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Conflict and Trade

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This article applies microeconomic theory to illustrate the plausibility of a relationship between international trade and conflict. It is argued that the mutual dependence established between two trading partners (dyads) is sufficient to raise the costs of conflict, thereby diminishing levels of dyadic dispute. This hypothesis of a negative relationship between conflict and trade is tested using a ten-year thirty-country cross section merged from four separate data sources. It is found that ceteris paribus countries with the greatest levels of economic trade engage in the least amounts of hostility. In fact, a doubling of trade on average leads to a 20% diminution of belligerence. This relationship appears robust, holding even more strongly when statistical adjustments are made for causality.

(1) INTRODUCTION

Eradicating hostility and promoting cooperation is an important step leading to peace. One method of diminishing hostility and bringing about cooperation (between two countries) is by legalistic dictum often initiated by third party nations. The problem is that attempts at peace imposed by others may be innately unstable, especially if the underlying differences originally separating the countries remain. For this reason, it seems that a more viable peace is one that exists naturally, without the need for outside intervention. This article concentrates on such types of coexistence in the hope that the peace science field has more valuable insights to gain from such a perspective.

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The article is motivated by the fact that not all countries are in conflict. In fact, data indicate that, on average, more cooperation exists than conflict. Yet still some country pairs (dyads) such as the United States and the USSR exhibit great amounts of hostility even though U.S. as well as USSR relations with many other countries are extremely cooperative. If there are reasons to explain existing *differences* in the across dyad levels of conflict, then insights could be applied to understanding how *natural* dyadic cooperation can evolve.

Specifically, a natural peace is one based in part on *mutual dependencies*. As will be explained, mutual dependence makes conflict more costly, thereby increasing the incentives toward cooperation, and hence toward peace. Probably many kinds of mutual dependencies affect dyadic conflict-cooperation levels. By concentrating solely on mutual dependencies of an economic nature, this article provides only an initial illustration of the assertion. However, if valid, the results may serve as the impetus to refine and extend the relationships studied here.

In this article, international trade is taken as a measure of mutual economic dependence. It is hypothesized that holding other factors constant, dyadic conflict would be negatively related to dyadic trade patterns. Thus, country pairs with the most mutual international trade should exhibit the least conflict. In addition, it is argued that the more essential and strategic the trade (i.e., the stronger the dependence), the greater the deterrent effect of trade on conflict.

These suppositions are tested by means of multiple regression analysis using a ten-year thirty-country cross section merged from four separate data sources. The importance of such a finding is that peace need not be imposed, but can come about naturally between countries. The policy implications are obvious. Peace should be obtained by establishing mutual trade dependencies across nations rather than by dictum. In fact, the analysis presented indicates that, on average, a doubling of trade between two countries leads to a 20% diminution of hostility between them.

The article is divided into six sections. Sections 2 and 3 motivate the model by establishing how trade is a form of mutual dependence, and by defining what is meant by conflict. Section 4 describes more rigorously the key hypothesis that a negative correlation exists between trade and conflict. The model is extended to strategic trade in Section 5, and a summary with qualifications is given in Section 6. Appendix A describes the data sources. Appendix B gives a mathematical representation of the model.

(2) INTERNATIONAL TRADE

Individuals do not produce everything they need. They find it advantageous to specialize. Division of labor comes about because persons work at what they do best, and trade for what they produce inefficiently. International trade occurs for the same reason. One country is not able to produce all it needs as efficiently as another. A country is said to have a comparative advantage over another when it is relatively more efficient in the production of a particular commodity. The existence of comparative advantages enables *both* countries to increase their own welfare through trade. Loss of existing trade, for example because of conflict, would imply potential welfare losses. As will be hypothesized, it is these potential welfare losses that deter conflict.

(3) POLITICAL INTERACTION

There are many philosophical problems in measuring political interactions. Questions exist concerning what hostility and cooperation constitute, as well as how and to whom such activities are vented. Presumably, measures of interaction should entail answers to these questions. Unfortunately, as we shall see, this is not the case.

Many deficiencies are embedded in current measures. Common measures include defense expenditures, data on wars, and casualty estimates. However, these measures have problems. In a sense, defense expenditures indicate general levels of hostility of a country. Yet defense expenditures need not reflect hostility at all. In fact, such expenditures could be viewed as a warning to other nations, serving the purpose of preventing hostility. Alternatively, they can even be a measure for the repression of domestic unrest.[1] Yet, even if defense expenditures did constitute a measure of conflict, such expenditures do not yield information about to whom hostilities are vented. Nor can one infer the type of conflict. War data yield information on a particular kind of conflict and on the particular participants. However, war is a particularly intensive form of interaction, and the number of dead or wounded varies with technology as well as country size. None of these measures deal with cooperation between countries or acts less hostile than war. Similarly, United Nations General Assembly voting behavior, which has been used rather successfully to measure political *attitudes,* need not reflect *actual*

1. I owe this last point to Bruce Russett.

conflict between countries.[2] Further UN votes often deal with a subset of possible country interactions.

Because of these deficiencies, a slightly different measure of dyadic interaction is chosen for this study. It entails the use of events data. The problem with events data is that they comprise interactions reported in newspapers. Many "secret" treaties and negotiations, as well as subtle country dealings not reported in newspapers, are obviously omitted.[3] However, the benefit of events data is that they measure cooperation as well as hostility. In addition, actor and target countries can easily be identified. Precise measures of the amounts of different kinds of hostility can be ascertained as well.

The data actually used in this study come from the Azar Conflict and Peace data bank, an extensive, longitudinal collection of more than 350,000 daily and yearly events reported by dyad from 47 newspaper sources.[4] These events are coded on a 15-point scale representing different kinds of conflict and cooperation.[5] The annual frequency of events in each category represents the amount of *each* type of dyadic interaction from an actor to a target country. Of the 31 countries in the data, this article concentrates on 30, so as to yield a possible 126,150 observations (841 dyads [29 squared] times 10 years times 15 categories of conflict).[6]

In order to compress this vast amount of information (to a possible 8410 observations), an overall index of net conflict is created to measure dyadic interaction. This index measures the overall amount of conflict between two countries and is denoted NETF (the net frequency of con-

2. Russett (1967) and Richardson (1978) are excellent examples of studies using UN data to ascertain foreign policy attitudes. Alker and Russett (1965) measure issue intensities by UN General Assembly speeches made by country delegates.

3. For other criticisms of events data, see Kegley (1975).

4. See Azar (1973). For a summary of this data, see Azar and Sloan (1975). For a complete description of the latest version of this data source, see Azar (1980).

5. The categories of dyadic interactions range from cooperative event categories: (1) voluntary unification into one country, (2) major strategic alliance, (3) military and economic support, (4) nonmilitary economic, technical, and industrial agreements, (5) cultural and scientific agreements, (6) official verbal support, and (7) minor official exchanges, to events depicting (8) neutral or nonsignificant acts, to conflict event categories: (9) mild verbal expression displaying discord, (10) strong verbal expressions displaying hostility, (11) diplomatic or economic hostile actions, (12) political actions, (13) small-scale military actions, (14) limited war acts, and (15) extensive war acts causing death, dislocation, and high strategic costs. For a discussion of how these categories can be scaled, see Azar and Havener (1976).

6. The thirty countries dealt with in this study are: United States, Canada, United Kingdom, France, Germany, Eastern Germany, Italy, Greece, Cyprus, USSR, Morocco, Algeria, Tunisia, Libya, Sudan, Iraq, Turkey, Iran, United Arab Republic, Syria, Lebanon, Jordan, Israel, Saudi Arabia, Kuwait, China, Japan, India, Pakistan, Indonesia.

flict). For a given dyad, NETF is computed as the frequency of conflictual events (those in categories 9 to 15) minus the frequency of cooperative events (those in categories 1 to 7). A negative value of NETF implies that more events fall into categories 1 to 7 than 9 to 15, hence that a cooperative interaction exists. A positive value implies that the preponderance of events fall into categories 9 to 15 so that on balance a conflict relationship exists.

It is interesting to note that this summary conflict statistic is comparable to that suggested by Richardson (1960) who states:

> Usually both threats and co-operation are going on simultaneously; so that as we have restricted ourselves to a single variable for one group, *that variable must represent the net result, the excess of threats over co-operation* [1960: 30; emphasis mine].

NETF differs from Richardson in the measures chosen for conflict and cooperation in that this article uses frequencies of events data.

(4) TRADE AND CONFLICT: WHY SHOULD THEY BE RELATED?

As indicated, this article seeks to relate trade and conflict. A negative correlation is hypothesized. Dyads with the most trade are expected to exhibit the least conflict (and most cooperation). Though without the theoretical and empirical foundation presented in this article, the hypothesis has a history emanating from the intellectual and commercial exchange that brought long eras of peace throughout the nineteenth and early twentieth centuries. Blainey (1973: 18) states: "The long peace that followed the Battle of Waterloo was increasingly explained as a result of the international flow of commodities and ideas." Read (1967: 146) says: "Cobden [the renowned nineteenth century British statemen] hoped that he had begun genuinely to persuade the peoples and Government of Europe that free trade could be 'not only a law of wealth and prosperity but a law of friendship . . . a web of concord woven between people and people.'" Others, such as John Bright, Henry Thomas Buckle, Sir Robert Peel, William Gladstone, John Stuart Mill, and Albert the Good proposed "variations of the same idea" (Blainey, 1973: 19). Unfortunately World War I—the most bitter, long-lasting, all-encompassing war among trading partners seems to have been sufficient to have dispelled much faith in this theory of peace. Indeed, with the

exception of Richardson (1960), Stigler (1963: 98), and perhaps also political scientists such as Cooper (1968), Keohane and Nye (1972), and Chadwick (1972), and perhaps the economist Boulding (1966),[7] not enough emphasis seems to be placed by modern theorists espousing this "free trade principle" as a foundation for peace. It is the contention of this article that the abandonment of this theory based on one data point (albeit one carrying a strong weight) may have been premature. In the remainder of this article, both theoretical and empirical reasons are given to support the contention.

The Model

The inverse relationship between trade and conflict is not merely asserted. Instead, a logical justification using economic theory is given. The basic model assumes what is standard economic theory, namely that countries maximize their own social welfare. This is done by obtaining the highest levels of material well-being possible. Given cross-country differences in technology and factor (resource) endowments, any one country can raise its social welfare by specializing in domestic production of commodities for which it has a comparative advantage, and trading for commodities produced relatively less efficiently. Thus, given different technologies and factor endowments across countries, trade patterns emerge.

Conflict is assumed to affect the terms of trade. Specifically, greater levels of conflict make trade more difficult. Reasons include retaliatory tariffs, quotas, embargoes, and other trade prohibitions.[8] Conflict thus raises the costs of trade, thereby making at least one of the countries worse off (in a welfare sense). The implicit price of being hostile is the diminution of welfare associated with potential trade losses.

This can easily be illustrated geometrically (Figure 1), but it may be skipped by the reader not interested in such detail.[9] Define curve AB to reflect a country's production possibility frontier. This curve defines the maximum combinations of commodities x and y that can be produced in a given country. Curves w^1, w^2, w^3, and so on represent in ascending order potential domestic welfare levels. Welfare level w^2 would be the maximum attainable if no trade were permitted. However, if trade is

7. However, Boulding (1966) does not interrelate the "threats market" with the "exchange market" as is done in this article.

8. Russet (1967: 122-123) makes a similar assumption.

9. A detailed geometric explanation of comparative advantage and trade is given in Caves and Jones (1977).

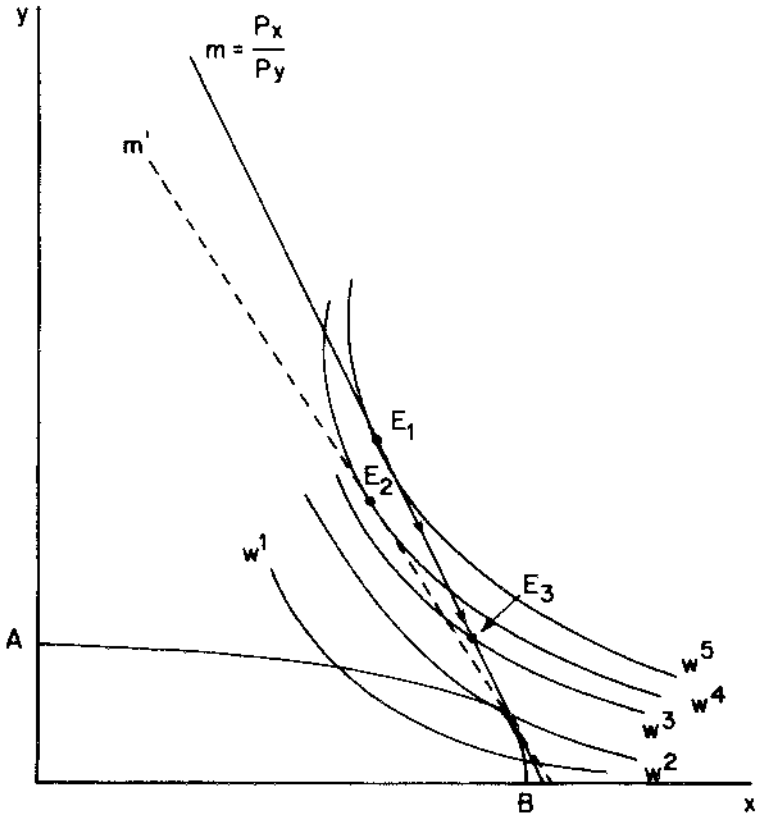

Figure 1: The Gains from Trade

permitted at the price ratio given by the line segment with slope m (again, see Caves and Jones [1977] for an explanation of the term of trade line), this welfare level can be raised to w^5. Restrictions of trade such as embargoes that do not affect the terms of trade lower potential welfare to perhaps w^4. Restrictions of trade that affect prices may result in less desirable terms of trade (m') and a new equilibrium E_2 and welfare level w^2. *Thus the price of being belligerent is an implicit price that increases with the level of trade. Ceteris paribus, the greater the amount of trade, the higher the price of conflict, and the less the amount of conflict that is demanded.* A test with cross-sectional data implies that

countries with the *most* trade (and with the most welfare gains from trade) have the *least* conflict, if other variables are held constant. These propositions can be expressed mathematically. (A simple version is given in Appendix B.)

Measuring the Trade-Conflict Relationship

This article concentrates on the relationship between trade and dyadic interactions. It is claimed that dyads with the most trade have the most to lose from conflict, and hence have lesser amounts of conflict. This section analyzes the validity of such a supposition.

Bivariate regression analysis treating conflict as a function of trade is used initially. Its form is given in equations 1 and 2 below:

$$NETF_{ij} = \alpha_0 + \alpha_1 x_{ij} + \epsilon \quad [1]$$

$$NETF_{ij} = \beta_0 + \beta_1 m_{ij} + \epsilon \quad [2]$$

where

$NETF_{ij}$ = net conflict of country i toward country j,

x_{ij} = exports of country i to country j,

m_{ij} = imports of country i from country j, and

ϵ = a random error term assumed normally distributed with mean zero.

The problem with bivariate regression is that other factors such as country attributes can influence this relationship. In general, country size would affect conflict and trade. So might population density (crowding hypotheses), school enrollments, electrical production (measures of development), defense expenditures (a general measure of country hostility), as well as other considerations. To net out these latter factors, multiple regression analysis is considered in addition to the bivariate regression models. (A description of these variables and data sources appear as Appendix A.) Equations take the following form

$$Z_{ij} = NETF_{ij} = \alpha_0 + \alpha_1 x_{ij} + \alpha_2 A_i + \alpha_3 A_j + \epsilon \quad [3]$$

$$Z_{ij} = NETF_{ij} = \beta_0 + \beta_1 m_{ij} + \beta_2 A_i + \beta_3 A_j + \epsilon \quad [4]$$

where A is a vector of country attributes (see Appendix Table A.1) for each actor and target country, and the other variables are as defined above. Negative coefficients for α_1 and β_1 would imply that countries with greater trade dependencies engage in less net conflict. Coefficients α_2, α_3, β_2, and β_3 reflect the impact of country attributes on conflict and can be thought of as other aspects of a price vector for conflict. The intercept terms reflect levels of conflict that would result independently of attributes or trade. In this study, we neglect the impact of country attributes and concentrate solely on the signs and magnitudes of α_1 and β_1.

For these coefficients a consistent pattern appears. Whether bivariate or multivariate forms are used (Table 1), in each year negative and statistically significant signs pervade. This means that for each year of data, those dyads engaged in the *most* trade have the *least* conflict even when adjusting for country attributes. When data for all years (1958-1967) are pooled, these results strengthen (Table 2), again implying a strong negative association between trade and conflict.[10]

Interpreting these coefficients as evidence that all conflicts could be eradicated by creating strong trade relationships would be naive. Although negative in value, one must assess the magnitudes of the trade coefficients. The relevant question concerns the percentage of diminution of conflict associated with a 1% increase in trade. This statistic, known as an *elasticity*, is defined and presented in Table 2. It indicates that a 1% increase in trade would decrease conflict (increase cooperation) by between 0.15% to 0.19%. *Thus doubling trade between two countries would lead to about a 15% to 19% decline in the net frequency of dyadic hostility.*

Simultaneity: The Trade-Conflict Relationship When Trade Is Treated Endogeneously

The coefficients presented in Tables 1 and 2 do not indicate the *direction of causality*. Thus from these tables, it cannot be ascertained whether trade diminishes conflict, or whether in fact the reverse is true, and it is really conflict that reduces trade. This distinction is crucial for

10. An additional independent variable representing year is introduced. It is assumed that this added variable eliminates possible heteroskedasticity of the disturbance matrix. To the extent that heteroskedasticity remains generalized, least-squares (GLS) estimation can be adopted.

TABLE 1
Impact of Trade on Conflict by Year
(t-values in parentheses)[3]

Specification[1]	*Adjustment for Country Attributes*	*Independent*[2] *Variable*	*1958*	*1959*	*1960*	*1961*	*1962*	*1963*	*1964*	*1965*	*1966*	*1967*
(1)	no	intercept	1.2980	1.4016	-.3860	-.3831	-.7327	-1.4532	-1.5758	-1.4041	-2.2960	-1.6816
			(4.0)	(3.4)	(1.4)	(1.1)	(2.8)	(6.4)	(9.0)	(5.5)	(7.3)	(4.7)
		X	-.0051	-.0073	-.0012	-.0074	-.0040	-.0036	-.0019	-.0005	-.0022	-.0020
			(4.7)	(6.0)	(1.5)	(7.7)	(3.9)	(6.3)	(4.8)	(1.1)	(4.2)	(3.7)
(2)	no	intercept	1.2946	1.3860	-.4107	-.4081	-.7631	-1.4872	-1.5741	-1.4064	-2.2985	-1.6975
			(4.0)	(3.4)	(1.4)	(1.2)	(2.9)	(6.4)	(9.0)	(5.5)	(7.3)	(4.7)
		M	.0052	-.0074	-.0010	-.0072	-.0037	-.0033	-.0019	-.0005	-.0022	-.0019
			(4.8)	(6.2)	(1.2)	(7.4)	(5.4)	(5.7)	(4.9)	(1.0)	(4.2)	(3.5)
(3)	yes	Intercept	10.8405	-13.3204	5.5861	11.7426	2.6492	-15.8983	-1.3963	0.8994	1.9377	-4.6669
			(1.6)	(0.9)	(0.6)	(1.6)	(1.0)	(2.4)	(0.8)	(0.4)	(0.8)	(1.2)
		X	.0022	.0015	-.0026	-.0056	-.0012	-.0021	-.0024	-.0013	-.0020	-.0048
			(2.2)	(0.9)	(2.3)	(4.3)	(1.7)	(2.8)	(5.2)	(2.9)	(3.4)	(5.6)
(4)	yes	intercept	10.8327	-13.4556	5.5544	11.7499	2.6300	-15.9436	-1.3997	0.8531	1.9307	-4.7328
			(1.6)	(0.9)	(0.6)	(1.6)	(1.0)	(2.4)	(0.8)	(0.4)	(0.8)	(1.2)
		M	-.0023	-.0018	-.0028	-.0056	-.0013	-.0019	-.0025	-.0015	-.0020	-.0046
			(2.3)	(1.1)	(2.5)	(4.3)	(1.8)	(2.6)	(5.5)	(3.2)	(3.5)	(5.4)
Number of Country Pairs (Dyads) in Sample			407	407	381	409	388	432	457	450	453	468

1. The specification refers to the following regressions:

(1) $NETI_{ij} = \alpha_0 + \alpha_1 x_{ij} + \epsilon$ (3) $NETI_{ij} = \alpha_0 + \alpha_1 x_{ij} + \alpha_2 A_i + \alpha_3 A_j + \epsilon$

(2) $NETI_{ij} = \beta_0 + \beta_1 m_{ij} + \epsilon$ (4) $NETI_{ij} = \beta_0 + \beta_1 m_{ij} + \beta_2 A_i + \beta_3 A_j + \epsilon$

2. Intercepts are the coefficients α_0 and β_0 of the regressions. The trade coefficients are α_1 and β_1 coefficients.

3. A t-value exceeding 1.96 implies statistical significance at the 0.05 level.

TABLE 2
Impact of Trade on Conflict
All Years Pooled
(t-values in parentheses)

Specification[1]	*Adjustment for Country Attributes*	*Independent Variable*	*Intercept*	*Coefficient*	*Elasticity*[2]
(1)	no	X	−1.3241 (13.7)	−.0028 (13.3)	.192
(2)	no	M	−1.3341 (13.8)	−.0027 (12.8)	.185
(3)	yes	X	−.0984 (0.1)	−.0023 (9.8)	.152
(4)	yes	M	−.1119 (0.1)	−.0023 (9.9)	.152

1. See Table 1 for specifications.
2. The percentage of impact on conflict given a 1% change in trade.
Computed as:

$$\text{Elasticity} = \frac{\partial \text{NEFT}}{\partial \text{X}} \quad \frac{\text{mean X}}{\text{mean NETF}}$$

and

$$\text{Elasticity} = \frac{\partial \text{NETF}}{\partial \text{M}} \quad \frac{\text{mean M}}{\text{mean NETF}}$$

policy purposes. Trade is postulated as an instrument to reduce conflict. If the trade is only a response to preexisting conflict levels, then no viable policy implications for the reduction of conflict would be obtained. Thus tests for causality are important.

One approach would entail appropriately lagging the trade data. This lagged model would entail rerunning equations 1 to 4 with appropriately lagged trade. 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.

To alleviate this problem, an alternative and more direct statistical technique is applied. This technique implies viewing the trade-conflict relationship as simultaneous. Conflict affects trade *and* trade affects conflict. In effect, trade is an endogenous predetermined variable in equations 1 to 4. As such, two-stage least-squares (TSLS) is an appropriate econometric technique for estimation in the presence of endogeneity.[11] In fact, not using TSLS would imply potentially biased estimates, because trade would be correlated with the residual (ϵ).

11. A detailed description of TSLS is given in Kelejian and Oates (1974: 228-233).

TABLE 3
Impact of Trade on Conflict[1]
with Trade Treated Endogenously
Two-Stage Least-Squares
(t-values in parentheses)

Specification	*Adjustments for Country Attributes*	*Independent Variable*	*Intercept*	*Coefficient*	*Elasticity*[2]
(3)	yes	X	−1.358 (−5.5)	−.0057 (−6.68)	.363
(4)	yes	M	−1.310 (−5.4)	−.0049 (−5.8)	.310

1. See Table 1 for specification.
2. See Table 2 for definition of elasticity.

As can be seen in Table 3, causality is as was predicted. An even stronger, more negative coefficient (−.0056 versus −.0028) is obtained. Thus, even when accounting for simultaneity, causality still runs *from trade to conflict*. Increases in trade diminish conflict.[12] In elasticity terms, the coefficients imply that a doubling of trade could reduce conflict by over 30%.

Disaggregation of Dyadic Interactions

Conflict has been measured as an index representing the excess of the frequency of conflicting events over cooperative events (NETF). One problem in using this summary measure of conflict is that it lacks content concerning *specific kinds* of conflict or cooperation. NETF does not yield information on which types of interactions are most sensitive to trade or whether trade affects conflict and cooperation in fundamentally different ways. Disaggregation of the conflict measure provides some insight. Accordingly equations 3 and 4 were reestimated for *each* cooperation-conflict category. Instead of NETF as the dependent variable, the *raw frequency of events in each category* was used in the following regression:

$$F_{ijk} = \alpha_0 + \alpha_1 x_{ij} + \alpha_2 A_i + \alpha_3 A_j + \epsilon \quad k = 1 \ldots 15 \qquad [5]$$

$$F_{ijk} = \beta_0 + \beta_1 x_{ij} + \beta_2 A_i + \beta_3 A_j + \epsilon, \quad k = 1 \ldots 15 \qquad [6]$$

12. In fact, when the entire two-equation system is estimated simultaneously with three-stage least-squares (not presented here), *no* evidence exists that conflict affects trade.

where

F_{ijk} = frequency of events in cooperation-conflict category k from country i to country j,

and the other variables are as previously defined.

The results (reported in Table 4) emphasize the importance of the relationship as originally postulated. Again the intercept, coefficients, and elasticities have the same meaning as before. The intercept indicates the frequency of events (in each category) were no trade to occur. The coefficients and elasticities indicate the effect of trade on each kind of dyadic interaction. A positive coefficient (elasticity) for a particular category implies that trade increases the events in that category. As can be seen, *trade tends to increase cooperation* (positive coefficients for all but one cooperation category) *and decrease conflict* (negative coefficients for most hostility categories).[13] Note also that the magnitudes of the elasticity measures decline from a positive .3 to slightly negative –.1. Thus trade raises cooperative events by greater magnitudes than it decreases hostile events.[14]

(5) DOES THEORY SAY ANYTHING MORE?

Thus far, theory has shown that trading countries experience a welfare gain. Conflict was assumed to hamper trade by implicitly raising costs through tariffs, quotas, and other means. Trading countries with significant trade relations would thus engage in less conflict, because they are most threatened by welfare losses associated with lost trade. It seems at least intuitively clear that a corollary exists. *Conflict would be most sensitive to trade of commodities particularly strategic to an economy.* The reason is obvious. Even small amounts of trade of essential commodities yield high welfare gains.

To test this hypothesis, one would need data not only on gross commodity trade flows, but also on some measure of the welfare gain (a

13. Categories 1 and 15 were omitted because of the small number of observations in these categories.

14. The weak coefficients for small-scale military actions and limited war acts is probably attributable to the relatively small number of observations in these categories. Only 51 and 52 events fall in these classifications compared to 2042 in category 10 (strong verbal dismay). The unexpected negative sign for category 4 (nonmilitary economic and technical agreements) may result because economic agreements may be unnecessary when trade already exists.

TABLE 4
Conflict Regressions Disaggregated by Type of Interaction*
(t-values in parentheses)

Cooperation/Conflict			*X*			*M*		
Scale	*Type*	*Number of Events*	*Intercept*	*Coefficient*	*Elasticity*	*Intercept*	*Coefficient*	*Elasticity*
2	major strategic alliance	122	0.0212 (0.7)	0.00009 (8.5)	.31	.0207 (0.7)	0.00008 (7.7)	.27
3	military & econ. support	560	.0154 (0.2)	0.00025 (9.8)	.19	.0155 (0.2)	0.00024 (9.3)	.19
4	nonmilitary econ. and tech. agreements	2197	−.2675 (−1.7)	−.00031 (−6.0)	−.06	−.2671 (−1.7)	−.00029 (−5.6)	−.06
5	cultural sci. agreements	1706	−.3657 (−2.7)	0.00048 (11.0)	.13	−.3642 (−2.6)	0.00047 (10.6)	.13
6	verbal support	1553	−.2203 (−1.4)	0.00053 (9.7)	.15	−.2167 (−1.4)	0.00053 (10.1)	.15
7	minor official exchanges	4294	−1.3104 (−3.7)	0.00092 (8.8)	.10	−1.2956 (−3.7)	0.00100 (9.6)	.11
8	neutral	288	−.1078 (−1.7)	0.00010 (5.0)	.17	−.1046 (−1.6)	0.00012 (6.2)	.20

Table 4 (Continued)

Cooperation/Conflict			*X*			*M*		
Scale	*Type*	*Number of Events*	*Intercept*	*Coefficient*	*Elasticity*	*Intercept*	*Coefficient*	*Elasticity*
9	mild verbal dismay	1346	−.4584 (−2.8)	0.00017 (3.5)	.06	−.4560 (−2.8)	0.00018 (3.7)	.07
10	strong verbal dismay	2042	−.8469 (−2.4)	−.00025 (−2.4)	−.06	−.8464 (−2.4)	−.00025 (−2.4)	−.06
11	diplomatic or economic hostile actions	422	−.0935 (−1.3)	−.00010 (−4.3)	−.10	−.0947 (−1.3)	−.00011 (−4.7)	−.12
12	political hostile actions	145	.0207 (0.5)	−.00002 (−1.5)	−.06	.0197 (0.5)	−.00003 (−2.2)	−.09
13	small scale military actions	51	.0007 (0.03)	−.000001 (−.13)	−.009	.0008 (.03)	−.0000007 (.10)	−.00002
14	limited war acts	52	.0195 (0.6)	0.000005 (0.5)	.08	.0193 (0.6)	0.000004 (0.5)	.06
NETF			.8828 (1.3)	−.0023 (9.8)	.152	.8664 (1.2)	−.0023 (9.9)	.152

*Total Sample for all years with adjustments for country attributes (3600 dyads in sample).

synonym for how strategic the commodity is to the country's welfare). Precise measures of these require knowledge of each country's demand and supply curves for all commodities, data which are unfortunately not available to the author. Thus, only cursory preliminary tests are currently possible, with the hope that refinement of these ideas may be forthcoming in future research.

It is well known that certain countries have unique attributes that give some indication of their trade. For example, Saudi Arabia exports mostly oil—a strategic commodity to many countries. (Saudi Arabia's exports outweighed its imports 4:1 for the ten-year period under study.) A priori because of the strategic value of oil, one would expect countries trading with Saudi Arabia to experience large welfare losses if trading were to cease. Thus, these countries should be sensitive to Saudi Arabian trade. Since Saudi Arabia is such a large exporter of strategic material, it need not be as sensitive to other countries.

This hypothesis concerning the sensitivity of the trade-conflict relationship to the strategic nature of trade can be tested. Regressions of the same nature as equations 1 to 4 run on a country by country basis would yield insight concerning this relationship. For example, to use the Saudi Arabian illustration, regressions should yield a low export elasticity (i.e., a small impact of trade on conflict) when Saudi Arabia is an actor trading with the rest of the world, and a high elasticity when Saudi Arabia is treated as a target by the rest of the countries.

Regressions limiting the actor or target to particular countries yield these kinds of expected results (Table 5). The trade-conflict elasticity with Saudi Arabia as actor is −.15. The negative sign implies that trade actually *increases* hostility. A country exporting an exceedingly strategic commodity can use its monopoly power without worry about being hostile. When Saudi Arabia is viewed as a target, the elasticity is well above average at 0.65. Apparently oil importers *minimize* hostility to Saudi Arabia.

These kinds of patterns emerge for other countries as well. Libya, also an oil exporter (though not to as great an extent), has the same pattern of coefficients. Similar results are obtained for East Germany, which appears to be a net exporter.

The same logic should apply to large self-sufficient countries. Thus the United States with large amounts of trade (note the low conflict measure of −9.02) whould have a large trade-conflict elasticity when viewed as a target country. Small countries with balance of payments problems should be highly sensitive to trade. This is the case for Lebanon and Israel.

TABLE 5

Conflict Regressions for Selected Countries
All Years Combined

Country		*NETF*	*X*	*X Coefficient*	*Elasticity*
United States	(A)	−9.02	714.49	−.00145	.12
	(T)	−3.68	560.28	−.00287	.44
Canada	(A)	−1.12	371.96	−.00067	.22
	(T)	−1.13	361.32	−.00037	.12
United Kingdom	(A)	−3.54	234.46	−.00679	.45
	(T)	−3.58	278.95	−.00613	.48
France	(A)	−2.42	197.08	−.00425	.35
	(T)	−2.94	235.32	−.00270	.22
Germany	(A)	−3.66	325.18	−.00377	.33
	(T)	−3.14	334.97	−.00501	.53
East Germany	(A)	0.29	10.39	0.00367	−.13
	(T)	0.11	5.83	−.03174	1.68
Saudi Arabia	(A)	−1.36	47.00	0.00434	−.15
	(T)	−1.73	11.60	−.09622	.65
Libya	(A)	− .39	21.55	0.00004	−.0002
	(T)	− .70	11.49	−.00769	.13
Lebanon	(A)	− .43	3.38	−.14025	1.10
	(T)	−1.60	15.98	−.05884	.59
Israel	(A)	− .77	15.28	−.02345	.47
	(T)	− .94	34.17	−.01509	.55

Key:

(A) = Country viewed as actor toward the other 20 nations.

(T) = Country viewed as target of the other 29 nations.

mean NETF = Mean frequency of net conflict–negative values imply net cooperation. NETF(A) represents hostility of country toward other nations, NETF(T) represents hostility of other nations toward the country.

mean X = Mean exports.

X Coefficient = The impact of exports on NETF; a negative coefficient implies that trade reduces conflict.

Elasticity = The elasticity between trade and conflict; a positive elasticity implies a reduction of conflict.

NOTE: The coefficients for the United States, Canada, United Kingdom, France, and Germany were from regressions that did *not* adjust for country size or other country attributes. The reason is because these coefficients were to represent large country-small country differences. The remainder of the coefficients were adjusted for the attributes listed in Table A.2. This is because these coefficients were presented to illustrate the import-export differences.

(6) QUALIFICATIONS AND CONCLUSIONS

Several qualifications are necessary concerning certain inherent aspects of the article. These are listed briefly. First, *only* two-country pairs are considered. No implications are obtained about coalitions. Similarly, market competition such as monopoly power or oligopolistic structures were ignored even in the theoretical section. Second, while some evidence is presented in Table 4, not enough of a distinction is made between *kinds* of hostility versus *levels* of hostility. Questions pertaining to the substitutability of one kind of conflict or another are not addressed. Third, international data have the reputation of being subject to measurement error. Attempts at corroboration with other data sets have been made. The world trade data originally compiled by Gillespie and Zinnes (n.d.) was found to be highly correlated with more recent compilations by the International Monetary Fund. The attribute data used were only those series of Bank's (1973) data set known to be subject to the least amount of error. Problems with events data have already been discussed in the text. Still new data sets for further corroboration are needed. Finally, better exploitation of the time series nature of the data (perhaps by enlarging the number of years in the data set) could enhance these two-stage least-squares statistical techniques.

Still, despite these caveats, it is thought that the main thrust of this article is correct. Its importance lies with the logical and rational approach used in defining dyadic trade-conflict relationships. A model was postulated, providing a justification why trade and conflict should be negatively related. Further, it was illustrated how this relationship is strengthened the more strategic the trade. The empirical results appear robust enough to give credence to the article's contentions.

REFERENCES

ALKER, H. R. and B. M. RUSSETT (1965) World Politics in the General Assembly. New Haven: Yale Univ. Press.

AZAR E. (1980) "The Conflict and Peace Data Bank (COPDAB) Project." J. of Conflict Resolution 24.

——— (1973) Study of the Behavior of 31 Nations from 1948 Through 1973. Political Science Department and Institute for Social Science Research, University of North Carolina at Chapel Hill.

——— and T. HAVENER (1976) "Discontinuities in the symbolic environment: a problem in scaling." Int. Interactions 2: 231-246.

AZAR, E. and T. J. SLOAN (1975) "Dimensions of Interaction: A Source Book for the Study of the Behavior of 31 Nations From 1948 Through 1973." Occasional Paper 8, International Studies.
BANKS, A. (1973) SUNY-Binghampton Cross-National Time-Series Data. Center for Comparative Political Research, State University of New York at Binghamton.
BLAINEY, G. (1973) The Causes of War. New York: Free Press.
BOULDING, K. (1966) "Towards a pure theory of threat systems." Amer. Econ. Rev. 53: 424-434.
CAVES, R. and R. JONES (1977) World Trade and Payments. Boston: Little, Brown.
CHADWICK, R. (1972) "Transactional data and analysis: in search of concepts." Int. Organization: 659-680.
COOPER, R. (1968) The Economics of Interdependence: Economic Policy in the Atlantic Community. New York: McGraw-Hill.
GILLESPIE, J. and D. ZINNES (1971) Military Expenditures Data: 1948-1970. Inter-University Consortium for Political Research, University of Michigan.
——— (n.d.) World Trade Data: 1958-1968. Inter-University Consortium for Political Research, University of Michigan.
KEGLEY, C. [ed.] (1975) International Events and the Comparative Analysis of Foreign Policy. Columbia: Univ. of South Carolina Press.
KELEJIAN, H. and W. OATES (1974) Introduction to Econometrics. New York: Harper & Row.
KEOHANE, R. and J. NYE (1972) Transnational Relations and World Politics. Cambridge, MA: Harvard Univ. Press.
NEWCOMBE, A. and J. WERT (1973) "The use of an inter-nation tensiometer for the prediction of war." Papers of the Peace Sci. Society (International): 73-83.
READ, D. (1967) Cobden and Bright: A Victorian Political Partnership. London: Edward Arnold.
RICHARDSON, L. F. (1960) Arms and Insecurity. Chicago: Quadrangle.
RICHARDSON, N. (1978) Foreign Policy and Economic Dependence. Austin: Univ. of Texas Press.
RUSSETT, B. M. (1967) International Regions and the International System Chicago: Rand-McNally.
STIGLER, G. (1963) The Intellectual and the Market Place and Other Essays. London: Macmillan.

Appendix A

DATA SOURCES

To perform empirical tests, data on dyadic conflict, international trade, and country attributes were used. (See text for sources.) These data were pooled for the years 1958-1967. Each source is discussed in turn.

(1) *Conflict and Peace Data Bank (COPDAB).* COPDAB is an extensive, longitudinal collection of more than 350,000 daily and yearly events data re-

TABLE A.1
Attribute Control Variables

Variable and Units of Measure	
1. Population density (person per square mile)	
2. Percentage of GNP originating in industry	
3. Highway vehicles per capita	
4. Secondary school enrollments per 1000	
5. University enrollments per capita	
6. All school enrollments per capita	
7. GNP per capita (U.S. dollars)	
8. Electrical production per capita (KWH/capita)	
9. Yearly percentage of change in population	
10. Yearly percentage of change in imports	multiply by (.01) to get percentage change
11. Yearly percentage of change in exports	
12. Yearly percentage of change in university enrollments	
13. Yearly percentage of change in GNP	
14. Defense Expenditures (millions of U.S. dollars)	

ported by dyad. Events are obtained as reported from 47 newspaper sources. These events are coded on the 15-point scale (described in note 5) representing different kinds of cooperation and conflict. This article concentrates on yearly summaries of dyadic conflict for all possible pairs of the 30 countries (see note 6) in the original survey. Of these 8410 possible data points (there exist 29 squared dyads for each of ten years), complete information exists for approximately 6000 observations. This information forms the basis of the sample. The selectivity bias caused by the sample containing a preponderance of NATO and Middle Eastern countries may bias the results. However, preliminary analyses indicate that this bias is not substantial, but further experimentation is planned. As indicated in the text, the conflict measure consists of frequency of events coded as conflict *minus* the frequency of events coded as cooperative between each dyad for *each* year.

(2) *World Trade Data.* Import and export data collected on a country by country directional basis, and compiled by Gillespie and Zinnes (n.d.), are used. All data are in U.S. dollars. Sources for the data are found in the International Monetary Fund series of annual volumes under the heading "Direction of Trade."

(3) *Attribute Data.* Standardizing variables to hold constant other factors that may affect both trade and conflict are included. Banks's (1973) Cross-National Time-Series Data Archive was used to select thirteen country attributes over each of the years (see Table A.1 for a listing of the attributes). These attributes were selected primarily because they had the least missing informa-

tion. However, including these variables enables possible verification of already established hypotheses concerning conflict. Also included are data on defense expenditures (compiled mostly from the UN Statistical Yearbook by Gillespie and Zinnes) to standardize for general levels of country militancy.

Appendix B
A MATHEMATICAL MODEL

Suppose a country's welfare function is

$$w = w(c,z) \qquad [B.1]$$

where arguments c and z represent desired consumption and apparent existing hostility. Formally (eliminating vector notation), consumption equals total production plus imports minus exports.

$$c = q + m - x \qquad [B.2]$$

where

$q = q_i$ = the production vector of each commodity i

$x = \sum_j x_i$ = the export vector of each commodity i to all countries j = 1 . . . K

$m = \sum_j m_i$ = the import vector of each commodity i from all countries j = 1 . . . K.

The z vector represents net conflict (NETF):

$z = z_i$ = net conflict vented at country j = 1 . . . K. [B.3]

Including c within the welfare function is obvious. Greater levels of consumption yield more welfare. Inclusion of z allows for the existence of noneconomic motivations for conflict and cooperation.

A country's trade can be represented as the value of exports of each commodity (i) to country (j) minus the value of imports:

$$\sum_i \sum_j x_{ij} Px_{ij} - \sum_i \sum_j m_{ij} Pm_{ij} = 0 \qquad [B.4]$$

where

x_{ij} = exports of commodity i to country j

m_{ij} = imports of commodity i from country j

Px_{ij} = price per unit charged to country i for commodity j,

and

Pm_{ij} = price per unit import to country i for commodity j.

If no balance of trade problems are permitted, then equation 2 holds as an equality.

As indicated, conflict is assumed to affect the price of trade.

Thus

$$Px_{ij} = f(z_j) \qquad [B.5]$$

and

$$Pm_{ij} = g(z_j) \qquad [B.6]$$

where z is already defined as conflict toward trade partner j.

It was hypothesized that hostility raises import prices and lowers export prices. Thus

$$\frac{\partial Px_{ij}}{\partial z_j} = Px'_{ij} = f' < 0 \qquad [B.7]$$

and

$$\frac{\partial Pm_{ij}}{\partial z_j} = Pm'_{ij} = g' > 0. \qquad [B.8]$$

This article seeks to ascertain whether countries with the most trade tend to have the least conflict, ceteris paribus. To answer this question

is to identify optimal levels of conflict or cooperation *given* existing consumption and trade patterns. Thus, rational behavior on the part of a country's decision makers implies choosing optimal levels of z that maximize B.1 given constraints B.2 through B.8. If we rid ourselves of cumbersome vector notation, this implies maximizing the following LaGrangian with respect to z:

$$\underset{z}{\text{Max}}\ L(z;c) = w(z;c) + \lambda \left[xP_x(z) - mP_m(z)\right]. \qquad [B.9]$$

Optimality conditions dictate:

$$\frac{\partial w}{\partial z} + \lambda \left[x \frac{\partial P_x}{\partial z} - m \frac{\partial P_m}{\partial z}\right] = 0 \qquad [B.10]$$

$$\frac{\partial w}{\partial \lambda} = xP_x(z) - mP_m(z) = 0 \qquad [B.11]$$

Equation B.11 is merely a restatement of the balance of payments constraint. Equation B.10 describes the mechanism by which a country decides on amounts of belligerence. The bracketed term represents the net cost associated with extra hostility (MC). It is the implicit price of receiving less money for exports while at the same time having to pay more for imports.

Given the postulated relationship between P_x, P_m, and z, the MC curve can be illustrated graphically (Figure B.1) as upward sloping (for example AA'). Its position depends on a country's level of m and x, as well as the specific $P_x(z)$ and $P_m(z)$ functions that hold. In equilibrium, this cost of hostility must just balance the welfare benefit of more hostility ($\partial w/\partial z$). Thus the intersection of the $\partial w/\partial z$ curve (DD') and MC depict the equilibrium amount of conflict. Even if a country is basically indifferent to being hostile ($\partial w/\partial w = 0$), an equilibrium net conflict-cooperation point exists. In this latter case, optimal conflict is decided only on economic grounds at the point where the MC curve intersects the horizontal axis.

Totally differentiating B.10 and B.11 and solving for dz/dx and dz/dm yields

$$\frac{dz}{dx} < 0 \qquad [B.12]$$

$$\frac{dz}{dm} < 0 \qquad [B.13]$$

implying that countries involved in *more* trade have on balance higher costs of conflict, and hence *ceteris paribus* are hypothesized to engage in *less* conflict.* This result serves as a justification for empirical study of conflict and trade.

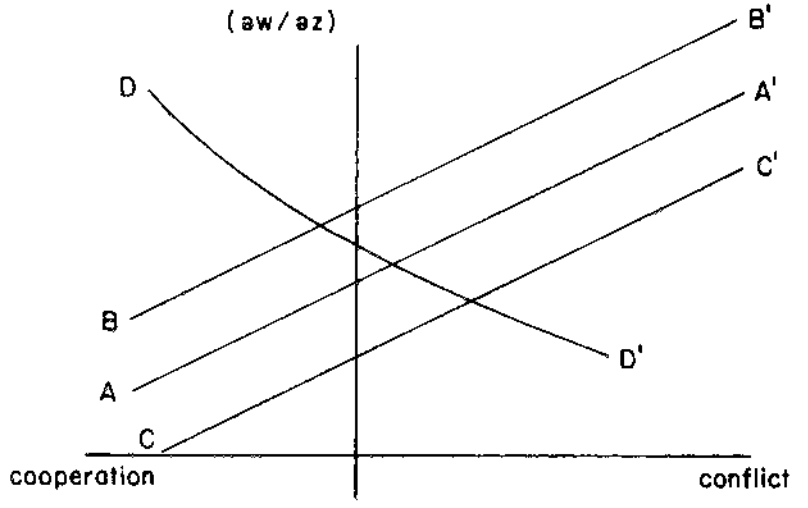

Figure B1: Determination of Conflict

*This result can easily be seen by appropriately shifting the MC curve in Figure B.1. If imports or exports are increased, MC shifts up (BB'), yielding less conflict. If imports or exports decrease, MC shifts down (CC'), yielding the opposite result. Further, the $\partial w/\partial z$ acts as a shift parameter. Those countries that benefit by being hostile tend to have greater equilibrium levels of hostility. The opposite is true for countries with $\partial w/\partial z < 0$.