Disarmament, Economic Conversion, and Management of Peace

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25 Strategic Trade and the Incentive for Cooperation

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INTRODUCTION

The basis of this chapter is that not all countries are in conflict. In fact, our motivation is that on the average there exists more cooperation than conflict, and that while some country pairs (dyads) such as the United States and the U.S.S.R. exhibit great amounts of hostility, these same countries have extremely cooperative relations with other nations. In short, if there are reasons explaining existing differences in the behavior of one country toward another, then these insights could be applied to understanding how cooperation evolves between one country and others. For this reason, this chapter takes the perspective of a given country, called an actor. It assumes that the actor has a given factor endowment (including technological prowess) not easily changed at least in the short run, so that trade patterns with other countries emerge. Given these trade patterns, a country is assumed to behave rationally in its foreign relations decisions. Specifically, if conflict leads to a dimunition of trade, then one implicit cost of conflict is the lost welfare gains associated with trade. Ceteris paribus, the rational actor would engage in smaller amounts of conflict the greater the associated potential welfare loss. In short, trade enhances cooperation and deters conflict.

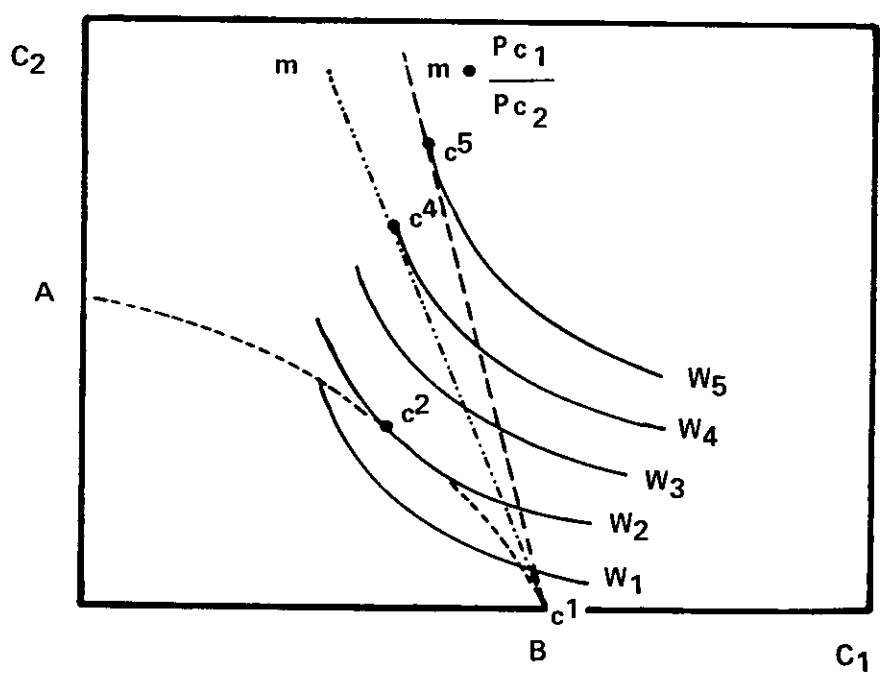
THE CONFLICT-TRADE MODEL

We begin with the standard assumptions used by international trade theorists to describe an actor country. Let the convex set $\{q\}$ containing possible output vectors q_i such that $\{q\} = U_i q_i$ for $i = 1, \ldots, n$, be the actor's production possibility frontier. In a two-commodity world $\{q\}$ can be represented by the set $\{q_1, q_2\}$, where output levels of each commodity q_1 and q_2 can be defined by the implicit function $f(q_1, q_2) \leq K$. Graphically this is merely the region on or below the production possibility frontier (AB) defined in Figure 25.1.

Next, to obtain rational behavior, we define a welfare function W(C, Z) for the decision maker in the country, assumed to be derived from the preference sets of the entire population.[1] This function depicts welfare levels associated with each possible consumption basket $[C = (c_1, c_2, \ldots, c_m)]$, but it is also dependent on another variable, $Z = (z_1, z_2, \ldots, z_k)$, representing conflict or cooperation toward any of k target countries, but which for now is assumed constant, and thus not part of the optimization process. The welfare function is assumed to be quasiconcave, such that $w(c, z) > 0$, $w_c > 0$, but that $w_{cc} < 0$. No assumptions are necessary for the effect of z on welfare levels, since z is for now constant. Social welfare curves w are depicted in Figure 25.1, with optimal consumption at $c_2 = (c_{12}, c_{22})$.

The simplest bilateral trade model assumes potential trade at a constant price ratio $m = p_{c_1}/p_{c_2}$. In the short run this yields an equilibrium $c_4 = (c_{14}, c_{24})$, while in the long run, because of increased specialization in do-

Figure 25.1
The Gains from Trade



mestic production, $c_5 = (c_{15}, c_{25})$ is achieved, with trade equalling $c_5 - c_1$. The combined gain from specialization in both production and trade is $W_5 - W_2$.

Suppose, for example through quotas, embargoes, or even blockades, conflict implies the cessation (or at least diminution) of trade. Then the implicit cost of conflict is the lost gains from trade $(W_5 - W_2)$ associated with decreased trade.[2] Obviously, the greater the welfare loss the greater the costs of conflict, and hence the smaller the incentive for conflict, independent of the countries' innate preferences for peace. Even if conflict does not directly diminish trade, but instead leads to trade restrictions that ultimately affect the terms of trade, the same result applies. In this case less desirable terms of trade result (e.g., m in Figure 25.1) implying a new equilibrium (c_1) and a lower welfare. Again the implicit price of conflict is $(W_5 - W_4)$, the lost welfare associated with diminished trade brought about by conflict.

To see how these potential welfare losses lead to greater cooperation and less conflict, we introduce more structure. Domestic consumption of commodity i, C_i, equals domestic production of q_i plus imports m_i minus exports x_i. As such,

$$C_i = q_i + m_i - x_i \tag{1}$$

$$m_i = \sum_{j=1}^{k} m_{ij} \tag{2}$$

and

$$x_i = \sum_{j=1}^{k} x_{ij} \tag{3}$$

where j indexes import and export partners, with k being the number of countries.

Next we define $Z[z_1, z_2, \ldots, z_k]$ to represent conflict (from the actor) to any target country j. The actor's welfare function as we have defined it is

$$W = W(C, Z) = W\left(\left[q_i + \sum_j m_{ij} - \sum_j x_{ij}\right], \left[z_j\right]\right) \tag{4}$$

where the bracketed terms are the commodity and conflict vectors just defined. Including C within the welfare function is obvious. Higher levels of consumption yield greater welfare levels. Including Z within the welfare function is unnecessary. However, including Z merely allows for the possibility of noneconomic motivations for conflict or cooperation.

Our purpose is to derive a relationship between economic trade and political conflict. As such, we must identify optimal conflict/cooperation levels given existing consumption and trade patterns.

Trade can be represented as the value of exports of each commodity i to country j minus the value of imports. If no balance-of-payments problems exist, then

$$\sum_{i}^{m}\sum_{j}^{k} x_{ij}\, P_{x_{ij}} - \sum_{i}^{m}\sum_{j}^{k} m_{ij}\, P_{m_{ij}} = 0 \tag{5}$$

where $P_{x_{ij}}$ = unit export price charged to country j for commodity i and $P_{m_{ij}}$ = unit import price charged by country j for commodity i.[3]

Prices are determined in the international market, but as indicated contain at least a component assumed to be dependent on dyadic conflict. Thus,

$$P_{x_{ij}} = f(z_j) \tag{6}$$

and

$$P_{m_{ij}} = g(z_j) \tag{7}$$

such that hostility raises the price that must be paid for imports and lowers the price at which exports can be sold:

$$\frac{\partial P_{m_{ij}}}{\partial z_j} = P'_{m_{ij}} = g' > 0 \tag{8}$$

$$\frac{\partial P_{x_{ij}}}{\partial z_j} = P'_{x_{ij}} = f' < 0 \tag{9}$$

If conflict, such as through embargoes or boycotts, leads to the complete cessation of trade, then $f' = -\infty$ and $g' = \infty$, though, as we will indicate, the net welfare loss associated with lost trade need not be great if alternative trade avenues exist.

Given this structure, as well as predetermined trade, rational behavior on the part of a country's decision makers implies choosing optimal levels of Z that maximize welfare level (4) subject to equations (1) through (3) and (5) through (9). This implies maximizing the following Lagrangian:

$$\max_{z_j} L = W\left[\left(q_i + \sum_j m_{ij} - \sum_j x_{ij}\right), z_j\right] + \lambda\left[\sum_i\sum_j x_{ij}P_{x_{ij}}(z_j) - \sum_i\sum_j m_{ij}P_{m_{ij}}(z_j)\right] \tag{10}$$

First-order optimality conditions for optimal conflict require

$$\frac{\partial W}{\partial z_j} = \lambda \left[\sum_i x_{ij} \frac{\partial Px_{ij}(z_j)}{\partial z_j} - \sum_i m_{ij} \frac{\partial Pm_{ij}(z_j)}{\partial z_j} \right] = 0 \tag{11}$$

$$\frac{\partial W}{\partial \lambda} = \sum_i \sum_j x_{ij} P_{x_{ij}} (z_j) - \sum_i \sum_j m_{ij} P_{m_{ij}} (z_j) = 0 \tag{12}$$

Equation (12) is merely the balance-of-payments constraint. Equation (11) describes the mechanism by which a country decides on the amount of belligerence. Since the bracketed term is the implicit price of receiving less money for exports while at the same time having to pay more for imports, it represents the marginal cost (MC) associated with extra hostility. In equilibrium, this cost of hostility must just balance the welfare benefit of added hostility ($\partial W/\partial z_j$). Note that equilibrium conflict/cooperation levels still arise even if hostility or cooperation implies no welfare gain ($\partial W/\partial z_j = 0$). In this case, optimal conflict is based purely on economic grounds. If imports or exports are increased, MC increases, thereby implying lower levels of conflict. Thus,

Proposition One: The greater an actor country's level of trade with a target, the smaller the amount of actor-to-target conflict.

To the extent that there are pressures not to increase foreign debt (especially in the long run), conflict induces a change in optimal imports and exports. The more unfavorable the relative price of trade induced by conflict, the more exports are forced to increase and imports decrease. The exact change in imports and exports can be derived from the maximization of equation (10) with respect to x and m. Eliminating subscripts,

$$\left(\frac{\partial W}{\partial C}\right) \left(\frac{\partial C}{\partial x}\right) + \lambda P_x(z) = 0 \tag{13}$$

$$\left(\frac{\partial W}{\partial C}\right) \left(\frac{\partial C}{\partial m}\right) + \lambda P_m(z) = 0 \tag{14}$$

imply demand and supply curves for imports and exports from which the implicit welfare losses associated with changed foreign trade can be computed. From the above, we can show that welfare losses increase proportionally with the inelasticity of the import demand and export supply curves. Hence,

Proposition Two: 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.

In short, we hypothesize that dyadic international conflict and the welfare gains of the associated dyadic trade are related. The greater the welfare gain, the smaller the level of conflict. Since welfare gains increase with the level of trade, yet decrease with the import demand and export supply elasticities, we can argue that countries with the most trade and the greatest gains from trade have the most to lose from conflict, and hence ceteris paribus have lesser amounts of conflict. Countries with the most elastic import demand and export supply curves gain the least trade, and hence ceteris paribus engage in greater conflict.

This chapter presents the preliminary empirical results obtained when the conflict-trade relationship was augmented by the inclusion of trade elasticities.

PRELIMINARY RESEARCH AUGMENTING THE TRADE-CONFLICT RELATIONSHIP WITH TRADE ELASTICITY DATA

Looking only at the aggregate trade-conflict relationship is insufficient. As we indicated, if conflict leads to the cessation or diminution of trade, caused by a possible change in the terms of trade, then one implicit cost of conflict is the lost economic gains from trade. The higher the gains from trade, the higher the implicit cost of conflict, and the greater the incentives for cooperation. However, trade alone does not determine the gains derived from it. Trade data must be augmented by country import demand and export supply elasticities. The more inelastic the import demand and export supply curves, the greater the levels of consumer surplus, and hence, the greater the trade gains. In turn, the greater the trade gain, the smaller the probability of conflict. Thus, the more inelastic the import demand and export supply curves, the smaller the probability of conflict, holding trade constant. While this result may appear obvious, to our knowledge there are no previous empirical tests of this hypothesis. Yet, such a test is important because verification of this latter result would add credence to the proposed economic model of dyadic conflict.

Bilateral Import Demand Elasticity Estimates and the Trade-Conflict Relationship

As a preliminary test of this hypothesis, we utilized already computed trade elasticities. Jaime Marquez (1988) developed a world trade model in which he estimated income and price elasticities for bilateral import equations over the period 1970 to 1984.[4] Marquez followed the imperfect-substitute model of Goldstein and Khan (1985) to estimate bilateral import elasticities. He did not disaggregate on a commodity-by-commodity basis.

Table 25.1
The Conflict-Trade Relationship Enhanced by Dyadic Trade Elasticities

Variable	Mean[1]	Coefficient[2]	Elasticity[3]
Constant		-071.18	
		(3.12)	
Dyadic Trade Elasticity	0.83	37.62	0.47
	(0.04)	(2.63)	
Exports (billions US $)	4.13	-4.49	0.28
	(0.67)	(4.47)	
Imports (billions of US $)	4.02	-8.21	0.50
GDP (actor)	232.8	0.0178	
GDP(actor)-GDP(target)	3.93	-0.056	0.003
	(39.0)	(2.20)	
Net Conflict	-66.68		
	(9.66)		
R^2		0.35	
Observations		178	

1 Standard error of mean in parentheses.

2 t-values in parentheses.

3 Computed at mean values.

Table 25.1 contains regression results for the conflict-trade model using the Marquez elasticities. Country trade and attribute data for 1973 were used to maintain some degree of time period comparability. As before, trade is inversely related to conflict, but the magnitude of the relationship is far stronger than before. A 10 percent rise in imports leads to a 5 percent reduction in conflict. For a 10 percent rise in exports conflict is reduced by almost 3 percent. Import demand elasticities also remain a strong deterrent. A 10 percent more elastic demand is associated with a 5 percent lower level of conflict. Here imports appear more powerful than exports as a deterrent to conflict. Using an oil crisis year may be the reason, but this will have to be investigated further.

To enhance the gains from trade argument, the difference in actor-target gross national product (GNP) is used as an exogenous proxy for differences in factor endowment. If actor and target GNP differences (GNPDIF) imply actor-target factor endowment differentials, then larger GNPDIF should raise the gains from trade and diminish conflict. Again the regression results (that is, the −0.56 coefficient) are consistent with this hypothesis.

Commodity-by-Commodity Bilateral Import Demand Elasticities and the Trade-Conflict Relationship

In this section we extend the analysis of the trade-conflict relationship further by incorporating bilateral demand elasticities that are disaggregated on a commodity-by-commodity basis.

Haas and Turner (1988) describe the International Monetary Fund (IMF) World Trade Model (WTM), which can be used as a source of import and export price elasticities computed in three merchandise trade categories (manufactures, agricultural goods, and raw materials) for 14 of the largest Organization for Economic Cooperation and Development (OECD) industrial countries.[5] The WTM is partial equilibrium in nature.[6] Import and export unit values and quantities for each of the three commodity classes as well as domestic wholesale prices are endogenously determined.

The WTM emphasizes the demand for a country's imports as the important behavioral relationship and treats the demand for a country's exports as the weighted sum of its trading partners' imports. Import demand functions depend on domestic activity and relative prices. Export supply is determined by the foreign market size, relative export prices, and relative capacity utilization. These equations are estimated for the period 1962 through 1983.

Although the IMF WTM does not yield bilateral trade elasticities, bilateral estimates can be obtained using the trade share matrix methodology as outlined in Armington (1969). According to Armington, for any given class of items, such as manufactures, the following relationship holds between various elasticities and market shares:

$$N_{ij} = (1 - S_{ij})e_i + S_{ij}n_i \qquad (15)$$

where N_{ij} = the partial elasticity of demand of buyers in the ith country for manufactures produced by the jth country, S_{ij} = the share of the jth country's manufactures in the ith country's total expenditure on manufactures, e_i = the elasticity of substitution in the ith market between manufactures of any pair of countries (including the ith), and n_i = the partial elasticity of demand buyers in the ith country for manufactures in general, irrespective of the source of supply. When $i \neq j$, then n_{ij} is the ith country's elasticity of import demand from j.

We have used this relationship to convert the WTM's n_i, a given country's total elasticity of demand for a given type of good (manufactures, agricultural goods, or raw materials), into bilateral elasticities n_{ij}. The shares S_{ij} are calculated from a square matrix of trade of a given type of commodity, using detailed dyadic OECD trade flow information. The elasticity of substitution e_i was calculated using the related estimates available in Marquez (1988). Since e ranged from 0.84 (Canada's total imports from Germany) to 1.67 (U.K.'s total imports from Canada), we set $e = 1$ for all types of commodities and regardless of the country pair. In future work we will test for the sensitivity of our results to e.

The regression results are shown in Tables 25.2 and 25.3. So that these results will be comparable with the results in the previous section, only data for 1973 were used. Future work will extend the time period from 1970 through 1986.

Table 25.2 shows the trade-conflict relationship when the dyadic trade elasticity for manufactures is used to measure the gains from trade. The signs are consistent with our expectations and with the results from the previous section, in which bilateral trade elasticities (not disaggregated by type of imported good) were used. Table 25.2 shows that exports and the import demand elasticity continue to be important determinants of net conflict. Imports, however, lose their significance. This is due to the fact that the Armington equation used to derive commodity-specific dyadic elasticities contains a lot of import information, namely a target country's share of an actor country's total manufactured imports. Therefore, under this elasticity specification, exports appear to be a greater deterrent to conflict than imports.

The results for the trade-conflict relationship using bilateral trade elasticities for raw materials are shown in Table 25.3. The raw materials elasticities computed in the WTM did not vary as much as the manufactures elasticities. Also, no elasticities were provided for five out of the fourteen countries. Consequently, we found that a slightly different specification from that given in Table 25.2 was needed. Rather than use the dyadic trade elasticities for raw materials that the Armington equation yields, we used the two terms of the Armington equation as two separate explanatory variables in our regressions.

The signs are consistent with our hypotheses concerning the effect of trade, factor endowments, and elasticities on net conflict. Imports were omitted from this regression since they were insignificant when the two Armington terms were included.

Table 25.2
The Conflict-Trade Relationship Using Manufactures Bilateral Elasticities

Variable	Mean	Coefficient	Elasticity
Constant		-759.21	
		(2.59)	
Dyadic Trade Elasticity	0.987	612.86	3.93
for Manufactures	(0.003)	(2.06)	
Exports to target	1394.47	-0.039	0.35
(millions of US$)	(174.64)	(2.11)	
Imports to target	1452.90	0.013	
(millions of U.S.$)	(189.22)	(0.78)	0.12
GDP of the actor	216.20	0.187	0.26
(billions of U.S.$)	(23.03)	(3.36)	
GDP(actor)-GDP(target)	15.20	-0.138	0.014
(billions of U.S.$)	(33.37)	(3.90)	
Net Conflict	-153.74		
	(10.98)		
R^2		0.19	
Observations		173	

Notes:

(i) To compute the manufactures dyadic trade elasticities, the trade share matrix contained all trade flows from the Standard International Trade Classification (SITC) sections 5 through 8 inclusive, all in millions of US$. SITC 5 is chemicals. SITC 6 is manufactured goods. SITC 7 is machinery and transport equipment. SITC 8 is miscellaneous manufactured articles. The data used was f.o.b. export data. A country's total imports of manufactures was converted from c.i.f. import to f.o.b. export using a country-specific conversion factor.

(ii) t-values appear in parentheses in the Coefficients column and the standard error of the mean appears in brackets in the Mean column.

Table 25.3
The Conflict-Trade Relationship Using Raw Materials Bilateral Elasticities

Variable	Mean	Coefficient	Elasticity
Constant		-1071.18	
		(1.82)	
Armington's first	0.954	916.07	5.46
term: $(1-S_{ij})$		(1.54)	
Armington's second	0.021	2627.77	0.34
term: $S_i n_i$		(3.31)	
Exports to target	1682.69	-0.041	0.43
(millions of U.S.$)		(5.79)	
GDP of the actor	263.95	0.22	0.36
(billions of U.S.$)		(3.68)	
GDP(actor)-GDP(target)	44.52	-0.136	0.038
(billions of U.S.$)		(2.96)	
Net Conflict	-160.00		
R^2		0.33	
Observations		111	

Notes:

(i) To compute the raw materials dyadic trade elasticities, the trade share matrix contained all trade flows from the SITC sections 2 plus 4, all in millions of U.S.$. SITC 2 is crude materials, inedible, except fuels. SITC 4 is animal and vegetable oils and fats. The data used was f.o.b. export data. A country's total imports of raw materials was converted from c.i.f. import to f.o.b. export using a country-specific conversion factor.

(ii) T-values appear in parentheses in the Coefficients column.

NOTES

1. Indeed, Lionel Robbins (1968) finds special interest groups to be unimportant in the formulation of policy so that an aggregate welfare function is viable.

2. At this point, we assume no direct costs of conflict.

3. Relaxing this restrictive balance-of-payments constraint does not alter the results.

4. Marquez's (1988) model explains bilateral trade flows among all trading partners in the world: Canada, Germany, Japan, the United Kingdom, the United States, other industrial countries, OPEC, non-OPEC developing countries, and the rest of the world. We further disaggregated the "other industrial countries" category, but because of the turbulent oil crises of the 1970s for now deleted the OPEC countries. Our disaggregation yields 178 dyads.

5. The countries are Austria, Belgium-Luxemburg, Canada, Denmark, France, the Federal Republic of Germany, Italy, Japan, the Netherlands, Norway, Sweden, Switzerland, the United Kingdom, and the United States.

6. Domestic demand in each country, nominal exchange rates, wages rates, commodity prices, and GNP deflators are all exogenous.