Trade Does Promote Peace:

New Simultaneous Estimates of the Reciprocal Effects of Trade and Conflict*

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Abstract

Two studies question whether economic interdependence promotes peace, arguing that previous research has not adequately considered the endogeneity of trade. Using simultaneous equations to capture the reciprocal effects, they report that trade does not reduce conflict, though conflict reduces trade. These results are puzzling on logical grounds. Trade should make conflict less likely, *ceteris paribus*, if interstate violence adversely affects commerce; otherwise, national leaders are acting irrationally. In re-analyzing the authors' data, this article shows that trade does promote peace once the gravity model is incorporated into the analysis of conflict. Both trade and conflict are influenced by nations' sizes and the distance separating them, so these fundamental exogenous factors must be included in models of conflict as well as trade. One study errs in omitting distance when explaining militarized disputes. The other does not adequately control for the effect of size (or power). When these theoretically informed changes are made, the pacific benefit of trade again appears. In new simultaneous analyses, the article confirms that trade promotes peace and conflict contemporaneously reduces commerce, even with extensive controls for traders' rational expectations of violence. Previous studies that address the endogeneity of trade by controlling for the years of peace—as virtually all have done since 1999—have not overstated the benefit of interdependence. Commerce promotes peace because violence has substantial costs, whether these are paid prospectively or contemporaneously.

Research on Kant's proposal for 'perpetual peace' has advanced rapidly in the last ten years. There is now extensive social scientific evidence that interdependence and international organizations as well as democracy reduce interstate conflict (Jervis, 2002; Gleditsch, 2008). These encouraging results have been noted outside academe. The World Trade Organization (WTO) lists ten benefits of the trading system it manages, the first being that it helps to keep the peace because 'sales people are usually reluctant to fight their customers' (World Trade Organization, 2003: 2). The second benefit highlighted is that disputes are handled constructively by the organization's institutions and procedures. It is a happy irony of the post-Cold War era that WTO now denotes the World Trade Organization, not the Warsaw Treaty Organization. But two recent articles, both of which simultaneously consider the reciprocal effects of trade and conflict, question the liberal peace.

Omar Keshk, Brian Pollins, and Rafael Reuveny (2004; hereafter KPR) acknowledge that most research supports liberal theory, but counsel caution because few studies have simultaneously estimated the reciprocal effects of trade and conflict. When KPR do, the pacific benefit of commerce disappears: an interstate dispute reduces bilateral trade, but trade does not reduce the risk of a dispute. Hyung Min Kim and David Rousseau (2005; hereafter KR) also note the growing consensus for the liberal peace, but they too report that the apparent benefit of commerce is eliminated when the effect of conflict on trade is simultaneously estimated. Both studies report that jointly democratic pairs of states are unusually peaceful.

Liberals have always argued that interdependence reduces conflict because conflict discourages commerce. The use of force reduces the gains from trade and imperils the flow of information necessary for the development of mutual understanding (Russett & Oneal, 2001). The costly nature of conflict is also central to contemporary applications of bargaining theory

(Fearon, 1995; Gartzke, 1999): commercial relations increase the likelihood of peace because trade and investment make costly signals possible. If military action at the lower end of the spectrum did not entail loss, national leaders would not be able to communicate private information about capabilities and resolve. In either account, economic interdependence promotes peace because conflict is inconsistent with mutually beneficial economic ties (Polachek & Xiang, 2008). It is appropriate, therefore, to consider their reciprocal effects.

Here we reconsider the puzzling results reported by KPR and KR. We conclude that their challenges to the liberal peace derive from inadequacies in the specification of the conflict equation in their simultaneous analyses. Conflict, like trade, is influenced by the sizes of states and their geographic proximity (Boulding, 1962). These fundamental, exogenous factors shape states' ability and willingness to fight, so they must be carefully represented. Otherwise, trade will serve as a proxy for the omitted variable and the results will be spurious (Hegre, 2008). We show that the pacific benefit of interdependence is apparent when the influences of size and proximity on interstate conflict are explicitly considered.

In the following section we discuss the relevance of the gravity model of international interactions to research on the causes of war and states' economic relations. We then show that KPR's and KR's doubts regarding the liberal peace are easily resolved when the effects of geography and size are carefully modeled. Finally, we produce new simultaneous estimates of the reciprocal effects of trade and conflict with the best available data and refined specifications that corroborate further liberal theory.

Modeling Trade and Conflict

KPR and KR correctly point out that single-equation studies of the liberal peace may be biased because it cannot be assumed that regression residuals are uncorrelated with the explanatory

variables. Each seeks to resolve this danger by replacing the trade variable in the conflict equation with an instrument: the predicted values from a regression of trade on a large set of explanatory variables. Similarly, each creates an instrument for conflict in the trade equation and simultaneously estimates the reciprocal influences. As a result, the coefficient of trade in the conflict equation becomes insignificant or even switches from negative to positive. This is attributed to correction of the simultaneity bias.[1]

Rather, their failure to find evidence of the liberal peace is due to proxy effects. If an important explanatory variable is omitted from the conflict equation, is included in the trade equation, and contributes significantly to the instrument for trade, the estimated coefficient of the trade instrument will reflect the influence of the omitted variable. Conflict and trade must be carefully modeled to eliminate this problem. In this section, we discuss the importance of the gravity model of international interactions in specifying the trade and conflict equations. We then show in re-analyses of KPR and KR that there is strong support for the liberal peace once this omitted-variable bias is eliminated.

It is well established that trade is proportional to the sizes of the trading partners measured by gross domestic product (GDP) and population, and, inversely, to the distance between them (e.g., Deardorff, 1998; Rose, 2006; Martin, Mayer & Thoenig, 2008; Tomz, Goldstein & Rivers, 2007; Long, 2008). This is a 'gravity' model because of its similarity to Newton's formula for the mutual attraction of two masses. Supply and demand are proportional to the size of an economy and increase with per capita income. Transportation and other transaction costs increase with distance; thus trade is inversely related to the distance separating

[1] Goldsmith's (2007) simultaneous analyses are of limited value because he includes both dyadic trade (the instrumented variable) and the lower trade-to-GDP ratio in the conflict equation. Whether trade promotes peace depends on the magnitudes of the coefficients of both terms, which he does not consider.

countries. Contiguity, on the other hand, facilitates commerce. The gravity model is not limited to positive interactions, however. The sizes of countries and their proximity also influence the likelihood of interstate conflict (Boulding, 1962; Werner, 1999; Bearce & Fisher, 2002; Xiang, Xu, & Keteku, 2007; and Hegre, 2008). Militarized disputes are more frequent between large, powerful states that are geographically proximate.

Large countries can project their power at great distance and engage several countries at once. They have more neighbors and far-reaching economic and political interests. Thus, a nation's size indicates both opportunity and willingness to use force. In studying interstate conflict, it is best represented with an explicit measure of active and potential military capabilities, such as the Composite Indicator of National Capabilities (CINC) of the Correlates of War (COW) Project (Singer, Bremer & Stuckey, 1972). Of course proximity also influences interstate conflict. Because of its importance, contiguity and the distance between two states' capitals should both be used in analyses of interstate violence (Oneal & Russett, 1999a). States that share a border are particularly prone to conflict, and non-contiguous states in the same region are more likely to fight than more remote pairs.[2] Nor is a dichotomous indicator of contiguity highly correlated with distance.

Failure to recognize the importance of size or proximity for interstate conflict biases the estimated effects of other influences—such as trade, alliances, or states' involvement in international organizations—that are themselves affected by these fundamental, exogenous factors. Studies of militarized disputes must, therefore, incorporate all elements of the gravity model to avoid proxy effects and spurious results.

[2] Also, two countries may be contiguous but have distant capitals. Such pairs should fight less than states that have proximate political (and economic) centers.

A system of simultaneous equations can only be estimated if it at least one variable can be found for each equation that affects that dependent variable but not the other. For the trade equation, a useful approach is to control for resistances to the flow of goods and services created by tariffs and non-tariff barriers, which of themselves do not inhibit military attack. Preferential trade agreements (PTAs) facilitate trade (Martin, Mayer, & Thoenig, 2008) and generally only affect countries' security relations indirectly (Mansfield, Milner, & Pevehouse, 2007). Including an indicator of a PTA satisfies the basic identification criterion for the trade equation. In addition, we also account in the trade equation for 'multilateral trade resistances,' which include the average trade barriers each country presents to the world outside any PTA and faces from others, language differences, and currency transaction costs (Anderson & van Wincoop, 2004). Country and year indicators capture the effects of trade resistances across countries and through time (Feenstra, 2002; Glick & Taylor 2005; Subramanian & Wei, 2007; Kastner, 2007). [3]

For the conflict equation, our primary instrument is relative size or the balance of power. In contemplating military action, national leaders must be concerned with the power of their state compared to that of its rival. The idea that an equal balance of power deters conflict has deep historical roots, as does the theory that an imbalance of national capabilities is more likely to preserve the peace. Empirical work indicates, however, that it is preponderance that deters military action (Bremer, 1992; Kugler & Lemke, 1996; Oneal, Russett, & Berbaum, 2003): the probability of interstate violence declines as the probability of the more powerful state's winning

[3] Country fixed effects could be allowed to vary through time; but this is computationally intensive and unnecessary at this stage. Dyadic fixed effects are not appropriate because the conflict equation has a dichotomous dependent variable (Oneal & Russett, 2001; King, 2001; also, Long, 2008): all dyads that never fought would be dropped, and all between-dyads variation would be ignored. In contrast to Glick & Taylor (2005) and Green, Kim & Yoon (2001), Oneal & Russett (2001) find a conflict-reducing effect of trade even using dyadic fixed effects. King (2001) summarizes discussion of this issue. See Glick & Taylor for other approaches to controlling for trade resistances.

increases. Preponderance deters military conflict even when controlling for the total capabilities in a dyad (Hegre, 2008). The use of countries' CINC scores to measure size in our conflict equation, and real GDP and population in our trade specification, also serves to identify the conflict instrument, as do the lower and higher democracy scores.

Questioning the 'Primacy of Politics'

KPR note that few studies have simultaneously estimated the reciprocal effect of conflict on trade. Thus, the partial correlation reported between economic interdependence and peace in most research may show only that conflict reduces trade, not a pacifying effect of commerce. They assess this possibility using a two-stage estimator for a two-equation system in which one endogenous variable is continuous (trade) and the other (conflict) is dichotomous (Maddala, 1983; Keshk, 2003). They find that militarized disputes reduce trade; but when this reciprocal effect is taken into account, higher levels of trade do not increase the prospects for peace. Indeed, as seen in the first pair of columns of Table I where KPR's results are reproduced, the coefficient for trade in the conflict equation is positive and nearly significant ($p < .12$). In other respects their findings are generally consistent with theoretical expectations and previous empirical analyses.[4] KPR conclude that simultaneity bias explains past support for the liberal peace, but the results they report—conflict reducing trade but trade increasing conflict—are difficult to explain theoretically. They are also inconsistent with the history of the post-World War II period, when trade expanded greatly, even relative to production, and interstate violence

[4] KPR include a measure of economic growth in the conflict equation (Table 1). See Pickering & Kisangani (2005) and Oneal & Tir (2006) for recent work on this complex subject.

fell dramatically (Gurr, Marshall, & Khosla, 2000; Harbom & Wallensteen, 2007: 625; Gleditsch, 2008).[5]

The lack of empirical support for liberal theory in KPR's analysis is easily reversed. Despite their claim, they did not reproduce 'current models' of interstate conflict (p. 1156), nor do they parallel 'the work of Oneal and Russett as faithfully as possible' (p. 1160). In explaining discrepant results regarding the effect of interdependence, Oneal & Russett (1999a) had emphasized the importance of modeling geographical proximity when all pairs of states are analyzed. In numerous reports between 1999 and 2004, including one (Oneal, 2003a) in a volume co-edited by Pollins, Oneal and Russett incorporated both distance and contiguity in their conflict equation. Instead of replicating any of these studies, KPR chose Oneal & Russett (1997), an early specification.

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Insert Table I about here

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To show the effect of properly modeling geographic proximity, we re-estimate KPR's (2004) two-equation system using their data and estimator, simply adding the logarithm of distance to the conflict equation. The second pair of columns in Table I, shows that the coefficient of bilateral trade is now negative, as expected. Distance as well as contiguity is very

[5] Martin, Mayer, & Thoenig (2008) show formally how globalization could increase international conflict even though dyadic disputes reduce bilateral trade. As long as a dispute does not significantly affect a country's trade with third parties, multilateral openness reduces the opportunity cost of using force. Consider, however, the results from Long (2008), Glick & Taylor (2005), and in Table 4, where militarized disputes with third parties do adversely affect bilateral trade. Martin et al.'s conclusion that openness increases conflict is novel; compare Oneal & Russett, 1997, 1999b; Schneider & Schulze, 2003; McDonald & Sweeney, 2007. Indeed, the pacific benefit of openness is one thing Gartzke & Li (2003), Oneal (2003b), and Barbieri & Peters (2003) agree on. Martin, Mayer & Thoenig (2008) find the bilateral trade-to-GDP ratio significantly associated with dyadic peace.

significant in the conflict equation.[6] The coefficients in the trade equation in columns 2 and 4 are identical because the instrument for conflict was generated with the same set of variables, which included distance. The positive correlation of trade with conflict KPR report is spurious. Including distance among the instruments for trade but excluding it from the conflict equation ensures that trade serves as its proxy.[7]

KPR acknowledge that geography is important for accounting for both trade and conflict but claim 'specific and well-accepted theoretical reasons' for excluding distance from the conflict equation and contiguity from the model of trade (p. 1167, fn. 25), but they do not indicate what these are. This claim is surprising given their acknowledgment that 'distance' in the gravity model of trade is a broad concept that 'may include anything that either facilitates or hinders the movement of goods and services' (p. 1161). The same logic applies to the conflict equation (Bearce & Fisher, 2002), since military conflict entails substantial transport costs. To argue that all pairs should be considered in analyses of interstate conflict, not just the politically relevant or politically active ones, but fail to model carefully the effects of geographic proximity, biases the test against liberal theory.[8]

Were the Classical Liberals Really Half Wrong?

KR do control for distance and contiguity and for major power status when simultaneously estimating the reciprocal effects of interdependence and conflict. Thus, their directed dyadic analysis of 'the aggressive use of force' (Sherman, 1994), 1960–1988, reflects the state of research on the liberal peace at the time they wrote. The first two columns of Table

[6] The pseudo-R^2 for the conflict equation increases from .419 to .429. The likelihood ratio statistic is 102.89.

[7] Thousands of missing observations in the Barbieri, Keshk, & Pollins (2003) data that KPR use can be filled by data from at least one trading partner. KPR miscode Polity scores in roughly 7000 observations.

[8] Robst, Polachek & Chang (2007) also conclude that KPR's instruments are invalid.

II reproduce their analysis. Conflict reduces interdependence, but a high trade-to-GDP ratio does not reduce conflict.[9] Since they find that democracies do not fight one another, KR conclude that the liberals were only half right.

Reestablishing the liberal peace is again easily accomplished, this time by refining the measure of national size in the conflict equation. Most researchers from Bremer (1992) onward have included a dichotomous indicator for the major powers identified by COW. A continuous measure of national capabilities is preferable for two reasons. First, it more accurately reflects the sizes of all states. The major-power indicator equals one for only five countries in the Cold War era and is a crude measure of size even for them. It does not distinguish the superpowers from Great Britain, France, and China. For all other countries the variable equals zero despite vast differences in their sizes. Nor does a dichotomous indicator capture the experience of states, like China and India, that have grown dramatically.

A second reason for refining the size measure is that COW identified the major powers from the retrospective consensus of historians, and a willingness to act militarily is apt to have

[9] KR use the gravity model to explain the bilateral trade-to-GDP ratio, not trade volume as in the economics literature. It is not clear this is justified. Furthermore, they analyze Sherman's (1994) data on international disputes, 1960–88. Sherman's cases consist of 223 disputes (Rousseau, 2005) varying in length from one to twenty-nine years. Each year of a dispute becomes a separate observation. It is important to test our theories with alternative datasets, as KR suggest; but there are sound reasons to prefer the COW data. First, there are fewer than 6000 dyad-years in KR's analysis, little more than one percent of the 510,000 dyad-year observations, 1960-88, if each state is paired with all others in a directed format. KR's small sample is biased, as dyads not involved in a dispute are excluded. In a comparable set of cases including pacific dyads as well as conflictual ones, the average trade-to-GDP ratio is. 00078; in KR's sample, it is less than a tenth as much (.000070). As liberals would expect, many of the peaceful dyads excluded from KR's sample are economically interdependent. Analyzing Sherman's data tells us more about the escalation of interstate conflict than its initiation. Using KR's limited sample produces some odd results, as they note. Contiguous states seem to fight significantly *less* than non-contiguous ones, and distance apparently *increases* the incidence of conflict (see Table 2, column 1). With a continuous measure of size, neither contiguity nor distance is near significance (column 3).

been an important element in their determinations. The major-power indicator is thus contaminated by knowledge of the outcome being predicted.[10] Werner (1999); Keshk, Pollins & Reuveny (2004); Hegre (2004, 2008, 2009); and Xiang, Xu, & Keteku (2007) are among those who substitute a continuous measure of power. Appreciating the limits of the major-power indicator is key to reversing KR's anomalous results.

Table II about here

The second two columns of Table II, replace the major-power indicator in KR's conflict equation with a continuous measure of size. We use the sum of the logarithms of the two states' GDPs from their posted data. The effect is dramatic. The coefficient of the initiator's trade-to-GDP measure of interdependence is now negative and very significant ($p < .001$). Size is, of course, positively associated with the use of force—large states fight more—and the coefficient is very significant ($p < .001$). Substituting a continuous measure for the major-power indicator greatly improves the conflict model's fit to the data without an increase in the number of parameters. The pseudo-R^2 goes from .41 to .63.[11] Column 4 shows that conflict still reduces trade; other results, too, are generally consistent with theoretical expectations. Careful modeling the exogenous effect of national sizes indicates the classical liberals were wholly right.

[10]Bremer (1992: 337) wrote: "I have long felt that the designation of some states as major powers was an overly subjective classification and somewhat ad hoc. With respect to war, there is also the distinct possibility that the well-established propensity for major powers to engage in war is tautological (i.e., states are considered major powers because they fight many wars)."

[11] The log likelihood in KR's original conflict model is –1053.13. Adding GDPs to this model, the log likelihood increases to –1035.57, a very significant difference. In the model excluding the major-power variable presented in the second column of Table 2, the log likelihood is –1048.36.

KR also test liberal theory using a non-directed analysis of militarized interstate disputes. They report that the evidence for the pacific benefit of bilateral trade in a single-equation probit estimation—adapted from Oneal, Russett & Berbaum (2003)—is eliminated when the reciprocal effect of conflict on trade is taken into account. Indeed, the coefficient of the bilateral trade-to-GDP ratio goes from negative to positive. KR conclude that 'the evidence strongly suggests that there is no pacifying effect of economic interdependence' (p. 538). They do not report the simultaneously estimated trade equation in their article, but it is in their replication files. As expected, large, proximate, rich countries trade most; democracy and alliances also increase bilateral commerce. Surprisingly, however, militarized disputes significantly *increase* bilateral trade. This is not consistent with any theory of which we are aware.

New Simultaneous Estimates of the Reciprocal Effects of Trade and Fatal Disputes

In this section, we conduct new tests of the pacific benefit of commerce while simultaneously estimating the effect of conflict on trade, using the same two-stage estimator (Keshk 2003), Oneal & Russett's (2005) conflict equation, and Long's (2008) gravity model of trade. Restoring the reciprocal, theoretically expected, adverse effects of trade and militarized disputes is accomplished in two steps (Table III). First, we reestablish the pacifying effect of commerce, as in the previous sections, by controlling for the sizes of nations and their geographical proximity in the conflict equation. Next, we include the indicator of a preferential trading agreement and country and year fixed effects in the trade equation to better capture the costs of commerce. This produces the plausible result that conflict disrupts trade. In Table IV, we use Long's data to provide additional evidence that commerce promotes peace. This analysis also indicates that a fatal militarized dispute has an adverse contemporaneous effect on bilateral

trade even with extensive controls for on-going domestic conflict, militarized disputes with third parties, and expert estimates of the risks of such violence.

We use the conflict equation justified at length in Oneal & Russett (2005) with four changes: First, we substitute the logarithm of the larger CINC score in each dyad for the major-power indicator. The larger state is the weak link in the chain of peaceful dyadic relations because it is less constrained in projecting military power. Second, we use the naïve probability of the larger state's winning a militarized dispute (Bennett & Stam, 2004; Bueno de Mesquita, 1981), instead of the capability ratio. This intuitive measure of the balance of power equals the larger state's CINC score divided by the sum of the two states' scores. Thus, the size of the smaller as well as the larger member of each dyad enters into the conflict equation. Third, we use the logarithm of the real value of trade (in millions of 1996 dollars), rather than the lower trade-to-GDP ratio, to be consistent with the trade equation. [12] These two approaches are equivalent in any event (Hegre, 2009). Finally, we revised the measure of system size so that it no longer depends upon the major-power indicator (Hegre, 2008)[13]

Our trade equation is derived from Long's (2009) sophisticated work on the determinants of bilateral trade, which takes into account traders' expectations of armed conflict. The classical liberals argued that the onset of interstate conflict will adversely affect commerce, but this would not be true if economic agents have perfect information about states' political relations (Morrow, 1999; Morrow, Siverson & Tabares, 1998; Schneider & Troeger, 2006). Then they would form accurate expectations of conflict and reduce their economic activities in anticipation of military

[12] We added USD 50,000 to all values of trade to allow log-transformation.

[13] We are indebted to Bennett & Stam (2000) and several versions of their EUGene data management program (http://www.eugenesoftware.org/) for much of our data and to Gleditsch (2002) for his trade and GDP data (version 5.0).

action. The actual onset of a militarized dispute would not then produce a contemporaneous decline in trade; the associated reduction in commerce would already have occurred.

Traders'ability to anticipate the future depends upon the quality of their information about states' political relations. To some degree, this must be uncertain. Even national leaders operate with imperfect information. Indeed, uncertainty resulting from each state's private information plays a prominent role in theoretical accounts of nations' occasional inability to settle differences peacefully (Fearon, 1995, Gartzke, 1999, Schultz, 2001). To the degree traders' information is limited, their expectations regarding states' future political relations will be inaccurate. Accordingly, the occurrence of conflict should often reduce trade contemporaneously. Certainly, nothing suggests that interstate violence should routinely increase trade. Long (2008) and Li & Sacko (2002) find that conflict does adversely affect trade, even controlling for variables likely to influence traders' expectations.

Long's (2008) gravity model of trade includes the two countries' GDPs, their GDPs per capita, and distance—measured in natural logarithms—plus indicators of contiguity and a preferential trading agreement. He includes contiguity in the trade equation because the presence of a common border facilitates commerce by reducing transportation costs (Frankel, 1997; Estevadeordal, Frantz & Taylor, 2003; Martin, Mayer & Thoenig, 2008; Rose, 2006). To this gravity model, Long adds four measures of states' political relations that should influence traders expectations of peace: indicators of whether the states are jointly democratic, allies, or strategic rivals (Thompson, 2001) and the similarity of states' alliance portfolios (Signorino & Ritter, 1999). Similar security commitments should assure traders that the states are unlikely to fight (Morrow, Siverson & Tabares, 1998) as would joint democracy (Bliss & Russett, 1998; Mansfield, Milner & Rosendorff, 2000) and the absence of a persistent rivalry. Long also

includes measures of actual domestic and interstate conflict and expert assessments of the risk of domestic and interstate violence. We consider these variables later.

We modify Long's trade equation in three ways. First, we convert his directed-dyadic tests of nations' exports to a non-directed analysis of total bilateral trade (exports plus imports). Importers will experience many of the same direct and indirect costs associated with conflict or the expectation of conflict as exporters do, and of course one country's exports are its partner's imports, so changing the variable on the left-hand side of the trade equation is not problematic. On the right-hand side of our trade equation, we identify the smaller and larger GDPs and the smaller and larger populations for each dyad-year, creating a specification we can couple with our non-directed analysis of fatal disputes. Second, we use refined data regarding PTAs (Mansfield, Milner & Pevehouse, 2007). Third, we replace Long's indicator of strategic rivalry with a spline function of the years of peace since the dyad's last fatal dispute (Beck, Katz & Tucker, 1998)—the same variables included in our conflict equation. The years of peace better measure states' historic relations than a dichotomous indicator of rivalry, and by construction it excludes information about the future. Like the major-power indicator, Thompson's (2001) list of rivalries was constructed retrospectively. Finally, we control, as in the conflict equation, for the number of states in the international system to reflect states' real interaction opportunities (Raknerud & Hegre, 1997; Hegre, 2008).[14]

The first two columns of Table III show new simultaneous estimation for the years 1950–2000. Trade reduces the incidence of fatal disputes; the coefficient is negative (–0.088) and

[14] Most studies of trade treat the international system as fixed in size, but the independence of numerous colonies in the 1960s and 1970s and the dissolutions of states at the end of the Cold War make this inappropriate. As the many new countries are paired with older states, an increasing proportion of dyads are non-contiguous, which implies that the importance of countries' trade with neighbors declined sharply. Controlling for system size adjusts for this implausible effect.

significant at the .001 level. Including distance and a continuous measure of size in the conflict equation produces strong evidence for the liberal peace. As in KR's analysis of militarized disputes, conflict seems (implausibly) to increase bilateral trade, however. The coefficients of the other variables in the two equations are, with few exceptions, as expected.

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Table III about here

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We reestablish the adverse effect of conflict on trade by accounting more carefully for barriers to trade. In the real world, trade is not free. Tariffs and other protectionist policies impede the flow of goods and services even after the numerous rounds of negotiations over the past sixty years. Country and year fixed effects are useful proxies for these resistances to commerce: some states have been more committed to *laissez faire* policies than others and have been the beneficiaries of reciprocal agreements, and the international trading regime as a whole has evolved over the post-World War II period.

Adding proxies for multilateral resistances to the trade model yields the results in the second two columns of Table III. Now, there is clear evidence for both elements of liberal theory: trade reduces conflict ($p < .001$), and conflict has an adverse contemporaneous effect on trade ($p < .004$), even when several important measures of states' political relations are held constant. Traders, like policy makers, suffer from uncertainty regarding the timing of interstate conflict; but Morrow (1999) is right, too: traders do form rational expectations of interstate conflict on the basis of strategic factors. The coefficient of conflict in the trade equation in column 4 (–0.096) is slightly less than half its value (–0.201) if joint democracy, allies, the

similarity of states' security arrangements, and the years of peace are omitted from this specification.

Accounting for barriers to trade with country and year effects has little impact on the coefficient of trade in the conflict equation; it is –0.088 in column 1 and –0.075 in column 3. Including fixed effects in the trade equation substantially changes only the estimate of the contemporaneous effect of conflict on trade. The results in the second two columns of Table III are very robust to alterations in either the trade or conflict equation as long as the influences of nations' sizes, contiguity, and distance are carefully modeled in the conflict equation and controls are introduced for multilateral resistances in the trade equation.[15] They are also robust if we allow for the effect of democracy to be conditional on economic development, as in Mousseau, Hegre & Oneal (2003).[16] Finally, the liberal peace is corroborated if the longer period, 1885-2000, is analyzed, though the PTA indicator must be dropped for lack of information prior to 1950.

It is important to note that the coefficient of trade (–0.075) in column 3 is larger in absolute magnitude than the estimate in a simple, single equation probit analysis (–0.059) with the same specification and cases. Thus, previous research that addresses the endogeneity of trade by controlling for the number of years since a dyad's last dispute has not exaggerated the importance of the liberal peace.

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[15] To assess the robustness of these results, we dropped all possible combinations of joint democracy, the similarity of alliance portfolios, and the alliance indicator from the trade equation. This did not affect our findings, as our posted log-files show. If zero values of trade are dropped, the coefficient of trade in the conflict equation remains –.075 ($p < .001$); the coefficient of conflict in the reciprocal equation equals –.281 ($p < .001$).

[16] Developed democracies, which are expected to have contract-intensive economies, are the most peaceful pairs of states; but we find strong evidence of a direct, substantively important democratic effect at all levels of development. Compare Mousseau (2009).

We present a final simultaneous analysis in support of liberal theory in Table IV. We converted Long's (2008) data to a non-directed format, again identifying the larger and smaller GDPs and GDPs per capita for each dyad-year. We use our bilateral trade data, instead of his export figures. With these changes, the data for his expanded gravity model can be used with Oneal and Russett's (2005) conflict equation. This limits the analysis to 1984–1997, but it allows us to control for the incidence of domestic conflicts and interstate disputes involving third parties. It also allows incorporation of the risk of domestic and interstate conflict using data from the PRS Group, a commercial organization that supplies its expert opinion to 80% of the largest corporations (Long, 2008: 93). To adapt these data to our non-directed format, we calculated the mean of the two states' measures of Domestic Armed Conflict and of Interstate Armed Conflict.[17] Similarly, we model traders' risk assessments with the average of the PRS measures of Internal Conflict Risk (for states i and j in year t) and the two External Conflict Risk variables. Finally, we control for states being Strategic Rivals (rather than the years of peace as in Table III) to make our results as comparable to Long's as possible. Long (2008) should be consulted for a detailed discussion of his variables.

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Table IV about here

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Table IV shows clear evidence for the liberal peace: trade reduces the incidence of fatal disputes. Again, the simultaneously estimated coefficient of trade is larger in column 2 than in a simple probit. In addition, a fatal MID contemporaneously reduces commerce, even with enhanced controls for political and strategic factors that influence trader's expectations of

[17] We dropped Long's (2008) indicator of contemporary dyadic conflict; this is the endogenous variable which we instrument.

conflict. As Long (2008) reports, trade is lower if expert opinion indicates a high risk of either domestic or interstate fighting, or the states are strategic rivals. On-going domestic conflict or a militarized dispute with a third party also adversely affects economic relations.[18] Finally, political factors, especially joint democracy and alliances, shape traders' willingness to do business internationally. Nevertheless, the evidence is clear: Wars, as well as rumors of war, reduce trade. It is hardly surprising, then, that trade increases the prospects for peace. All that is necessary is that the beneficiaries of commerce are rational and able to influence national policy.

Conclusion

Liberals expect economically important trade to reduce conflict because interstate violence adversely affects commerce, prospectively or contemporaneously. Keshk, Reuveny, & Pollins (2004) and Kim & Rousseau (2005) report on the basis of simultaneous analyses of these reciprocal relations that conflict impedes trade but trade does not deter conflict. Using refined measures of geographic proximity and size—the key elements in the gravity model of international interactions—reestablishes support for the liberal peace, however. Without careful specification, trade becomes a proxy for these fundamental exogenous factors, which are also important influences on dyadic conflict. KPR's and KR's results are spurious. Large, proximate states fight more and trade more. Our re-analyses show that, as liberals would expect, commerce reduces the risk of interstate conflict when proximity and size are properly modeled in both the conflict and trade equations.

[18] Ward, Siverson & Cao (2007) note that COW's dyadic disputes are not truly independent. When they control for dependencies among disputes, the evidence for the commercial peace is eliminated. As a test, we added the measure of interstate conflict with a third party to the conflict equation in Table 4. This had little effect. Ward et al. do not consider that trade networks influence dispute dependencies (Kinne, 2009). These networks supplement the pacific benefit of bilateral trade (Maoz, 2006, 2009). Consequently, Dorussen & Ward (2010) conclude that there has been a progressive realization of the liberal ideal of a security community of trading states after World War II.

We provided new simultaneous estimates of liberal theory using Oneal & Russett's (2005) data and conflict equation and a trade model derived from Long (2008). These tests confirm the pacific benefit of trade. Trade reduces the likelihood of a fatal militarized dispute, 1950–2000 in our most comprehensive analysis, as it does in the years 1984-97 when additional measures of traders' expectations of domestic and interstate conflict are incorporated (Long, 2008) and in the period 1885-2000. This strong support for liberal theory is consistent with Kim's (1998) early simultaneous estimates, Oneal, Russett & Berbaum's (2003) Granger-style causality tests, and recent research by Robst, Polachek & Chang (2007). Reuveny & Kang (1998) and Reuveny (2001) report mixed results.

It is particularly encouraging that, when simultaneously estimated, the coefficient of trade in the conflict equation is larger in absolute value than the corresponding value in a simple probit analysis. Thus, the dozens of published articles that have addressed the endogeneity of trade by controlling for the years of peace—as virtually all have done since 1999—have not overstated the benefit of interdependence. Admittedly, our instrumental variables are not optimal. In some cases, for example, in violation of the identification rule, the creation or end of a PTA may be a casus belli. More importantly, neither of our instruments explains a large amount of variance. Thus, future research should be directed to identifying better instruments.

Our confidence in the commercial peace does not depend entirely on the empirical evidence, however; it also rests on the logic of liberal theory. Our new simultaneous estimates—as well as our re-analyses of KPR and KR—indicate that fatal disputes reduce trade. Even with extensive controls for on-going domestic conflict, militarized disputes with third parties, and expert estimates of the risks of such violence, interstate conflict has an adverse contemporaneous effect on bilateral trade. This is hardly surprising (Anderton & Carter, 2001; Reuveny, 2001; Li

& Sacko, 2002; Oneal, Russett & Berbaum, 2003; Glick & Taylor, 2005; Kastner, 2007; Long, 2008; Findlay & O'Rourke, 2007; cf. Barbieri & Levy, 1999; Blomberg & Hess, 2006; and Ward & Hoff, 2007). If conflict did not impede trade, economic agents would be indifferent to risk and the maximization of profit. Because conflict is costly, trade should reduce interstate violence. Otherwise, national leaders would be insensitive to economic loss and the preferences of powerful domestic actors. Whether paid prospectively or contemporaneously, the economic cost of conflict should reduce the likelihood of military conflict, *ceteris paribus*, if national leaders are rational.

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Table I: Replication of Keshk, Pollins and Reuveny (2004) and New Results with Gravity Model in Conflict Equation

	Keshk, Pollins and Reuveny's Model, 1950–92		Adding ln(distance) to conflict equation	
	Conflict equation	***Trade equation***	***Conflict equation***	***Trade equation***
DisputeAB,t (instrument)		-.044***		-.044***
		(.015)		(.015)
Total_tradeAB,t-1		.90***		.90***
		(.0012)		(.0012)
Total_tradeAB,t-1 (instrument)	.0063		–.0084**	
	(.0040)		(.0042)	
DisputeAB,t-1	1.96***		1.90***	
	(.050)		(.050)	
Higher_Trend_DependenceAB,t	-45.33		-47.10	
	(45.34)		(45.34)	
Lower_growthAB,t	-.0091**		-.0084**	
	(.0046)		(.0046)	
Lower_DemocracyAB	-.13***		-.12***	
	(.022)		(.022)	
Capability_ratioAB,t	-.0002**		-.00031**	
	(.0001)		(.00011)	
Higher_GDPAB,t	.097***		.097***	
	(.013)		(.013)	
ContiguityAB	1.22***		1.00***	
	(.040)		(.045)	
AlliancesAB,t	.012	.013	–.0055	.013
	(.042)	(.014)	(.042)	(.014)
GDPAt		.23***		.23***
		(.0051)		(.0051)
GDPBt .		.23***		.23***
		(.0050)		(.0050)
PopulationAt		-.047***		-.047***
		(.0065)		(.0065)
PopulationBt		-.081***		-.081***
		(.0046)		(.0046)
DistanceAB		-.25***	–.22***	-.25***
		(.0080)	(.022)	(.0080)
Lower_DemocracyAB,t .		.0500***		.0500***
		(.0050)		(.0050)
Constant	-4.70***	-4.25***	-4.27***	-4.25***
	(.24)	(.094)	(.24)	(.094)
Pseudo-R^2/R^2	.419	.929	.429	.929

Conflict data: Militarized Interstate Disputes (MIDs) as in Keshk, Pollins and Reuveny (2004), based on Jones, Bremer & Singer (1996).
N = 143,792
Standard errors from Maddala procedure in parentheses.
Two-Tailed Tests: *** Significant at 1%; ** Significant at 5%; * Significant at 10%.

Table II: Replication of Kim and Rousseau (2005), 'use of force' as conflict variable, and New Results with Gravity Model in Conflict Equation

	Kim & Rousseau's Liberal Peace Model, 1960–88		Substituting GDPs for major power indicator in conflict equation	
	Conflict Equation	***Interdependence Equation***	***Conflict Equation***	***Interdependence Equation***
Use of force		-0.71***		-0.74***
		(0.078)		(0.079)
Economic interdependence	–0.012		–0.11***	
	(0.018)		(0.025)	
Actor's democracy	–0.011**	–0.056***	–0.015***	–0.056***
	(0.0052)	(0.012)	(0.0053)	(0.012)
Opponent's democracy	0.016***	0.035**	0.014*	0.036***
	(0.0055)	(0.014)	(0.0055)	(0.014)
Actor's democracy dummy opponent's democracy*	–0.051***	0.023	–0.042***	0.021
	(0.012)	(0.025)	(0.012)	(0.025)
Balance of forces	2.14***		2.21***	
	(0.53)		(0.52)	
Balance of forces squared	–1.61***		–2.25***	
	(0.52)		(0.50)	
Shared alliance ties	–0.055	3.83***	0.32*	3.82***
	(0.11)	(0.21)	(0.13)	(0.21)
Satisfaction with the status quo	–0.65***		–0.56***	
	(0.076)		(0.077)	
Non-communist countries		1.21***		1.12***
		(0.20)		(0.20)
Contiguity	–0.20**		–0.014	
	(0.089)		(0.095)	
Distance	0.086***	–0.52***	-0.0037	–0.52***
	(0.032)	(0.082)	(0.033)	(0.082)
Major power	–0.45***			
	(0.12)			
Different civilization group	–0.14*		–0.090	
	(0.078)		(0.079)	
Conflict interaction level	–0.36***		0.021	
	(0.093)		(0.11)	
GDPs		0.30***	0.086***	0.30***
		(0.042)	(0.018)	(0.042)
Populations		0.23***		0.23***
		(0.052)		(0.052)
Shared PTA membership		0.75***		0.75***
		(0.20)		(0.20)
Former colonial relationship		3.59***		3.63***
		(0.70)		(0.70)
Shared OECD membership		1.05**		1.13**
		(0.48)		(0.48)
Shared regional membership		–2.56***		–2.56***
		(0.21)		(0.21)
Peace year	–1.34***		–1.25***	
	(0.075)		(0.076)	
Spline 1	–0.13***		–0.12***	
	(0.011)		(0.012)	

Spline 2	0.029***		0.027***	
	(0.0033)		(0.0033)	
Spline 3	–0.0012**		–0.0012**	
	(0.00058)		(0.00059)	
Constant	–0.83**	–15.25***	–2.99***	–15.29***
	(0.41)	0.86	(0.63)	0.86
Pseudo-R^2/R^2	.462	.180	.465	.181

Conflict data: International disputes as in Kim & Rousseau (2005), based on Sherman (1994).
N = 5476. Each column consists of the coefficient estimator (first line) and the standard error (second line) of each variable. All significance tests are two-tailed: * p <= 0.10, ** p <= 0.05, *** p <= 0.01.

Table III: Simultaneous Estimations based on Oneal and Russett's (2005) Conflict Equation and Long's (2008) Trade Equation , 1950-2001

	Without fixed effects		With fixed effects for year and country in trade equation	
	Conflict Equation	***Trade Equation***	***Conflict Equation***	***Trade Equation***
MID with fatalities		0.97***		-0.096***
(instrument)		(0.10)		(0.027)
Log trade	–0.088***		–0.075***	
(instrument)	(0.016)		(0.012)	
Log smaller GDP		0.99***		1.14***
		(0.021)		(0.015)
Log larger GDP		1.24***		0.96***
		(0.022)		(0.015)
Log smaller		-0.43***		–-1.07***
population		(0.027)		(0.019)
Log larger		–0.55***		–1.11***
population		(0.027)		(0.019)
Log capabilities of	0.34***		0.32***	
larger country	(0.026)		(0.022)	
Largest's share of	–1.72***		–1.68***	
total capabilities	(0.16)		(0.15)	
Contiguity	0.54***	–1.26***	0.54***	–0.038
	(0.070)	(0.088)	(0.069)	(0.047)
Log distance	–0.37***	–0.50***	–0.36***	–0.85***
	(0.027)	(0.040)	(0.025)	(0.014)
Joint democracy		1.23***		-0.022***
score		(0.099)		(0.018)
Lower democracy	–0.028***		–0.028***	
score	(0.0046)		(0.0045)	
Higher democracy	0.020***		0.020***	
score	(0.0033)		(0.0031)	
Shared alliance ties	–0.043	0.41***	–0.062	0.29***
	(0.058)	(0.063)	(0.056)	(0.017)
Preferential Trade		0.97***		0.72***
Agreements		(0.053)		(0.014)
Similarity of		0.084		0.18
Alliance Portfolios		(0.075)		(0.023)
System size	–0.31***	-1.93***	–0.31***	-1.14***
	(0.087)	(0.10)	(0.084)	(0.064)
Peace year	–0.082***	0.16***	–0.085***	0.015***
	(0.010)	(0.014)	(0.010)	(0.023)
Spline 1	–0.00033***	0.00081***	–0.00035***	0.00015***
	(0.00008)	(0.00009)	(0.00008)	(0.00002)
Spline 2	0.00016***	-0.00042***	0.00017***	-0.000099***
	(0.00005)	(0.00006)	(0.00005)	(0.00001)
Spline 3	–0.000012	0.000043	–0.000014	0.000020***
	(0.00001)	(0.00001)	(0.00001)	(0.000002)
Constant	3.47***	-6.11	3.25***	14.12
	(0.41)	(0.28)	(0.35)	(0.50)
N	279,343		279,343	

Conflict data: Fatal Militarized Interstate Disputes (MIDs) as in Oneal & Russett (2005), based on Maoz (1999).
Each column consists of the coefficient estimator (first line) and the standard error (second line) for each variable. The estimates for the year and country fixed effects included in column 4 are not shown.
All significance tests are two-tailed: * p <= 0.10, ** p <= 0.05, *** p <= 0.01.

Table IV: Estimations based on Oneal and Russett (2005)'s Conflict Equation and Long's (2008) Trade Equation and Data, 1984-1997

	Conflict Equation	***Trade Equation***
MID with fatalities (instrument)		-0.19*** (0.056)
Log trade (instrument)	–0.16*** (0.032)	
Log smaller GDP		0.85*** (0.010)
Log larger GDP		0.97*** (0.011)
Log smaller GDP per capita		–0.0023 (0.013)
Log larger GDP per capita		0.075*** (0.013)
Log capabilities of larger country	0.52*** (0.069)	
Largest's share of total capabilities	–2.34*** (0.41)	
Contiguity	0.60*** (0.13)	0.84*** (0.038)
Log distance	–0.42*** (0.065)	–1.02*** (0.022)
Joint democracy score		0.33*** (0.029)
Lower democracy score	–0.024** (0.0094)	
Higher democracy score	0.026*** (0.0086)	
Shared alliance ties	0.41*** (0.12)	0.53*** (0.044)
Preferential Trade Agreements		0.032 (0.028)
Similarity of Alliance Portfolios		–0.021 (0.100)
Strategic Rivals		–1.40*** 0.10
Domestic Armed Conflict		–0.31*** 0.033
Interstate Conflict w/ 3rd Party		–0.39*** 0.033
Internal Conflict Risk		0.37*** 0.054
External Conflict Risk		0.15*** 0.044
Peace year	0.0062 (0.031)	
Spline 1	0.0045* (0.00023)	
Spline 2	–0.00035** (0.00015)	
Spline 3	0.000099*** (0.000033)	

Constant	4.90***	-10.50
	(0.97)	(0.19)
N	100,630	

Conflict data: Fatal Militarized Interstate Disputes (MIDs) as in Oneal & Russett (2005), based on Maoz (1999).
Each column consists of the coefficient estimator (first line) and the standard error (second line) for each variable.
All significance tests are two-tailed: * p <= 0.10, ** p <= 0.05, *** p <= 0.01.