287**
GE-CH	0.000	0.000	0.075	0.048
	0.108	10.996**	12.460	-23.955*
CH-SU	0.973	0.000	0.990	0.443
	-0.039	0.767**	-19.804	48.467

Notes: See notes to Tables 7-4 and 7-5. The top value is the joint significance level and the bottom figure is the value of the sum of coefficients of all lags.

Table 7-9. Joint Significance and Sums of Lags in Equations (5) and (6).

Panel A: Equation 5 (Cooperation Flow from J to K)

Dyad	CPJK	CPKJ	TJK	TKJ
US-JA	0.532	0.000	0.086	0.019
	0.232	0.785**	165.325**	-154.910**
US-SU	0.000	0.000	0.635	0.478
	0.539**	0.292**	6.564	72.420
US-CH	0.039	0.000	0.100	0.008
	-0.162	0.920**	33.183**	-17.976*
US-GE	0.000	0.000	0.068	0.017
	-0.305	0.491**	-100.256*	-34.918
JA-SU	0.001	0.000	0.823	0.756
	-0.132	1.069**	-3.005	7.908
JA-CH	0.000	0.000	0.007	0.001
	-0.533**	1.114**	12.816**	-12.822**
JA-GE	0.000	0.000	0.032	0.000
	-0.487*	1.162**	-14.348**	18.317**
GE-SU	0.098	0.000	0.000	0.000
	-0.501**	1.297**	-80.225**	89.346**
GE-CH	0.005	0.000	0.000	0.448
	-0.699**	1.373**	0.655	6.699
CH-SU	0.500	0.000	0.000	0.003
	0.273	0.459*	-28.304	44.766

Panel B: Equation 6 (Cooperation Flow from K to J)

Dyad	CPKJ	CPJK	TKJ	TJK
US-JA	0.144	0.000	0.081	0.002
	0.244*	0.562**	169.250**	-190.250**
US-SU	0.010	0.000	0.385	0.472
	0.512**	0.574**	-121.477	5.985
US-CH	0.560	0.000	0.001	0.001
	0.049	0.928**	21.161**	-29.986**
US-GE	0.009	0.000	0.244	0.588
	0.122	1.008**	99.600	11.054
JA-SU	0.009	0.000	0.812	0.787
	-0.180	1.143**	0.213	-3.850
JA-CH	0.006	0.000	0.156	0.098
	-0.330*	1.617**	4.176	-7.326*
JA-GE	0.001	0.000	0.003	0.001
	0.099	0.930**	-11.169	8.064*
GE-SU	0.008	0.000	0.007	0.000
	-0.497**	1.659**	-102.004**	91.528**
GE-CH	0.093	0.000	0.521	0.000
	-0.597*	1.372**	-4.104	1.417
CH-SU	0.056	0.000	0.008	0.174
	0.233	0.777**	-25.119	13.660

Notes: See notes to Tables 7-6 and 7-7. The top value is the joint significance level and the bottom figure is the value of the sum of coefficients of all lags.

CHAPTER 8: SEM ESTIMATION FROM TOTAL TRADE VOLUMES

Chapter 7 was devoted to an empirical investigation of a SEM from total trade value data under the assumption of one traded good. Chapter 8 retains the one traded good assumption but empirically investigates a SEM from total trade volumes in partial equilibrium. While in chapter 7 the economic part of the model is solved to obtain a trade gravity like equation for BT value, in this chapter we estimate bilateral demand, bilateral supply, and CC equations for each dyad. The empirical model is estimated for all dyads formed among the United States (US), the (former) Soviet Union (SU), Japan (JA), and (West) Germany (GE) which are four major political and economic actors. The choice of dyads, as well as sample time and data frequency, however, is also affected by the availability of multilateral and BT values, volumes, and prices.

A SEM from total trade volumes has an advantage over a SEM from total trade values since it implies clear hypotheses on the effect of CC on BT. As in the case of the SEM from trade values, however, the effect of BT on CC in the SEM from trade volumes is theoretically ambiguous and needs to be investigated empirically.

8.1 Empirical Model

The SEM in chapter 7 is estimated from net conflict and separate sums of conflict and cooperation as the measures of CC. In the SEM of chapter 7, the use of separate sums of conflict and cooperation entails six equations where the use of net conflict entails four equations. In chapter 8, a SEM using separate sums of conflict and cooperation as the measures of CC entails eight equations, while that using net conflict includes six equations. The results in Chapter 7 and Appendix 3 reveal, however, a relatively low sensitivity to the type of CC measure used in the estimation. Furthermore, while bilateral and multilateral total trade values are available starting in 1948, bilateral and multilateral total trade volumes and prices are available only since 1963. Given the larger complexity of this SEM, the robustness of chapter's 7 results to the type of CC measure used, and the fewer BT volume and price data points available, the SEM from total BT trade volumes is estimated here using net conflict as the measure of CC.

The SEM is estimated from chapter 6's equations (3), (5), and (13) which are written below for the case of one traded good which is produced in j and consumed in k and for CC sent from j to k. As (3) and (5) in chapter 6 include BT prices and volumes, (13) is modified to include BT prices and quantities, or P_{jk} and Q_{jk} respectively, as separate variables to maintain simultaneity. A similar set of equations may be written for BT volumes and CC flows from k to j. To simplify the notations, the sums in the denominators of equations (3), for the bilateral demand and (5), for the bilateral supply, are replaced by PT_k and PS_j, respectively. These three equations, with a short title for each, are as follows.

Demand of k from j:

$$Q_{jk}=\frac{b_{jk}{}^{\sigma_k}P^{*}{}_{jk}{}^{-\sigma_k}M_k}{PT_k} \tag{1}$$

Supply from j to k:

$$Q_{jk}=\frac{P_{jk}{}^{\tau_j}X_j}{a_{jk}{}^{\tau_j+1}PT_j} \tag{2}$$

CC from j to k:

$$CC_{jk_t}=\gamma\lambda_0+\gamma\lambda_1 CC_{kj_t}+(1-\gamma)\,CC_{jk_{t-1}}+\beta_P P_{jk_t}+\beta_Q Q_{jk_t}+\delta_P P_{kj_t}+\delta_Q Q_{kj_t}+\gamma e_{jk_t}. \tag{3}$$

Operationalizing CC as net conflict, the number of equations in the SEM from total trade volume is six: demand of j from k, supply of k to j, demand of k from j, supply of j to k, net conflict from j to k, and net conflict from k to j. In empirical analysis, the terms PT_k and PS_j in (1) and (2), are approximated by the multilateral trade price indicies (or trade unit values).

The variable P^*_{jk} is included in the estimation as one term since the theoretical model implies the same regression coefficients for its components as disscused in chapter 6 and 7. Similarly, the model constrains the coefficients of the multilateral import and export expenditures, M_k, M_j, X_j, and X_k, to be equal, with opposite signs, to those of the multilateral import and export prices, PS_k, PS_j, PT_j, and PT_k, respectively. Accordingly, real multilateral import and export expenditures are used as explanatory variables by computing the ratios between M_k and PS_k, M_j and PS_j, X_k and PT_k, and X_j and PT_j and using those ratios in the estimation.

The logarithm transformations of (1) and (2) are taken to make them linear in logarithms. Following this transformation, (1) and (2) include the levels of CC, logarithms of total BT prices and volumes, and logarithms of real multilateral import and export expenditures. To maintain simultaneity, total BT prices and volumes in (3) are replaced by their logarithm transformations.

Consumers and producers in j and k are assumed to observe both the CC flows going from j to k and from k to j. As before, all economic agents are assumed to have access to the same information set on the bilateral relations. Accordingly, CC_{jk} and CC_{kj}, in the form of net conflict flows, are included in the demand and supply equations as independent variables. The governments of j and k are assumed to act on a net conflict scale. The empirical model is estimated separately for each dyad.

Equations (1) and (2) are written under the assumption of market clearing. In reality, however, the process of reaching economic equilibrium may not be instantaneous, as was disscused in chapter 7. To accommodate possible changes in the economic and the political environments over time, equations (4) - (9) below include lagged variables.[1] As in Grossman (1982), the lags are entered into the demand and the supply equations unconstrained.[2] As in chapter 7, the number of lags to be used is determined empirically.[3]

The equations to be estimated, with a short title for each, are written as follows.

Bilateral demand of k from j:

$$QJK_t=a_0+\sum_{S=0}^{1}(a_{1s}RMK_{t-s}+a_{2s}NJK_{t-s}+a_{3s}NKJ_{t-s})+\sum_{S=0}^{2}(a_{4s}PJK+a_{5s}TEJK)+u_{1t} \quad (4)$$

Bilateral supply of j to k:

$$QJK_t=b_0+\sum_{S=0}^{1}(b_{1s}RXJ_{t-s}+b_{2s}NJK_{t-s}+b_{3s}NKJ_{t-s})+\sum_{S=0}^{2}(b_{4s}PJK)+u_{2t} \quad (5)$$

Bilateral demand of j from k:

$$QKJ_t=c_0+\sum_{S=0}^{1}(c_{1s}RMJ_{t-s}+c_{2s}NJK_{t-s}+c_{3s}NKJ_{t-s})+\sum_{S=0}^{2}(c_{4s}PKJ+c_{5s}TEKJ)+u_{3t} \quad (6)$$

Bilateral supply of k to j:

$$QKJ_t=d_0+\sum_{S=0}^{1}(d_{1s}RXK_{t-s}+d_{2s}NJK_{t-s}+d_{3s}NKJ_{t-s})+\sum_{S=0}^{2}(d_{4s}PKJ)+u_{4t} \quad (7)$$

Net conflict flow from j to k:

$$NJK_t=e_0+\sum_{S=0}^{1}e_{1s}(NKJ_{t-s})+\sum_{S=1}^{2}(e_{2s}NJK_{t-s})+PQJK_t+u_{5t} \quad (8)$$

Net conflict from k to j:

$$NKJ_t=f_0+\sum_{S=0}^{1}(f_{1s}NJK_{t-s})+\sum_{S=1}^{2}(f_{2s}NKJ_{t-s})+PQKJ_t+u_{6t}\ . \quad (9)$$

$PQJK_t$ and $PQKJ_t$ in (8) and (9) are given by:

$$PQJK_t=\sum_{s=0}^{1} (e_{3s}QJK_{t-s}+e_{4s}QKJ_{t-s}+e_{5s}PJK_{t-s}+e_{6s}PKJ_{t-s}) \quad (10)$$

$$PQKJ_t=\sum_{s=0}^{1} (f_{3s}QJK_{t-s}+f_{4s}QKJ_{t-s}+f_{5s}PJK_{t-s}+f_{6s}PKJ_{t-s}) \quad , \quad (11)$$

and the u's are structural disturbance terms.

In the above equations (4) through (11), the definitions of variables are listed below:

QJK	=	logarithm of total trade volume from j to k,
QKJ	=	logarithm of total trade volume from k to j,
PJK	=	logarithm of total BT price paid by k to j,
PKJ	=	logarithm of total BT price paid by j to k,
RMK	=	logarithm of total multilateral real import value of k,
RMJ	=	logarithm of total multilateral real import value of j,
RXJ	=	logarithm of total multilateral real export value of j,
RXK	=	logarithm of total multilateral real export value of k,
NKJ	=	level of net conflict sent from k to j,
NJK	=	level of net conflict sent from j to k,
TEJK	=	logarithm of the combined terms of the tariffs that k imposes on j and the value of k's currency in terms of j's currency,
TEKJ	=	logarithm of the combined terms of the tariffs that j imposes on k and the value of j's currency in terms of k's currency.

The subscript t denotes time and the subscript s denotes lag number. The estimates of the parameters a,...,f are the regression coefficients. The coefficients of TEJK and PJK, and TEKJ and PKJ, respectively, are constrained to be equal as dictated by the theoretical model, where TEJK and TEKJ are presented in (2) in chapter 6.[4] The imposition of these restrictions and those from using the real multilateral trade values is expected to increase the efficiency of the estimation.

8.2 Dyads and Data

There are six dyads and 12 trade or CC flows in the sample as we distinguish between the actor and the target countries. The dyads used here, however, are a subset of those used in chapter 7. The estimation of demand and supply equations requires a complete set of bilateral and multilateral trade prices, volumes, and values. Such data are not available, however, for dyads which include China. For dyads which include the (former) Soviet Union, it is possible to generate missing trade data under a certain assumption which is disscused below. The CC data, exchange rates, and tariffs for all countries, and the multilateral trade values of the SU are from chapter 7. The following description of the trade data applies also to chapter 9 which uses (disaggregated) data from the same sources used here.

Data on BT prices in precise measures over long time periods for any country are not available (see Geraci and Preow, 1982; Ranuzzi, 1981, 1982; Italianer, 1986; Bergstrad, 1986, 1987; and Marquez, 1991, 1992).[5] Accordingly, authors use various approximations to generate BT prices. Ranuzzi (1981,1982), Italianer (1986), and Marquez (1991, 1992) use BT unit values as a proxy for prices.[6] Warner and Kreinin (1983), Helkie and Hooper (1988), Kohli and Morey (1988), Kohli (1991), Shilies (1991) and others use multilateral trade unit values as a proxy for BT prices. Geracci and Preow (1982) and Pollins (1989b) compute BT prices for total trade from weighted multilateral trade unit values. Marquez and McNeilly (1988) and Marquez (1991, 1992) argue, however, that studies using multilateral trade prices to compute, or approximate, BT prices run the risk of biased results due to measurement errors.[7]

In this study, BT unit value indices which are constructed from highly disaggregated trade data are used to approximate BT prices. Multilateral and bilateral total and disaggregated trade unit value indices, volume indices, and values from 1963 to 1980 are from Italianer (1986), and from 1979 to 1994 they are from the European Commission's VOLIMEX. Both data sets include total as well as disaggregated trade data.

Italianer's (1986) data include yearly unit value indices and values for 13 reporters and partners from the OECD and five trading blocs partners. The data, computed from dollars, are disaggregated along five categories which are listed in chapter 9 and are expressed using 1975 as the base year for all indicies. Italianer's methodology was adopted by the European Commission's VOLIMEX project in the mid 1980s. The Commission increased the number of reporters, partners, and goods, changed the format of reports, and changed the source of raw data from the OECD to the UN. VOLIMEX data include yearly unit values indicies, values, and volume indicies from 1979 to 1994, for 24 reporters and partners from the OECD, some non OECD partners, and a few trading blocs. Data are available in the SITC one digit or the NACE-R44 trade classifications. These data are computed from dollars and are expressed using 1990 as the base year for all indicies.

As mentioned above, VOLIMEX data are based on national reports to the UN where Italianer's (1986) data are based on national reports to the OECD. The reports, however, include trade values and volumes adjusted for the cost of insurance and freight and disaggregated along SITC five digits categories. Both data sets are constructed using a similar methodology as follows.[8] For each low level SITC category, a bilateral and multilateral trade unit value is created by dividing values by volumes. Disaggregated values and unit values are aggregated into values and unit value indicies for groups of goods. In VOLIMEX, unit value indicies are used to generate aggregated BT volume indicies. Since Italianer's (1986) data do not include volume indicies, they are computed here by converting values into indicies and dividing them by the unit value indicies from the same base year, as done in Grossman (1982).

Italianer's trade categories are aggregates of VOLIMEX's NACE-R44 categories (Italianer, 1986:258). At our request, the European Commission sent us VOLIMEX trade data aggregated into Italianer's categories for our dyads. Trade time series from 1963 to 1994 are created by splicing the "Italianer like" VOLIMEX and Italianer's (1986) data sets using the following procedure. First, indicies in both data sets are expressed using 1980 as a common base year. Second, trade indicies and values in 1979, which is the only remaining overlapping year between VOLIMEX and Italianer (1986) data when expressed in base year 1980, are compared to each other. As the difference between the two data sets is found to be mostly smaller than five percent, the two data sets, expressed in base 1980, are spliced by using VOLIMEX data from 1979 to 1994 and Italianer's data from 1963 to 1978. The resulting time series is then expressed using 1990 as the base year.

Each BT flow is available as reported by the two trade partners in a dyad. These reports may not match, however, for a given good and/or point in time although they apply to the same flow. This is a known problem in all BT data sets.[9] VOLIMEX data include a yearly quality flag per each variable, pointing out the percent of missing reports in the data used to generate it. Accordingly, we choose the reporter country for both VOLIMEX and Italianer's data sets as the one with the highest data quality in VOLIMEX. This procedure was recommended to me by the European Commission.

Italianer's (1986) data set does not include the SU as a trade partner. Instead, the Community of Mutual Economic Assistance (CMEA) economic bloc is included as a trade partner. VOLIMEX data include the (former) SU as a trade partner. Under the assumption that the 1963-1980 growth rates of US, JA, and GE trade with the CMEA bloc are similar to the growth rates of their trade with the SU, data for the SU are generated by extrapolating VOLIMEX backwards, from 1979 to 1963, using the CMEA growth rates from Italianer (1986). As the two data sets overlap in 1979 and 1980, it is possible to check their match for the SU generated data in 1979 when 1980 is used as a base year. The differences between those SU trade series in 1979 are found to be smaller than 10 percent in most cases.

8.3 Summarizing the Hypotheses

The testable hypotheses derived from the model which are relevant to an emprical analysis of BT and CC from total trade volumes, are rewritten below as follows.

The total BT demand equation will have a negative slope with respect to the total BT price, and a positive slope with respect to the real multilateral total import expenditure.

The total BT supply equation should have positive slopes with respect to the total BT price and the multilateral total real export expenditure.

The bilateral demand and supply equations will both have a positive slope with respect to net conflict, or demand and supply will decrease with conflict and increase with cooperation.

The signs of the inertia term in the CC equations is ambiguous. CC inertia, however, is expected to be statistically significant. Following many results in the literature on foreign policy interaction, the sign of reciprocity is expected to be mostly positive.

The effect of BT on CC, while ambiguous, should be statistically siginificant. Several forces may determine the sign of the effect of BT prices or volumes and CC. For instance, higher import price may prompt importers, or actors, to be hostile toward exporters, or targets. As actors' imports are the targets' exports, higher export price may prompt targets' cooperation, which may prompt actors' reciprocity. Yet, actors facing higher import price may also become friendly toward exporters hoping to reduce price, and so on.[10]

8.4 Results

The model in equations (4) through (9) above is estimated per dyad by using two stage least squares. A statistical software package RATS version 4.0 has been used. As in chapter 7, consistent standard errors are obtained by using the method of Newey and West (1987). Three hypotheses tests are conducted: (1) t tests on the significance of lags coefficients; (2) F tests on the joint significance of lags coefficients; and (3) t tests on the sums of lags coefficients.[11]

The estimation results are summarized below and are fully presented in Appendix 4. In general, results from testing the joint significance of lags coefficients show that the variables in the model significantly contribute to the explanation of the dependent variables. At least one sum of lags coefficients of CC is found to be significant in 11 out of 12 demand equations and in 9 out of 12 supply equations. Hence, CC matters for demand and supply from total trade. Similarly, at least one sum of lags of trade coefficients is found to be siginificant in 8 out of 12 CC flows. Hence, trade is a determinant of CC in most dyads in the sample.

Table 8-1 and 8-2 summarize results from testing the significance of the sums of lags coefficients and individual lags coefficients. A statistical significance level of 10 percent is used throughout the disscusion.[12] Typically, the results from lags coefficients and from sums of lags coefficients reveal similar patterns while the majority of the results confirms our hypotheses.

Results from the Demand and Supply Equations

The signs of lags coefficients and sums of lags coefficients in the demand and supply equations are summarized in Table 8-1.[13]

[Insert Table 8-1 here: Signs of Coefficients in Demand and Supply]

In Table 8-1, the majority of the signs of lags coefficients and sums of lags coefficients of bilateral prices and real multilateral trade expenditures have the expected signs. In demand and supply combined, 51 lags coefficients of price out of 72 in Panel A and 17 sums of lags coefficients of price out of 24 in Panel B reject the hypothesis of a wrong sign. In the case of the real multilateral export and import expenditures, 43 individual lags coefficients out of 48 in Panel A, and 22 sums of lags coefficients out of 24 in Panel B, reject the hypothesis of a wrong sign.

The number of wrong price signs in Table 8-1 is slightly lower compared to several economic studies estimating BT demand and supply equations. Direct comparison, however, may not be possible as studies differ in data sources, model specification, estimation methods, sample times, and data frequency. Price and Thornblade (1972), Stone (1979), Geraci and Preow (1982), Grossman (1982), Ranuzzi (1982), Hutshinson et al. (1986), Marquez (1991, 1992), and Onitsuka (1994) for instance, also find, at times, a positively price sloped bilateral demand function. In supply, the frequency of wrong BT price slopes is slightly higher in those studies than in our study.[14] The frequency of correctly signed or expected expenditure elasticities of demand and supply in those studies is mostly as in our study.

In Panel A, 27 out of 48 CC coefficients reject the hypothesis that a rise in conflict is associated with more demand, and 38 out of 48 CC coefficients reject the hypothesis that a rise in conflict is associated with more supply. In Panel B, results from sums of lags coefficients of CC in supply greatly confirm our hypothesis as 18 out of 24 sums reject the hypothesis of a wrong sign. Results from the sums of lags coefficients of CC in demand partially agree with our expectations as 11 out of 24 sums of lags coefficients reject the hypothesis of a wrong sign. In 13 cases demand is found, however, to increase with conflict. We will return to this point in the end of this chapter.

Results from the Net Conflict Equations

The signs of the lags coefficients and sums of lags coefficients in the CC equations are presented in Table 8-2.

[Insert Table 8-2 here: Signs of Coefficients in CC Equations.]

In Panel B, the sums of lags coefficients of reciprocity are statistically significant in 10 out of 12 CC flows, inertia in 5, export volume in 5, import volume in 4, export price in 6, and sums of lags coefficients of import price are statistically significant in 6 out of 12 CC flows.

In Panels A and B, the signs of the majority of lags coefficients and sums of lags coefficients of reciprocity are positive while those of inertia are mostly negative. In Panel A, two lags coefficients of inertia are found to be positive while eight are negative. For reciprocity, 12 lags coefficients are positive while two are negative. In Panel B, The sums of lags coefficients of inertia are all negative while nine out of 10 sums of lags coefficients of reciprocity are positive. Hence, in our sample, inertia acts as a negative feedback while reciprocity acts as a positive feedback.

Combining results in Panel A and B of Table 8-2, the signs of lags coefficients (Panel A) and sums of lags coefficients (Panel B) of bilateral prices and volumes are mostly ambiguous. That is, no clear effect of BT prices and volumes on CC is revealed either in the theoretical model or in the empirical test. This result agrees with our hypotheses. The association of export with cooperation and import with conflict which was revealed by the estimation results from the SEM in chapter 7 is generally not supported, however, by the estimation results in this chapter.[15]

Last, we may use our results to evaluate Polachek and McDonald's (1992:277) prediction. These authors argue that the lower is the price elasticity of an actor's bilateral import demand and export supply, more bilateral cooperation will be induced by BT. As was discussed in chapter 2, this prediction is based on the assumption that governments derive positive utility from both trade and conflict. In general, argues Polachek, bilateral trade will induce cooperation, the size of which depends on those price elasticities. We, however, do not find in favor of this prediction. In our results, the effect of BT on CC is not clear, regardless of the magnitude of the price elasticities of bilateral import demand or export supply. This was demonstrated in chapter 7, as well as here.

8.5 Concluding Remarks

In chapter 8 we estimated a SEM from total trade volumes and prices for all dyads formed among the United States, Japan, (West) Germany, and the (former) Soviet Union. Time series data from 1963 to the early 1990s are used. CC is measured as net conflict.

In the bilateral demand and supply equations, the price slopes of demand and supply are found to have the expected sign. The trade expenditure slopes of demand and supply are found to be mostly positive as expected. Overall, the effect of CC on bilateral demand and supply is found to be positive in most cases, or demand and supply mostly increase with bilateral cooperation and decrease with bilateral conflict. While the bilateral supply is found to increase with cooperation in the majority of cases, the bilateral demand is found to increase with conflict in some cases, an effect which is not anticipated by the model.

In the CC equations, reciprocity is found to be statistically significant in the majority of cases and is always positive. A statistically siginificant inertia is present in a smaller number of cases and is mostly negative. Hence, it is found that conflict begets conflict while past conflict sent by an actor tends to attenuate the conflict sent in the current period. The effects of trade volumes and prices on CC are found to be empirically unclear. This is in accordance with our prior expectations. That is, BT may generate conflict or cooperation when investigated from an interaction model embedded in a SEM. This result is different from the one obtained by Polachek (1978, 1980, 1992) and others who find that BT causes cooperation. Those models, however, are not SEMs and do not model the behavior of both trade partners.

Finally, two explanations are offered to account for the increase of bilateral demand with conflict which is found in some cases. First, this result may be related to our relatively small sample size. Second, it is possible to conjecture social forces which may push to increase the bilateral demand in response to bilateral conflict. For instance, when an actor expresses conflict toward a target, in particular over unbalanced trade, the target may import more to appease the actor. An increase in conflict may also be mitigated by vested interests in trade which may increase bilateral demand as a signal to feuding governments. Our emprical analysis, however, can not distinguish among such effects as they are not included in the theoretical model.

ENDNOTES

1. Some studies estimate demand and supply equations without lags under the assumption of instantaneous adjustment. For example, see Goldstein and Khan (1978), Stone (1979), and Marquez (1991, 1992).

2. Price and Thornblad (1972), Wilson and Takas (1977), Geraci and Preow (1982), Grossman (1982), Ranuzzi (1982), Haynes, Hutchinson and Mikesell (1986), Marquez and McNeilly (1988), and Onitsuka (1994) specify demand and/or supply equations without CC using lags of explanatory variables. The number of lags used varies, however, from few quarters to few years.

3. The lags used appear to be the best over all, with low significance levels for the coefficients, the largest number of anticipated signs of price and expenditures elasticities, and good R^2 values.

4. We have experimented with alternative specifications. As in Price and Thornblad (1972), a trend term is found to be mostly not significant with fewer correctly signed elasticities. Other alternatives included a Koyock lag specification without a trend as in Ranuzzi (1982), and Italianer and d'Alcantara (1986), and instantaneous adjustments without lags and trend as in Goldstein and Khan (1978), Stone (1979), and Marquez (1991, 1992).

5. BT prices are only available from the US Bureau of Labor Statistics. The data start in 1991 and are only available for total trade. The U.S. is the only reporter. Partners include DCs, LDCs, the EU, and the NICs as a trading blocs, and Canada and Japan as individual countries.

6. Ranuzzi (1981,1982) constructs bilateral and multilateral unit value indices for France, Germany, Italy, and UK, from 1970 to 1978, in food, basic materials, mineral fuels, and manufactures.

7. The limitations of using unit values as a proxy for prices are discussed by Kravis and Lipsey (1971) and others. According to Italianer (1986) and Marquez (1991, 1992), however, if unit values are constructed from highly disaggregated trade data they may serve as a reasonable approximation for prices.

8. See Italianer, 1986:chapter 7; and VOLIMEX Classification Plan, 1993:Version 1.3 for details.

9. Matching trade reports of counties for the same trade flow is a problem faced by all reporting organizations. To our best knowledge, based on our disscusion with both the UN and the European Commission, this problem is still not solved. We ignore differences between the reports of the two trade partners for the same trade flow.

10. Other reasoning are also possible. For instance, as the importer sends conflict toward the exporter due to higher import price, the target may reciprocate with conflict. Similar reasoning apply to the effect of BT volume on CC.

11. For coefficients with theoretically unambiguous signs, one tailed t tests are performed as in Stone (1979) and Bergstrand (1985). Otherwise, two tailed t tests are performed. In log linear models, coefficients which are not different from zero may be interpreted as zero elasticities as in Goldstein and Khan (1978), Stone (1979), Grossman (1982), and Haynes et al. (1986).

12. The spirit of results does not change when a 5% significance level is used.

13. Grossman (1982) refers to the sums of lags coefficients in BT demand or supply as "total elasticities." Studies specifying BT models from lags report the sums of lags coefficients and/or the individual coefficients (i.e. Haynes, Hutchinson, and Mikesell 1986; Bergstrand, 1986; 1987; and Onitsuka 1994).

14. Stone (1979), Ranuzzi (1981, 1982), and Geraci and Preow (1982) report that the estimation results of the BT supply functions are significantly poorer than those of BT demand function.

15. A weak tendency is revealed, however, for the effect of export price on CC. A rise in actors' export price causes conflict from actor to target in 6 out of 10 cases in Panel A and in 4 out 6 cases in Panel B.

Table 8-2. Signs of Coefficients in CC Equations

Panel A: Results from individual lags coefficients

Variable	Positive Sign	Negative sign
Inertia	2	8
Reciprocity	12	2
Export volume	5	5
Import volume	4	3
Export price	4	6
Import price	7	6

Panel B: Results from sums of lags coefficients

Variable	Positive Sign	Negative sign
Inertia	0	5
Reciprocity	9	1
Export volume	3	2
Import volume	3	2
Export price	2	4
Import price	3	3

Notes: Inertia refers to the lag(s) of actor's net conflict. Reciprocity refers to the current and lag(s) of the target net conflict. Export and import volumes are the quantities exported or imported by the actor, respectively. Export and import prices refers to those received and paid by the actor, respectively. Positive and negative signs refer to those of statistically significant coefficients or sums of coefficients in the level of 10 percent from a two tailed t test.

CHAPTER 9: SEM ESTIMATION FROM DISAGGREGATED TRADE VOLUMES

Price and Thornblade (1972:46) argue that while many researchers in the literature write about the need to empirically study disaggregated trade, "the major argument against disaggregation is the very large data handling problem that it presents" In our view this quote is still relevant today, in particular when applied to the trade and conflict literature. As demonstrated in chapter 2, the investigation of disaggregated trade and conflict is called for in the literature but is very rarely performed.

The models in chapters 7 and 8 are estimated under the assumption that there is only one traded good, *total trade*. Chapter 9 relaxes the assumption of one traded good and investigates the relationship between CC and BT in various goods using a SEM from trade volumes. The sample includes all dyads formed among the United States (US), Japan (JA), and (West) Germany (GE).

9.1 Empirical Model

The empirical model in chapter 9 consists of equations (3) for bilateral demand, (5) for bilateral supply, and a modification of (13) for CC, which are presented in chapter 6. In chapter 6, the CC equation was developed assuming that governments consider trade in all sectors when deciding on CC. Under this assumption, however, the number of required instruments or first stage regressors exceeds the sample size.

The use of partial equilibrium analysis is common in the disaggregated BT literature (i.e., Price and Thornblade, 1972; Arad, Hirsch, and Tovias, 1983; Bergstrand, 1989, Harigan, 1993). In the trade and conflict literature, Polachek (1980) investigates the relationship between trade flows in oil and CC, separately from other goods. Similarly, Polachek and Gasiorowski (1982) investigate the correlation between US trade with the entire

Warsaw Pact and CC from the US toward each of the Pact members, separately for capital goods, raw materials, and agriculture.

For the analysis to be done here, I assume, in the spirit of the above partial equilibrium investigations, that governments' CC due to a certain BT category is not affected by BT in other categories. This assumption greatly simplifies the empirical analysis as it allows to estimate the model separately for each good in a dyad.[1]

The equations to be estimated here are similar to those estimated in chapter 8 except that the bilateral and multilateral total trade price and quantity terms are replaced by the appropriate dissagregated trade terms. As the only difference between chapter's 9 and chapter's 8 models is the index i (denoting a good) added to the names of trade variables in chapter 8, I do not present the estimated equations here, referring the reader to chapter's 8 equations (4) through (11) for a detailed account of the variables and lags used here.

As in chapter 8, consumers and producers are assumed to observe net conflict sent from j to k and from k to j, while governments are assumed to act on a net conflict scale. When CC is measured as net conflict, the model includes six equations for each good: demand of j from k, supply of k to j, demand of k from j, supply of j to k, net conflict from j to k, and net conflict from k to j. As before, the variables PT_{ik} and PS_{ij} are approximated by multilateral disaggregated trade unit values, and P^{*}_{ijk} is included as one term for each good.[2] Real multilateral disaggregated trade expenditures are used as explanatory variables by computing the ratios between M_{ik} and PS_{ik}, M_{ij} and PS_{ij}, X_{ik} and PT_{ik}, and X_{ij} and PT_{ij}, respectively.

The logarithm transformation is taken to make the equations linear in logarithms. As in chapter 8, the BT terms in the CC equations are operationalized as the logarithms of prices and volumes and unconstrained lags of all the explanatory variables are used. The number of lags used is determined empirically as in Price and Thornblad (1972), Grossman (1982), and Marquez and McNielly (1988).[3]

9.2 Dyads and Data

Five trade categories or goods are analyzed as in Italianer (1986) and Italianer and d'Alcantara (1986). Using Italianer's notations the five goods are as follows: (1) agriculture and fishery or good A; (2) fuels and power or good E; (3) minerals and chemicals or good Q; (4) machines, transport equipment, and electronics or good K; and (5) food, clothing, paper, plastics, rubber and miscellaneous or good C. The goods included in each of these trade categories are listed in Table 9-10 (Italianer, 1986:258).

In general, the choice of dayds, as well as the sample time, data frequency, and goods is determined by the availability of multilateral and BT value, volume, and price data. Yearly bilateral and multilateral disaggregated trade data from 1963 to 1980 are from Italianer (1986) and from 1979 to 1994 are from the European Commission VOLIMEX.[4]

There are three dyads and six trade flows for each good in the sample. The dyads used are a subset of those used in chapters 7 and 8. The estimation of disaggregated BT demand and supply functions requires the use of bilateral and multilateral trade prices, BT volumes, and multilateral trade expenditures, for each good. A complete set of the required data was not available for China and the (former) Soviet Union.[5] In sum, dyads formed among the US, JA, and GE are used here. The CC data, exchange rates, and tariffs, are similar to those used in chapters 7 and 8.

9.3 Hypotheses

The testable hypotheses in chapter 9 which are directly implied by the model are similar to those disscused in chapter 8 for total trade. Namely, for each good we expect to find negatively sloped bilateral demand and supply with respect to price, positively sloped bilateral demand and supply with respect to multilateral trade expenditures, positive effect of CC on both bilateral demand and supply, and positive reciprocity in the CC equations. As before, according to our model the signs of the coefficients of CC inertia, and the effects of disaggregated BT prices and quantities on CC are theoretically ambiguous.

We may further hypothesize about the relationship between BT and CC in various goods. The model developed in chapter 6 implies that the more elastic are bilateral demand and supply of a certain good with respect to price, the more responsive they will be to a change in CC. A high price elasticity for a certain good implies that it has readily available substitutes. Thus, we expect to find a stronger tendency of bilateral conflict to reduce BT, the higher is the elasticity of bilateral demand and supply with respect to bilateral price, for that good.

9.4 Results

The model is estimated separately for each of the three dyads and the five goods included in the sample. A statistical software package RATS 4.0 is used. As in chapters 7 and 8, the equations are estimated using two stage least squares and consistent standard errors are obtained from Newey and West's (1987) method. Hypotheses tests are conducted per equation, as in chapters 7 and 8. A statistical significance level of 10 percent is used throughout the disscusion.

The estimation results which are summarized here are fully presented in Appendix 5. As in the previous chapters, the results include sums of lags coefficients, the joint significance of lags coefficients, and individual lags coefficients. In general, results from the joint significance of lags coefficients show that the variables in the model significantly contribute to the explanation of the dependent variables. Thus, the results presented below are mostly from the sums of lags coefficients and are summarized in two parts: one for bilateral demand and supply and the other for CC. Although we study three dyads and five goods, the number of estimated parameters which are obtained in the estimation is already large. The need for a meaningful summary of empirical results, across goods and dyads, is obvious. Clearly, there is more than one way to summarize our estimation results. Summarizing the results as follows seems meaningful as it presents them both across goods and across dyads.

Results from the Demand and Supply Equations

Tables 9-1 through 9-4 summarize results from sums of lags coefficients in demand and supply. These results are fully presented in Appendix 5's Tables A5-1 through A5-4, A5-7 through A5-10, and A5-13 though A5-16. Specifically, the signs of lags coefficients of prices, real multilateral trade expenditures, and bilateral CC are presented for each traded good in a dyad. According to the hypotheses formulated in chapter 6, the slopes of the bilateral demand and supply with respect to price are expected to be negative or positive, respectively. The slopes with respect to the real multilateral import and export expenditures, however, are expected to be positive, while the slopes of demand and supply with respect to cooperation are expected to be positive.

Table 9-1 presents results from counting the number of cases which reject the hypotheses that bilateral demand and supply have wrongly signed slopes with respect to price and real multilateral import and export expenditures.

[Insert Table 9-1 here: Signs of Sums of Price and Expenditure Coefficients in Demand and Supply.]

The results from signs of sums of lags coefficients of price and real trade expenditure are as follows. Out of 30 cases, the hypothesis that demand has a positive slope with respect to price is rejected in 25 cases, the hypothesis that supply has a negative slope with respect to price is rejected in 21 cases, the hypothesis that demand has a negative slope with respect to real multilateral import expenditure is rejected in 28 cases, and the hypothesis that supply has a negative slope with respect to multilateral real export expenditure is rejected in 29 cases. In all, with few exceptions, the economic variables in the bilateral demand and supply equations are correctly signed.

The effect of bilateral CC on BT volumes is investigated next. CC is operationalized as two variables in each economic equation, net conflict sent from actor A to target B and net conflict sent from actor B to target A. In all, there are 20 sums of coefficients of net conflict per dyad.[6] The effect of CC on BT demand and supply is expected to be positive. Tables 9-2 through 9-4 summarize estimation results from the signs of sums of lags coefficients of net conflict.

Table 9-2 shows the number of statistically significant sums of lags coefficients of net conflict in demand and supply, across goods and dyads.

[Insert Table 9-2 here: Significance From Sums of CC Coefficients in Demand and Supply per Good]

In Table 9-2, the number of statistically siginificant sums of CC terms in demand and supply is 81, across all goods and dyads. This is more than double the number of non-siginificant CC terms which is 39. Hence, for the dyads used here, bilateral CC is found to be a statistically significant determinant of bilateral demand and supply. While the number of statistically significant CC effects varies along goods and dyads, it is always higher than the number of non significant effects.

The signs of the sums of lags coefficients of net conflict in the bilateral demand and supply of all goods (combined) in a dyad are shown in Table 9-3.

[Insert Table 9-3 here: Signs from Sums of CC Coefficients in Demand and Supply.]

In Table 9-3, a decrease in net conflict (less cooperation) is mostly associated with a decrease in trade volumes, as expected. There is a total of 60 cases for demand or supply in the sample. The hypothesis that an increase in conflict is associated with more trade is rejected in 34 equations of bilateral demand and in 47 equations of bilateral supply. Over all, in 81 out of 120 cases an increase in net conflict is associated with an increase in BT volumes. Yet, in 26 cases out of 60 the hypothesis that demand increases with bilateral conflict is not rejected. As in chapter 8, two explanations may be offered. First, this result may be related to our relatively small sample size. Second, we may conjecture the presence of social forces pushing to increase import with conflict which are not included in the model.

Results from the signs of the sums of lags coefficients of net conflict in different goods are presented in Table 9-4.

[Insert Table 9-4 here: Signs from Sums of CC Coefficients in Demand and Supply per Good.]

In Table 9-4, the number of cases which reject the hypothesis that an increase in conflict leads to higher BT volumes is counted for each good. For each good in a dyad, there are eight sums of CC coefficients, four in demand and four in supply. The hypothesis that conflict leads to more bilateral demand or supply is mostly rejected. As before, the tendency of bilateral conflict to reduce BT volumes is found to be stronger in supply than in demand. In supply, this tendency is strongest in machines, transport equipment and electronics (good K) and fuels and power (good E), and weakest in good, paper, plastic, rubber, and miscellaneous (good C). In demand, this tendency is strongest in agriculture and fishery (good A), noticeable in fuel and power (good E) and minerals and chemicals (good Q), and weakest in good C.

Results from the Net Conflict Equations

Results from the estimation of the net conflict equations are summarized next from sums of lags coefficients and individual lags coefficients which are fully presented in Appendix 5 in Tables A5-5, A5-6, A5-23, A5-24, A5-11, A5-12, A5-29, A5-30, A5-17, A5-18, A5-35, and A5-36. Specifically, the signs of bilateral prices and volumes and CC inertia and reciprocity are investigated here. The model includes two net conflict equations, one for the flow from j to k and the other for k to j. Tables 9-5 and 9-6 present results from sums of lags coefficients, across dyads. Tables 9-7 and 9-8 present results from sums of lags coefficients and individual lags coefficients across goods. As in chapter 8, export price (volume) is the price (volume) an actor charges (sends to) a target, and import price (volume) is the price (volume) the actor pays (receives from) the target.

The signs of the sums of lags coefficients of reciprocity and inertia are summarized in Table 9-5.

[Insert Table 9-5 here: Signs of Reciprocity and Inertia from Sums of Coefficients in Net Conflict.]

There is a total of five sums of lags coefficients of reciprocity and inertia per each CC flow as the model is estimated separately for each good. The sums of lags coefficients of reciprocity are found to be statistically significant in 22 out of 30 cases and are all positive. The sums of lags coefficients of inertia are found to be statistically siginificant in 14 out of 30 cases and are mostly negative. The spirit of these results is similar to those disscused chapter 7 and 8.[7]

The signs of the statistically significant sums of lags coefficients of bilateral prices and volumes in the equations of net conflict are presented in Table 9-6.

[Insert Table 9-6 here: Signs of Trade Variables from Sums of Coefficients in Net Conflict.]

In Table 9-6, as the volume of Japan's export to the US increases, it becomes friendly toward the US. This effect is also noticeable, but weaker, in the behavior of Germany toward the US. A negative effect of import price on cooperation is strongest in the case of Japan's import from the US, and US's import from Germany. Counting statistically significant cases across dyads, in nine out of 12 cases a rise in export volume causes cooperation from exporter toward the importer, while in nine out of 11 cases a rise in import price causes conflict from importer toward the exporter. The effects of import volume and export price on net conflict do not reveal a clear pattern. These results partially support our hypotheses. They also seem to support results which are reported in chapter 7, as a similar tendency is revealed here from the effect of BT terms on CC. The spirit of these results, however, does not agree with chapter's 8 results. We return to this point in the end of this chapter.

The number of statistically significant sums of lags coefficients and individual lags coefficients of bilateral prices and volumes across goods in all dyads, is reported in Panel A and Panel B of Table 9-7, respectively, and is found to vary across goods.

[Insert Table 9-7 here: Significance of Trade Variables in Net Conflict per Good.]

In Table 9-7, Panels A and B reveal similar tendencies. In Panel A, the highest total number of siginificant sums of lags coefficients of trade terms occurs in Good Q (minerals and chemicals) and the lowest in good A (agriculture). In Panel B, the highest total number of significant individual lags coefficients of trade occurs in good Q and the lowest in good E (fuels and power).

The signs of the sums of lags coefficients and of individual lags coefficients along goods, in all dyads, are reported in Table 9-8.

[Insert Table 9-8 here: Signs of Trade Variables in Net Conflict per Good.]

Combining results in Panel A and B in Table 9-8, the positive effect of export volume on cooperation from exporter to importer is strongest in good Q and, somewhat less, in good K. A rise in export price of good K tends to cause cooperation from exporter to importer but this effect is not strong in our results. The effect of import volume on cooperation from importer to exporter is most pronounced in good Q and is negative. The effect of import price on cooperation from importer to exporter is clearest in good K and is negative. Other goods' prices and volumes do not show a clear pattern in the results.

Additional Investigations Across Goods

The price elasticities of the bilateral demand and supply are presented in Table 9-9.

[Insert Table 9-9 here: Average Price Elasticities from Sums of Lags Coefficients.]

Table 9-9 presents the average price elasticities from sums of lags coefficients of bilateral price in demand and supply, for each good. These results were obtained as follows. For each good in all dyads, the correctly signed sums of lags coefficients of price (negative ones for demand and positive ones for supply) were obtained from Appendix 5. The average of these figures, for each good, are computed and presented.

Our model predicts an unambiguous fall in the BT volume when bilateral conflict rises. The responsiveness of the bilateral demand and supply volumes to conflict, however, depends on demand and supply price elasticities. The higher those price elasticities, the more responsive to CC the bilateral demand and supply are. The five goods categories in Table 9-9 can be grouped according to their sums of the bilateral supply and demand price elasticities.[8] We find that the bilateral trade volume in fuel and power (good E) is the most responsive to bilateral conflict.[9] Next in the level of sensitivity to bilateral conflict are bilateral trade volumes in machines, electronics and transport equipment (good K) and agriculture (good A). Minerals and chemicals (good Q) and miscellaneous goods such as paper, plastics etc. (good C) are the least sensitive to bilateral conflict.

Finally, Polachek and Gasiorowski (1982) hypothesize that the stronger is an economic sector in a country, indicative of comparative advantage, trade in that sector will induce a higher level of cooperation. This prediction follows directly from Polachek's (1978, 1980, 1992) assumption that governments derive a positive utility from both conflict and trade (chapter 2). Clearly, our model is not suited to evaluate this claim as it does not include the strength of various national economic sectors, or their comparative advantage, as variables. Still, we may use our estimation results to indirectly evaluate this prediction.

To simplify, we look at the US-Japan dyad. Investigating only one case is clearly not sufficient for generalizations and is only used here as an illustration. As we did not study the comparative advantage of US and Japan, we can only assume their strong and weak sectors, relative to each other. Thus, we assume that Japan has a comparative disadvantage in fuel and power (good E) and minerals and chemicals (good Q), and a comparative advantage in machines, electronics, and transport equipment (good K). The US is assumed to have a comparative advantage in chemicals and minerals (good Q) and agriculture (good A), and a comparative disadvantage in machines, electronics and transport equipment (good E).

In the following, we use results from sums of lags coefficients of trade volumes in Table A5-5 in Appendix 5. We may summarize these results as follows. First, the effect of good K trade volume (Japan's good of comparative advantage) on CC from Japan to US is not statistically siginificant. Second, a rise goods Q and E trade volumes (Japan's goods of comparative disadvantage) generates cooperation from Japan to US. Third, a rise in good Q trade volume (US' good of comparative advantage) generates conflict from US to Japan.

Fourth, a rise in good A trade volume (US' good of comparative advantage) generates cooperation from US to Japan. Only the fourth result agrees with Polachek and Gasiorowski's (1982) prediction.

9.4 Concluding Remarks

In all, the results obtained in chapter 9 support our hypotheses. In most cases, the slopes of the bilateral demand and supply equations with respect to price and trade expenditures are signed as expected. The effect of CC on BT is found to be positive in most cases. That is, bilateral demand or supply volumes increase with cooperation and decrease with conflict. As in chapter 8, however, in some cases the bilateral demand is found to increase with conflict. As discussed in chapter 8, while these results may be related to our relatively small sample, it is also possible that social forces which are not modeled here are at play.

In the net conflict equations, reciprocity is found to be statistically siginificant in the majority of cases and is always positive. A statistically siginificant inertia is found in a smaller number of cases and, to a great extent, is negative. Combining results across goods and dyads, a rise in export volume is found to cause cooperation from exporter to importer, and a rise in import price is found to cause conflict from importer to exporter. The effect of import volume and export price on CC is found to be ambiguous.

Across trade categories, a rise in the export volume of minerals and chemicals (good Q), and machines, transport equipment, and electronics (good K), is found to cause cooperation from exporter to importer. A rise in the export price of machines, transport equipment, and electronics seems to cause cooperation from exporter to importer, while a rise in the import price of that category seems to cause conflict from importer to exporter. A rise in the import volume of minerals and chemicals is found to cause conflict from importer to exporter. The comparative advantage hypothesis which was formulated by Polachek and Gasiorowski (1982) is mostly not confirmed here, at least not for the US-Japan dyad.

In bilateral supply, the tendency of bilateral conflict to reduce trade volumes is strong in the trade categories of machines, transport equipment, and electronics, and fuels and power (good E). In bilateral demand, the tendency of bilateral conflict to reduce trade volumes is found to be strong in the category of agriculture and fishery (good A) and is noticeable in the categories of fuel and power, and minerals and chemicals. The effect of CC on bilateral demand and supply is found to be weakest in the trade aggregate of food, clothing, paper, plastics, rubber and miscellaneous (good C). These results are also confirmed by the investigation of the price elasticities in Table 9-9 and above. The more price elastic demand and supply of a good are, the more sensitive that good is to CC. Bilateral trade volumes in fuels and power are found to be the most sensitive to bilateral conflict.

The estimation results from the effects of BT on CC partially agree with our expectations. Yet, certain tendencies, which were not expected, are revealed from the analysis. Three explanations may be offered to account for these results. First, as before, the results may be related to the relatively small sample size. Second, the dyads analyzed in chapter 9 involve only industrialized market economies. Finally, it is possible that the effect of BT on CC is not entirely ambiguous. These results, however, are not confirmed in chapter 8 and are partially supported in chapter 7. Thus, more research is needed before definitive conclusions may be reached at. We will return to this issue in the conclusion chapter of the dissertation.

ENDNOTES

1. The full information maximum likelihood (FIML) estimation method may alleviate the number of instruments problem. FIML is not used here because: (1) it is not available in RATS; (2) it involves non linear optimization which is known to be very sensitive to model specification (Intriligator, Bodkin, and Hsiao, 1996:389); and (3) a multi trade sector SEM from FIML is complicated and, to our best knowledge, was not yet tried in the literature.

2. Tariffs computed from total import are used as sectoral tariffs were not available.

3. As in chapter 8, the lags used here appear to be the best overall, with good t statistic for sums of lags coefficients, largest number of correctly signed demand and supply elasticities, and good R^2 values.

4. To our best knowledge, Italianer (1986) and the European Commission are the only sources which compile relatively long time series of disaggregated BT prices and volumes.

5. Bilateral disaggregated trade data for the SU may be generated as in chapter 8. Multilateral disaggregated trade data for the SU are, in principle, available for some years, but not in Italianer's (1986) trade categories which are used here. Converting those data into Italianer's (1986) categories requires highly disaggregated data which we could not locate. BT data for China are available in VOLIMEX, but not in Italianer's (1986) data.

6. There are five goods per dyad, two demand and supply equations, and two CC terms per equation. In all, there are 20 cases per dyad.

7. The individual lags coefficients of reciprocity are mostly significant and positive. The significant individual lags coefficients of inertia are mostly negative.

8. The sum of those price elasticities is used because both the shifts of demand and supply with conflict cause BT volume to decline.

9. We would like to emphasize that these are elasticities of *bilateral* demand and supply. While the *multilateral* demand for oil of a country may not be price elastic, for instance, this need not be the case for bilateral demand (or supply) of fuels and power due to the availability of competing trade origins and destinations.

Table 9-1. Signs of Sums of Price and Expenditure Coefficients in Demand and Supply.

Dyad	Wrong Sign	P(D)	P(S)	M(D)	X(S)
US-JA	Reject	8	6	10	10
	Not reject	2	4	0	0
US-GE	Reject	9	7	9	10
	Not reject	1	3	1	0
JA-GE	Reject	8	8	9	9
	Not reject	2	2	1	1
All Dyads	Reject	25	21	28	29
	Not reject	5	9	2	1

Notes: Wrong Sign is theoretically unexpected. A 10 percent significance level from a one t tailed test is used. P(D) and P(S) are demand and supply price slopes, respectively. M(D) and X(S) are import and export expenditure slopes, respectively. (Not) Reject indicates (not) rejecting the wrong sign.

Table 9-2. Significance from Sums of CC Coefficients in Demand and Supply per Good.

Dyad	Significant	A	E	Q	K	C	All goods
US-JA	Yes	6	4	4	6	6	26
	No	2	4	4	2	2	14
US-GE	Yes	4	6	7	4	8	29
	No	4	2	1	4	0	11
JA-GE	Yes	6	5	5	4	6	26
	No	2	3	3	4	2	14
All Dyads	Yes	16	15	16	14	20	81
	No	8	9	8	10	4	39

Notes: A=Agriculture and fishery; E=Fuels and power; Q=Minerals and chemicals; K=machines, transport equipment, and electronics; C=Food, clothing, paper, plastics, rubber, and miscellaneous. A 10 percent significance level from one tailed t test is used.

Table 9-3. Signs from Sums of CC Coefficients in Demand and Supply.

Dyad	Wrong Sign	Demand	Supply	Total (Demand and Supply)
US-JA	Reject	12	18	30
	Not reject	8	2	10
US-GE	Reject	10	13	23
	Not reject	10	7	17
JA-GE	Reject	12	16	28
	Not reject	8	4	12
All Dyads	Reject	34	47	81
	Not reject	26	13	39

Notes: Wrong Sign is theoretically unexpected. The entry (Not) Reject indicates (not) rejecting the wrong sign. A 10 percent significance level from one tailed t test is used.

Table 9-4. Signs from Sums of CC Coefficients in Demand and Supply per Good.

Dyad	Wrong sign	A	E	Q	K	C
US-JA	D: Reject	3	2	2	2	3
	D: Not reject	1	2	2	2	1
	S: Reject	3	4	4	4	3
	S: Not reject	1	0	0	0	1
	T: Reject	6	6	6	6	6
	T: Not reject	2	2	2	2	2
US-GE	D: Reject	3	3	2	2	0
	D: Not reject	1	1	2	2	4
	S: Reject	4	4	2	3	0
	S: Not reject	0	0	2	1	4
	T: Reject	7	7	4	5	0
	T: Not reject	1	1	4	3	8
JA-GE	D: Reject	3	2	3	2	2
	D: Not reject	1	2	1	2	2
	S: Reject	3	3	3	4	3
	S: Not reject	1	1	1	0	1
	T: Reject	6	5	6	6	5
	T: Not reject	2	3	2	2	3
All Dyads	D: Reject	9	7	7	6	5
	D: Not reject	3	5	5	6	7
	S: Reject	10	11	9	11	6
	S: Not reject	2	1	3	1	6
	T: Reject	19	18	16	17	11
	T: Not reject	5	6	8	7	13

Notes: D (S): denotes demand (supply) T: denotes total number of cases. A,E,Q,K,C denote goods. A=Agriculture and fishery; E=Fuels and power; Q=Minerals and chemicals; K=machines, transport equipment, and electronics; C=Food, paper, plastics, rubber, and miscellaneous. (Not) Reject indicates (not) rejecting the wrong sign. A 10 percent significance level from one tailed t test is used.

Table 9-5: Signs of Reciprocity and Inertia from Sums of Coefficients in Net Conflict.

Net conflict	Sign	Reciprocity	Inertia
US-JA	>0	5	0
	<0	0	2
JA-US	>0	5	0
	<0	0	2
US-GE	>0	2	0
	<0	0	2
GE-US	>0	1	0
	<0	0	3
JA-GE	>0	4	3
	<0	0	1
GE-JA	>0	5	0
	<0	0	1
All dyads	>0	22	3
	<0	0	11

Notes: The first country is the actor; the second is the target. Entries are number of cases where the sums of reciprocity and inertia coefficients are significant at the 10 percent from a two tailed t test.

Table 6. Signs of Trade Variables from Sums of Coefficients in Net Conflict.

Dyad	Sign	Q Export	Q Import	P Export	P Import
US-JA	>0	0	1	0	0
	<0	1	1	1	1
JA-US	>0	3	1	0	0
	<0	0	0	1	2
US-GE	>0	1	1	1	0
	<0	0	1	1	2
GE-US	>0	2	0	1	0
	<0	0	2	0	1
JA-GE	>0	2	1	2	0
	<0	0	1	1	2
GE-JA	>0	1	2	1	1
	<0	2	1	1	1
All Dyads	>0	9	6	5	2
	<0	3	6	5	9

Notes: The first country is the actor; the second is the target. Entries are number of cases where the sums of coefficients of export volume, import volume, export price, and import price, are significant at the 10 percent from a two tailed t test. Negative sign indicates conflict. Net conflict is from actor j to target k. Q Export is the quantity exported by j. Q import is the quantity imported by j. P Export is the price j charges for its export P Import is the price j pays for its import.

Table 9-7. Significance of Trade Variables in Net Conflict per Good.

Panel A: Result from sums of coefficients

Variable	A	E	Q	K	C
Q Export	1	3	4	2	2
Q Import	2	1	4	1	4
P Export	0	1	4	2	3
P Import	2	1	3	2	3
Total	5	6	15	7	12

Panel B: Results from individual coefficients

Variable	A	E	Q	K	C
Q Export	6	5	6	6	6
Q Import	4	3	9	6	7
P Export	4	6	8	9	5
P Import	5	3	8	6	4
Total	19	17	31	27	22

Note: Net conflict is from actor j to target k. Q Export is the quantity exported by j. Q import is the quantity imported by j. P Export is the price j charges for its export P Import is the price j pays for its import. Total is the number of statistically significant effects of trade variables on net conflict. A,E,Q,K,C are goods. A=Agriculture and fishery; E=Fuels and power; Q=Minerals and chemicals; K=machines, transport equipment, and electronics; C=Food, paper, plastics, rubber, and miscellaneous. A 10 percent significance level from two tailed t test is used.

Table 9-8. Signs of Trade Variables in Net Conflict per Good.

Panel A: Result from statistically siginificant sums of coefficients

Variable	Sign	A	E	Q	K	C
Q Export	>0	1	2	3	2	1
	<0	0	1	1	0	1
Q Import	>0	2	1	1	0	2
	<0	0	0	3	1	2
P Export	>0	0	0	2	2	1
	<0	0	1	2	0	2
P Import	>0	0	0	1	0	1
	<0	2	1	2	2	2

Panel A: Result from statistically significant individual coefficients

Variable	Sign	A	E	Q	K	C
Q Export	>0	4	3	5	4	4
	<0	2	2	1	2	2
Q Import	>0	3	2	2	2	3
	<0	1	1	7	4	4
P Export	>0	2	4	4	5	2
	<0	2	2	4	4	3
P Import	>0	2	1	4	2	2
	<0	3	2	4	4	2

Notes: Net conflict is sent from actor j to target k. Q Export is the quantity exported by j. Q import is the quantity imported by j. P Export is the price j charges for its export P Import is the price j pays for its import. A,E,Q,K,C are goods. A=Agriculture and fishery; E=Fuels and power; Q=Minerals and chemicals; K=machines, transport equipment, and electronics; C=Food, paper, plastics, rubber, and miscellaneous. A negative sign means more conflict. A 10 percent significance level from a two tailed t test is used.

Table 9-9. Average Price Elasticities from Sums of Lags Coefficients

Good	Demand price elasticity	Supply price elasticity	Sums of elasticities
A	-0.392	0.451	0.843
E	-1.881	1.660	3.541
Q	-0.223	0.309	0.532
K	-0.206	0.608	0.814
C	-0.350	0.312	0.662

Notes: A,E,Q,K,C are goods. A=Agriculture and fishery; E=Fuels and power; Q=Minerals and chemicals; K=machines, transport equipment, and electronics; C=Food, paper, plastics, rubber, and miscellaneous. "Sums of elasticities" denotes the sum of the absolute values of the price elasticities of the bilateral demand and supply.

Table 9-10. Italianer's (1986) Trade Categories

Italianer's Category	Nace-Clio categories	Description
A	01	Agriculture, forestry and fishing products
E	03	Coal, lignite (brown coal) and briquettes
	05	Products of cooking
	07	Crude petroleum, natural gas and petroleum products
	09	Electric power, gas, stem and water
	11	Production and processing of radioactive materials/ores
Q	13	Ferrous and no-ferrous ores and metals, non-radioactive
	15	Non-metallic mineral products
	17	Chemical products
K	19	Metal products except machinery and transport equipment
	21	Agricultural and industrial machinery
	23	Office and data processing machines, precision and optical instruments
	25	Electrical goods
	27	Motor vehicles
	29	Other transport equipment
C	31	Meats, meat preparation and preserves, slaughtered animals products
	33	Milk and dairy products
	35	Other food products
	37	Beverages
	39	Tobacco products
	41	Textiles and clothing
	43	Leathers, leather and skin goods, footwear
	45	Timber, wooden products and furniture
	47	Paper and printing products
	49	Rubber and plastic products
	51	Other manufacturing products and goods not classified.

CHAPTER 10: CONCLUSION

A common theme characterizes the results from the different investigations performed in this study. As states continually re-evaluate friends and foes, economic variables do not fully explain BT patterns and political variables do not fully explain CC relations. The two are interdependent and as such the use of SEM, or possibly Vector AutoRegression (VAR) model, in future BT and CC research appears to be unavoidable.

Our theoretical analysis and empirical results demonstrate that international BT and political CC are simultaneously determined. Although we have identified certain regularities on the interaction of BT and CC, this relationship is found to vary across dyads and goods. In our theoretical model, a rise in CC is expected to cause a rise of BT volume. The effects of CC on BT value and price and of BT variables on CC in the model are ambiguous but expected to be statistically siginificant. The model's predictions are mostly confirmed by empirical results.

The conclusion chapter is presented in three parts. First, the various investigations performed in the dissertation are summarized. Second, the contribution of our study to the literature is highlighted. Finally, possible avenues to be taken in future research on the relationship between BT and CC are outlined.

10.1 Summary of the Investigations

Chapter 2 reviews the literature on BT and CC. While many authors recognize that the relationship between BT and CC may vary across dyads and goods, all quantitative studies use a similar approach by pooling total BT values and CC data and estimating models in which the BT and CC causality is assumed to flow in a certain direction. Yet, many authors in the literature argue, without analysis, that the BT and CC causality may be reciprocal. A causality investigation is recommended in the literature but is not performed. The BT and CC causality is investigated in chapters 4 and 5 by splicing the COPDAB and WEIS to generate a long time series of CC.

Chapter 3 investigates the highly debated issue of the compatibility of the COPDAB and WEIS. It is found that COPDAB and WEIS are compatible in many cases and a regression based splicing method is developed. While the degree of match between COPDAB and WEIS differs across dyads, there are dyads in which the splicing method works well. The developed splicing method is used to generate the time series of CC for the dyads analyzed in the dissertation. In principle, this method can be applied to splice any type of events data sets and thus be useful in future applied research in international relations. The fact that our splicing method is dyad dependent can be regarded as important, as it does not constrain us to assume the same behavior of COPDAB and WEIS for all the dyads.

The splicing technique developed in chapter 3 does not guarantee success for all dyads. It is possible that different measures of conflict and cooperation from the ones used in chapter 3 may produce a better match between COPDAB and WEIS. It is also possible that our splicing method may not work for some dyads. At least for the dyads investigated in the dissertation, however, WEIS and COPDAB can be regarded as compatible data sets.

The investigation of BT and CC causality is called for by many authors in the literature. Chapters 4 and 5 were devoted to BT and CC Granger causality analyses in 16 dyads. While the Granger analyses are bivariate and their limitations are well documented in the literature, many studies in the literature have used Granger's method as a heuristic device to investigate the causal relationships between economic and/or political variables. We regard the results of chapters 4 and 5 as a strong indicator for certain directions to take in subsequent analyses and not as a substitute for a fully specified model of BT and CC.

The BT and CC causality from quarterly total trade data reported by the IMF is investigated in chapter 4. It is found that the causal relationship between total BT and CC is generally reciprocal. These results are distinctly different from those in previous studies in the literature. At the same time, our results strongly suggest that the methodology of pooled, time-series-cross-section analysis which is widely used in the literature for trade and conflict has to be re-evaluated, as they show that a dynamic model is different across dyads. The empirical models of trade in Pollins (1989a, 1989b) and the empirical models of CC in Polachek (1978, 1980, 1992) are equally supported in their assumption on BT and CC causality so that a better model may be obtained by modifying and/or combining them into one.

The BT and CC causality from dissagregated trade reported by the UN is investigated in chapter 5. First, the causality analysis from chapter 4 is repeated using total trade data computed by aggregating the UN data. Similar causal relations are found to hold when UN or IMF data, yearly or quarterly, are used. It is found that the Granger causality between disaggregated BT and CC, which is dyad and good dependent, tends to be reciprocal. Whether or not a dyad is classified as an enduring rivalry is found to have only a marginal effect on the causal direction. Certain goods show some tendency toward a unidirectional BT and CC causality. In metals, petroleum, basic manufactures, and high technologies causality from CC to BT is more pronounced, whereas in food, beverages, and miscellaneous manufactures causality from BT to CC is more frequent.

In all, we find a reciprocal causality between BT and CC when total or disaggregated trade data are used. These findings indicate that BT and CC appear to be interdependent. Limitations of Granger causality analysis not withstanding, the findings in chapters 4 and 5 suggest the need to develop a simultaneous equation model (SEM) to study the BT and CC relationship. Such a model needs to distinguish among dyads and goods.

A theoretical SEM of the interaction between disaggregated BT and CC is developed in chapter 6. The actors in the model are consumers, producers, and governments of two trading countries. Consumers are assumed to distinguish among goods according to their country of origin. Producers are assumed to distinguish among goods according to their country of destination, based on bilateral CC. Governments are assumed to choose the level of CC based on an interaction or action/reaction model of foreign policy while taking BT of all goods into account. The consumer's utility maximization and the producer's profit maximization problems are solved. Two dyadic SEMs are derived, a model from BT values and a model from BT volumes and prices.

In the SEM from BT values, the value of BT is expressed analytically as a function of CC and other variables under the assumption that BT markets are small. Governments are assumed to observe BT values of all goods. This SEM may be used when BT prices are not available. The CC part of this SEM is, to some extent, like the model in Polachek (1978, 1980, 1992). Polachek, however, considers only one trade partner, and assumes that governments derive a positive utility from conflict. The BT part of this SEM is, to some extent, like the model in Pollins (1989a). Pollins, however, considers only total imports of one trade partner, does not deal with exports, and deals only with cooperation.

In the SEM from BT volumes, demand and supply equations which include CC as an explanatory variable are obtained for each good. Governments are assumed to observe BT volumes and prices of all goods. The estimation of this SEM requires disaggregated BT prices. The CC part of the SEM from BT volumes relates to Polachek's model as disscused above. In addition, in this SEM CC depends on BT volumes and prices of all goods while in Polachek's model CC depends on total BT value. The BT part of this SEM is, to some extent, like the one in Pollins (1989b). Pollins (1989b), however, considers only one trade partner, deals only with the effect of cooperation on total BT demand, and does not use BT prices proper.

The following hypotheses, grouped in four categories, are formulated from our SEMs:

BT and CC hypotheses:

1. A rise in cooperation or conflict will cause a rise or decline in BT volume, respectively.
2. The effect of CC on BT value and price is ambiguous.
4. The effect of CC on BT value and price will be statistically siginificant in the estimation.
5. The effects of BT value, volume, or price on CC are ambiguous.
6. The effects of BT value, volume, or price on CC will be statistically siginificant in the estimation.
7. The relationship between BT and CC will change across dyads and/or goods.

CC hypotheses:

1. The effect of inertia on CC will be ambiguous.
2. The effect of reciprocity on CC will be positive.
2. Reciprocity and inertia will be statistically significant in the estimation.

BT volume hypotheses:

1. BT demand (supply) volume will decline (rise) with BT price.
2. BT demand (supply) volume will rise with real multilateral import (export) expenditures.
3. BT demand volume will decline with tariffs or exporter's currency appreciation.

BT value hypotheses:

1. BT value will rise with the real multilateral import value.
2. The effect of real multilateral export expenditure on BT value will be ambiguous.
3. The effect of real multilateral export expenditure on BT value will be statistically siginificant.
4. BT value will decline with tariffs or exporter's currency appreciation.

SEMs from total BT values for all dyads formed among the United States, Japan, (West) Germany, the (former) Soviet Union, and China are estimated per dyad in chapter 7. Net conflict and separate sums of conflict and cooperation are alternately used as the measures of CC resulting in two SEMs, one with six equations and the other with four equations per dyad. A SEM from total BT volume for all dyads formed among the United States, Japan, (West) Germany, and the (former) Soviet Union is estimated per dyad in chapter 8. A SEM from disaggregated BT volume for all dyads formed among the United States, Japan, and (West) Germany and for five goods is estimated in chapter 9 per dyad.

The pure BT value and volumes hypotheses are confirmed by the empirical analysis to a large extent and are not summarized here as this is not the focus of our dissertation. We refer the reader to the concluding remarks of chapters 7-9 for that purpose. The CC-BT link is not confined to dyads in which one or both countries are not from the OECD and is generally driven by the behavior of the exporter and the importer as in many cases both directions of BT and CC are found to be statistically significant. The results are generally robust to the way CC is operationalized. This is regarded as a sign for the robustness or strength of the BT-CC link in the model. Finally, pooling dyads to study BT and CC needs to be further investigated as our results do not seem to support the hypothesis that coefficients are similar across dyads.

Other empirical results which deal with BT and CC may be summarized as follows.

First, a statistically significant effect of CC on BT values or volumes is found in most cases. The effect of BT values or volumes on CC is statistically significant in smaller number of cases than the effect of CC on BT, but still in most cases. At least one BT variable in the CC equations is found to be statistically siginificant in all goods. In all, the estimations' results indicate that CC is a statistically significant determinant of BT and BT is a statistically siginificant determinant of CC. That is, BT and CC are found to be interdependent.

Second, the sign of the effect of CC on BT value is mostly not clear. BT demand and supply volumes are found to increase with CC in the majority of cases. These results greatly confirm our hypotheses. Results for demand are less clear than for supply as in some cases the demand for import is found to rise with conflict. In supply, the positive effect of CC on BT is most apparent in the aggregates of machines, transport equipment and electronics (good K), and fuels and power (good E). In demand, it is most apparent in agriculture and fishery (good A).

Third, CC reciprocity is found to be statistically significant and positive in most cases and in all the SEMs, as expected. Hence, CC reciprocity is positive regardless of the way BT is measured. This is regarded as a sign of robustness or strength of the concept of reciprocity in the model. Inertia is found to be significant in fewer cases and its sign is not clear when investigated from BT value, and mostly negative when investigated from BT volumes.

Fourth, the effect of BT on CC follows certain patterns when investigated from values and, to some extent, disaggregated volumes but not when investigated from total volumes. A rise in total import value is found to cause conflict from importer to exporter while a rise in total export value is found to cause cooperation from exporter to importer. Combining results from disaggregated BT across goods and dyads, a rise in export volume causes cooperation from exporter to importer, a rise in import price causes conflict from importer to exporter, but the signs of the effects of import volume or export price are not clear. Across goods, BT in minerals and chemicals (good Q), and good K affect CC in more cases than other goods. A rise in the export volume of goods Q and K causes cooperation from exporter to importer. A rise in export price of good K causes cooperation from exporter to importer. A rise in import volume of good Q and import volume or price of goods K and E causes conflict from importer to exporter. Hence, these results partially agree with the prediction that the effect of BT on CC will be ambiguous.

10.2 Contribution

This dissertation contributes to the literature in several ways. While in past studies a particular causality direction between BT and CC has been simply assumed, we answer a need, clearly stated in the literature, to investigate the causality between BT and CC. Our structural model of BT and CC is simultaneous and is substantially different from BT models or BT and CC models in the literature. Using our model we are able to demonstrate that economic variables alone do not fully explain BT while CC is endogenously determined with BT.

Previous studies deal with the relationship between total BT and CC and model the behavior of one trade partner by pooling many dyads. We recognize distinct dyads, goods, consumers, producers, and governments of both trade partners, symmetrically and simultaneously. The call to distinguish among dyads and goods and to investigate BT and CC simultaneity, however, is frequently mentioned in the literature, but was not fulfilled until now.

Answering a call in the literature to investigate the relationship between BT in various goods and CC, we develop such a model and estimate it for three dyads and for five goods. For the dyads in the sample, we are able to identify goods in which BT is more sensitive to CC and goods in which BT generates conflict. Using our model we are partly able to identify which BT variable -- export price, export quantity, import price, or import quantity -- generates conflict or cooperation.

BT studies in economics deal mostly with OECD countries. Our investigations enlarge this set by including countries such as Indonesia, Egypt, Turkey, Argentina, Peru, the (former) Soviet Union, and China. Though it is hard to obtain their data, China and the (former) Soviet Union are major economic and political states in the period studied. Yet, we find that CC is also a determinant of BT for OECD countries such as the United States, Germany, and Japan.

In sum, we contribute to the following literatures in economics and political science: (1) the relationship between BT and CC; (2) empirical BT; (3) Granger causality studies; and (4) quantitative models of foreign policy.

10.3 Future Research

We may now suggest several avenues to be taken in future research. More dyads and goods need to be investigated. Once a large number of dyads and goods is investigated, patterns may be identified in the results depending on the type and existence of rivalries, regions, regime type, size of governments, the size of BT, and geographical/cultural distance. If coefficients are similar across certain dyads, then those dyads can be pooled together in order to increase the statistical efficiency of the estimation.

The empirical investigation from disaggregated BT may be extended. In particular, the assumption on the separability of CC decision making along goods may be removed and a full multi- sector BT and CC SEM may be estimated where all traded sectors appear in the CC equations. This requires the use of the full information maximum likelihood estimation method which is available in some statistical software packages such as SAS. The effort involved in such an analysis is not small and the estimation may encounter problems unique to non linear optimization such as convergence problems. Nevertheless, such analysis may increase our understanding of the link between BT in various sectors and CC.

The effects of BT on CC and of CC on bilateral demand need to be further investigated as our empirical results identify some tendencies which do not support our predictions. In general, in some cases export is found to cause cooperation from exporter to importer, import is found to cause conflict from importer to exporter, and conflict is found to stimulate the demand for import. The results on the effect of BT on CC, however, are not conclusive as they are supported by the investigations from total BT values, not supported by the investigations from total BT volumes, and partially supported by the investigations from disaggregated BT volumes. The results on the positive effect of conflict on bilateral demand may be due to our relatively small sample but may also point out that certain social forces are missing from our model.

Whether or not the BT and CC link depends on the level of CC or BT or the level of BT is also to be considered. While we have partially touched this issue in chapter 5, more research is called for. It is possible that CC or BT need to surpass a certain threshold level before their effect on each other becomes noticeable.

Finally our model can be utilized to investigate the interaction of CC and BT of systems containing more than two countries. While BT and CC models in the literature are dyadic, a few studies argue that a dyad may not be the optimal unit of analysis to analyze foreign policy interaction, in particular for great powers. Goldstein and Freeman (1990) and

Goldstein (1991), for example, argue that the political relations of the United States, the (former) Soviet Union, and China need to be investigated as a triangle. Vector AutoRegression (VAR) models involving CC are used but without BT. Enlarging our analysis to apply to more countries may not be easy but is in principle possible. We believe that a microfounded structural approach is to be preferred over the VAR approach. Yet, at the initial stage of such a project, a VAR analysis involving BT and CC variables may play the role played by the Granger analysis used here. That is, the VAR analysis may serve as a heuristic device to point out relationships between BT and CC in a multi-country research design.

Results from a pure CC VAR analysis (without BT) which I have conducted recently reveal two interesting findings. First, bilateral political relations of great powers dyads seem to be affected by the dyad members' bilateral political relations with other great powers in the system. Second, it seems that the triangular unit of analysis used by Goldstein and Freeman (1990) may not be sufficiently large to investigate the political relations of great powers. My initial findings point out that a five country unit of analysis containing the US, the (former) USSR, China, Germany and Japan, seems to better capture their post 1950 bilateral political relations. These results, however, should be regarded as preliminary and are clearly outside the scope of my dissertation.

In future research I intend to enlarge the above VAR model by including bilateral trade variables to create a multi-country trade and conflict/cooperation empirical model. The dyadic-based theoretical and empirical analyses presented in this dissertation, however, provide a firm foundation for future work on more complex multi-country political economic models.

REFERENCES

Achen, C. (1986) "Necessary and Sufficient Conditions for Unbiased Aggregation of Cross Sectional Regressions." Presented at the Third Annual Methodology Conference, Harvard University, Cambridge, MA, August 7-10.

Achen, C. (1987) "Statistical Models for Event Data: A Review of Errors in Variable Theory, "Paper delivered at the First DDIR (Data Development for International Research) Conference on Event Data, Columbus, Ohio, May 29-30.

Aitken, Norman D. (1973), "The Effect of EEC and EFTA on European Trade: A Temporal Cross-Section Analysis," American Economic Review, 63, 881-892.

Alker, H. (1988) "Toward Globalized Event Data Research on Avoidable War," DDIR-Update 3 (Data Development for International Research), Merriam Laboratory, University of Illinois, Champaign.

Allison, G. T. (1971), Essence of Decision: Explaining the Cuban Missile Crisis, Little Brown: Boston.

Anderson, James E. (1979), "A Theoretical Foundation for the Gravity Equation," American Economic Review, 69, 106-116.

Andriole, S. J., and W. Hopple (1984) "The Rise and Fall of Events Data: From Basic Research to Applied Use in the U.S. Department of Defense," International Interactions, 10, 293-309.

Angell, Norman (1911), The Great Illusion; A Study of the Relation of Military Power in Nations to their Economic and Social Advantage, New York: Putnam.

Arad, Ruth, and Seev Hirsch (1981) "Peacemaking and Vested Interests." International Studies Quarterly, 25, 439-68.

Arad, Ruth, Seev Hirsch, and Alfred Tovias (1983) The Economics of Peacemaking: Focus on the Egyptian-Israeli Situation, New York: St. Martin's Press.

Armington, Paul S. (1969), "A Theory of Demand for Products Distinguished by Place of Production," International Monetary Fund Staff Papers, 16, 158-177

Ashley, Richard (1980) The Political Economy of War and Peace: The Sino-Soviet-American Triangle and the Modern Security Problematique, London: Frances Pinter.

Attfield, C. L. F. (1991), "Estimation and Testing When Explanatory Variables are Endogenous: An Application to a Demand System," Journal of Econometrics, 48, 395-408.

Azar, Edward (1982), Conflict and Peace Data Bank (COPDAB) 1948-1978: Daily Aggregations, ICPSR 7767.

Azar, E. (1984) "The Conflict and Peace Data Bank (COPDAB) Project," Journal of Conflict Resolution, 24, 143-153.

Azar, E., S. E. Cohen, T. O. Jukan, and J. McCormick (1972) "Making and Measuring the International Event as a Unit of Analysis," International Events Interaction Analysis: Some Research Considerations, eds, E. Azar, R. A. Brody, and C. McClelland, Sage: Beverly Hills, California.

Azar, E., and T. Sloan (1975) "Dimension of Interaction: A Source Book for the Study of the Behavior of 31 Nations, from 1948 through 1973," Studies of Conflict and Peace, Department of Political Science, University of North Carolina, Chapel Hill.

Azar, Edward and Thomas Havener (1976) "Discontinuities in the Symbolic Environment: A Problem in Scaling", International Interactions, 2, 231-246.

Baldwin, David (1985) Economic Statecraft, Princeton: Princeton University Press.

Ball, L., and G. Mankiw (1993) "Relative Price Changes as Aggregate Supply Shocks," Working Paper, October, Indiana University, Bloomington, Indiana.

Balassa, B. (1978) "The New Protectionism and the International Economy," Journal of World Trade Law, 12, 409-436.

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

Banerjee, A., J. Dolado, W. Galbraith, and D. Hendry (1993) Co-Integration Error Correction and the Econometric Analysis of Non-Stationary Data, Oxford Press.

Barten, A. P. (1971), "An Import Allocation Model for the Common Market," Cahiers Economiques de Bruxelles, 50, 153-164,

Barsky, Robert B. and Jeffrey A. Miron (1989), "The Seasonal Cycle and the Business Cycle," Journal of Political Economy, 97, 503-534.

Batra, Ravi (1993) The Myth of Free Trade: A Plan for America's Economic Revival, New York: Maxwell Macmillan.

Benigni, M. Ester (1989), "The Concept of Dependence in International Trade, An Analysis of a Few Indicators," Rivista Internazionale di Scienze Economiche e Commerciali, 36, 413-436.

Bergeijk, Peter A. G. (1994), Economic Diplomacy, Trade, and Commercial Policy: Positive and Negative Sanctions in a New World Order, Vermont: Edward Elgar.

Bergstrand, Jeffrey H. (1985), "The Gravity Equation in International Trade: Some Microeconomic Foundations and Empirical Evidence," The Review of Economics and Statistics, 67, 472-481.

Bergstrand, Jeffrey, H. (1986), "United-States-Japanese Trade: Predictions Using Selected Economic Models," New England Economic Review, May-June, 26-37.

Bergstrand, Jeffrey, H. (1987), "The U.S. Trade Deficit: A Perspective from Selected Bilateral Trade Models," New England Economic Review, May-June, 20-31.

Bergstrand, Jeffrey H. (1989), "The Generalized Gravity Equation, Monopolistic Competition, and the Factor Proportion Theory in International Trade," Review of Economics and Statistics, 89, 143-153.

Bhagwati, J. (1964), "The Pure Theory of International Trade: A Survey," Economic Journal, 74, 1-84.

Bhagwati, J. (1988), Protectionism, Cambridge: MIT Press.

Bikker, Jocob, (1987) "An International Trade Flow Model with Substitution: An Extension of the Gravity Model," Kyklos, 40, 315-337

Bond, Marian E. (1985), "Export Demand and Supply for Groups of Non-Oil Developing Countries," International Monetary Fund Stuff Papers, 32, 56-77

Borrus, Michael and John Zysman (1992) "Industrial Competitiveness and American National Security," in Wayne Sandholtz et al., The Highest Stakes: The Economic Foundations of the Next Security System, 7-52, New York: Oxford University Press.

Boulding, Kenneth E. (1962), Conflict and Defence: A General Theory, Harper: New York.

Brada, Josef C., and Jose A. Mendez (1985), "Economic Integration Among Developed, Developing and Centrally Planned Economies: A Comparative Analysis," The Review of Economics and Statistics, 67, 449-556.

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

Caporaso, James A., Dependence, Dependency, and Power in the Global System: A Structural and Behavioral Analysis," International Organization, 32, 13-43.

Choucri, Nazli and Robert North (1975) Nations in Conflict: National Growth and International Violence, San Francisco: W.H. Freeman.

Chow, G. (1960) "Tests of Equality Between Sets of Coefficients in Two Linear Regressions," Econometrica, 28, 591-605.

Cohen, Stephen and John Zysman (1987) Manufacturing Matters: The Myth of the Post-Industrial Economy, New York: Basic Books

Conybeare, John. 1985. "Trade Wars: A comparative Study of the Anglo-Hans, Franco-Italian and Smoot-Hawley Conflicts." World Politics. 38, 147-72.

Cooper, Richard N. (1985) "Economic Interdependence and Coordination of Economic Policies," in Jones Ronald and Peter Kenen (eds.), Handbook of International Economics, 2, Amsterdam: North Holland.

Davies, J. L., and C. K. McDaniel (1994) "A New Generation of International Event-Data," International Interactions, 20, 55-78.

Deardorf, Alan V. and Robert Stern (1986), The Michigan Model of World Production and Trade, Cambridge: The MIT press.

Deaton, Angus and John Muellbauer (1980), Economics and Consumer Behavior, Cambridge: Cambridge University Press.

De Crombrugghe, D. (1995). "Linked Estimation for Units of the Same Kind, or: How They Are All Alike and Yet So Different," Tijdschrift voor Economie en Management, XL, 323-353.

De Melo, Jaime and Sherman Robinson (1985), "Product Differentiation and Trade Dependence of the Domestic Price System in Computable General Equilibrium Trade Models," in International Trade and Exchange Rates, T. Peeters et al. (eds.), North Holland: Amsterdam, 93-107.

De Melo, Jaime and Sherman Robinson (1989), "Product Differentiation and the Treatment of Foreign Trade in Computable General Equilibrium Models of Small Economies," Journal of International Economics, 27, 47-67.

Dickey, D., and W. Fuller (1979) "Distribution of the Estimators for Autoregressive Time Series with a Unit Root," Journal of the American Statistical Association, 74, 427-431.

Dickey, D., and W. Fuller (1981) "Likelihood Ratio Tests for Autoregressive Time Series with a Unit Root," Econometrica, 49, 1057-1072.

Diewert, W. E. and C. J. Morrison (1988), "Export Supply and Import Demand Functions: A Production Theory Approach," in Robert C. Feenstra (ed.), Empirical Methods for International Trade, MIT Press: Cambridge, MA, 207-229.

Direction of Trade Statistics (various years), International Monetary Fund.

Dixon, P. B., B. R. Parmenter, J. Sutton, and D. P. Vincent (1982), ORANI: A Multi sectoral Model of the Australian Economy, Amsterdam: North-Holland.

Dixon, W. (1983) "Measuring Interstate Affect." American Journal of Political Science, 27, 828-51.

Dixon, William J. (1986), "Reciprocity in United States-Soviet Relations: Multiple Symmetry or Issue Linkage?" American Journal of Political Science, 30, 421-444.

Dixon, William J. and Bruce E. Moon (1993), "Political Similarity and American Trade Patterns," Political Research Quarterly, 46, 5-25.

Eichengreen, Barry and Douglas A. Irwin (1995), "Trade Blocks, Currency Blocks and the Reorientation of World Trade in the 1930s," Journal of International Economics, 38, 1-24.

Engle, Robert F. and Byung Sam Yoo (1991) "Forecasting and Testing in Co-integrated Systems," in Long Run Economic Relationships, Reading in Cointegration, eds, R. F. Engle and C. W. J. Granger, Oxford University Press, New York.

Farris, L., H. R. Alker, K. Carley, and F. L. Sherman (1980) Phase-Actor Disaggregated Butterworth-Scranton Codebook, Cambridge, MA: Massachusetts Institute of Technology, Center for International Studies, working paper.

Feld, Warner (1979), "Global Allies or Competitors: U.S. Policy Toward an Ascendant European Community and Japan," in Charles E. Kegley Jr. and Pat McGowan (eds.) Challenges to America: U.S. Foreign Policy in the 1980's, Beverly Hills: Sage, 171-200.

Firebaugh, G. and B. Bullock (1986), "Levels of Processing of Exports: New Estimates for 73 Less Developed Countries in 1970 and 1980," International Studies Quarterly, 30, 330-350.

Gaddis, J. (1987) "Expanding the Data Base: Historians, Political Scientists, and the Enrichment of Security Studies," International Security, 12, 3-21.

Gasiorowski, Mark J. (1986) "Economic Interdependence and International Conflict: Some Cross-National Evidence," International Studies Quarterly, 30, 23-38.

Gasiorowski, Mark J. and Solomon W. Polachek (1982) "Conflict and Interdependence: East West Trade and Linkages in the Era of Detente," Journal of Conflict Resolution, 26, 709-729.

Geller, D. (1993) "Power Differentials and War in Rival Dyads." International Studies Quarterly, 37, 173-93.

Geraci, Vincent J. and Wilfred Preow (1982), "An Empirical Demand and Supply Model of Multilateral Trade,"The Review of Economics and Statistics, 64, 432-441.

Geweke, John (1984) "Inference and Causality in Economic Time Series Models." In Handbook of Econometrics, eds., Z. Griliches and M.D. Intriligator, Vol. 2. Amsterdam: North Holland.

Gochman, Charles, and Zeev Maoz (1984) "Militarized Interstate Disputes, 1816-1976, Procedures, Patterns, and Insights." Journal of Conflict Resolution, 28, 585-615.

Goertz, G., and P. Diehl (1993) "Enduring Rivalries: Theoretical Constructs and Empirical Patterns." International Studies Quarterly, 37, 147-71.

Goldstein, Morris and Mohsin S. Khan (1978), "The Supply and Demand For Export: A Simultaneous Approach," Review of Economics and Statistics, 60, 275-286.

Goldstein, Joshua S (1985) "Kondratieff Waves as War Cycles." International Studies Quarterly. 29, 411-44.

Goldstein, J. S. (1991), "Reciprocity in Superpower Relations: An Empirical Analysis," International Studies Quarterly, 35, 195-209.

Goldstein, J. S. (1992), "A Conflict Cooperation Scale for WEIS Events Data, Journal of Conflict Resolution, 36, 369-385.

Goldstein, Joshua S., and J. Freeman (1990) Three Way Street, Strategic Reciprocity in World Politics, The University of Chicago Press.

Gorman, W. M. (1959), "Separable Utility and Aggregation," Econometrica, 27, 469-481.

Gould, David M. (1994), "Immigrant Links to the Home Country: Empirical Implications for U.S. Bilateral Trade Flows," Review of Economics and Statistics, 81, 302-316.

Gowa, Joanne (1989), "Bipolarity, Multipolarity, and Free Trade," American Political Science Review, 83, 1245-1256.

Gowa, Joanne (1994), Allies, Adversaries, and International Trade, Princeton: Princeton University Press

Granger, C. W. J. (1969) "Investigating Causal Relations by Econometric Models and Cross-Spectral Methods," Econometrica, 37, 424-438.

Granger, C. W. J. (1980) "Testing for Causality: A Personal Viewpoint." Journal of Economic Dynamics and Control. 2, 329-52.

Granger, C. W. J., and P. Newbold (1974) "Spurious Regressions in Econometrics," Journal of Econometrics, 2, 111-120.

Grilli, E. (1990) "Protectionism and the Developing Countries," in E. Grilli and E. Sassoon (eds.), The New Protectionist Wave, New York: New York University Press.

Greene, H. W. (1993) Econometric Analysis, MacMillan Publishing Company: New York.

Grossman, G. M. (1982), "Import Competition from Developed and Developing Countries," Review of Economic and Statistics, 64, 271-280.

Gruber, W. H. and Vernon R. (1970), "The Technology Factor in a World Trade Matrix," in Vernon R. (ed.) The Technology Factor in International Trade, New York: Columbian University Press.

Guilkey, David, and Michael Salemi. (1982) "Small Sample Properties of Three Tests for Granger Causal Ordering in a Bivariate Stochastic System." Review of Economics and Statistics. 64, 668-80.

Gujarati, Da Modor (1995), Basic Econometrics, McGraw Hill: New York.

Hamilton, James D. (1994), Time Series Analysis, Princeton: Princeton University Press.

Heckscher E. (1949) [1950], "The Effect of Foreign Trade on the Distribution of Income," Economisk Tisskrift, Reprinted as chapter 13 in H. S. Ellis and L. M. Metzler (eds.), Readings in the Theory of International Trade, Irwin: Homewood, IL

Hass, E. B. (1968) Collective Security and the Future International System, Denver, Colorado: University of Denver, The Social Science Foundation and Graduate School of International Studies, Monograph Series in World Affairs, 5, no. 1.

Hasenkamp, George (1976), Specification and Estimation of Multiple-Output Production Functions, Springer-Verlag, New York.

Havener, T., and A. Peterson (1975) "Measuring Conflict/Cooperation in International Relations: A Methodological Inquiry," in Theory and Practice of Events Research: Studies in Inter-nation Actions and Interactions, edited by E. E. Azar and J. D. Ben-Dak, New York: Gordon and Breach, 57-61.

Haynes, Stephen E., Michael M. Hutchison, Raymond F. Mickesell (1986), "U.S.-Japanese Bilateral Trade and the Yen-Dollar Exchange Rate: An Empirical Analysis," Southern Economic Journal, 52, 923-932.

Helkie, W. and P. Hooper (1988), "An Empirical Analysis of the External Deficit, 1980-1986," in R. Bryant, G. Holtham, P. Hooper (eds.), External Deficit and the Dollar, Brookings Institution: Washington D.C.

Hermann, L. (1988), "Two Kinds of Events Data," DDIR-Update 3 (Data Development for International Research), Merriam Laboratory, University of Illinois, Champaign.

Hickman, Bert G. (1973), "A General Linear Model of World Trade, in R.J. Ball and C. Moriguchi (eds.), International Linkage of National Economic Models, Amsterdam: North Holland, 21-43.

Hickman, Bert G. and Lawrence J. Lau (1973), "Elasticities of Substitution and Export Demands in a World Trade Model," European Economic Review, 4, 347-380.

Hirschman, Albert (1980) [1945] National Power and the Structure of Foreign Trade, Berkeley: University of California Press.

Hoole, Francis, and Chi Huang (1989) "The Global Conflict Process." Journal of Conflict Resolution. 33, 142-63.

Howell, L. D. (1983) "A Comparative Study of the WEIS and COPDAB Data Sets," International Studies Quarterly, 27, 149-159.

Howell, L. D. (1984) "Comparative Analysis with Events Data -- A Reply to McClelland," International Studies Quarterly, 28, 111-113.

Hsiao, Cheng (1979) "Causality Tests in Econometrics." Journal of Economic Dynamic and Control. 1, 321-46.

Huang, Roger, and William Kracaw (1984) "Stock Market Returns and Real Activity: A Note." Journal of Finance. 39, 267-73.

Hufbauer, Gary Clyde, (1970), "The Impact of National Characteristics and Technology on the Commodity Composition of Trade in Manufactured Goods," in Vernon R. (ed.) The Technology Factor in International Trade, New York: Columbian University Press.

International Financial Statistics, various years, International Monetary Fund.

International Monetary Fund Direction of Trade Statistics (1992) "Computer Subscription Documentation."

Intriligator, Michael D., Ronald G. Bodkin, and Cheng Hsiao (1996), Econometric Models, Techniques, and Applications, Upper Saddle Point, NJ: Prantice Hall.

Italianer, Alexander (1986), Theory and Practice of International Trade Linkage Models, Boston: Kluwer.

Italianer, Alexander and G. d'Alcantara (1986), "Modelling Bilateral Sectoral Trade Flows," in P. Artus and O. Guvenen in collaboration with F. Gagey (eds.) International Macroeconomic Modelling for Policy Decisions, Boston: Martinus Nijhoff Publishers.

Joerding, Wayne (1986) "Economic Growth and Defense Spending: Granger Causality." Journal of Development Economics. 21, 35-40.

Kang, Heejoon (1985) "The Effects of Detrending in Granger Causality Tests." Journal of Business and Economic Statistics. 3(4), 344-9.

Kang, Heejoon (1989) "The Optimal Lag Selection and Transfer Function Analysis in Granger Causality Tests." Journal of Economic Dynamics and Control. 13, 151-69.

Keohane, R. O. and J. S. Nye (1977), Power and Interdependence, Boston: Little Brown.

King, G. (1989) "Event Count Models for International Relations: Generalizations and Applications," International Studies Quarterly, 33, 123-147.

Knetter, Michael (1992), "Exchange Rates and Corporate Pricing Strategies," NBER Working Paper Series, No. 4151.

Kohli, Ulrich (1991), Technology, Duality and Foreign Trade: The GNP Function Approach to Modeling Imports and Exports, The University of Michigan Press: Ann Arbor

Kohli, Ulrich and Edward R. Morey (1988), "U.S. Imports by Origin: A Characteristics Approach," Kyklos, 41, 51-74.

Kravis, Irving B. and Robert E. Lipsey (1984) "The Study of International Price Levels," Research summary for the NBER conference on Research on Recent and Prospective U.S. Trade Policy, March, 1984, Cambridge MA: NBER.

Kunimoto, K. (1977) "A Topology of Trade Intensity Indices," Hitsubashi Journal of Economics, 17, 15-32.

Lancaster, K. J. (1966), "A New Approach to Consumer Theory," Journal of Political Economy, 74., 132-157.

Leamer, Edward E. (1990), "Optimal Aggregation of Linear Net Export Systems," in Barker, Terry and M. Hashem Pesaran (ed.) Disaggregation in Econometric Modelling, London: Routledge.

Lebovic, J. (1985) "Capabilities in Context: National Attributes and Foreign Policy in the Middle East," Journal of Peace Research, 22, 47-67.

Leng, R., and J. D. Singer (1988) "Militarized Interstate Crises: The BCOW Topology and its Applications," International Studies Quarterly, 32, 155-183.

Linnemann, Hans (1966), An Econometric Study of International Trade Flows, Amsterdam: North Holland.

Looney, Robert (1991) "Defense Expenditures and Economic Performance in South Asia: Tests of Causality and Interdependence." Conflict Management and Peace Science. 11(2), 37-67.

Magee Stephen P. (1975), "Prices, Incomes, and Foreign Trade," in P. B. Kenan (ed.), International Trade and Finance: Frontiers for Research, Cambridge: Cambridge University Press.

Mansfield, Edward D. (1994), Power, Trade, and War, Princeton: Princeton University Press.

Maoz, Zeev (1985), "Foreign Policy Decision Making: A Progress Report," The Jerusalem Journal of International Relations, 7, 28-63.

Marquez, Jaime (1991), "The Econometric of Elasticities or the Elasticity of Econometrics: An Empirical Analysis of the Behavior of U.S. Imports," International Finance Discussion Papers, Number 396, May.

Marquez, Jaime (1992), "The Autonomy of Trade Elasticities: Choice and Consequences," International Finance Discussion Papers, Number 422, January

Marquez, Jaime and Caryl McNeilly (1988), "Income and Price Elasticities for Exports of Developing Countries," Review of Economics and Statistics, 87, 306-318.

McClelland, C. (1968) "International Interaction Analysis: Basic Research and Some Practical Applications," Appendix G in World Event/Interaction Survey (WEIS), Coding Manual 6th Revision, Revised by Tomlinson R., United State Naval Academy.

McClelland, C. (1971) "The Management and Analysis of International Event Data," Working Paper, University of Southern California, Los Angeles.

McClelland, C. (1983) "Let the User Beware," International Studies Quarterly, 27, 169-177.

McGinnis, Michael D. and John T. Williams. 1989. "Change and Stability in Superpower Rivalry." American Political Science Review, 83: 1101-23.

Mehra, Y. P. 1977. "Money, Wages, Prices and Causality." Journal of Political Economy, 85,1227-44.

Mitchell, B. R. (1992), International Historical Statistics: Europe 1750-1988, New York: Stockton.

Mitchell, B. R. (1995), International Historical Statistics: African, Asia, and Oceanic, New York: Stockton.

de Montesquieu, Baron (1900), The Spirit of Laws, translated by Thomas Nugent, Colllier Press, New York.

Moon, Bruce E. (1985), "Consensus or compliance? Foreign-policy change and external dependence," International Organization, 39, 297-329.

Moore, Will H. (1995), "Action-Reaction or Rational Expectations? Reciprocity and the Domestic International Nexus During the Rhodesia Problem," Journal of Conflict Resolution, 39, 129-167.

Mussa, M. (1974) "Tariffs and the Distribution of Income: The Importance of Factor Specificity, Substitutability, and Intensity in the Short and Long Run," Journal of Political Economy, 82, 1191-1204.

Nagy, Andras (1983) "The Treatment of International Trade in Global Markets." International Institute for Applied Systems Analysis Working Papers WP-83-25: Laxenburg, Austria.

Nelson, Charles, and Heejoon Kang (1981) "Spurious Periodicity in Inappropriately Detrended Time Series." Econometrica. 49, 741-51.

Nelson, Charles, and Heejoon Kang (1984) "Pitfalls in the Use of Time as an Explanatory Variable in Regression." Journal of Business and Economic Statistics. 2, 73-82.

Nelson, C. Mark (1995), "Exchange Rates and Fundamentals: Evidence on Long Horizon Predictability," American Economic Review, 85 201-218.

Newey, W. and K. West (1987), "A Simple Positive Semi-Definite, Heteroscedasticity and Autocorrelation Consistent Covariance Matrix," Econometrica, 55, 703-708.

Ohlin, Bertil (1933), Interregional and International Trade, Harvard University Press: Cambridge

Olechowski, A. and G. Sampson (1980), "Current Trade Restrictions in the EEC, the United States and Japan," Journal of World Trade Law, 14, 220-231

Oneal, John R., Frances H. Oneal, Zeev Maoz, and Bruce Russet (1996), "The Liberal Peace: Interdependence, Democracy, and International Conflict, 1950-1985," Journal of Peace Research, 33, 11-28.

Onitsuka, Yusuke (1994), "Supply Pressure and the Export-Import Performance in the Japan-U.S. Bilateral Trade, IMF Working Papers, WP/94/53, International Monetary Fund.

Park, Tong, Farid Abolfathi, and Michael Ward (1976) "Resource Nationalism in Foreign Policy Behavior of Oil Exporting Countries." International Interactions. 2, 247-62.

Parker, K. T. (1979), "Modeling inter-regional activity by use of trade biases," in J. M. L. Janssen et al. (eds.), Models and Decision Making in National Economies, Amsterdam: North-Holland.

Pelzman, Joseph (1977), "Trade Creation and Trade Diversion in the Council of Mutual Economic Assistance, 1954-1970, American Economic Review, 67, 713-722.

Pierce, David A (1977) "Relationships--and Lack Thereof--Between Economic Time Series, with Special Reference to Money and Interest Rates." Journal of the American Statistical Association. 72(Application Sections), 11-22.

Phillips, P. (1986) "Understanding Spurious Regressions," Journal of Econometrics, 33, 311-340.

Phillips, P., and P. Perron. 1988. "Testing for a Unit Root in Time Series Regression." Biometrika. 75, 335-46.

Phillips, Warren R. (1978), "Prior Behavior as and Explanation of Foreign Policy," in M. A. East, S. A. Salmore, and C. F. Hermann (eds.) Why Nations Act: Theoretical Perspectives for Comparative Foreign Policy Studies, Beverly Hills: Sage.

Price, James E. and James B. Thornblade (1972), U.S. Import Demand Functions Disaggregated By Country and Commodity," Southern Economic Journal, 30, 46-57.

Polachek, Solomon W. (1980) "Conflict and Trade," Journal of Conflict Resolution, 24, No. 1, 55-78.

Polachek, Solomon W. (1992), "Conflict and Trade: An Economics Approach to Political International Interactions, in Isard W. and C. Anderton (eds.) Economics of Arms Reduction and the Peace Process, Amsterdam: Elsevier Science Publishers, 89-120

Pollins, Brian M. (1989a) "Conflict, Cooperation, and Commerce: The Effect of International Political Interactions on Bilateral Trade Flows," American Journal of Political Science, 33, No. 3, 737-761.

Pollins, Brian M. (1989b) "Does Trade Still Follow the Flag?" American Political Science Review, 83, No. 2, 465-480.

Powell, Alan A. and F. H. G. Gruen (1968) "The Constant Elasticity of Transformation Production Frontier and Linear Supply System," International Economic Review, 9, 315-328.

Poyhonen, Pentt (1963a), "Toward a General Theory of International Trade," Econmisk Tidskrift,16, 69-77.

Poyhonen, Pentt (1963b)," A Tentative Model for the Volume of Trade between Countries," Weltwirtschaftliches Archive (Review of World Economics), 90, 93-100.

Price, James E. and James B. Thornblade (1972), "U.S. Import Demand Functions Disaggregated By Country and Commodity, Southern Economic Journal, 25, 46-57.

Pulliainen, Kyotsti (1963), A World Trade Study: An Econometric model of the pattern of commodity flows of international trade in 1948-1960. Economiska Samfundets Tidskrift, 16, 78-91.

Rajmaira, Sheen and Michael D. Ward (1990), "Evolving Foreign Policy Norms: Reciprocity in the Superpower Triad," International Studies Quarterly, 34, 457-475.

Ranuzzi, P. (1981), "The Experience of the EEC Eurolink Project in Modeling Bilateral Trade Linkage Equations," Journal of Policy Modeling, 3, 153-172.

Ranuzzi, P. (1982), "The Bilateral Trade Linkages of the Eurolink Model: An Analysis of Foreign Trade and Competitiveness," Internal paper-Directorate General for Economic and Financial Affairs, EC, No. 6, January.

Richardson, Neil R. (1976), "Political compliance and United States trade dominance," Political Science Review, 70, 1098-1109

Richardson, Neil R. and Charles W. Kegley (1980), "Trade Dependence and Foreign Policy compliance: A longitudinal Analysis," International Studies Quarterly, 24., 191-222

Roeder, Philip G. (1985), "The Ties that Bind: Aid, Trade, and Political Compliance in Soviet Third World Relations," International Studies Quarterly, 29., 191-216

Russett, B. M. (1967) International Regions and International System. Chicago: Rand-McNally.

Sapir, Andre (1981), "Trade Benefits under the EEC Generalized System of Preferences," European Economic Review, 15., 339-355.

Sargent, Thomas. 1976. "A Classical Macroeconometric Model for the United States." Journal of Political Economy. 84, 207-37.

Savage, I. Richard and Karl W. Deutsch (1960), "A Statistical Model of the Gross Analysis of Transaction Flows," Econometrica, 28, 551-572.

Sayrs, L. (1987) "Trade, Reciprocity and Peace," Paper Presented at the American Political Association Meetings, Chicago.

Sayrs, Lois (1989a), "Trade and Conflict Revisited: Do Politics Matter?" International Interaction, 14, 155-175.

Sayrs, Lois (1989b) Pooled Time Series Analysis. New York: Sage Publications.

Sayrs, Lois (1990), "Expected Utility and Peace Science: An Assessment of Trade and Conflict," Conflict Management and Peace Science, 11, 17-44

Schrodt, P. (1988) "Experimental Results on Coding the New York Times and FBIS," DDIR Update 3 (Data Development for International Research), Merriam Laboratory, University of Illinois, Champaign.

Schrodt, P., and C. Donald (1990) "Machine Coding of Events Data," Paper Presented at the Annual Meeting of the International Studies Association, Washington, DC, April.

Schrodt, P., and D. J. Gerner (1994) "Validity Assessment of a Machine-Coded Event Data Set for the Middle East, 1982-92," American Journal of Political Science, 38, 825-854.

Shoven, John B. and John Whalley (1984), "Applied General Equilibrium Models of Taxation and International Trade: A Introduction and Survey," Journal of Economic Literature, 22, 1007-1051.

Shea, John (1993), "Do Supply Curves Slope Up?," The Quarterly Journal of Economics, 108, 1-33.

Sherman F. L. (1994) "SHERFACS: A Cross-Paradigm, Hierarchical and Contextually Sensitive Conflict Management Data Set," International Interactions, 20, 79-100.

Shiells, C. (1991) , "Errors in Import Demand Estimates Based Upon Unit Value Indexes," Review of Economics and Statistics, 73, 378-382.

Sims, Christopher (1972) "Money, Income, and Causality." American Economic Review. 62, 540-52.

Sloan, T. (1975) "The Development of Cooperation and Conflict Interaction Scales: An Advance in the Measurement and Analysis of Events Data," in Theory and Practice of Events Research Studies in International Actions and Interactions, edited by Edward E. Azar and Joseph D. Ben-Dak, 29-39, Gordon and Breach, New York.

Smith, Adam (1937) [1776], An Inquiry into the Nature and Causes of the Wealth of Nations, New York: Modern Library.

Smith, David A. and Roger J. Nemeth (1988), "An Empirical Analysis of Commodity Exchange in the International Economy: 1965-1980," International Studies Quarterly, 32, 227-240.

Solow, M. Robert (1955), "The Production Function and the Theory of Capital," The Review of Economic Studies, 23, 101-108.

Statistical Yearbook of China, various years, New York: Oxford University Press.

Stern, Robert M., Jonathan Francis, and Bruce Schumacher (1976), Price Elasticities in International Trade: An Annotated Bibliography, London: McMillan, for the trade policy research center.

Stone, Joe A. (1979), "Price Elasticities of Demand for Imports and Exports: Industry Estimates for the U.S., The E.E.C., and Japan," Review of Economic and Statistics, 64, 306-312.

Strotz, R. H. (1957), "The Empirical Implications of a Utility Tree," Econometrica, 25.

Summary, Rebecca M. (1989), "A Political-Economic Model of U.S. Bilateral Trade," The Review of Economic and Statistics, 89, 179-182

Taplin, Grant (1967), "Models of World Trade", International Monetary Fund Staff Papers, Vol. 14, 433-453.

Thompson, W., and D. Rapkin (1982) "Conflict, Inertia, and Reciprocity: Coping with the Western Block," in Foreign Policy: USA/USSR, Charles E. Kegley, Jr. and Pat McGowan, eds., 241-265.

Thompson, W. R. and L. Vescera (1992), "Growth Waves, Systemic Openness, and Protectionism," International Organization, 46, 493-532.

Tinbergen, Jan (1962), Shaping the World Economy: Suggestions for and International Economic Policy, The Twentieth Century Fund, New York.

Tollison, Robert D. and Thomas D. Willet (1973), "International Integration and the Interdependence of Economic Variables," International Organization, 27, 255-271.

Tyson, Laura D'Andrea (1992), Who's Bashing Whom: Trade Conflict in High-Technology Industries, Washington: Institute for International Economics.

Vasquez, J., and R. Mansbach (1984) "The Role of Issues in Global Co-operation and Conflict," British Journal of Political Science, 14, 128-142.

Vincent, J. (1979) Project Theory, University of Maryland Press.

Vincent, J. (1983) "WEIS vs. COPDAB: Correspondence Problems," International Studies Quarterly, 27, 161-168.

Vogel, Steven (1992), "The power behind 'Spin-Ons': The military implications of Japan's Commercial Technology, in Wayne Sandholtz et al., The Highest Stakes: The Economic Foundations of the Next Security System, 55-80, New York: Oxford University Press.

Volimex (1990), Classification Plane 1.3, European Commission.

Vries, M. (1990), "Interdependence, Cooperation and Conflict: An Empirical Analysis," Journal of Peace Research, 27, 429-444

Walter, I (1972), "Nontariff Protection Among Industrial Countries: Some Preliminary Empirical Evidence," Economica Internatzionale, 55, 335-354.

Waltz, Kenneth N. (1970), "The Myth of Interdependence," in Charles P. Kindelberger (ed.) The International Corporation, Cambridge: MIT Press.

Ward, M. (1981) "Seasonality, Reaction, Expectation, Adaptation, and Memory in Cooperative and Conflictual Foreign Policy Behavior," International Interactions, 8, 229-245.

Ward, Michael D. (1982), "Cooperation and Conflict in Foreign Policy Behavior: Reaction and Memory," International Studies Quarterly, 26, 87-126.

Ward, M (1987) "Cargo Cult Science and Eight Fallacies of Comparative Political Research." International Studies Notes. 13(3), 75-7.

Ward, Michael D. and Sheen Rajmaira (1992), "Reciprocity and Norms in U.S.-Soviet Foreign Policy," Journal of Conflict Resolution, 36, 342-368.

Whalley, John (1982), "Trade Agreement Using General Equilibrium Computational Methods," Journal of Policy Modeling, 4, 341-361.

Whalley, John (1984), Trade Liberalization among Major World Trading Areas," MIT Press: Cambridge, MA.

White, H. (1980) "A Heteroscedasticity Consistent Covariance Matrix Estimator and A Direct Test for Heteroscedasticity," Econometrica, 48, 817-838.

Wilkenfeld, Jonathan, Gerald W. Hopple, Paul J. Rossa, and Stephen J. Andriole. (1980), Foreign Policy Behavior: The Interstate Behavior Analysis Model, Beverly Hills: Sage.

Wilson, John F., and Wendy E. Takacs (1977), "Differential Responses to Price and Exchange Rate Influences in the Foreign Trade of Selected Industrial Countries," Federal Reserve Board, International Finance Division Discussion Paper No. 104.

World Event Interaction Survey (WEIS), Coding Manual (1993), 6th Revision (Draft), Revised by Rodney Tomlinson, Department of Political Science, United States Naval Academy.

APPENDIX 1: RESULTS FROM SPLICING COPDAB and WEIS

The splicing method described in chapter 3 is used to generate time series of CC. The following are results from the regression of quarterly WEIS on COPDAB during their overlapping period. Table A1-1 shows results from net conflict, Table A1-2 from sum cooperation, and Table A1-2 from sum conflict. All CC series are tested for unit root and are found to be stationary. Dyads' names follow chapters 4-9. The first two letters in a name denote the actor and the last two the target. A_0 is the intercept and A_1 is the slope. The compatibility between COPDAB and WEIS is generally good with slope coefficients significantly different from zero at the 5%. Only exceptions are for JA-GE and GE-JA, where the slope coefficients are not significant. For these cases, CC for the COPDAB and WEIS are used as if they are continuous series, instead of using the small slope coefficient estimates obtained from the regression equations.

TABLE A1-1: Splicing COPDAB and WEIS from Net Conflict

Dyad	A_0	A_1
ETSO	-12.061	1.379**
MOAL	-25.757**	1.487**
CIAR	-0.468	0.052
SUCH	-27.613*	1.350**
CHSU	-24.124*	1.640**
USSU	42.085	2.132**
SUUS	-13.559	2.453**
USJA	39.507*	0.792**
JAUS	27.596	0.780**
USGE	33.029*	1.171**
GEUS	18.479	0.990**
SUJA	2.724	0.912**
JASU	3.636	0.873**
SUGE	-4.044	1.860**
GESU	-12.444**	1.884**
JAGE	2.377**	0.032
GEJA	0.554	0.106
USCH	37.978*	0.892**
CHUS	-59.505**	1.307**
JACH	9.998	0.731**
CHJA	-13.775	1.198**
CHGE	-4.188	0.958**
GECH	0.900	0.731**

Notes: A_0 is the intercept. A_1 is the slope. Coefficients siginificant at the 5% (10%) are indicated by ** (*).

TABLE A1-2: Splicing COPDAB and WEIS from Sum Cooperation

Dyad	A_0	A_1
SUCH	0.857	1.053**
CHSU	2.772	1.252**
USSU	36.299	2.615**
SUUS	85.047	2.597**
USJA	16.315	1.488**
JAUS	59.842**	0.918**
USGE	45.245**	1.058**
GEUS	42.255**	1.075**
SUJA	29.630**	0.633**
JASU	28.755**	0.563**
SUGE	1.707	2.049**
GESU	-10.166	1.786**
JAGE	2.386**	0.030
GEJA	0.528	0.107
USCH	-3.132	1.475**
CHSU	18.269**	2.258**
JACH	5.416	0.805**
CHJA	-0.546	1.117**
CHGE	2.014	0.465**
GECH	-0.811	0.849**

Notes: A0 is the intercept. A_1 is the slope. Coefficients siginificant at the 5% (10%) are indicated by ** (*).

TABLE A1-3: Splicing COPDAB and WEIS from Sum Conflict

Dyad	A_0	A_1
SUCH	-27.887**	1.277**
CHSU	-25.206**	1.593**
USSU	-133.604**	1.602**
SUUS	-264.873**	1.569**
USJA	-23.495**	0.776**
JAUS	-30.613**	1.289**
USGE	-10.293**	0.603**
GEUS	-10.104	1.970**
SUJA	-16.671**	1.014**
JASU	-6.834	1.418**
SUGE	-7.568	1.994**
GESU	0.096	1.828**
JAGE	NA	NA
GEJA	NA	NA
USCH	-14.542**	0.184**
CHSU	-108.204**	1.187**
JACH	-4.765**	0.180
CHJA	-12.016**	1.118**
CHGE	-1.584	2.632**
GECH	0.138	0.304**

Notes: A_0 is the intercept. A_1 is the slope. Coefficients siginificant at the 5% (10%) are indicated by ** (*).

APPENDIX 2: MODEL DEVELOPMENT

This Appendix presents the solution steps of the consumers' and the producers' optimization problems. To simplify, without loss of generality, it is assumed that there are four trading units, where j denotes the place of production; k denotes the place of consumption.; and i (i=1,2,...n) denotes goods. A good is denoted by Q_i. Consumers are assumed to differentiate goods by type and country of origin. Q_{ijk} denotes the quantity of good i produced in country j and consumed in country k which we designate as a product. P_{ijk} denotes the price of product Q_{ijk}. Q_{ikk} denotes the quantity of a product which is produced domestically. P_{ikk} is the price of that product. Producers are assumed to operate in perfect competition, hence they are price takers. Producers in each sector produces for all countries, however, goods shipped to different destinations are assumed to be considered by producers as imperfect substitutes. Within a sector goods are assumed to be homogenous. Thus, food from Holland is considered the same product by consumers in Denmark regardless of which firm in Holland's food industry produces it, or consumers do not distinguish between firms in a sector.

A3.1 Consumers

Consumers are assumed to maximize utility by allocating their income among goods. Consumers' preferences are assumed to be weakly separable to reduce the scope of the problem at hand. It is also assumed that goods can be aggregated into groups to reduce the size of the information set required. Aggregation implies that the solution can utilize quantity and price indices of baskets' of goods. Separability implies that goods can be divided into groups that hold commodities of the same kind such that preferences how to allocate income among goods within a group can be considered independent of goods in other groups. Hence, utility can be divided to sub-utilities, each depending on goods within a particular group. This implies the existence of a decision making tree.

The decision making tree of consumers is assumed to have three stages. *In the first stage*, consumers allocate income over goods i=1,2,...,n. *In the second stage*, consumers allocate the expenditure allocated to good i in the first stage over imported and domestic sources. *In the third stage*, consumers allocate the expenditures on imports of good i among suppliers (or, exporters).

A representative consumer in country k consumes products produced in all units, including domestic products. In equation (1), Q_k denotes a vector of all the quantities consumed by country k. Similarly, in equation (2), P_k denotes a vector of prices paid in country k.

$$Q_K = (Q_{11k}, Q_{12k}, Q_{13k}, Q_{14k}, \ldots, Q_{n1k}, Q_{n2k}, Q_{n3k}, Q_{n4k}) \quad k=1,2,3,4 \qquad (1)$$

$$P_K = (P_{11k}, P_{12k}, P_{13k}, P_{14k}, \ldots, P_{n1k}, P_{n2k}, P_{n3k}, P_{n4k}) \quad k=1,2,3,4 \qquad (2)$$

Grouping all products of good i, the vectors of quantities and prices in equations (1) and (2) can be written as in (3) and (4) where, Q_{ik} is a quantity index of a good i and P_{ik} is the price index of that good (or, group of products).

$$Q_K = (Q_{1k}, Q_{2k} \ldots Q_{nk}) \qquad (3)$$

$$P_K = (P_{1k}, P_{2k} \ldots P_{nk}) \qquad (4)$$

The utility function of a representative consumer in country k , denoted as U_k , depends on the quantities of all products consumed in country k, Q_k, and on BR, a generic bilateral political relations term, fully introduced in equation (9).

$$U_k = U_k(Q_k\ ,\ BR) \tag{5}$$

Since U_k is weakly separable it is possible to collapse it as in equation (6), where U_{ik} is the sub-utility from good i's products. Bilateral relations enter the sub-utility of each good and is assumed to be exogenous to the consumer.

$$U_k=U_k[U_{1k}(Q_{11k},Q_{12k},Q_{13k},Q_{14k},BR)\ ,\ \ldots\ ,U_{nk}(Q_{n1k},Q_{n2k},Q_{n3k},Q_{n4k},BR)] \tag{6}$$

Equation (6) holds under the assumption that the marginal rate of substitution among any two products is independent of the quantities consumed of other goods (Armington, 1969).

Consumers in k maximize utility by choosing Q_k given their income Y_k. Utilizing separability of preferences the problem is solved in three stages while assuming that when consumers allocate income over broad categories (i.e. food, shelter) in stage one, and among foreign and domestic sources in stage two, they do not consider bilateral conflict and cooperation. (7) and (8) give the first stage optimization problem:

$$\max\ U_k(Q_{1k},Q_{2K},\ldots,Q_{nk},BR)\quad w.r.t.\quad Q_{ik}\quad (i=1,2,..,n) \tag{7}$$

$$S.T.\quad \sum_{i=1}^{n} P_{ik}Q_{ik} = Y_k \tag{8}$$

The solution of the optimization problem stated in equations (7) and (8) is given by:

$$Q_{ik} = Q_{ik}(Y_k,P_{ik},BR)\qquad (i=1,2,..,n) \tag{9}$$

A similar optimization problem to that stated in equations (7) and (8) is solved by consumers to decide on the allocation of the expenditure on Q_{ik} among domestic and foreign sources. The outcome of this process determines M_{ik}, the consumers' expenditure on imported good i. Below, we focus on the allocation of M_{ik} among products Q_{ijk} while taking bilateral CC into account.

All consumers are assumed to have access to the same information on CC. Agents in countries j and k, may value CC differently. The bilateral relations between countries j and k, CC^{jk}, as viewed by consumers of Q_{ijk} are modeled as a variable b_{ijk}; $b_{ijk} = \exp(\gamma_{ik}CC^{jk})$, where γ_{ik} is positive. This monotonic transformation is chosen so that the logarithm transformation of b_{ijk} will produce the full spectrum of CC values, from $-\infty$ to ∞. Positive CC values imply cooperation while negative CC values imply conflict. Hence, b_{ijk} approaches zero for extremely high conflict levels and infinity for extremely high cooperation levels.

Assume that the sub-utility from good i, U_{ik}, is a CES function as in (10). Country k imports from each of the three units, or it consumes goods produced in j where, j=1,2,3. The constant elasticity of substitution among products *i* in country *k* is given by σ_{ik} ($0 < \sigma_{ik} < \infty$) in (11).

$$U_{ik} = (b_{i1k}Q_{i1k}^{\alpha_{ik}} + b_{i2k}Q_{i2k}^{\alpha_{ik}} + b_{i3k}Q_{i3k}^{\alpha_{ik}})^{\frac{1}{\alpha_{ik}}} , \tag{10}$$

$$\sigma_{ik} = \frac{1}{1-\alpha_{ik}} \tag{11}$$

The price of Q_{ijk} is modeled in (12). P_{ijk} is the price of X_{ijk} free on board (f.o.b.) in the producer's currency. C_{ijk} is the ratio of good i's price including cost insurance and freight (c.i.f), to its f.o.b. price; ($C_{ijk} \geq 1$). T_{ijk} is the effect of tariff imposed by k on good i from j; $TR_{ijk} = (1+t_{ijk})$, where t_{ijk} is ad-valorem tariff. E_{jk} is the spot value of *k*'s currency in terms of j's currency.

$$P^{*}_{ijk} = \frac{P_{ijk}C_{ijk}TR_{ijk}}{E_{jk}} \tag{12}$$

A consumer in country k maximizes sub-utility U_{ik}, by choosing the quantities Q_{i1k}, Q_{i2k}, and Q_{i3k} to consume or import from each of the three units, subject to the constraint that his expenditures on good i can not exceed his total expenditures on import for that good, M_{ik}. This optimization problem is given in equations (13) and (14) below.

$$\max U_{i1} \;\; w.r.t. \;\; Q_{i1k}, Q_{i2k}, Q_{i3k} \tag{13}$$

$$S.T. \quad P^{*}_{i1k}Q_{i1k} + P^{*}_{i2k}Q_{i2k} + P^{*}_{i3k}Q_{i3k} = M_{ik} \tag{14}$$

In (13), w.r.t. denotes "with respect to" (or, by choosing), and S.T. denotes "subject to." Solving this optimization problem we maximize the lagrangian in expression (15).

$$L = U_{ik} + \lambda\,(M_{ik} - P^{*}_{i1k}Q_{i1k} - P^{*}_{i2k}Q_{i2k} - P^{*}_{i3k}Q_{i3k}) \tag{15}$$

In (15), λ denotes the lagrange multiplier of this problem. Taking the first order conditions of equation (15) we get equations (16), (17) and (18).

$$(b_{i1k}Q_{i1k}^{\alpha_{ik}} + b_{i2k}Q_{i2k}^{\alpha_{ik}} + b_{i3k}Q_{i3k}^{\alpha_{ik}})^{\frac{1}{\alpha_{ik}}-1}\, b_{i1k}Q_{i1k}^{\alpha_{ik}-1} - \lambda P_{i1k} = 0 \tag{16}$$

$$(b_{i1k}Q_{i1k}^{\alpha_{ik}} + b_{i2k}Q_{i2k}^{\alpha_{ik}} + b_{i3k}Q_{i3k}^{\alpha_{ik}})^{\frac{1}{\alpha_{ik}}-1}\, b_{i2k}Q_{i2k}^{\alpha_{ik}-1} - \lambda P_{i2k} = 0 \tag{17}$$

$$(b_{i1k}Q_{i1k}^{\alpha_{ik}} + b_{i2k}Q_{i2k}^{\alpha_{ik}} + b_{i3k}Q_{i3k}^{\alpha_{ik}})^{\frac{1}{\alpha_{ik}}-1}\, b_{i3k}Q_{i3k}^{\alpha_{ik}-1} - \lambda P_{i3k} = 0 \tag{18}$$

Solving equations (16), (17), and (18) for the demand of product Q_{ijk} we get equation (19), for the demand for good i of country k from country j. (19) is written under the assumption that country k imports good i from N countries instead of only 3. For a system of four countries there are six bilateral import demand functions each as in (19). For a system of N countries there are N(N-1) bilateral demand functions.

$$Q_{ijk}{}^{D}=\frac{b_{ijk}{}^{\sigma_{ik}}P^{*}{}_{ijk}{}^{-\sigma_{ik}}M_{ik}}{\sum_{j=1}^{N}(b_{ijk}{}^{\sigma_{ik}}P^{*}{}_{ijk}{}^{1-\sigma_{ik}})} \tag{19}$$

A3.2 Producers

Assume a single factor of production (i.e. labor) which is internationally immobile. The amount of factor of production available for a sector i in country j, is denoted by R_{ij}. Producers in sector i of country j allocate production among the domestic market and the other three units. Under separability as in consumption, only the allocation of resources among export destinations is solved here. A representative producer is assumed to allocate factor of production among export products according to a constant elasticity of transformation function (CET). In each sector the elasticity of transformation between any two products is assumed to be constant and producers are price takers. The allocation of sectoral resources to production are modeled in equation (20).

$$R_{ij}=(\ a_{ij1}Q_{ij1}^{\phi_{ij}}+a_{ij2}Q_{ij2}^{\phi_{ij}}+a_{ij3}Q_{ij3}^{\phi_{ij}}\ )^{\frac{1}{\phi_{ij}}} \tag{20}$$

In (20), the constant elasticity of transformation between products, τ_{ij} ($0 < \tau_{ij} < \infty$) is given by:

$$\tau_{ij}=\frac{1}{\phi_{ij}-1} \tag{21}$$

Bilateral relations as viewed by producers of Q_{ijk} is modeled as a variable a_{ijk} which multiplies the quantity of each product in (20). Similar to the demand side, bilateral relations as viewed by Q_{ijk}'s exporters are modeled with a variable a_{ijk}, $a_{ijk} = \exp(-\delta_{ij}CC^{jk})$, where δ_{ij} is positive. Hence, a_{ijk} approaches infinity for high levels of conflict and zero for high levels of cooperation.

Sector i's expenditure on factor of production, X_{ij}, is given in equation (22), where, W_{ij} is the price paid for one unit of factor of production. Since in perfect competition profits equal zero, X_{ij} equals sector i's expenditure on factor of production.

$$X_{ij} = W_{ij}R_{ij} \tag{22}$$

The profit of a representative producer in sector *i* of country j, Π_{ij}, is given in equation (23):

$$\Pi_{ij}=\sum_{k=1}^{3}(P_{ijk}Q_{ijk})-W_{ij}R_{ij} \tag{23}$$

Producers maximize profits by choosing Q_{ij1} , Q_{ij2} and Q_{ij3}, while taking prices as given. Substitute R_{ij} from equation (20) in equation (23) and write the first order conditions for profit maximization with respect to Q_{ij1}, Q_{ij2} and Q_{ij3}. This gives equations (24), (25) and (26).

$$P_{ij1}-\frac{W_{ij}}{\Phi_{ij}}a_{ij1}\Phi_{ij}Q_{ij1}^{\Phi_{ij}-1}\left(\sum_{k=1}^{3}a_{ijk}Q_{ijk}^{\Phi_{ij}}\right)^{\frac{1}{\Phi_{ij}}} = 0 \tag{24}$$

$$P_{ij2}-\frac{W_{ij}}{\Phi_{ij}}a_{ij2}\Phi_{ij}Q_{ij2}^{\Phi_{ij}-1}\left(\sum_{k=1}^{3}a_{ijk}Q_{ijk}^{\Phi_{ij}}\right)^{\frac{1}{\Phi_{ij}}} = 0 \tag{25}$$

$$P_{ij3}-\frac{W_{ij}}{\Phi_{ij}}a_{ij3}\Phi_{ij}Q_{ij3}^{\Phi_{ij}-1}\left(\sum_{k=1}^{3}a_{ijk}Q_{ijk}^{\Phi_{ij}}\right)^{\frac{1}{\Phi_{ij}}} = 0 \tag{26}$$

Solving (24), (25) and (26) for Q_{ij1}, Q_{ij2} and Q_{ij3} while using (22) gives the supply function of product Q_{ijk}. As before, (27) is written assuming there are N export markets. In a system of N export markets there are N(N-1) bilateral supply functions.

$$Q_{ijk}{}^{S}=\frac{P_{ijk}{}^{\tau_{ij}}X_{ij}}{a_{ijk}^{\tau_{ij}+1}\sum_{k=1}^{N}a_{ijk}^{-\tau_{ij}}P_{ijk}{}^{\tau_{ij}+1}} \tag{27}$$

A3.3 Market Clearing

We assume that all markets clear. Hence, equation (28) holds for all sectors i in j and k.

$$Q_{ijk}{}^{D}=Q_{ijk}{}^{S}=Q_{ijk} \tag{28}$$

Equations (14), (19), (20), (22), (27), and (28) produce a system of equations that can be solved to obtain quantity and price of products in terms of a_{ijk}, b_{ijk}, t_{ijk}, c_{ijk}, σ_{ik}, and τ_{ij}. Such solution does not produce a reduced form as conflict and cooperation are endogenous. We rewrite those expressions below as equations (29) to (34) for the case of three importers and exporters.

Three sectoral import expenditure equations:

$$P^{*}{}_{i1k}Q_{i1k}\ +\ P^{*}{}_{i2k}Q_{i2k}\ +\ P^{*}{}_{i3k}Q_{i3k}\ =\ M_{ik} \tag{29}$$

Six bilateral import demand functions:

$$Q_{ijk}{}^{D}=\frac{b_{ijk}{}^{\sigma_{ik}}P^{*}{}_{ijk}{}^{-\sigma_{ik}}M_{ik}}{\sum_{j=1}^{3}(b_{ijk}{}^{\sigma_{ik}}P^{*}{}_{ijk}{}^{1-\sigma_{ik}})} \tag{30}$$

Three sectoral resource allocation in production for export:

$$R_{ij}=(\ a_{ij1}Q_{ij1}^{\phi_{ij}}+a_{ij2}Q_{ij2}^{\phi_{ij}}+a_{ij3}Q_{ij3}^{\phi_{ij}}\ )^{\frac{1}{\phi_{ij}}} \tag{31}$$

Three sectoral export expenditure equations:

$$X_{ij} = W_{ij}R_{ij} \tag{32}$$

Six bilateral export supply functions:

$$Q_{ijk}{}^{S} = \frac{P_{ijk}{}^{\tau_{ij}}X_{ij}}{a_{ijk}^{\tau_{ij}+1}\sum_{k=1}^{3} a_{ijk}^{-\tau_{ij}}P_{ijk}{}^{\tau_{ij}+1}} \tag{33}$$

Six market clearing conditions:

$$Q_{ijk}{}^{D} = Q_{ijk}{}^{S} \tag{34}$$

In the case of 3 exporters and importers expressions (29)-(34) include 27 equations per sector. Other than CC, there are 27 endogenous variables per sector: 6 $Q_{ijk}{}^{D}$, 6 $Q_{ijk}{}^{S}$, 6 P_{ijk}, 3 M_{ik}, 3 X_{ij}, and 3 W_{ij}. For the case of N exporters and importers there are $3N^2$ endogenous variables and equations.

Assume that the market of product Q_{ijk} is small relative to other markets. It follows that the effect of changes in bilateral quantities and prices on the expenditures M_{ik} and X_{ij} and the price terms in the denominators of Q^D and Q^S, denoted as PS_{ik} and PT_{ij} accordingly, is small. Hence, PS_{ik}, PT_{ij}, M_{ik} and X_{ij} may be assumed exogenous. Hence, equations (30), (33) and (34) define partial equilibrium for product Q_{ijk}

Assuming partial equilibrium for each product, the economic part of our model can be solved analytically. Equations (30), (33) and (34) are used to obtain expressions of price and quantity in terms of exogenous variables (t_{ijk}, c_{ijk}, X_{ij}, M_{ik}, PT_{ij}, PS_{ik}) and the endogenous CC variables (a_{ijk}, b_{ijk}). Substituting (30) and (33) into (34) and solving for the bilateral price while holding the above variables exogenous, we get equation (35) for P_{ijk}, in which PT_{ij} and PS_{ik} are given in (36) and (37) and ETC_{ijk} is given by E_{jk} / ($TR_{ijk}C_{ijk}$).

$$P_{ijk}=\left(M_{ik}X_{ij}^{-1}a_{ijk}^{\tau_{ij}+1}b_{ijk}^{\sigma_{ik}}PT_{ij}PS_{ik}^{-1}ETC_{ijk}^{\sigma_{ik}}\right)^{\frac{1}{\tau_{ij}+\sigma_{ik}}} \tag{35}$$

$$PT_{ij}=\sum_{k=1}^{3} a_{ijk}^{-\tau_{ij}}P_{ijk}^{\tau_{ij}+1} \tag{36}$$

$$PS_{ik}=\sum_{j=1}^{3} b_{ijk}^{\sigma_{ik}}P^{*}{}_{ijk}^{1-\sigma_{ik}} \tag{37}$$

The solution for the quantity of bilateral trade in product Q_{ijk} is derived by substituting P_{ijk} from equation (35) into equation (30), or (33), and is given in equation (38).

$$Q_{ijk}=M_{ik}^{\frac{\tau_{ij}}{\tau_{ij}+\sigma_{ik}}}X_{ij}^{\frac{\sigma_{ik}}{\tau_{ij}+\sigma_{ik}}}a_{ijk}^{\frac{-\sigma_{ik}(\tau_{ij}+1)}{\tau_{ij}+\sigma_{ik}}}b_{ijk}^{\frac{\sigma_{ik}\tau_{ij}}{\tau_{ij}+\sigma_{ik}}}PT_{ij}^{-\frac{\sigma_{ik}}{\tau_{ij}+\sigma_{ik}}}PS_{ik}^{-\frac{\tau_{ij}}{\tau_{ij}+\sigma_{ik}}}ETC_{ijk}^{\frac{\tau_{ij}\sigma_{ik}}{\tau_{ij}+\sigma_{ik}}} \tag{38}$$

The sectoral trade value is derived by multiplying Q_{ijk} in (38) by P_{ijk} from (35). The result, T_{ijk}, is given in (39), where PL_{ijk} is given in (40). In (39), bilateral trade value depends on sector sizes, bilateral relations, weighted sectoral price levels, and trade resistance.

$$T_{ijk}=M_{ik}^{\frac{\tau_{ij}+1}{\tau_{ij}+\sigma_{ik}}}X_{ij}^{\frac{\sigma_{ik}-1}{\tau_{ij}+\sigma_{ik}}}a_{ijk}^{\frac{(\tau_{ij}+1)(1-\sigma_{ik})}{\tau_{ij}+\sigma_{ik}}}b_{ijk}^{\frac{(\tau_{ij}+1)(\sigma_{ik})}{\tau_{ij}+\sigma_{ik}}}PL_{ijk}ETC_{ijk}^{\frac{(\tau_{ij}+1)(\sigma_{ik})}{\tau_{ij}+\sigma_{ik}}} \tag{39}$$

$$PL_{ijk}=PT_{ij}^{\frac{-(\sigma_{ik}-1)}{\tau_{ij}+\sigma_{ik}}}PS_{ik}^{\frac{-(\tau_{ij}+1)}{\tau_{ij}+\sigma_{ik}}} \tag{40}$$

Expression (39) can be rewritten as (41), which appears in equation 8 in chapter 6, by noting that the exponent of PT_{ij} is similar to that of X_{ij} and the exponent of PS_{ik} is similar to that of PS_{ik}.

$$T_{ijk}=(RM_{ik})^{\frac{\tau_{ij}+1}{\tau_{ij}+\sigma_{ik}}}(RX_{ij})^{\frac{\sigma_{ik}-1}{\tau_{ij}+\sigma_{ik}}}a_{ijk}^{\frac{(\tau_{ij}+1)(1-\sigma_{ik})}{\tau_{ij}+\sigma_{ik}}}b_{ijk}^{\frac{(\tau_{ij}+1)(\sigma_{ik})}{\tau_{ij}+\sigma_{ik}}}ETC_{ijk}^{\frac{(\tau_{ij}+1)(\sigma_{ik})}{\tau_{ij}+\sigma_{ik}}} \tag{41}$$

In equation (41), $RM_{ik}=M_{ik}/PS_{ik}$ and $RX_{ij}=X_{ij}\ /\ PT_{ij}$.

APPENDIX 3: SEM FROM TOTAL TRADE VALUES AND NET CONFLICT

This appendix reports estimation results from SEM in which CC is measured as net conflict, which is the sum of conflict and cooperation emanating from an actor to a target. While economic agents are assumed to observe the overall levels of conflict and of cooperation in the six equations SEM, they are assumed to observe net conflicts from both directions in the four equations SEM. Moreover, whereas governments in the six equations SEM are assumed to act on separate conflict and cooperation scales, governments in this SEM are assumed to act on a net conflict measure. The notations in (A1) through (A4) follow chapter 7, except that NJK (NKJ) is net conflict from j to k (from k to j), and a_{is}, b_{is}, c_{js}, and d_{js} are regression coefficients. The following are the model's equations:

Equation (A1), trade flow from j to k:

$$TJK_t=a_0+\sum_{S=0}^{2}(a_{1s}RMK_{t-s}+a_{2s}RXJ_{t-s}+a_{3s}NJK_{t-s}+a_{4s}NKJ_{t-s}+a_{5s}ETJ_{t-s})+a_6t+u_{1t}$$

Equation (A2), trade flow from k to j:

$$TKJ_t=b_0+\sum_{S=0}^{2}(b_{1s}RMJ_{t-s}+b_{2s}RXK_{t-s}+b_{3s}NJK_{t-s}+b_{4s}NKJ_{t-s}+b_{5s}ETK_{t-s})+b_6t+u_{2t}$$

Equation (A3), net conflict flow from j to k:

$$NJK_t=c_0+\sum_{S=0}^{2}(c_{1s}TJK_{t-s}+c_{2s}TKJ_{t-s}+c_{3s}NKJ_{t-s})+\sum_{S=1}^{3}(c_{4s}NJK_{t-s})+u_{3t}$$

Equation (A4), net conflict flow from k to j:

$$NKJ_t=d_0+\sum_{S=0}^{2}(d_{1s}TJK_{t-s}+d_{2s}TKJ_{t-s}+d_{3s}NJK_{t-s})+\sum_{S=1}^{3}(d_{4s}NKJ_{t-s})+u_{4t}$$

The four equations SEM is estimated by two stage least squares with the consistent robust standard errors from Newey and West (1987). As before, three hypotheses are tested:

tests on individual coefficients, tests on groups of lags of each variable, and tests on sums of lags of each variable to investigate if they are different from zero. A significance level of 10 percent is used throughout. Results are reported in Tables A3-1 through A3-6.

Tables A3-1 and A3-2 report coefficients of the BT equations. There are altogether 20 cases. Results on the joint significance of lag coefficients and those on the sums of coefficients of lags, in the BT equations, are reported in Table A3-3; Panel A is for equation (A1) and Panel B is for equation (A2). Tables A3-4 and A3-5 report the coefficients of variables in the net conflict equations. Results on the joint significance of lag groups and those on the sums of lags in the net conflict equations are reported in Table A3-6, where Panel A is for equation (A4) and in Panel B is for equation (A5).

In Tables A3-1 and A3-2 At least one lag of RMK and RMJ is statistically significant in 13 cases and at least one lag of RXK and RXJ is significant in 14 cases. For NJK and NKJ, at least one lag is significant in 17 cases, and one lag of ETJ and ETK is significant in 17 cases. Out of 24 significant coefficients of RMK and RMJ, 15 are positive; and out of 23 significant coefficients of RXJ and RXK, 14 are positive. Out of 27 statistically significant coefficients of ETJ and ETK, 18 are positive. Out of 49 significant coefficients of lags of NKJ and NJK 28 are positive. For contemporaneous lags, 8 are positive out of 9 significant coefficients of RMK and RMJ, and 9 out of 13 significant coefficients of ETJ and ETK are positive.

In Table A3-1, the majority of groups of coefficients in (A1) and (A2) are statistically different from zero. Moreover, the hypothesis that lags of CC are jointly zero is rejected. For statistically significant results, 8 groups of lag coefficients of RMK, 8 of RMJ, 8 of RXJ, 8 of RXK, 12 of net conflict from exporter to importer, 13 of net conflict from importer to exporter, and 16 groups of lag coefficients of ETJ and ETK, combined, are jointly statistically different from zero. The majority of cases are also statistically different from zero at the 5 % level. Furthermore, in 15 trade flows out of 20, politics matters for trade. That is, in 15 dyads at least one group of lag coefficients of NKJ and/or NJK is statistically significantly different from zero. The signs of the majority of significant sums of coefficients of variables in Table A3-3 are consistent with our expectations. In 11 out of 13 significant cases, the sign of sums of coefficients of lags of ETJ and ETK is positive. Similarly, out of 13 significant cases, 9 sums of lag coefficients of RMK and RMJ are also positive. Hence, a reduction in tariffs, an appreciation of exporter currency, and an increase in importer multilateral income cause an increase in BT. The signs of RXJ, RXK, NKJ, and NJK are empirically ambiguous. In particular, in 10 cases cooperation increases BT while in 8 cases cooperation decreases BT.

In Tables A3-4 and A3-5, at least one coefficient of net conflict inertia is significant in 16 out of 20 cases, while at least one coefficient of net conflict reciprocity is significant in all cases. At least

one lag coefficient of BT is significant in 16 dyads. The sign of coefficients of conflict inertia is negative in 16 cases and positive in 8 cases. Reciprocity, however, is overwhelmingly positive as 33 out of 35 significant coefficients are positive. Similarly to the six equations SEM, export causes more net conflict or more cooperation from exporter to importer, while import causes less net conflict or

less cooperation from importer to exporter.

In Table A3-6, net conflict inertia weakly explains contemporaneous net conflict. Out of 20 flows, sums of lag coefficients of NJK in Panel A and those of NKJ in Panel B are statistically different from zero in 11 cases. The majority of the statistically significant sums of lag coefficients of net conflict inertia are negative. Therefore, for many dyads in the sample, net conflicts are attenuating over time. Most of the reciprocity sums are statistically significantly different from zero. Out of 20 net conflict flows, 18 are statistically different from zero and are all positive.

Finally, BT exerts a statistically significant effect on net conflict in all 10 dyads. Out of 7 significant sums of coefficients of export lags, 5 are positive. Yet, out of 10 significant sums of coefficients of import lags 6 are negative. Thus, bilateral export causes less conflict and more cooperation toward a trade partner, while bilateral import causes more conflict and less cooperation toward a trade partner.

Table A3-1. Coefficients of Equation (A1), Trade Flow From J to K.

Dyad	RMK	RXJ	NJK	NKJ	ETJ	a_0 / R^2
US-JA	0.340	0.766**	4.398*	-0.746	-0.464**	-10.403**
	-0.725**	1.159**	0.037	-0.427	0.722**	
	0.136	-0.290	1.846	-1.457	-0.709**	0.994
US-SU	8.658**	4.996**	-0.913	-0.977	1.411	-145.825**
	-1.377	-1.780	-0.562	0.514	-1.358	
	1.354*	-2.836**	3.255*	-0.844	-0.979	0.977
US-CH	3.770**	7.224	-0.832	12.020	5.058**	-184.636**
	-0.343	-2.219	-6.518	9.424	-1.815	
	-0.221	2.117	4.713	0.413	2.459	0.956
US-GE	0.178	0.147	-0.154	1.455	0.264	35.787**
	0.269	-0.266	-0.151	2.607**	0.201	
	0.019	-0.996**	-0.197	2.778	1.472*	0.988
JA-SU	3.427**	2.289	9.075	-0.669	-0.182	-203.018**
	4.273*	4.013	-3.043	0.083	-3.669*	
	3.573**	-2.805**	12.686	-1.798	-4.295	0.954
JA-CH	0.168	3.809**	42.457**	-35.41**	-1.222	81.404
	-0.135	-0.077	73.048*	-11.307	0.873	
	0.517	-6.391**	34.306**	5.512	1.706**	0.926
JA-GE	-0.185	0.523**	5.754	-35.803**	0.614**	5.729**
	0.426	-0.013	22.369**	-13.604	0.832**	
	-0.191	-0.071	-28.586*	55.740**	-0.226	0.998
GE-SU	2.650	0.976	7.510	-12.177	-7.346	-75.980**
	-1.262	-1.819	11.004	-15.551*	11.683	
	3.713	1.061	20.208	-14.428 *	-4.660	0.912
GE-CH	0.120	-0.858	46.565	-21.043	-7.837**	9.771
	1.715*	0.157	17.711**	-78.749**	7.043**	
	-1.118**	0.571	10.321**	13.305*	0.326	0.931
CH-SU	-0.233	1.021**	7.608**	-7.429**	0.989**	-32.127**
	0.907	0.129	6.756**	1.862	-0.580	
	1.665**	-0.625**	-0.330	8.735**	2.163**	0.984

Notes: Column headings match variable names in the equation. In each group of three numbers, the top is for lag 0, followed by lag 1 and lag 2. The constant term at the top and R^2 below are given in the last column, a_0 / R^2. Coefficients significant at the 5% (10%) are indicated by ** (*). The coefficients of NJK and NKJ are multiplied by 10,000.

Table A3-2. Coefficients in Equation (A2), Trade Flow From K to J.

Dyad	RMJ	RXK	NKJ	NJK	ETK	b_0 / R^2
US-JA	0.142	0.340	-1.230	3.678	0.752**	6.968
	0.015	0.237	-0.157	-1.786	-0.574*	
	-0.417	0.271	-0.959	1.337	0.548	0.996
US-SU	2.510**	-0.499	1.450*	-2.870**	-1.072*	-27.019**
	1.110	-0.200	-0.024	-0.114	-1.797**	
	-1.343**	0.556	-0.572	1.542**	-1.425**	0.956
US-CH	-2.667	3.563*	21.496**	-22.455*	1.836	112.450
	-1.726	0.823	7.545	-13.106*	-2.348	
	2.780	-8.521**	0.944	-0.940	5.195	0.929
US-GE	0.465*	-0.095	2.591**	-0.934	1.055**	9.814**
	0.118	0.069	0.312	-1.854	-0.461	
	-0.535*	0.456**	0.806	-2.408**	0.079	0.995
JA-SU	-1.540*	4.368**	-18.459	43.943**	-4.604**	-122.053**
	-2.234*	4.971**	-0.822	-2.736	0.208	
	-1.431	5.124**	-3.744	9.714	4.286**	0.961
JA-CH	0.432	1.586**	25.730**	-23.035*	-0.341	25.621*
	1.737**	-0.499	4.765	-14.817	1.314*	
	-1.813**	-1.757**	14.311**	-12.934*	-0.059	0.977
JA-GE	0.886**	-0.736	-42.617**	42.683**	0.391*	9,751
	0.023	0.383	-49.259**	39.768**	0.191	
	-0.552**	0.532*	-7.141	-10.825	0.073	0.994
GE-SU	1.909**	-4.697**	1.516	-11.826**	5.796**	26.678**
	0.262	0.711	0.266	-7.360**	-2.528	
	1.729**	-0.113	-5.693**	0.588	6.475**	0.984
GE-CH	0.164	0.629**	-8.824*	9.884	1.133**	21.061**
	-0.268	0.318	-9.136**	31.911**	0.443	
	-0.440	-0.388**	-1.499	17.637**	-0.480	0.990
CH-SU	0.742**	0.537	-5.111**	5.542**	0.746*	17.754**
	0.553	-0.217	0.169	5.603**	-0.432	
	-0.457**	-1.111	5.421**	0.410	-0.486	0.961

Notes: Column headings match variable names in the equation. In each group of three numbers, the top is for lag 0, followed by lag 1 and lag 2. The constant term at the top and R^2 below are given in the last column, b_0 / R^2. Coefficients significant at the 5% (10%) are indicated by ** (*). The coefficients of NJK and NKJ are multiplied by 10,000.

Table A3-3. Joint Significance and Sums of Lags Equations (A1) and (A2).

Panel A: Equation A1 (Trade Flow from J to K)

Dyad	RMK	RXJ	NJK	NKJ	ETJ
US-JA	0.000	0.000	0.298	0.695	0.010
	-0.249*	1.635**	6.282	-2.631	-0.450**
US-SU	0.000	0.002	0.309	0.458	0.870
	8.635**	0.360	1.779	-1.307	-0.926
US-CH	0.000	0.000	0.433	0.000	0.000
	3.205**	7.123**	-2.636	21.857**	5.702**
US-GE	0.000	0.036	0.622	0.013	0.000
	0.466**	-1.114**	-5.034	6.840**	1.937**
JA-SU	0.000	0.004	0.516	0.996	0.150
	11.274**	3.498	18.717	-2.385	-8.147
JA-CH	0.791	0.000	0.001	0.043	0.000
	-0.670	-2.658*	149.812**	-41.208*	1.356**
JA-GE	0.207	0.018	0.003	0.000	0.000
	0.049	0.439**	-0.462	6.332	1.220**
GE-SU	0.076	0.670	0.554	0.212	0.444
	5.100	0.217	38.718	-42.157	-0.322
GE-CH	0.000	0.681	0.000	0.000	0.000
	0.716**	-0.130	326.889**	-86.487**	-0.468
CH-SU	0.000	0.000	0.000	0.000	0.000
	2.339**	0.525**	14.034**	3.167	2.572**

Panel B: Equation A2 (Trade Flow from K to J)

Dyad	RMJ	RXK	NKJ	NJK	ETK
US-JA	0.418	0.001	0.604	0.158	0.000
	-0.260	0.848**	-2.416	3.229	0.727*
US-SU	0.000	0.953	0.238	0.000	0.000
	2.277**	-0.143	0.854	-1.442	-4.294**
US-CH	0.120	0.003	0.000	0.137	0.298
	-1.614	-4.134**	29.985**	-44.965*	4.683
US-GE	0.010	0.000	0.029	0.001	0.000
	0.049	0.430**	3.708	-5.196**	0.673**
JA-SU	0.000	0.000	0.096	0.000	0.000
	-5.205**	14.463**	-23.024*	50.921**	-0.109
JA-CH	0.017	0.000	0.017	0.378	0.028
	0.355	-0.670	44.806**	-50.789*	0.914**
JA-GE	0.000	0.392	0.001	0.008	0.000
	0.358	0.180	-99.019**	71.626**	0.654**
GE-SU	0.000	0.000	0.000	0.036	0.000
	3.901**	-4.099**	-3.916	-18.598**	9.744**
GE-CH	0.000	0.000	0.008	0.000	0.079
	-0.545**	0.559**	-19.458	-59.431**	1.096**
CH-SU	0.000	0.018	0.019	0.000	0.000
	8.380**	-0.792**	2.000	11.556**	-0.172

Notes: See notes to Tables A3-1 and A3-2. The top value is the joint significance level and the bottom figure is that of the sum of coefficients of all lags.

Table A3-4. Coefficients in Equation (A3), Net Conflict From J to K.

Dyad	NJK	NKJ	TJK	TKJ	c_0 / R^2
US-JA	0.010	0.714**	-223.367*	92.476	1484.804**
	-0.417**	0.125	223.917**	-72.73	
	0.257**	0.209**	36.289	-97.509	0.670
US-SU	-0.253**	0.722**	206.864**	-142.244	15394.823**
	0.004	0.202**	-12.108	-581.189**	
	-0.034	0.083	280.081**	-571.130*	0.866
US-CH	0.409**	0.398**	113.713**	10.532	92.357
	-0.168**	-0.434**	-91.121*	-14.324	
	-0.141	0.100**	43.964	-56.121**	0.761
US-GE	0.045	0.544**	-90.289	-31.736	2695.144**
	-0.090	-0.022	-257.687**	-260.429	
	-0.287**	0.124	269.364**	267.327**	0.570
JA-SU	0.241	0.709**	-14.573	125.397	-101.436
	-0.333	-0.058	-3.371	-85.412	
	0.211*	0.333*	-29.807	25.451	0.658
JA-CH	-0.453**	0.778**	19.850	-12.040	483.856**
	-0.537**	0.009	-0.782	-12.986	
	-0.249**	0.286**	39.177**	-61.878**	0.717
JA-GE	-0.094	0.934**	-5.014	16.224*	-13.788
	-0.069	0.079	13.185	-17.028**	
	-0.331**	0.143	-22.201**	18.758**	0.813
GE-SU	-0.050	0.818*	45.015	-125.690**	1014.232*
	0.088	0.157*	-105.453	28.351	
	0.016	-0.098	24.758	88.818	0.813
GE-CH	-0.382*	0.353**	6.009	-11.105	-256.946**
	-0.376*	0.002	25.722**	10.971	
	-0.056	0.135	-25.120**	6.240	0.713
CH-SU	0.243**	1.035**	105.108	96.666	-2012.451**
	0.036	-0.592**	103.519	-83.100	
	0.122*	-0.094	-328.638**	211.477	0.915

Notes: Column headings match variable names in the equation. In each group of three numbers, the top is for lag 0, followed by lag 1 and lag 2, except for the group of lag coefficients of NJK, which are for lags 1 through 3. The constant term at the top and R^2 below are given in the last column, c_0 / R^2. Coefficients significant at the 5% (10%) are indicated by ** (*).

Table A3-5. Coefficients in Equation (A4), Net Conflict From K to J.

Dyad	NKJ	NJK	TKJ	TJK	d_0 / R^2
US-JA	-0.098	0.927**	-115.156	365.497**	-1952.039**
	-0.279**	0.168*	57.072	-349.848**	
	-0.199**	0.386**	157.738	-58.694	0.679
US-SU	-0.248	1.127**	385.457	-190.262**	-19733.919**
	-0.055	0.458**	505.880*	- 76.660	
	-0.037	-0.013	755.355*	-336.417**	0.855
US-CH	0.616**	0.893**	-14.077	-14.077	-1008.525**
	-0.060	-0.808**	-169.894*	156.439**	
	-0.099	-0.016	121.634**	-86.768**	0.771
US-GE	0.172*	0.314*	-59.072	-86.675	363.579
	-0.534**	-0.267	168.384	267.380**	
	-0.056	0.406*	-39.915	-264.875**	0.514
JA-SU	0.055	0.816**	-62.496	1.732	100.947
	-0.164	-0.006	42.672	12.514	
	-0.251**	0.110	6.118	-6.440	0.533
JA-CH	0.090	0.883**	57.708	-28.374	-389.887**
	-0.380**	0.391**	-5.880	5.822	
	0.192	0.601**	18.197	-24.816	0.741
JA-GE	-0.189	0.725*	-13.872*	5.507	28.423
	0.053	0.213	17.468*	-27.870**	
	0.220**	0.010	-14.393**	30.213**	0.783
GE-SU	-0.267*	1.015*	189.520**	-52.579	-1633.576**
	0.090	0.187**	-40.090	146.488	
	-0.033	-0.061	-129.422	-42.217	0.843
GE-CH	-0.100	1.086**	8.617	-0.456	-248.251
	-0.182	0.351	5.595	-20.566	
	-0.192	0.111	8.496	8.888	0.580
CH-SU	0.142	0.549**	31.955	158.358	-781.044
	-0.034	-0.093	-30.457	-354.936**	
	-0.085	0.229**	8.701	226.228*	0.916

Notes: Column headings match variable names in the equation. In each group of three numbers, the top is for lag 0, followed by lag 1 and lag 2, except for the group of lag coefficients of NKJ, which are for lags 1 through 3. The constant term at the top and R^2 below are given in the last column, d_0 / R^2. Coefficients significant at the 5% (10%) are indicated by ** (*).

Table A3-6. Joint Significance and Sum of Lags in Equations (A3) and (A4).

Panel A: Equation A3 (Net Conflict Flow from J to K)

Dyad	NJK	NKJ	TJK	TKJ
US-JA	0.000	0.000	0.003	0.023
	-0.150	1.048**	36.839	-77.766*
US-SU	0.178	0.000	0.000	0.000
	-0.283*	1.006**	474.837**	-1294.562**
US-CH	0.007	0.000	0.000	0.007
	0.100	0.065	66.561**	-59.913**
US-GE	0.000	0.003	0.016	0.206
	-0.331**	0.647**	-78.611	-24.838
JA-SU	0.193	0.000	0.695	0.693
	0.119	O.984**	-47.752	65.437
JA-CH	0.002	0.000	0.000	0.000
	-1.240**	1.074**	58.244**	-86.904**
JA-GE	0.000	0.000	0.052	0.000
	-0.494*	1.157**	-14.030**	17.954**
GE-SU	0.531	0.000	0.570	0.016
	0.055	0.877**	-35.680	-8.519
GE-CH	0.000	0.003	0.000	0.794
	-0.814**	0.490**	6.690	6.106
CH-SU	0.142	0.000	0.095	0.032
	0.369**	0.349**	-120.011**	225.043**

Panel B: Equation A4 (Net Conflict Flow from K to J)

Dyad	NKJ	NJK	TKJ	TJK
US-JA	0.002	0.000	0.292	0.005
	-0.577**	1.481**	99.654	-43.046
US-SU	0.327	0.000	0.000	0.000
	-0.339*	1.572**	1646.691**	-603.339**
US-CH	0.000	0.000	0.107	0.000
	0.457**	0.069	-8.363	55.594
US-GE	0.000	0.000	0.732	0.154
	-0.417*	0.454*	69.397	-84.170
JA-SU	0.018	0.000	0.725	0.711
	-0.359**	0.920**	7.807	-13.706
JA-CH	0.004	0.000	0.041	0.133
	-0.098	1.877**	70.024**	-47.368**
JA-GE	0.006	0.000	0.004	0.002
	0.084	0.949**	-10.796	7.851*
GE-SU	0.000	0.000	0.001	0.311
	-0.210	1.142**	20.008	51.691*
GE-CH	0.066	0.000	0.532	0.286
	-0.474	1.548**	22.808	-12.133
CH-SU	0.417	0.000	0.996	0.142
	0.023	0.689**	10.199	29.649

Notes: See notes to Tables A3-4 and A3-5. The top value is the joint significance level and the bottom figure is that of the sum of coefficients of all lags.

APPENDIX 4: SEM FROM TOTAL TRADE VOLUMES

This appendix presents estimation results of lags coefficients, sums of lags coefficients, and joint significance of lags coefficients for the SEM from total trade volumes which was presented and disscused in Chapter 8. Lags coefficients are reported per equation in Tables A4-1 and A4-2 for total BT demand, 3-4 for total BT supply, and in Tables A4-7 and A4-8 for CC. Sums and joint significance of lags coefficients are reported in Table A4-5 for total BT demand and supply and in Table A4-9 for CC. Results are from net conflict as the measure of CC.

Table A4-1. Coefficients of Equation 1, Demand of K from J.

Dyad	PJK	RMK	NJK	NKJ	ETK	a_0 / R^2
US-JA	0.055	0.237*	1.787**	-0.744	0.055	-10.091**
	0.168**	0.470**	1.054	-2.555**	0.168**	
	-0.657**				-0.657**	0.888
US-GE	-0.229**	0.409**	-1.067**	-1.183**	-0.229**	-10.810**
	0.096	0.182	-3.334**	-0.464	0.096	
	-0.102				-0.102	0.954
JA-GE	-0.284**	1.205**	33.496**	-91.667**	-0.284**	-42.471**
	-0.117*	0.998**	-66.523**	90.728**	-0.117*	
	0.572**				0.572**	0.983
US-SU	0.319*	2.380**	3.452**	-1.443**	0.319*	-45.884
	-0.907**	0.082	1.708**	-0.915**	-0.907**	
	0.765**				0.765**	0.921
JA-SU	-0.869**	0.890**	-6.209*	-3.918**	-0.869**	-61.549*
	-0.516**	1.879*	2.783**	-6.183**	-0.516**	
	-0.652*				-0.652*	0.940
GE-SU	0.710**	0.574**	-5.253**	9.228**	0.710**	-9.904**
	-0.773**	-1.047**	-7.633**	11.020**	-0.773**	
	1.122**				1.122**	0.840

Notes: Headings match variables' names. In each group of numbers, the top is for lag 0, followed by lag 1 and, for BT price, by lag 2. Significance is from a one tail t test. The constant term at the top and R^2 below are given under a_0 / R^2. K is the second country in a dyad and J is the first. Significance at the 5 % (10%) is indicated by ** (*). NJK and NKJ's coefficients are multiplied by 10^4.

Table A4-2. Coefficients of Equation 2, Demand of J from K.

Dyad	PKJ	RMJ	NKJ	NJK	ETJ	b_0 / R^2
US-JA	0.056	-0.160	5.601**	-4.331*	0.056	8.963*
	0.564**	-0.689**	3.835**	-10.505**	0.564**	
	-0.312**				-0.312**	0.216
US-GE	-0.676**	0.822**	0.418	-1.917**	-0.676**	-51.280
	0.281**	1.097*	0.287	1.593**	0.281**	
	-0.286**				-0.286**	0.632
JA-GE	-0.215**	2.220**	31.663**	0.246	-0.215**	-22.437**
	0.054	-1.135	-67.549**	60.181**	0.054	
	0.328**				0.328**	0.950
US-SU	-0.515**	1.193**	-0.359	-0.067	-0.515**	-27.801
	-0.271	0.357	1.076**	-0.996**	-0.271	
	-0.011				-0.011	0.917
JA-SU	-0.860**	1.649**	-0.551	7.006**	-0.860**	-14.336**
	0.832**	-0.905	-3.449**	6.245**	0.832**	
	-0.059				-0.059	0.795
GE-SU	0.066*	1.191**	5.338**	-7.160**	0.066*	-28.675**
	-0.450**	0.307**	2.566**	-5.225**	-0.450**	
	-0.252**				-0.252**	0.948

Notes: Headings match variable names. In each group of numbers, the top is for lag 0, followed by lag 1 and, for BT price, by lag 2. Significance is from one tail t test. The constant term at the top and R^2 below are given under b_0 / R^2. K is the second country in a dyad and J is the first. Significance at the 5 % (10%) is indicated by ** (*). NJK and NKJ's coefficients are multiplied by 10^4.

Table A4-3. Coefficients of Equation 3, Supply of J to K.

Dyad	PJK	RXJ	NJK	NKJ	c_0 / R^2
US-JA	-0.618**	0.727**	-1.720	5.028**	-12.931**
	0.186	0.458	0.645	3.992**	
	0.411**				0.889
US-GE	-0.176	0.378**	-2.318**	-0.896	-9.591**
	0.009	0.396**	-3.653**	1.068**	
	-0.132				0.929
JA-GE	0.838**	0.675**	10.832	-6.126	-14.522*
	-0.572*	0.067	-13.164	-31.557	
	0.589**				0.983
US-SU	-0.464*	2.771**	13.039**	0.419	-45.164**
	0.235	-0.517*	32.368**	-2.188**	
	1.319**				0.958
JA-SU	-0.173	0.807**	-5.334*	-0.795	-24.885
	0.229	0.482	2.429	-5.175	
	-0.331**				0.961
GE-SU	0.654*	0.726**	-7.813**	6.687**	-16.028
	0.102	0.092	-5.734**	6.762**	
	-0.533				0.926

Notes: Headings match variable names. In each group of numbers, the top is for lag 0, followed by lag 1 and, for BT price, by lag 2. Significance is from one tail t test. The constant term at the top and R^2 below are given under c_0 / R^2. K is the second country in a dyad and J is the first. Significance at the 5 % (10%) is indicated by ** (*). NJK and NKJ's coefficients are multiplied by 10^4.

Table A4-4. Coefficients of Equation 4, Supply of K to J.

Dyad	PKJ	RXK	NKJ	NJK	d_0 / R^2
US-JA	-0.619**	1.211**	1.897**	0.428	-27.529**
	0.111	0.229	-0.583	0.643	
	-0.140				0.930
US-GE	0.253	2.523**	0.007	-1.880**	-27.185**
	-1.292**	-1.151**	0.082	1.847	
	0.579**				0.869
JA-GE	-0.215*	2.220**	31.664**	0.246	-22.437**
	0.054	-1.135**	-67.548**	60.181**	
	0.327**				0.950
US-SU	-0.728**	0.269	0.457	0.261	-25.361**
	0.441	1.086**	-0.126	0.489*	
	0.346				0.923
JA-SU	-0.705**	0.320**	-0.957	6.219**	-25.158**
	-0.202	1.033**	-0.940	3.590**	
	0.149				0.948
GE-SU	-0.126	0.926**	5.065**	-4.983**	-23.429**
	-0.034	0.331	5.812**	-6.059**	
	-0.324**				0.958

Notes: Headings match variable names. In each group of numbers, the top is for lag 0, followed by lag 1 and, for BT price, by lag 2. Significance is from one tail t test. The constant term at the top and R^2 below are given under d_0 / R^2. K is the second country in a dyad and J is the first. Significance at the 5 % (10%) is indicated by ** (*). NJK and NKJ's coefficients are multiplied by 10^4.

Table A4-5. Joint Significance and Sums of Coefficients of Lags in Demand.

Panel A: Equation 1 (Demand of K from J)

Dyad	PJK	RMK	NJK	NKJ	ETK
US-JA	0.001	0.000	0.000	0.000	0.000
	-0.434**	0.707**	0.944**	-3.299**	-0.434**
US-GE	0.000	0.000	0.000	0.000	0.000
	-0.235**	0.591**	-0.234**	-1.647**	-0.234**
JA-GE	0.000	0.000	0.000	0.000	0.000
	0.171**	2.209**	-33.027**	1.984	0.171**
US-SU	0.000	0.000	0.000	0.000	0.000
	0.176**	2.462	5.160**	-2.359**	0.176**
JA-SU	0.000	0.000	0.000	0.000	0.000
	-2.037**	2.770**	-3.425**	-1.501**	-2.037**
GE-SU	0.000	0.000	0.000	0.000	0.000
	1.056**	-0.473**	-12.887**	20.249**	1.056**

Panel B: Equation 2 (Demand of J from K)

Dyad	PKJ	RMJ	NKJ	NJK	ETJ
US-JA	0.120	0.000	0.000	0.000	0.000
	0.310**	-0.894**	9.440**	-14.835**	0.310**
US-GE	0.000	0.000	0.044	0.406	0.000
	-0.681**	1.920**	0.705	-0.323	-0.681**
JA-GE	0.000	0.000	0.027	0.000	0.000
	0.167**	1.086**	-35.885**	60.427**	0.167**
US-SU	0.014	0.000	0.000	0.000	0.014
	-0.797**	1.560**	0.717	-1.062**	-0.797**
JA-SU	0.000	0.000	0.000	0.000	0.000
	-0.087**	0.744**	-4.000**	13.251**	-0.087**
GE-SU	0.000	0.000	0.000	0.000	0.000
	-0.636**	1.498**	7.905**	-12.385**	-0.636**

Note: Headings match variables in the equation reported. The top figure is the joint significance and the bottom figure is the value of sum of lags' coefficients. K is the second country in a dyad and J is the first. Sums significant at the 5 % (10%) are indicated by ** (*). Significance levels of sums of coefficients are from one tail t test. Sums of NJK and NKJ's coefficients are multiplied by 10^4.

Table A4-6. Joint Significance and Sums of Coefficients of Lags in Supply.

Panel A: Equation 3 (Supply of J to K)

Dyad	PJK	RXJ	NJK	NKJ
US-JA	0.000	0.000	0.660	0.006
	-0.021	1.843**	-1.075	2.830**
US-GE	0.625	0.001	0.000	0.001
	-0.298	0.774**	-5.971**	0.172
JA-GE	0.000	0.000	0.754	0.631
	0.856**	0.184**	-2.331	43.755
US-SU	0.000	0.000	0.000	0.000
	1.091**	2.254**	4.541**	-1.769**
JA-SU	0.000	0.165	0.001	0.020
	-0.275	1.290**	-2.911	-2.944*
GE-SU	0.343	0.139	0.005	0.041
	0.222	0.818*	-13.548**	13.448**

Panel B: Equation 4 (Supply of K to J)

Dyad	PKJ	RXK	NKJ	NJK
US-JA	0.000	0.000	0.001	0.001
	-0.649*	1.441**	1.313	1.071
US-GE	0.000	0.000	0.994	0.102
	-0.459	1.371**	0.089	-0.032
JA-GE	0.132	0.000	0.265	0.758
	0.098	1.198**	60.604	17.364
US-SU	0.026	0.005	0.565	0.058
	0.059	1.355**	0.330	0.750
JA-SU	0.000	0.000	0.050	0.000
	-0.758**	1.353**	-1.897**	9.809**
GE-SU	0.000	0.000	0.000	0.000
	-0.483	1.257**	10.878**	-11.042**

Note: Headings match variables in the equation reported. The top figure is the joint significance and the bottom figure is the value of sum of lags' coefficients. K is the second country in a dyad and J is the first. Sums significant at the 5 % (10%) are indicated by ** (*). Significance levels of sums of coefficients are from one tail t test. Sums of NJK and NKJ's coefficients are multiplied by 10^4.

Table A4-7. Coefficients of Equation 5, Net Conflict from J to K.

Dyad	NJK	NKJ	QJK	QKJ	PJK	PKJ	e_0 / R^2
US-JA	0.085	0.753**	-420.235**	213.264	-316.910	418.313**	64.865
	-0.221**	0.110	402.929	-351.958	490.651	-449.513**	0.689
US-GE	-0.322**	0.082**	-173.506	53.502	1147.692	-172.036	209.824**
	-0.183	-0.038	110.873	-253.614	-172.036	-1247.183	0.388
JA-GE	0.257*	0.807**	64.872**	8.348	91.605**	-84.178**	-5.932
	-0.154	-0.506**	-50.250**	-4.518	-74.522**	38.648	0.873
US-SU	-0.112	0.944**	221.120*	-19.816	-885.386	5007.319**	-268.920
	0.302**	0.043	-613.108**	-1752.769**	-458.784	-1520.911*	0.946
JA-SU	-0.067	0.338*	169.079	304.004**	494.610**	13.011	130.220**
	-0.169	0.102	-229.661**	-91.819	-715.473**	8.758	0.774
GE-SU	-0.445**	0.942**	-215.837	-238.763**	644.077**	51.040	-41.107
	0.049	0.409**	26.274	105.286	-328.662**	-205.935*	0.854

Notes: Column headings match names in the equation. In each group of numbers, the top is for lag 0, followed by lag 1. In the case of NJK the figures are for lags 1 and 2. Significance levels from two tailed t tests. The constant term at the top and R^2 below are given under e_0 / R^2. K is the second country in a dyad and J is the first. Coefficients significant at 5 % (10%) are indicated by ** (*).

Table A4-8. Coefficients of Equation 6, Net Conflict from K to J.

Dyad	NKJ	NJK	QKJ	QJK	PKJ	PJK	f_0 / R^2
US-JA	0.110	0.688**	-6.073	569.716**	-323.038	143.362	106.507**
	-0.161*	0.019	237.727*	-429.047**	320.386	-500.674**	0.766
US-GE	-0.075	0.142	125.198	-279.844	525.946	1853.436**	76.296
	-0.248**	-0.692**	-353.930**	355.017**	-2938.626**	1573.711**	0.581
JA-GE	0.244	0.827**	-12.307	-33.220	46.318	-62.278	7.031
	-0.012	-0.199	7.063	30.827*	-58.450**	85.028**	0.804
US-SU	0.089	0.833**	-321.816	157.734	-4243.736**	817.282**	581.569**
	-0.262**	0.037	1967.168**	358.500	610.961	22.414	0.954
JA-SU	-0.009	0.509**	-129.733	13.187	-268.992*	141.604	101.994**
	-0.100	0.068	108.538	148.523	-47.442	-120.936	0.613
GE-SU	-0.509**	0.821**	290.372**	156.539	-36.507	-623.286**	95.997*
	-0.102*	0.571	3.212	24.193	187.078**	189.364*	0.868

Notes: Column headings match names in the equation. In each group of numbers, the top is for lag 0, followed by lag 1. In the case of NKJ the figures are for lags 1 and 2. Significance levels from two tailed t tests. The constant term at the top and R^2 below are given under f_0 / R^2. K is the second country in a dyad and J is the first. Coefficients significant at 5 % (10%) are indicated by ** (*).

Table A4-9. Joint Significance and Sums of Lags in Net Conflict.

Panel A: Equation 5 (Net conflict from J to K)

Dyad	NJK	NKJ	QJK	QKJ	PJK	PKJ
US-JA	0.182	0.000	0.044	0.254	0.319	0.015
	-0.135	0.863**	-17.306	-138.694	173.741	-31.201
US-GE	0.116	0.557	0.806	0.280	0.066	0.017
	-0.505*	0.043	-62.633	-200.112	2038.422**	-1419.220**
JA-GE	0.205	0.000	0.058	0.569	0.000	0.000
	0.103	0.301	13.622	3.830	17.082	-45.529
US-SU	0.000	0.000	0.007	0.000	0.000	0.000
	0.189	0.988**	-391.988**	-1772.586**	-1344.170**	3486.408**
JA-SU	0.253	0.150	0.113	0.000	0.004	0.955
	-0.236	0.440**	-60.583	212.185**	-220.863	21.770
GE-SU	0.000	0.000	0.259	0.002	0.005	0.202
	-0.395**	1.352**	-189.562	-133.477	315.415	-154.895

Panel B: Equation 6 (Net conflict from K to J)

Dyad	NKJ	NJK	QKJ	QJK	PKJ	PJK
US-JA	0.195	0.000	0.015	0.000	0.360	0.003
	-0.051	0.707**	231.654**	140.668	-2.652	-357.312**
US-GE	0.055	0.000	0.001	0.052	0.003	0.041
	-0.323*	-0.550**	-228.732**	75.173	-2412.680**	3427.148**
JA-GE	0.113	0.000	0.349	0.083	0.003	0.000
	0.231	0.627**	-5.244	-2.393	-12.132	22.750
US-SU	0.000	0.000	0.000	0.128	0.000	0.000
	-0.173*	0.869**	1645.352**	516.235*	-3632.775**	839.696**
JA-SU	0.340	0.001	0.715	0.046	0.104	0.782
	-0.111	0.578**	-21.195	161.710**	-316.435**	20.667
GE-SU	0.000	0.000	0.000	0.383	0.002	0.003
	-0.611**	1.393**	293.584**	180.732	150.571**	-433.921**

Note: Column headings match variable names in the equation. The top figure is the joint significance level and the bottom figure is the value of the sum of lags' coefficients. K is the second country in a dyad and J is the first. Sums significant at the 5 % (10%) are indicated by ** (*). Significance levels are from two tailed t test.

APPENDIX 5: SEM FROM DISAGGREGATED TRADE VOLUMES

This appendix presents estimation results of SEM from disaggregated trade volumes which was presented in chapter 9. Sums of lags coefficients and the joint significance level of groups of lags coefficients in the model are reported in Tables A5-1 through A5-18. Tables A5-1 through A5-6 report estimation results from the U.S.-Japan dyad, Tables A5-7 through A5-12 from the U.S.-Germany dyad, and Tables A5-13 through A5-18 report estimation results from the Japan-Germany dyad. For each dyad, the first table reports results from estimation of the demand equation of nation A from nation B, the second from the supply of B to A, the third from the demand of B from A, the fourth from the supply of A to B, the fifth table from the net conflict sent from A to B, and the sixth table reports results from the estimation of the net conflict equation sent from nation B to nation A. Goods are identified by their Italianer's nomenclature (A, E, Q, K , C).

Tables A5-19 through A5-36 follow the structure of tables A5-1 through A5-18 but report results from individual lags coefficients for each estimated equation in the model. Tables A5-19 through A5-24 report individual lags coefficients from the estimation of the model for the U.S.-Japan dyad, Tables A5-25 through A5-30 from the U.S.-Germany dyad, and Tables A5-31 through A5-36 report lags coefficients from the estimation of the model for the Japan-Germany dyad.

Table A5-1. Joint Significant and Sums of Lags Coefficients, Demand of Japan (K) from US (J).

Good	RMK	PJK	NKJ	NJK	ETK
A	1.221*	0.023	1.354*	-1.718*	0.023
	0.000	0.000	0.000	0.000	0.000
E	0.270**	-0.943**	9.111**	-6.835**	-0.943**
	0.000	0.000	0.006	0.010	0.000
Q	0.961**	0.336**	-3.006**	1.144	0.336**
	0.000	0.000	0.000	0.317	0.000
K	0.883**	-0.043**	-2.341**	2.235**	-0.043**
	0.000	0.000	0.001	0.000	0.000
C	0.866*	0.124**	-1.271	2.268**	0.124**
	0.000	0.000	0.000	0.000	0.000

Notes: Headings match equation's names. In each two numbers group, the top is the sum of lags coefficients and the bottom is the joint significance. Net conflicts entries are multiplied by 10,000. Significance at the 5% (10%) from a one tail t test is indicated by ** (*).

Table A5-2. Joint Significance and Sums of Lags Coefficients, Supply of US (J) to Japan (K).

Good	RXJ	PJK	NKJ	NJK
A	0.772**	0.179*	9.939**	-4.391*
	0.000	0.000	0.000	0.116
E	0.477*	-0.116	-2.648	2.400
	0.278	0.002	0.835	0.836
Q	0.286**	0.569**	7.994**	-2.948
	0.017	0.000	0.000	0.318
K	0.780**	-0.135	9.523*	-1.617
	0.000	0.000	0.165	0.697
C	0.956**	0.288**	6.946**	-1.064
	0.000	0.000	0.000	0.736

Notes: Headings match equation's names. In each two numbers group, the top is the sum of lags coefficients and the bottom is the joint significance. Net conflicts entries are multiplied by 10,000. Significance at the 5% (10%) from a one tail t test is indicated by ** (*).

Table A5-3. Joint Significance and Sums of Lags Coefficients, Demand of US (J) from Japan (K).

Good	RMJ	PKJ	NKJ	NJK	ETJ
A	-0.230	-0.523**	5.715**	7.092**	-0.523**
	0.000	0.000	0.000	0.050	0.000
E	-0.007	-5.272**	25.517**	-39.590**	-5.272**
	0.000	0.000	0.000	0.000	0.000
Q	1.154**	-0.413**	1.109**	-3.155**	-0.413**
	0.000	0.000	0.000	0.000	0.000
K	0.508**	0.000	8.420**	-2.302**	0.000
	0.000	0.000	0.000	0.000	0.000
C	0.386**	-0.477**	8.463**	-3.224**	-0.477**
	0.000	0.000	0.000	0.008	0.000

Notes: Headings match equation's names. In each two numbers group, the top is the sum of lags coefficients and the bottom is the joint significance. Net conflicts entries are multiplied by 10,000. Significance at the 5% (10%) from a one tail t test is indicated by ** (*).

Table A5-4. Joint Significance and Sums of Lags Coefficients, Supply of Japan (K) to US (J).

Good	RXK	PKJ	NKJ	NJK
A	0.884**	-0.387**	-1.912	5.989**
	0.000	0.000	0.180	0.050
E	0.584	-2.356	12.793	-16.526
	0.585	0.424	0.346	0.154
Q	0.521**	-0.055*	0.285	-0.171
	0.000	0.005	0.002	0.059
K	1.168**	-0.286**	2.540**	-2.078
	0.000	0.000	0.109	0.001
C	0.633**	-0.268**	9.950**	-6.688**
	0.000	0.000	0.000	0.000

Notes: Headings match equation's names. In each two numbers group, the top is the sum of lags coefficients and the bottom is the joint significance. Net conflicts entries are multiplied by 10,000. Significance at the 5% (10%) from a one tail t test is indicated by ** (*).

Table A5-5. Joint Significance and Sums of Lags Coefficients, Net Conflict from US (J) to Japan (K).

Good	NJK	NKJ	QKJ	QJK	PKJ	PJK
A	-0.133	0.757**	263.282**	-1.938	75.958	127.480
	0.275	0.002	0.007	0.996	0.003	0.044
E	-0.431**	0.804**	-28.212	1.800	47.314	25.274
	0.039	0.000	0.134	0.001	0.494	0.571
Q	-0.330*	0.902**	71.527	-329.869*	791.670	-672.618*
	0.187	0.000	0.000	0.183	0.122	0.084
K	-0.182	0.673**	-9.421	62.450	-44.193	-42.541
	0.076	0.000	0.034	0.000	0.003	0.000
C	-0.152	0.727**	-324.938*	67.852	1142.351	-1575.509
	0.067	0.000	0.021	0.713	0.367	0.005

Notes: Headings match equation names. In each two numbers, the top is the sum of lags coefficients and the bottom is the joint significance. Significance from two tail t test at the 5% (10%) is indicated by ** (*).

Table A5-6. Joint Significance and Sums of Lags Coefficients, Net Conflict from Japan (K) to US (J).

Good	NKJ	NJK	QKJ	QJK	PKJ	PJK
A	-0.534**	1.182**	-84.753	216.878	37.230	-379.530**
	0.000	0.000	0.126	0.001	0. 927	0.003
E	-0.287**	1.178**	86.972**	54.567	-25.702	-160.782**
	0.000	0.000	0.006	0.444	0.383	0.106
Q	-0.093	0.730**	268.858**	408.880**	-571.000**	207.538
	0.476	0.000	0.055	0.000	0.021	0.453
K	-0.026	0.691**	70.473	165.798	-161.320	-131.866
	0.000	0.000	0.714	0.086	0.000	0.281
C	-0.260	0.770**	394.710*	121.937	-987.672	1091.318
	0.266	0.000	0.052	0.207	0 .527	0.533

Notes: Headings match equation names. In each two numbers, the top is the sum of lags coefficients and the bottom is the joint significance. Significance from two tail t test at the 5% (10%) is indicated by ** (*).

Table A5-7. Joint Significance and Sums of Lags Coefficients, Demand of Germany (K) from US (J).

Good	RMK	PJK	NKJ	NJK	ETK
A	-1.335*	-0.972**	3.770**	-8.521**	-0.972**
	0.002	0.029	0.000	0.024	0.029
E	1.274**	0.992**	-4.440**	2.496**	0.992**
	0.000	0.000	0.000	0.000	0.000
Q	0.392**	-0.052	0.000	-4.939**	-0.052
	0.000	0.010	0.181	0.000	0.010
K	0.706**	-0.216**	-0.482**	-4.427**	-0.216**
	0.000	0.000	0.076	0.000	0.000
C	0.556**	-0.371**	-5.474**	-6.284**	-0.371**
	0.000	0.000	0.000	0.003	0.000

Notes: Headings match equation names. In each two numbers, the top is the sum of lags coefficients and the bottom is the joint significance. Significance from a one tail t test at the 5% (10%) is indicated by ** (*). Entries of net conflicts are multiplied by 10,000.

Table A5-8. Joint Significance and Sums of Lags Coefficients, Supply of US (J) to Germany (K).

Good	RXJ	PJK	NKJ	NJK
A	0.032	0.149	4.279**	2.421
	0.579	0.900	0.103	0.611
E	-0.374	0.388**	-0.862	3.378
	0.289	0.029	0.296	0.708
Q	1.186**	-0.634**	1.158*	-5.532**
	0.000	0.000	0.157	0.000
K	0.316**	0.594**	3.025**	-7.640**
	0.004	0.000	0.004	0.000
C	0.410*	0.530	-2.008*	-10.763**
	0.232	0.002	0.192	0.001

Notes: Headings match equation names. In each two numbers, the top is the sum of lags coefficients and the bottom is the joint significance. Significance from a one tail t test at the 5% (10%) is indicated by ** (*). Entries of net conflicts are multiplied by 10,000.

Table A5-9. Joint Significance and Sums of Lags Coefficients, Demand of US (J) from Germany (K).

Good	RMJ	PKJ	NKJ	NJK	ETJ
A	2.186**	0.990**	11.600**	3.292	0.990**
	0.000	0.000	0.000	0.000	0.000
E	5.038**	-0.518**	19.075**	50.000**	-0.518**
	0.000	0.022	0.010	0.000	0.022
Q	1.231**	-0.189**	2.030**	-2.762**	-0.189**
	0.000	0.000	0.000	0.000	0.000
K	0.618**	-0.324**	0.648	1.008	-0.324**
	0.000	0.012	0.606	0.473	0.012
C	1.213**	-0.740**	-2.119**	-4.224**	-0.741**
	0.000	0.000	0.000	0.000	0.000

Notes: Headings match equation names. In each two numbers, the top is the sum of lags coefficients and the bottom is the joint significance. Significance from a one tail t test at the 5% (10%) is indicated by ** (*). Entries of net conflicts are multiplied by 10,000.

Table A5-10. Joint Significance and Sums of Lags Coefficients, Supply of Germany (K) to US (J).

Good	RXK	PKJ	NKJ	NJK
A	0.745**	0.888**	-0.101	-2.597
	0.000	0.023	0.994	0.067
E	0.576	2.215**	42.71**	39.185**
	0.000	0.000	0.000	0.000
Q	1.406**	-0.532**	1.235*	-2.901**
	0.000	0.000	0.138	0.001
K	1.157**	-0.221	-1.587	2.562
	0.000	0.000	0.567	0.385
C	1.941**	-2.074**	-3.100**	-6.721**
	0.000	0.000	0.020	0.048

Notes: Headings match equation names. In each two numbers, the top is the sum of lags coefficients and the bottom is the joint significance. Significance from a one tail t test at the 5% (10%) is indicated by ** (*). Entries of net conflicts are multiplied by 10,000.

Table A5-11. Joint Significance and Sums of Lags Coefficients, Net Conflict from US (J) to Germany (K).

Good	NJK	NKJ	QKJ	QJK	PKJ	PJK
A	-0.206	0.231	189.273*	296.065*	-631.148**	-161.818
	0.666	0.327	0.000	0.007	0.032	0.624
E	-0.197	0.285**	9.800	76.364	8.224	-167.883**
	0.466	0.001	0.854	0.023	0.040	0.040
Q	-0.242*	0.144	34.308	-175.684	-46.794	-75.025
	0.184	0.084	0.702	0.354	0.941	0.904
K	-0.435	0.098	70.996	-251.622	41.736	4.525
	0.359	0.050	0.905	0.009	0.691	0.555
C	-0.583**	0.342**	-136.072**	-15.346	-679.410**	1054.148**
	0.001	0.037	0.061	0.921	0.033	0.014

Notes: Headings match equation names. In each two numbers, the top is the sum of lags coefficients and the bottom is the joint significance. Significance from two tail t test at the 5% (10%) is indicated by ** (*).

Table A5-12. Joint Significance and Sums of Lags Coefficients, Net Conflict from Germany (K) to US (J).

Good	NKJ	NJK	QKJ	QJK	PKJ	PJK
A	-0.248	-0.227	69.328	230.340	-964.811	437.810
	0.000	0.141	0.157	0.290	0.019	0.321
E	-0.0418**	-0.269	68.399**	53.117	5.788	-324.554
	0.000	0.000	0.001	0.373	0.906	0.017
Q	-0.412**	-0.128	110.898	-656.933**	383.737	-377.175
	0.000	0.000	0.708	0.000	0.000	0.000
K	-0.600	-0.353	737.813**	-610.507*	1225.757**	-1645.290**
	0.000	0.000	0.000	0.255	0 .040	0.001
C	-1.010**	0.437**	-7.968	-292.675	303.385	-127.244
	0.000	0.000	0.032	0.218	0.000	0.000

Notes: Headings match equation names. In each two numbers, the top is the sum of lags coefficients and the bottom is the joint significance. Significance from two tail t test at the 5% (10%) is indicated by ** (*).

Table A5-13. Joint Significance and Sums of Lags Coefficients, Demand of Germany (K) from Japan (J).

Good	RMK	PJK	NKJ	NJK	ETK
A	-0.550**	-0.0008	18.891	23.052**	-0.0008
	0.000	0.000	0.372	0.027	0.000
E	0.179	-2.285**	-43.428**	266.440**	-2.285**
	0.000	0.000	0.000	0.000	0.000
Q	1.692**	-0.241**	-339.918**	106.798**	-0.241**
	0.000	0.000	0.000	0.000	0.000
K	1.907**	-0.240**	13.804	-31.922**	-0.240**
	0.000**	0.000	0.000	0.000	0.000
C	0.560**	-0.034**	84.090**	-28.643**	-0.034**
	0.000	0.002	0.000	0.004	0.002

Notes: Headings match equation names. In each two numbers, the top is the sum of lags coefficients and the bottom is the joint significance. Significance from a one tail t test at the 5% (10%) is indicated by ** (*). Entries of net conflicts are multiplied by 10,000.

Table A5-14. Joint Significance and Sums of Lags Coefficients, Supply of Japan (J) to Germany (K).

Good	RXJ	PJK	NKJ	NJK
A	0.359**	-0.211**	-9.691	35.165**
	0.003	0.000	0.489	0.063
E	0.819**	-0.487**	-299.063**	7.001
	0.000	0.000	0.113	0.607
Q	1.102**	0.049	-141.39**	107.860**
	0.000	0.186	0.089	0.122
K	1.035**	0.870**	52.291	-17.840
	0.000	0.000	0.076	0.090
C	0.608**	0.117	-76.501	21.518
	0.000	0.046	0.090	0.209

Notes: Headings match equation names. In each two numbers, the top is the sum of lags coefficients and the bottom is the joint significance. Significance from a one tail t test at the 5% (10%) is indicated by ** (*). Entries of net conflicts are multiplied by 10,000.

Table A5-15. Joint Significance and Sums of Lags Coefficients, Demand of Japan (J) from Germany (K).

Good	RMJ	PKJ	NKJ	NJK	ETJ
A	1.708**	-0.063	-2.095**	126.789**	-0.063
	0.000	0.000	0.000	0.000	0.000
E	1.810**	-0.388	-770.249**	-456.236**	-0.388
	0.000	0.000	0.000	0.000	0.000
Q	0.929**	0.215**	10.080	-5.711	0.215**
	0.000	0.000	0.000	0.000	0.000
K	0.528**	0.149**	-140.164**	156.701**	0.149**
	0.000	0.000	0.000	0.000	0.000
C	0.837**	-0.126**	-161.511**	109.355**	-0.126**
	0.000	0.000	0.000	0.000	0.000

Notes: Headings match equation names. In each two numbers, the top is the sum of lags coefficients and the bottom is the joint significance. Significance from a one tail t test at the 5% (10%) is indicated by ** (*). Entries of net conflicts are multiplied by 10,000.

Table A5-16. Joint Significance and Sums of Lags Coefficients, Supply of Germany (K) to Japan (J).

Good	RXK	PKJ	NKJ	NJK
A	0.139	0.558**	-258.817**	155.544*
	0.309	0.000	0.043	0.196
E	-4.028**	2.379**	-276.002	-122.351
	0.000	0.000	0.476	0.339
Q	1.325**	-0.511	105.798**	-64.359
	0.000	0.391	0.104	0.338
K	0.951**	0.361**	15.071**	15.418
	0.000	0.020	0.019	0.945
C	1.025**	-0.110	-249.669**	16.509**
	0.000	0.034	0.000	0.000

Notes: Headings match equation names. In each two numbers, the top is the sum of lags coefficients and the bottom is the joint significance. Significance from a one tail t test at the 5% (10%) is indicated by ** (*). Entries of net conflicts are multiplied by 10,000.

Table A5-17. Joint Significance and Sums of Lags Coefficients, Net Conflict from Japan (J) to Germany (K).

Good	NJK	NKJ	QKJ	QJK	PKJ	PJK
A	0.223**	0.707**	1.623	8.563	7.295	-12.035
	0.023	0.000	0.937	0.043	0.095	0.056
E	-0.042	0.935**	0.246	-4.709	3.088	-2.952
	0.063	0.000	0.253	0.203	0.853	0.193
Q	-0.690**	1.625**	-16.460**	37.827**	-138.423**	110.996**
	0.000	0.000	0.000	0.000	0.000	0.000
K	0.200**	-0.074	2.238	14.999**	-78.292**	54.889**
	0.004	0.000	0.664	0.002	0.000	0.000
C	-0.101	1.206**	17.182**	-8.013	14.372	-28.934**
	0.619	0.000	0.000	0.206	0.619	0.010

Notes: Headings match equation names. In each two numbers, the top is the sum of lags coefficients and the bottom is the joint significance. Significance from two tail t test at the 5% (10%) is indicated by ** (*).

Table A5-18. Joint Significance and Sums of Lags Coefficients, Net Conflict from Germany (K) to Japan (J).

Good	NKJ	NJK	QKJ	QJK	PKJ	PJK
A	0.006	0.624**	-5.721	0.132	-2.821	9.695
	0.646	0.000	0.055	0.044	0.571	0.149
E	0.066	0.510**	-4.108**	8.737*	-5.549	1.838
	0.886	0.000	0.053	0.213	0.724	0.798
Q	-0.270**	1.162**	15.762**	-31.554**	106.213**	-87.032**
	0.000	0.000	0.000	0.000	0.000	0.000
K	0.527	0.586**	-1.083	-8.518	28.702	-13.757
	0.104	0.000	0.746	0.244	0.006	0.030
C	-0.332	0.828**	-19.218**	26.358**	-41.232**	42.773**
	0.127	0.000	0.000	0.049	0.131	0.004

Notes: Headings match equation names. In each two numbers, the top is the sum of lags coefficients and the bottom is the joint significance. Significance from two tail t test at the 5% (10%) is indicated by ** (*). Entries of net conflicts are multiplied by 10,000.

Table A5-19. Coefficients, Demand of Japan (K) from US (J).

Good	RMK	PJK	NKJ	NJK	ETK	a_0 / R^2
A	0.898**	0.049	1.841**	-1.849**	0.049	-21.031**
	0.323	-0.179**	-0.486	0.131	-0.179**	
		0.153**			0.153**	0.969
E	-0.461	-0.044	4.253**	-1.867	-0.044	9.512**
	0.731*	-0502**	4.858*	-4.968**	-0.502**	
		-0.396**			-0.396**	0.633
Q	1.419**	-0.031	0.242	-0.264	-0.031	-21.557**
	-0.459**	-0.100*	-2.765**	1.409*	-0.100*	
		0.468**			0.468**	0.951
K	0.957**	-0.152**	0.941*	1.105**	-0.152**	-13.601**
	-0.075*	-0.147**	-3.282**	1.129**	-0.147**	
		0.256**			0.256**	0.996
C	0.895**	0.078**	-2.193**	3.181**	0.078**	-16.513**
	-0.029	0.173**	0.923**	-0.912**	0.173**	
		-0.126**			-0.126**	0.996

Notes: Headings match equation's names. In each group of numbers, the top is for lag 0, followed by lag 1. Lag 2 is used for PJK and ETK. The constant term at the top and R^2 below are given under a_0 / R^2. Coefficients significant in one t tailed test at the 5 % (10%) are indicated by ** (*). Coefficients of NKJ and NJK are multiplied by 10,000.

Table A5-20. Coefficients, Supply of US (J) to Japan (K).

Good	RXJ	PJK	NKJ	NJK	b_0 / R^2
A	0.986**	-0.753**	4.800**	-3.333**	-13.312
	0.213	0.572**	5.140**	-1.061	
		0.360**			0.957
E	0.085	0.810**	2.256	-1.563	-7.952**
	0.391	-0.557**	0.144	-1.084	
		-0.370**			0.130
Q	0.683**	-0.201	4.768**	-1.814	-4.906**
	-0.398**	-0.059	3.226	-1.133	
		0.829**			0.890
K	0.571**	-0.435	7.063**	-3.097	-14.142
	0.209	-0.240	2.460	1.481	
		0.541**			0.706
C	0.055**	0.703**	4.070**	0.258	-16.481
	0.897**	0.108	2.875*	-1.319	
		-0.523**			0.975

Notes: Headings match equation's names. In each group of numbers, the top is for lag 0, followed by lag 1. Lag 2 is used for PJK and ETK. The constant term at the top and R^2 below are given under b_0 / R^2. Coefficients significant in one t tailed test at the 5 % (10%) are indicated by ** (*). Coefficients of NKJ and NJK are multiplied by 10,000.

Table A5-21. Coefficients, Demand of US (J) from Japan (K).

Good	RMJ	PKJ	NKJ	NJK	ETJ	c_0 / R^2
A	1.070**	-0.384**	7.106**	3.782*	-0.384**	7.086*
	-1.370**	0.369**	-1.391	3.331**	0.369**	
		-0.508**			-0.508**	0.791
E	2.034**	-2.633**	-3.844	-10.633**	-2.633**	26.209**
	-2.041**	1.580**	29.361**	-2.895**	1.580**	
		-4.219**			-4.219**	0.857
Q	0.966**	-0.415**	-1.392**	-1.339**	-0.415**	-17.953**
	0.187**	0.011	2.501**	-1.817**	0.011	
		-0.008			-0.008	0.903
K	-0.341**	0.218**	-0.911	-5.615**	0.218**	-9.210**
	0.849**	0.434**	9.331**	-17.415**	0.434**	
		-0.652**			-0.652**	0.481
C	1.822**	-0.932**	8.773**	-3.320**	-0.932**	-4.537**
	-1.435**	0.053	-0.310	0.095	0.053	
		0.401**			0.401**	0.537

Notes: Headings match equation's names. In each group of numbers, the top is for lag 0, followed by lag 1. Lag 2 is used for PJK and ETK. The constant term at the top and R^2 below are given under c_0 / R^2. Coefficients significant in one t tailed test at the 5 % (10%) are indicated by ** (*). Coefficients of NKJ and NJK are multiplied by 10,000.

Table A5-22. Coefficients, Supply of Japan (K) to US (J).

Good	RXK	PKJ	NKJ	NJK	b_0 / R^2
A	1.252**	0.044	-0.0004	3.608**	-11.683**
	-0.367**	-0.227	-1.912	2.381*	
		-0.205			0.885
E	0.868	-0.782	4.426	-4.590	-0.849
	-0.285	-0.804*	8.367*	-11.935**	
		-0.770			0.867
Q	-0.132	-0.033	-1.111**	1.405**	-8.853**
	-0.033	-0.370**	1.391*	-1.576*	
		0.347**			0.906
K	0.872**	-0.611**	1.412	0.238	-21.297**
	0.296**	0.309**	1.112*	-2.326**	
		0.0157			0.989
C	-0.470**	-2.134**	3.306**	-3.013**	-9.885**
	1.102**	0.201	6.664**	-3.675**	
		1.664**			0.685

Notes: Headings match equation's names. In each group of numbers, the top is for lag 0, followed by lag 1. Lag 2 is used for PJK and ETK. The constant term at the top and R^2 below are given under d_0 / R^2. Coefficients significant in one t tailed test at the 5 % (10%) are indicated by ** (*). Coefficients of NKJ and NJK are multiplied by 10,000.

Table A5-23. Coefficients, Net Conflict from US (J) to Japan (K).

Good	NJK	NKJ	QKJ	QJK	PKJ	PJK	e_0 / R^2
A	0.039	0.489**	186.746**	-16.431	469.422**	-780.761**	154.921**
	-0.172*	0.268*	76.536	14.493	-393.464**	908.241**	0.758
E	-0.177*	0.473**	-98.013**	-351.389**	110.172	-59.933	224.000**
	-0.254*	0.332**	69.801**	353.189**	-62.858	85.207	0.719
Q	-0.042	0.665**	2 78.680**	-321.716	155.263	278.680**	72.732
	-0.288**	0.237*	-207.154**	-350.902	636.407**	-270.156**	0.687
K	0.069	0.551**	373.319**	-338.739**	474.135**	-390.552**	89.852**
	-0.250**	0.122	-382.740**	401.189**	-518.329**	348.011**	0.728
C	0.099	0.660**	366.532*	-90.372	767.222	-346.560	56.778
	-0.250**	0.066	-691.469**	158.224	375.128	-1228.949**	0.674

Notes: headings match equation's names. In each group of numbers, the top is for lag 0, followed by lag 1. The constant term at the top and R^2 below are given under e_0 / R^2. Coefficients significant at the 5 % (10%) from one t tailed test are indicated by ** (*).

Table A5-24. Coefficients, Net Conflict from Japan (K) to US (J).

Good	NKJ	NJK	QKJ	QJK	PKJ	PJK	f_0 / R^2
A	-0.418**	0.867**	59.277	-322.610*	-25.011	795.954**	-12.978
	-0.116	0.315**	-144.031**	549.489**	62.241	-1175.485**	0.758
E	-0.076	0.827**	51.295	163.421	-142.451	-138.579	10.019
	-0.210**	0.351**	35.677	-108.854	116.747	-22.203	0.678
Q	-0.020	0.621**	45.608	459.902**	-378.708**	299.959	42.505
	-0.073	0.109	241.249*	-51.020	-192.292	-92.420	0.762
K	0.216	0.751**	-191.548	450.994**	-558.081*	144.904	45.639
	-0.243**	-0.060	262.022	-285.196**	396.761	-276.771	0.733
C	-0.109	0.683**	-259.621	258.054	-135.361	425.536	27.680
	-0.151	0.087	654.331**	-136.117	-852.311	665.781	0.748

Notes: headings match equation's names. In each group of numbers, the top is for lag 0, followed by lag 1. The constant term at the top and R^2 below are given under e_0 / R^2. Coefficients significant at the 5 % (10%) from one t tailed test are indicated by ** (*).

Table A5-25. Coefficients, Demand of Germany (K) from US (J).

Good	RMK	PJK	NKJ	NJK	ETK	a_0 / R^2
A	-1.861**	-0.457**	2.611	-1.983**	-0.457**	31.992*
	0.526	-0.090	3.510**	-6.539**	-0.090	
		-0.425*			-0.425*	0.704
E	-3.609**	-0.822**	-0.674*	4.357**	-0.822**	-32.502**
	4.883**	1.412**	-3.731**	-1.860**	1.412**	
		0.402**			0.402**	0.139
Q	0.824**	-0.178	7.805**	-3.520**	-0.178	-6.294**
	-0.431**	-0.115	-7.860	-1.421**	-0.115	
		0.241**			0.241**	0.664
K	0.391**	-0.175**	-0.715**	-2.004**	-0.175**	-10.207**
	0.315**	-0.002	0.233	-2.383**	-0.002	
		-0.038			-0.038	0.981
C	1.079**	-0.739**	-3.343**	0.244	-0.739**	-6.281
	-0.523*	0.846**	-2.131**	-6.528**	0.846**	
		-0.478**			-0.478**	0.894

Notes: Headings match equation's names. In each group of numbers, the top is for lag 0, followed by lag 1. Lag 2 is used for PJK and ETK. The constant term at the top and R^2 below are given under a_0 / R^2. Coefficients significant in one t tailed test at the 5 % (10%) are indicated by ** (*). Coefficients of NKJ and NJK are multiplied by 10,000.

Table A5-26. Coefficients, Supply of US (J) to Germany (K).

Good	RXJ	PJK	NKJ	NJK	b_0 / R^2
A	0.431	0.192	1.717	1.704	-1.078
	-0.399	-0.037	2.562**	0.716	
		0.005			0.139
E	0.180	-0.124	-1.243*	2.587	5.828*
	-0.554	0.820**	0.380	0.790	
		-0.307*			0.344
Q	0.839**	-0.638**	0.229	-3.768**	-20.548**
	0.347**	-0.785**	0.929*	-1.765**	
		0.789**			0.847
K	2.988**	0.797**	-0.697	-0.694	-21.357
	-1.831**	-1.445**	-0.890	3.256*	
		0.426			0.749
C	0.088	-0.333	-1.549	-3.699**	-7.131
	0.322	0.837**	-0.459	-7.064**	
		0.025			0.792

Notes: Headings match equation's names. In each group of numbers, the top is for lag 0, followed by lag 1. Lag 2 is used for PJK and ETK. The constant term at the top and R^2 below are given under b_0 / R^2. Coefficients significant in one t tailed test at the 5 % (10%) are indicated by ** (*). Coefficients of NKJ and NJK are multiplied by 10,000.

Table A5-27. Coefficients, Demand of US (J) from Germany (K).

Good	RMJ	PKJ	NKJ	NJK	ETJ	c_0 / R^2
A	2.219**	0.114	6.295**	-3.758**	0.114	-45.526
	-0.033	-0.445**	5.304**	7.051**	-0.445**	
		1.321**			1.321**	0.451
E	1.662**	-0.507**	3.824*	23.610**	-0.507**	-87.392**
	3.377**	0.008	1.525**	26.391**	0.008	
		-0.019			-0.019	0.570
Q	1.834**	0.411**	-0.363**	-1.597**	0.411**	-19.425**
	-0.604**	-0.765**	-2.399**	3.627**	-0.765**	
		0.165**			0.165**	0.839
K	0.346**	-0.243**	0.656	0.756*	-0.243*	-8.122**
	0.272**	-0.071	-0.008	0.252	-0.071	
		-0.011			-0.011	0.520
C	0.330**	-0.218**	-1.902**	-1.253**	-0.218**	-14.374**
	0.883**	-0.193**	-2.322**	-0.866	-0.193**	
		-0.329**			-0.329**	0.967

Notes: Headings match equation's names. In each group of numbers, the top is for lag 0, followed by lag 1. Lag 2 is used for PJK and ETK. The constant term at the top and R^2 below are given under c_0 / R^2. Coefficients significant in one t tailed test at the 5 % (10%) are indicated by ** (*). Coefficients of NKJ and NJK are multiplied by 10,000.

Table A5-28. Coefficients, Supply of Germany (K) to US (J).

Good	RXK	PKJ	NKJ	NJK	d_0 / R^2
A	0.699	-0.157	0.158*	-3.620**	-10.746*
	0.046	0.607**	-0.258	1.022	
	0.438*			0.885	
E	8.024**	1.007**	21.737**	8.747	-9.055
	-7.447**	0.112	20.972**	30.438**	
		1.097**			0.741
Q	1.416**	-1.063**	0.798*	-2.923*	-24.643**
	-0.010	-0.149	0.438*	0.014	
		0.680**			0.937
K	2.988**	0.797**	-0.697	-0.695	-21.357
	-1.831**	-1.445**	-0.890	3.256*	
		0.426			0.749
C	0.605**	-0.976	-1.573**	-2.550**	-33.686**
	1.336**	-0.801*	-1.527	-4.171**	
		-0.297			0.846

Notes: Headings match equation's names. In each group of numbers, the top is for lag 0, followed by lag 1. Lag 2 is used for PJK and ETK. The constant term at the top and R^2 below are given under d_0 / R^2. Coefficients significant in one t tailed test at the 5 % (10%) are indicated by ** (*). Coefficients of NKJ and NJK are multiplied by 10,000.

Table A5-29. Coefficients, Net Conflict from US (J) to Germany (K).

Good	NJK	NKJ	QKJ	QJK	PKJ	PJK	e_0 / R^2
A	-0.164	0.097	-300.351**	41.722	-613.574	-226.443	252.995**
	-0.042	0.134	489.624**	254.342**	-17.573	64.625	0.439
E	-0.046	0.227**	7.152	-207.029**	-166.631**	-124.278	240.018**
	-0.150	0.057	2.648	283.393*	174.855**	-43.605	0.432
Q	-0.121	0.192	-144.427*	-264.107	-297.435*	95.290	263.968**
	-0.121	-0.048	178.735	88.422	250.641	-170.315	0.337
K	-0.214	0.133*	98.271	-931.219**	323.949	-665.961	367.710
	-0.221	-0.035	-27.275	679.597**	-282.213	670.487*	0.429
C	-0.321**	0.190*	803.969*	11.950	21.921	404.324	285.452**
	-0.262	0.152	-940.042**	-27.296	-701.331*	649.824**	0.575

Notes: headings match equation's names. In each group of numbers, the top is for lag 0, followed by lag 1. The constant term at the top and R^2 below are given under e_0 / R^2. Coefficients significant at the 5 % (10%) from one t tailed test are indicated by ** (*).

Table A5-30. Coefficients, Net Conflict from Germany (K) to US (J).

Good	NKJ	NJK	QKJ	QJK	PKJ	PJK	f_0 / R^2
A	0.213**	0.213	-128.105*	477.643	-362.289	214.099	218.706
	-0.461**	-0.440*	197.434*	-247.303	-602.521	223.711	0.538
E	0.192*	0.327**	-26.315	-186.522	-71.661	-44.169	163.752
	0.536**	-0.596**	94.715	239.640	77.449*	-280.386*	0.526
Q	0.042	0.357	101.000*	-398.599**	1869.007**	-1283.894**	147.240
	-0.454**	-0.485**	9.898	-258.333**	-1485.270**	906.719*	0.560
K	-0.018	0.181	612.780**	-1208.887*	1074.189*	-1207.129*	367.999*
	-0.583**	-0.534*	125.033	598.379	151.568	-438.162	0.575
C	-0.383	0.531**	-1104.631*	-340.072*	1851.882**	-1241.767**	170.638*
	-0.627**	-0.094	1096.663*	47.397	-1548.497**	1114,524**	0.722

Notes: headings match equation's names. In each group of numbers, the top is for lag 0, followed by lag 1. The constant term at the top and R^2 below are given under f_0 / R^2. Coefficients significant at the 5 % (10%) from one t tailed test are indicated by ** (*).

Table A5-31. Coefficients, Demand of Germany (K) from Japan (J).

Good	RMK	PJK	NKJ	NJK	ETK	a_0 / R^2
A	-0.057	-0.483**	-18.580	51.373**	-0.483**	8.805**
	-0.493*	-0.040	37.470	-28.321	-0.040	
		0.522**			0.522**	0.714
E	-4.014**	-1.386**	-366.626**	265.844**	-1.386**	7.140
	4.193**	-0.850**	-67.655	0.596	-0.850**	
		-0.050			-0.050	0.594
Q	0.943**	-1.090**	-201.391**	105.250**	-1.090**	-27.705**
	0.749**	-0.839**	-13.852**	1.547	-0.839**	
		1.688**			1.688**	0.869
K	1.240**	-0.100	-24.048	15.650*	-0.100	-32.308**
	0.668**	-0.272**	37.853**	-47.573**	-0.272**	
		0.132**			0.132**	0.996
C	1.208**	0.127**	50.371**	-20.213**	0.127**	-10.083**
	-0.648**	-0.126**	33.719**	-8.431	-0.126**	
		-0.034			-0.034	0.763

Notes: Headings match equation's names. In each group of numbers, the top is for lag 0, followed by lag 1. Lag 2 is used for PJK and ETK. The constant term at the top and R^2 below are given under a_0 / R^2. Coefficients significant in one t tailed test at the 5 % (10%) are indicated by ** (*). Coefficients of NKJ and NJK are multiplied by 10,000.

Table A5-32. Coefficients, Supply of Japan (J) to Germany (K).

Good	RXJ	PJK	NKJ	NJK	b_0 / R^2
A	0 .348**	-0.490**	-21.045	47.539**	-4.961
	0.011	-0.001	11.354	-12.374	
		0.280**			0.802
E	0.253	-0.899**	-9.813	-88.066	-9.861**
	0.566*	-0.083	-289.249	95.075	
		0.495**			0.694
Q	0.629*	-0.168	-65.893*	39.469	-18.599
	0.473	-0.594	-75.500	68.391*	
		0.811**			0.879
K	0.883**	0.670**	-3.016	23.360	-18.786**
	0.152**	0.057	55.308**	-41.200*	
		0.144			0.992
C	1.708**	0.783**	-49.199*	28.258*	-10.290**
	-1.100**	-0.518**	-27.301	-6.739	
		-0.148			0.796

Notes: Headings match equation's names. In each group of numbers, the top is for lag 0, followed by lag 1. Lag 2 is used for PJK and ETK. The constant term at the top and R^2 below are given under b_0 / R^2. Coefficients significant in one t tailed test at the 5 % (10%) are indicated by ** (*). Coefficients of NKJ and NJK are multiplied by 10,000.

Table A5-33. Coefficients, Demand of Japan (J) from Germany (K).

Good	RMJ	PKJ	NKJ	NJK	ETJ	c_0 / R^2
A	0.127	-0.488**	-45.878**	-38.167**	-0.488**	-27.718**
	1.581**	0.337**	-16.366**	16.495**	0.337**	
		0.089			0.089	0.870
E	8.146**	5.117**	46.684**	-1213.509**	5.117**	-24.487
	-6.336	-6.109**	-1237.097**	757.273**	-6.109**	
		0.604			0.604	0.190
Q	1.484**	0.302**	64.535**	40.920**	0.302**	-18.778**
	-0.555**	-0.382**	-54.451*	64.535**	-0.382**	
		0.294			0.294	0.942
K	0.283**	-0.086	-69.799**	80.926**	-0.086	-10.712
	0.245**	0.711**	-70.365**	75.775**	0.711**	
		-0.475**			-0.475**	0.913
C	0.707**	-0.253**	-10.488**	82.153**	-0.253**	-12.108**
	0.129**	0.337**	-56.662**	27.019**	0.337**	
		-0.210**			-0.210**	0.985

Notes: Headings match equation's names. In each group of numbers, the top is for lag 0, followed by lag 1. Lag 2 is used for PJK and ETK. The constant term at the top and R^2 below are given under c_0 / R^2. Coefficients significant in one t tailed test at the 5 % (10%) are indicated by ** (*). Coefficients of NKJ and NJK are multiplied by 10,000.

Table A5-34. Coefficients, Supply of Germany (K) to Japan (J).

Good	RXK	PKJ	NKJ	NJK	d_0/ R^2
A	0.127	-0.489**	-45.878**	-38.170**	-27.718**
	1.580**	0.337**	-16.367**	16.495**	
		0.089			0.870
E	-2.837*	-2.776*	-56.122	-37.107	65.742**
	-1.191	1.769	-219.880	-85.244	
		3.386**			0.793
Q	2.250**	-0.272	52.525*	-32.880	-23.266
	-0.925**	-0.048	53.274**	-31.478	
		0.269*			0.933
K	4.255**	0.820**	107.417**	11.042	-17.582**
	-3.304**	0.013	43.295*	4.375	
		-0.472			0.860
C	1.244**	0.243*	-104.942**	72.837**	-17.760**
	-0.219	-0.163	-144.726	92.249**	
		-0.190			0.974

Notes: Headings match equation's names. In each group of numbers, the top is for lag 0, followed by lag 1. Lag 2 is used for PJK and ETK. The constant term at the top and R^2 below are given under d_0 / R^2. Coefficients significant in one t tailed test at the 5 % (10%) are indicated by ** (*). Coefficients of NKJ and NJK are multiplied by 10,000.

Table A5-35. Coefficients, Net Conflict from Japan (J) to Germany (K).

Good	NJK	NKJ	QKJ	QJK	PKJ	PJK	e_0 / R^2
A	0.304**	0.920**	1.131	37.212**	-7.250*	29.568*	1.014
	-0.081	-0.213*	0.491	-28.648	14.546**	-41.603**	0.825
E	0.120	0.932**	-1.564	1.413	0.898	1.323*	2.528
	-0.162**	0.022	1.810*	-6.122	2.189	-4.276	0.791
Q	-0.502**	1.127**	5.096	51.394**	-148.614**	166.384**	-10.535**
	-0.188**	0.497**	-21.555*	-13.567	10.191	-55.388**	0.904
K	0.363**	0.670**	-0.432	67.346**	-102.784**	118.568**	-7.066**
	-0.163**	-0.744**	2.671	-52.347**	24.492**	-63.679**	0.898
C	-0.023	1.009*	33.559**	11.955*	-3.741	0.898	-7.377**
	-0.078	0.195	-16.377*	-19.968	18.114	-29.832*	0.846

Notes: headings match equation's names. In each group of numbers, the top is for lag 0, followed by lag 1. The constant term at the top and R^2 below are given under e_0 / R^2. Coefficients significant at the 5 % (10%) from one t tailed test are indicated by ** (*).

Table A5-36. Coefficients, Net Conflict from Germany (K) to Japan (J).

Good	NKJ	NJK	QKJ	QJK	PKJ	PJK	f_0 / R^2
A	0.059	0.771**	-5.420**	-29.394**	5.579	-26.454**	6.095
	-0.053	-0.146	-0.301	29.527**	-8.400	36.149*	0.781
E	0.045	0.705**	-2.660	1.875	-5.222	-0.057	2.744
	0.020	-0.195	-1.448	6.686	-0.326	1.894	0.753
Q	-0.435*	0.713**	-9.589**	-43.407**	127.373*	-140 .802**	9.511*
	0.164*	0.448**	25.351**	11.853**	-21.159	53.770**	0.911
K	0.515	0.925**	-3.696	-43.033*	70.616*	-90.916*	8.694**
	0.012	-0.339**	2.612	34.514	-41.914*	77.160**	0.776
C	-0.288	0.761**	-34.900**	7.512	-19.521	16.070	11.223
	-0.044	0.066	15.682*	18.845	-21.711	26.702**	0.831

Notes: headings match equation's names. In each group of numbers, the top is for lag 0, followed by lag 1. The constant term at the top and R^2 below are given under f_0 / R^2. Coefficients significant at the 5 % (10%) from one t tailed test are indicated by ** (*).

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