

The Enduring Quest for Kantian Peace: Assessing Simultaneous Equation Models on the Relationship of Economic Interdependence and Interstate Conflict

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Abstract: This paper weighs in on the enduring empirical debate between liberals, who argue that trade acts as a suppressor of militarized disputes, and those whose results fail to find any substantive relationship between these two variables. Recently researchers have turned to simultaneous equation models to deal with the endogeneity of trade and conflict. Relying on the latest insights from identification theory for two stage least square models, this paper contends that the two most recent models Keshk, Pollins, and Rueveny (2004) and Hegre, Oneal and Russet (2010) are both misspecified, leading to biased results. I then use their data to create a better specified model affirming that an increase in total trade between a dyad will reduce the probability that the dyad will engage in a conflict with fatalities.

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It is unfortunate that the debate over the possibility that trade has a pacific effect on interstate conflict has been construed as a disagreement between liberal and realist theories.

Simplistically, the liberal position is characterized as promoting the idea that trade interdependence creates opportunity costs that make conflict less appealing¹, while the realist argument is summarized as advocating the idea that increased contact from these trading relationships actually creates more opportunities for hostilities between states². Although there are real differences between the two philosophies on the role of trade, the arguments on both sides are varied and not necessarily as diametrically opposed as much of the literature suggests.

This same dynamic is present in the enduring empirical debate between liberals, such as Oneal and Russett, who argue for the superiority of their model showing that trade acts as a suppressor of militarized disputes, and those whose results fail to find any substantive relationship between these two variables, namely Barbieri and more recently Keshk, Pollins, and Reuveny³. While the early models of each side used divergent measures of trade as well as other modeling differences, their most recent empirical research is more directly comparable, including an agreement on the best measurement of trade interdependence and the need for the use of a simultaneous equations model to account for the endogeneity of trade and conflict.

¹ Oneal and Russett 1997, 1999, 2005

² Simmons 2003

³ Reuveny seems to have reversed his position in Li and Reuveny 2011.

Yet, due to a discrepancy as to the theoretical specification of the distance control variable, they appear to find very different results.

The debate between these two sides has become ensnared in the problematic conclusion that the only way to decide which results are stronger depends on what one already believes about trade and conflict – a discouraging state for the value of empirical research on this subject.

Relying on the latest insights from identification theory for two stage least square models, it is my contention that the two most recent models Keshk, Pollins, and Rueveny 2004, hereafter KPR; and Hegre, Oneal and Russett 2010, hereafter HOR are both misspecified. This paper examines the weakness of both models which are leading to biased results. I then use their data to create a better specified model to determine conclusively the effect of trade on the probability of conflict.

In doing so, I find that trade does indeed appear to have a pacific effect on interstate relations. While this argument rests on technical specifications, my goal for this research is to lead the debate in more fruitful directions. For, unlike Oneal and Russett⁴, I do not believe this empirical association is enough to confirm that the liberal position is correct. There still remain competing theories that could explain these results. For example, the notion that trade is a signal rather than a cause of decreased militarized disputes also predicts a negative relationship between interdependence and conflict⁵. Thus, although there is still room to improve the basic trade and conflict model, there is an urgent need for new models that can shed light upon the

⁴ 1997, 1999, 2005

⁵ Gartzke 2003

circumstances that might increase, or on the other hand, nullify the effectiveness of trade as a suppressor of militarized conflicts.

The following section situates the empirical debate over the pacific benefits of trade within the larger literature on economic interdependence and conflict. I then proceed to the analysis of the KPR and HOR papers. This allows me to explore what conclusions can be drawn from the improved model, as well as, address the larger questions that remain. Finally, this paper concludes by suggesting some fruitful steps that empirical research might undertake next.

Literature

With the end of the Cold War followed by a period of intensifying interstate trade ties through global, regional and bilateral agreements, it is not surprising that international relations scholars began to earnestly explore the possible links between increasing economic interdependence and a global era of decreased interstate conflicts.⁶ Unfortunately, more than two decades of empirical research has done more to establish the difficulty of evaluating the influence of trade on conflict than to definitively prove or disprove the liberal hypothesis that increased economic interdependence between states reduces their probability of going to war. This is not to say, however, that the research conducted thus far hasn't shed real insights on our understanding of these two possibly interlinking processes. This section will highlight some of the large questions and counterclaims to the liberal ideal before exploring the state of quantitative research on this subject.

⁶ The decrease in the number and intensity of interstate conflict is documented in Wallensteen and Sollenburg (2001).

One of the most glaring gaps in the research on trade and conflict is lack of a theory to explain how foreign policy decisions might be constrained by economic dependence. As Arthur Stein points out, the link between government policy and commercial interests is far from intuitive, for “just as governments override commercial concerns in imposing sanctions, they also override commercial considerations by getting into political disputes with states with whom they engage in substantial commerce”⁷. Fortunately, theorists and researchers are beginning to address this issue by proposing and testing competing conceptualizations of the state.

Beth Simmons suggests that one possible way to conceptualize trading constraints on foreign policy is the median-voter theory. This perspective views “foreign policy making...[as an] extension of domestic politics, which we can think of as influenced by the range of ‘voter preference’”⁸. Therefore, the more democratic a government, the greater the likelihood that they would be limited by the preferences of the electorate, which of course includes commercial interests⁹. One of the unique features of this formulation is that “trade produces a public good, not simply a private benefit (and certainly not a negative security externality)”¹⁰.

Empirical studies that focus on the interaction of regime type and trade support this perspective on the state. One such study was produced by Gelpi and Grieco¹¹, who argue that the median voter theory is more consistent with Kant’s theory of *Perpetual Peace*. They explain, “Kant’s basic hypothesis regarding economic interdependence is that it may dampen the risk of

⁷ 2003:122

⁸ Simmons 2003: 35-6

⁹ 36

¹⁰ *ibid.*

¹¹ 2003

war between states *if the governments of those states are responsive to and representative of a wider rather than a narrower range of societal interests*. In modern terms we would call such states democracies”¹². In addition to Kant’s thesis they also build their argument upon two insights found in Bueno de Mesquita et al. (1999a, 1999b): “first, democratic leaders need public policy success to stay in office to a much greater degree than is true for nondemocratic leaders; and second, the need for public policy success gives democratic leaders a greater incentive than autocrats to promote aggregate economic growth”¹³. In order to test their theory that “democratic leaders [should] be relatively more concerned than nondemocratic leaders about the prospective effects of the breakdown of foreign trade as the result of a militarized dispute”, they constructed an empirical model that used the interaction of economic interdependence and regime type as their independent variable¹⁴.

The results of their model confirmed democratic peace theory which holds “that democratic states are generally less likely to engage in military conflict with one another. This holds true even in the absence of interdependence”¹⁵. Moreover, Gelpi and Grieco found support for their theory “that *between* democratic states, trade dependence acts as an *additional* constraint on the outbreak of military conflict”¹⁶. Interestingly, their results also provided support for the realist contention that trade might increase conflict when it came to autocratic

¹² 45-6

¹³ 48-9

¹⁴ 49

¹⁵ 54

¹⁶ 54-5

states “because the entangling of economies gives them a cause for conflict without introducing commensurate constraints against the use of force”¹⁷.

Gelpi and Grieco’s results are unfortunately more suggestive than conclusive due to the model’s extreme simplicity, which did not include many important control variables. While they did update their analysis in a later article by using a directed dyad approach as opposed to the more typical undirected dyad analyses, they still failed to incorporate influential variables, in addition to using a problematic measure for trade interdependence that has since been abandoned in current empirical models¹⁸. Regardless, their study is a compelling example of how empirical studies can advance our theoretical understanding of the impact of trade on conflict.

Another possible way to conceptualize the constraint of economic interests on foreign policy decisions is through a pluralistic theory of the state, which “recognizes groups, rather than individual voters, as the most important unit to influence policy”¹⁹. This notion underlies most liberal explanations of the pacific benefits from trade. Pluralism differs from the median voter theory in that trade is not a public good, but rather “the assumption more often is that traders gain from undisturbed trade. Traders—not ‘the state,’ not ‘the public’—face opportunity costs when lucrative trade relationships are disrupted”²⁰. The need to keep these large commercial interests satisfied, then, influences a state’s willingness to engage in interstate conflict. While the HOR paper to be analyzed later does not explicitly address a theory of the state, elsewhere

¹⁷ 54

¹⁸ 2008

¹⁹ Simmons 2003: 37

²⁰ *ibid*

Oneal and Russett have articulated the theoretical underpinnings of their decades long research project that rests on this pluralistic formulation and is discussed in further detail below.

Promoting a more unique perspective, Patrick McDonald bridges civil society and foreign policy decisions by extending the Kantian liberal peace ideal to explore the “links between financing war and the potential for peace”²¹. McDonald argues that “a government’s need and ability to secure private sector resources to finance the construction of a war machine capable of defending territory, projecting national power, and even conquering other states can shape its decisions for war and the character of its foreign policy”²². This in turn, forces “the state to rely on the private sector for revenue ... simultaneously restricting its ability to tax or seize these assets,” and thus empowering non-government actors to help establish “a more pacific foreign policy”²³.

McDonald’s model examines the influence of the amount of public property a government owns on its willingness to engage in militarized disputes. States that possess a great deal of public property are freed from the need to use the private sector to finance a war. His results support his hypothesis that “by increasing the pool of resources that governments do not extract from the private sector, public property serves as an important source of revenue that can enhance a government’s capacity to remain in office and achieve its policy goals”²⁴.

Therefore, his model demonstrates that states possessing a large public sector are positively

²¹ 2007: 571

²² Ibid.

²³ Ibid.

²⁴ 579

correlated with the amount of militarized disputes entered into annually, while there is a negative relationship for those states that must rely on the private sector²⁵.

All three conceptualizations of the state presented here are evidence that our understanding of how trade interdependence might encourage a pacific foreign policy is underdeveloped. On the other hand, they are also indicative that researchers are increasingly exploring this question and are yielding fruitful if still tentative results.

Realists have posited two main challenges to the liberal peace theory. The traditional argument contends that trade interdependence may actually lead to increased conflict. This theory rests on a formulation of the state (even democratic ones) as being largely autonomous from civil society, or at least imbued with enough autonomy that “major foreign policy decisions are relatively unconstrained by civil society’s current attitudes or preferences”²⁶. As for what the autonomous state is trying to achieve, mainstream realists argue that national security is the primary goal. The concern is that “if extreme relative gains can create externalities that threaten security one might expect an autonomous state to take preemptive actions that could escalate into violent interstate conflict to deal with these externalities”²⁷. In other words, if one state seems to benefit a great deal more than their trading partner, the state that benefits the least may feel threatened by this situation, prompting events that could lead to a militarized dispute.

²⁵ 577

²⁶ Simmons 2003: 33

²⁷ 34

Simmons points out that the flaw in this argument is that “security externalities are said by some realists to deter trade in the first place. Moreover, trade probably accounts for a small proportion of the differential productivity growth that some scholars suggest leads to major power conflicts”²⁸. In general, empirical studies would appear to support Simmons as they have consistently failed to find any link between trade interdependence and an increase in conflict. However, when trade is disaggregated there are some specific situations where trade might lead to increased conflict. For example, this might occur in trading relationships with autocratic states²⁹, or with states possessing a great deal of public property³⁰, as well as, when trade dependence is related to specific sectors that are seen as more vulnerable to a state’s security interests³¹.

A more sophisticated challenge holds that trade, rather than being a causal mechanism for reducing conflict, actually diminishes informational uncertainty, which in turn results in a reduction in militarized disputes. This argument emerges from the belief that “an explanation for the impact of interdependence on peace must address the causes of war”³². Stein echoes this sentiment and explains that “in any strategic-choice setting, costly conflicts should not occur....The explanation for the occurrence of costly conflict is that actors have private information about their resolve and have no credible way to signal that to others short of incurring the costs of conflict”³³. Therefore, according to Garzke, “if states fight because they

²⁸ Ibid.

²⁹ Gelpi and Grieco 2003 & 2008

³⁰ MacDonald 2007

³¹ Li and Reuveny 2011

³² Gartzke 2003: 103

³³ 2003: 117

have trouble identifying mutually acceptable bargains short of a contest, then factors that allow states to reduce uncertainty should more often allow interdependent states to avoid the need for military violence”³⁴. Both Stein and Gartzke contend that empirical studies linking trade interdependence to a decreased probability of conflict are consistent not only with liberal trade theory but also with the argument that trade disruptions are a signaling device decreasing the informational uncertainty, thus, leading to fewer opportunities for a conflict to escalate into a militarized dispute. The dispute between liberal theory and this alternative explanation is over the causality of trade. For the in signaling theory of trade, economic interdependence “does not reduce conflict; it provides an instrument of statecraft short of military action”³⁵.

Garztke, along with Li and Boehmer, argue that the idea that trade is used by states as a signaling device is supported when capital markets are used to represent interdependence rather than trade³⁶. They assert that capital markets are a superior measure because they “link aspects of domestic economies that otherwise have little global exposure”³⁷. Additionally, capital is concerned with risk, thus markets “react to political violence in ways that are arguably both more sensitive and more unwavering” (ibid). Moreover, while states do sometimes trade with the enemy, “political shocks to capital market equilibria invariably imply capital flight and/or higher rents in the shadow of costly contests” (ibid). The authors also contend that “other macropolitical aspects of international economics-such as the need for monetary policy coordination-are also omitted in previous studies of interdependence” (ibid).

³⁴ 102

³⁵ Stein 2003: 118

³⁶ 2001

³⁷ 392

Examining political relevant dyads for the years 1951-1985, Garztko et al. find that capital markets are statistically and substantively associated with a decrease in the likelihood of conflict. The most notable divergence from the trade based models is that the democracy score is not statistically significant, further challenging liberal theory³⁸. It should be noted, however, that by using capital instead of trade as a measure of economic interdependence the sample sizes are much smaller, which increases the potential for biased results.

Interestingly, one of the authors of this study, Quan Li, must have changed his mind in the intervening years, because he and Reuveny recently published a study that purports to directly challenge the signaling argument as well as some liberal theoretical formulations of the state. They do so by questioning the logic that “assumes that conflict always harms trade, modeled by one commonly known opportunity cost”³⁹. Instead they hypothesize that “trade could be heterogeneous enough across flow directions and sectors to generate peace, conflict, or even no effect at all” (438). Seeking support for their argument, Li and Reuveny disaggregate the trading sectors for the years 1970 – 1997, and find that “increases in the initiator’s imports of agriculture and fishery goods, energy goods, and chemical and mineral goods, and exports of miscellaneous consumption goods reduce the likelihood of MID initiation. In contrast, increases in the initiator’s exports of energy goods and manufactured goods and imports of manufactured goods increase the likelihood of MID initiation”⁴⁰.

³⁸ 412

³⁹ 2011: 443

⁴⁰ 438

While both studies are important to advancing the state of empirical research beyond a simplistic focus on total trade, there are serious limitations to this sort of data, and thus researchers must be cautious in extrapolating too much from these conclusions. In this vein, Katherine Barbieri warns that “the measures of the strategic importance of commodities traded require information that is not available for a large number of countries or for a significant period of time”⁴¹. Likewise, Russett shares his concern regarding the potential biases such studies may introduce from the limited data of these other economic variables⁴². He explains that “the biases are potentially serious, so one must be very careful about generalizing. Small and unrepresentative samples can suggest a great deal about process, causal mechanisms, and compounding or confounding effects of third variables. But broad generalizations...require measures that cover a long time period and a large and diverse sample”⁴³. Researchers need to be more upfront about the limitations of their data even as they assert their unique contributions to the knowledge of trade’s impact on a state’s willingness to engage in a militarized conflict.

Although the end of WWII brought about a great deal of interest in the liberal hypothesis that increased trade interdependence leads to decreased military conflicts, until the mid-1990’s there was almost no empirical investigation of this theory. It was during this latter period that interest in the liberal peace model spiked again as scholars began to search for a new paradigm following the end of the Cold War which was accompanied by increased global integration of

⁴¹ 2003:217

⁴² 2003

⁴³ 163

national economies. At the same time better data collection for trade figures and militarized disputes became available.

Some of the earliest empirical studies can be found in the work of Barbieri, challenging liberal theory, and Oneal and Russett, defending the notion of Kantian peace. Barbieri describes her research program as seeking “to incorporate a more diverse set of relationships than had previously been considered and to treat liberal and realist economic theories of trade on an equal footing”⁴⁴. Over the years both she and Oneal and Russett have expanded their research “by refining measures, expanding [their] database to incorporate more states, relying on new statistical techniques, and focusing on the impact of trade on the various phases of the conflict process and the various characteristics of conflict”⁴⁵.

The most significant differences in the research produced by Oneal and Russett are the fact that “they consistently find an inverse relationship between trade and conflict,” as well as that their investigation is part of a larger agenda that “seeks to incorporate trade within the broader context of what has been referred to as ‘the Kantian tripod for peace’”⁴⁶. This tripod refers to democratic regimes, trade interdependence, and international organizations. Although Oneal and Russett have explored the possibility that membership in international organizations may have a pacific effect on conflict, it is the first two elements that are consistently found in all of their empirical studies.

⁴⁴ Barbieri and Schnider 1999: 397

⁴⁵ Ibid.

⁴⁶ 397-8

In 1995 and 1996 Barbieri asserted that not only did her results fail to support the idea that “trade provides a path to interstate peace,” but rather her evidence showed that “extensive economic interdependence increases the likelihood that dyads engage in militarized dispute”⁴⁷. However, many others were skeptical of these results, believing that “Barbieri's measure of interdependence is responsible for her findings”⁴⁸. ONeal and Russett also criticized these results for Barbieri’s failure to control for distance which allowed for the possibility of finding “a spurious association between interdependence and conflict: states geographically proximate have a high incidence rate of disputes, because proximity produces opportunities to fight and issues to fight about”⁴⁹.

During the same time period, ONeal and Russett and their colleagues directly contested these results, producing models that show trade dependence (total bilateral trade relative to GDP) did reduce the probability of conflict in the post WWII era⁵⁰. In 1997, ONeal and Russett confirmed these results in an improved model, and they began to articulate their theoretical argument, explaining the processes by which they believed trade inhibits militarized conflicts. As typical for liberal theorists, their formulation rests on the opportunity costs that would be incurred by a disruption in trade. Such a disruption “would endanger an importer's supply of needed goods and services, and alternative sources would be less satisfactory in price and/or quantity. Similarly, military conflict damages exporters' interests”⁵¹. Not only do states face high costs from a militarized dispute, but also trade interdependence creates a more pacific

⁴⁷ 1996: 42

⁴⁸ Gartzke et al 2001: 395, ONeal and Russett 1997

⁴⁹ 1997: 272

⁵⁰ ONeal, ONeal, Maoz, and Russett 1996

⁵¹ 270

community as “trade and foreign investment are media for communicating on a broad range of matters beyond the specific commercial exchange taking place. These communications form a potentially important channel for averting interstate conflict. In sum, economic interdependence contributes to the creation of a ‘security community’, in which shared values make the resort to force unimaginable”⁵².

In 2003, Russett further clarified their theoretical argument, by emphasizing trade as a suppressor of conflict.

Among the well-known inducements to conflict are major power status, proximity, contiguity, and a near-equal power ratio. The presence of one or more of these conditions in any pair of states can be considered a near-necessary condition for a “mutation” or event: a serious diplomatic dispute. Without them, the two states are in large degree politically irrelevant to each other for purposes of violent conflict...The other variables are more usefully considered as potential suppressors, the weakness of one or more of which allows the diplomatic dispute ‘mutation’ to become a disease (MID). They include the Kantian influences of joint democracy, high mutual trade relative to GDP, economies generally open to trade with many nations, and many shared intergovernmental organization (IGO) memberships. To these should be added being allied⁵³.

More recently the empirical shift has been to simultaneous equation models to take into account the fact that conflict would reduce levels of trade in addition to the expectation that trade might reduce the probability of conflict. KPR asserted that the use of this model refuted claims that there was a significant relationship between trade and conflict. HOR took issue with the lack of a control for distance in the conflict side of the model and provided a replication that reestablished the negative relationship between economic interdependence and

⁵² Ibid.

⁵³ 166-7

militarized disputes. The continued disparity in results due to seemingly minor specification differences has led some to conclude that whether or not there are pacific benefits to trade depend to some extent on what the researcher already believes about the relationship of trade and conflict. In order to address this unsatisfactory conclusion, the following section uses current identification techniques to assess the specifications of recent empirical research. In this way, the potential of economic trade to exert a pacific effect on the probability of militarized disputes may be conclusively determined.

The Model

Initially, large N studies examining the impact of economic interdependence on the probability of engagement in militarized disputes that result in fatalities, used the logistical (or the similar probit) regression of a dichotomous conflict variable on trade and other controls⁵⁴. More recently, however, researchers became concerned that these results might be biased due to the endogeneity of trade and conflict—the fact that while trade might reduce the probability of conflict, conflict has also been shown to reduce the amount of trade. Employing the two stage probit least squares model, KPR⁵⁵ claim that once the endogeneity bias is taken into account, trade no longer seems to reduce the probability of conflict. In response, the staunch defenders of the liberal tradition, HOR⁵⁶ argue that these results were not due to the new model, but rather the failure to control for distance in the conflict equation. Notably, this was the same problem they found with Barbieri's 1996 study, and once again point out how this leads to a

⁵⁴ Barbieri 1996; Oneal, Oneal, Maoz, Russett 1996; Oneal and Russett 1997; Oneal and Russett 1999; Gartzke, Li, and Boehmer 2001; Gelpi and Greco 2003; Oneal and Russett 2005

⁵⁵ 2004

⁵⁶ 2010

spurious positive correlation of trade and militarized disputes. Upon correcting for this misspecification, trade appeared to significantly reduce the probability of a militarized dispute.

Unfortunately, both studies suffer from the flawed assumption that a two stage estimator would provide more robust results than a simple probit. However, the literature on two stage estimators is clear that if instruments are weak or violate the assumption that they not be correlated with the error term of the equation, the results are actually more biased and inconsistent than OLS or maximum likelihood⁵⁷. This section aims to test the strength and appropriateness of the instruments being used in the trade and conflict simultaneous equation models by following the suggestions laid out by Sovey and Green⁵⁸. Additionally, this analysis shows that once valid instruments are established the model does affirm a negative relationship between trade and conflict.

KPR⁵⁹ took aim at Oneal and Russett's⁶⁰ probit model demonstrating the positive effects of trade in reducing militarized conflicts by using a two stage estimator for trade and conflict. They argue that while their analysis remained faithful Oneal and Russett's⁶¹ probit equation for conflict, once endogeneity was taken into account the effects of trade lost any substantial significance. HOR took some issue with their degree of faithfulness, but their reply largely centered on the theoretical unsoundness of not including distance between country A and B as part of the conflict equation. HOR argue that the same logic that would induce one to use

⁵⁷ Bartels 1991

⁵⁸ 2011

⁵⁹ 2004

⁶⁰ 1999

⁶¹ 1999

distance in the gravity model for trade applies to conflict “since military conflict entails substantial transport costs”⁶². Table I displays their results for the KPR model in its original form contrasted with the results from including distance in both sides of the equation. With this small change, trade once again appears significant within a 95% confidence interval.

⁶² 2010: 766

Replication of Table I from Hegre, Oneal and Russett (2010)

	KPR model, 1950-92		Adding ln(distance) to conflict	
	Conflict	Trade	Conflict	Trade
Log Trade Instrument	0.006 (0.00)		-0.008* (0.00)	
Dispute Instrument		-0.044** (0.02)		-0.044** (0.02)
Higher Trend Dependence	-45.270 (45.34)		-47.103 (45.34)	
Lower Growth	-0.009* (0.00)		-0.008 (0.00)	
Lower Democracy	-0.130*** (0.02)	0.050*** (0.01)	-0.117*** (0.02)	0.050*** (0.01)
Alliances	0.012 (0.04)	0.013 (0.01)	-0.055 (0.04)	0.013 (0.01)
Capability ratio	-0.000* (0.00)		-0.000** (0.00)	
Contiguity	1.218*** (0.04)		1.004*** (0.05)	
Higher GDP	0.097*** (0.01)		0.173*** (0.02)	
GDP_A		0.230*** (0.01)		0.230*** (0.01)
GDP_B		0.234*** (0.01)		0.234*** (0.01)
Population_A		-0.047*** (0.01)		-0.047*** (0.01)
Population_B		-0.081*** (0.00)		-0.081*** (0.00)
Distance		-0.246*** (0.01)	-0.216*** (0.02)	-0.246*** (0.01)
Dispute_lag		0.899*** (0.00)		0.899*** (0.00)
Trade_lag	1.963*** (0.05)		1.898*** (0.05)	
Constant	-4.696*** (0.24)	-4.253*** (0.09)	-4.275*** (0.24)	-4.253*** (0.09)

Data from Keshk, Pollins and Reuveny (2004)
N = 143,792. Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

In addition to reestablishing the gains of trade in the KPR model, HOR generate their own two stage probit least squares model. On the conflict side they adapt their own probit equation established in Oneal and Russett⁶³, and for the trade equation they adapt Long's⁶⁴ gravity model.

The conflict equation is represented as

$$\text{Prob}(\text{ Militarized Disputes with Fatalities}) = \phi(\beta_0 + \beta_1 \log(\text{trade}) + \beta_2 \text{ lower democracy} + \beta_3 \text{ higher democracy} + \beta_4 \text{ contiguity} + \beta_5 \log(\text{distance}) + \beta_6 \text{ probability of winning} + \beta_7 \text{ alliances} + \beta_8 \text{ larger capability score} + \beta_9 \text{ system size} + \beta_{10} \text{ Spline } 1_t + \beta_{11} \text{ Spline } 2_t + \beta_{12} \text{ Spline } 3_t).$$

While their trade equation is

$$\text{Prob}(\log(\text{total trade})) = \phi(\beta_0 + \beta_1 \text{ Militarized Disputes with Fatalities} + \beta_2 \text{ contiguity} + \beta_3 \log(\text{distance}) + \beta_4 \text{ alliances} + \beta_5 \log(\text{higher GDP}) + \beta_6 \log(\text{lower GDP}) + \beta_7 \log(\text{smaller population}) + \beta_8 \log(\text{higher population}) + \beta_9 \text{ joint democracy} + \beta_{10} \text{ preferential trade agreement} + \beta_{11} \text{ similarity alliance portfolios} + \beta_{12} \text{ system size} + \beta_{13} \text{ Spline } 1_t + \beta_{14} \text{ Spline } 2_t + \beta_{15} \text{ Spline } 3_t).$$

The results for both their original probit model and from the second stage of the simultaneity model are presented in Table III. The most surprising outcome which they did not reflect upon in their central argument is that the coefficient of the trade effect actually doubles in the two stage model suggesting that rather than there being a dampening effect of trade and conflict, once endogeneity is taken into account, the effect of trade actually grows stronger. As will be explored further this unexpected effect is probably due to the flawed manner in which they apply the two stage model.

⁶³ 2005

⁶⁴ 2008

Partial Replication of Table III from Hegre, Oneal and Russett (2010)

	HOR model, 1950-2001		
	Probit	Conflict Equation	Trade Equation
Log Trade	-0.047*** (0.01)		
Log Trade Instrument		-0.087*** (0.02)	
MID with Fatalities Instrument			0.715*** (0.14)
Lower Democracy	-0.028*** (0.00)	-0.026*** (0.00)	
Higher Democracy	0.011*** (0.00)	0.014*** (0.00)	
Contiguity	0.617*** (0.08)	0.731*** (0.09)	0.356*** (0.10)
SQRT Distance	-0.014*** (0.00)	-0.015*** (0.00)	-0.017*** (0.00)
Probability of Winning	-1.419*** (0.16)	-1.774*** (0.19)	
Allies	-0.032 (0.06)	-0.010 (0.06)	-0.187*** (0.05)
Log Higher Capabilities	0.264*** (0.02)	0.338*** (0.03)	
Log Smaller GDP			1.221*** (0.02)
Log Larger GDP			1.367*** (0.02)
Log Smaller Population			-0.505*** (0.03)
Log Higher Population			-0.631*** (0.03)
Joint Democracy			0.557*** (0.08)
Preferential Trade Agreements			0.830*** (0.04)
Similarity of Alliance Portfolios			0.850*** (0.10)
System Size	-0.201 (0.10)	-0.080 (0.11)	-0.417*** (0.09)
Peace Year	-0.093*** (0.01)	-0.094*** (0.01)	0.064*** (0.02)
Spline 1	-0.000*** (0.00)	-0.000*** (0.00)	0.000** (0.00)
Spline 2	0.000*** (0.00)	0.000*** (0.00)	-0.000* (0.00)
Spline 3	-0.000 (0.00)	-0.000 (0.00)	0.000 (0.00)
Constant	0.584* (0.24)	1.336*** (0.32)	-12.352*** (0.50)
N	294,718	294,718	294,718

Data from Hegre, Oneal and Russett (2010)
Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

One of the greatest difficulties in producing a simultaneous equation model for conflict and trade is coming up with instruments that should only affect trade through their impact on conflict and those that should only affect conflict through their impact on trade. The variables instrumenting for conflict are actually pretty straight forward as they are both derived from the CINC capabilities score. These instruments are the “logarithm of the larger CINC score in each dyad” and the “naïve probability of the larger state’s winning a militarized dispute” calculated as “the larger state’s CINC score divided by the sum of the two states’ scores”⁶⁵. It seems entirely plausible that these two variables would only have an impact on the amount of a dyad’s trade dependent on whether or not they were engaged in a conflict.

The variables used for instrumenting trade, however, are a little more complicated. These instruments are the Log of the smaller GDP, Log of the larger GDP, Log of the smaller population, Log of the larger population, Preferential Trade Agreements (PTA), and the similarity of states’ alliance portfolios. The population size is not included in the conflict equation because it is one of the factors that help make up the CINC capabilities score. Furthermore, it also seems reasonable that PTAs and the similarity of alliance portfolios affect conflict only through trade. However, excluding GDP may be a little more controversial. KPR, for example, include the higher state’s GDP in the conflict equation, because “many have found that nations with larger economies are more likely to become involved in armed conflict”⁶⁶. The results of their own model, however, show its insignificance to the conflict equation. When

⁶⁵ HOR 2010: 768

⁶⁶ 2004: 1167

it was included in HOR's model it similarly failed to produce any significant results or affect the other coefficients.

Other issues that affect simultaneous equations are the problem of weak instruments and the overidentification of instruments. The literature on two stage estimators cautions that the results of these models are only as good as their instruments. When the instruments are weak, the results will have greater bias than those produced by the OLS estimator⁶⁷. To address this issue, Staiger and Stock⁶⁸ designed a way to test for weak instruments, which is based on the Cragg-Donald⁶⁹ first-stage F statistic⁷⁰. Staiger and Stock propose a rule of thumb that two stage models with an F-statistic less than 10 should be regarded as producing biased results⁷¹. They regard 10 as the critical value because "standard asymptotic approximations to the distributions of the main instrumental variables statistics break down when the mean of the F statistic is small"⁷². Stock and Yogo confirm that when the number of instrumental variables is small, an F statistic of 10 equates to "a 5% test that the worst-case relative bias is 10% or less"⁷³. They do caution, however, that when the number of instrumental variables is great, 10 might be too conservative of a figure⁷⁴. The results of the weak identification test in Table IV show that the instruments for both trade and conflict are very strong.

⁶⁷ Bartels 1991

⁶⁸ 1997

⁶⁹ 1993

⁷⁰ Stock and Yogo 2005:82

⁷¹ 1997:557

⁷² Ibid.

⁷³ 2005: 102

⁷⁴ Ibid.

Table IV First Stage Results from Hegre, Oneal and Russett (2010)

	1950-2001	
	Conflict Equation	Trade Equation
Log Trade	-0.047*** (0.01)	
MID with Fatalities		-0.486*** (0.10)
Lower Democracy	-0.028*** (0.00)	
Higher Democracy	0.011*** (0.00)	
Contiguity	0.617*** (0.08)	0.714*** (0.02)
SQRT Distance	-0.014*** (0.00)	-0.028*** (0.00)
Probability of Winning	-1.419*** (0.16)	
Allies	-0.032 (0.06)	-0.095*** (0.01)
Log Higher Capabilities	0.264*** (0.02)	
Log Smaller GDP		1.173*** (0.00)
Log Larger GDP		1.312*** (0.00)
Log Smaller Population		-0.349*** (0.00)
Log Higher Population		-0.530*** (0.00)
Joint Democracy		0.200*** (0.01)
Preferential Trade Agreements		0.852*** (0.01)
Similarity of Alliance Portfolios		0.469*** (0.01)
System Size	-0.201 (0.10)	-0.586*** (0.02)
Peace Year	-0.093*** (0.01)	-0.008** (0.00)
Spline 1	-0.000*** (0.00)	-0.000** (0.00)
Spline 2	0.000*** (0.00)	0.000** (0.00)
Spline 3	-0.000 (0.00)	-0.000** (0.00)
Constant	0.584* (0.24)	-14.535*** (0.04)
N	294,718	294,718
Weak identification test	111.274	5000
Sargan statistic	8.548**	292.495***

* p<0.05, ** p<0.01, *** p<0.001

Another problem with two stage estimators that can result in unreliable estimates is when the instrument is correlated with error term. If the model uses more than one instrumental variable, it is possible to use a $N * R^2$ test to assess the null hypothesis that all instruments are uncorrelated with the error in the equation. The result of this test is the Sargan statistic in Tables IV and V. Unfortunately, we can see that for both the conflict and trade instruments in Table IV, the Sargan statistic rejects the null hypothesis. Consequently, we cannot have confidence in the second stage results in Table III because the instruments are in fact correlated with the error term.

The Sargan statistic can only provide information on the instrumental variables as a group, but it cannot provide guidance as to which variable is causing the overidentification problem. While it is not possible to test each variable separately, it is feasible to apply a *difference-in-Sargan* test or *C* test, which allows one “to test as subset of the original” instruments⁷⁵. When examining all of the possible combinations of two or more variables to instrument for trade in the conflict equation, only the higher and lower GDP scores are valid.

Finding variables to instrument for conflict is more difficult. The instruments being utilized by HOR are both derived from the CINC score. Of the six components that make up this score, two are based on population data of the state for a given year. My intuition is that the inclusion of the population data into the score is one element responsible for the correlation with the error for the trade equation since population is a control variable. Therefore I recalculated the CINC score without factoring for population. Problematically, the log of the higher score was still

⁷⁵ Baum 2006: 201

correlated with the error term, and the probability of winning was too weak to use as an instrument on its own. Therefore, I included an additional variable – major power (coded one if one of the dyads includes a major power and 0 otherwise – that when combined with the probability of winning makes for a strong instrument uncorrelated with the error of the equation. I do so with the caveat from HOR that the major power variable is identified “from the retrospective consensus of historians, and a willingness to act militarily is apt to have been an important element in their determinations. The major-power indicator is thus contaminated by knowledge of the outcome being predicted”⁷⁶.

⁷⁶ 2010: 767

Table V

	Probit
Log Trade	-0.051*** (0.01)
Lower Democracy	-0.025*** (0.00)
Higher Democracy	0.009* (0.00)
Contiguity	0.527*** (0.09)
SQRT Distance	-0.015*** (0.00)
Probability of Winning	-0.448** (0.15)
Allies	0.094 (0.06)
Major Power	0.288*** (0.06)
Log Smaller Population	0.109*** (0.02)
Log Higher Population	0.142*** (0.02)
Preferential Trade Agreements	-0.372*** (0.07)
Similarity of Alliance Portfolios	0.076 (0.06)
System Size	-0.200 (0.11)
Peace Year	-0.095*** (0.01)
Spline 1	-0.000*** (0.00)
Spline 2	0.000** (0.00)
Spline 3	-0.000 (0.00)
Constant	-3.535*** (0.26)
N	294,718

Data from Hegre, Oneal and Russett (2010), NMC v4.0, and InterStateWarData v4.0
Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

There still remains one unresolved issue: what to do with the rejected trade instruments? They cannot be controlled for on the trade side unless it also seems appropriate to include them in the conflict equation. Yet the expectation that they should only affect conflict through trade has already been established. There is one exception. Population was not controlled for in the conflict equation because it was being included in the probability of winning based on the CINC score. Now that it has been factored out of that score, it makes sense to include it in both equations. On the other hand there is no theoretically sound reason to believe that PTAs or the similarity of alliance portfolios should directly affect the probability of conflict. If they are included, the instrumental variables for conflict become correlated with the error term. For both of these reasons the two variables were necessarily dropped from the model.

Table VI New Two Stage Probit Least Squares Model 1950-2001

	First Stage Results		Second Stage Results	
	Conflict	Trade	Conflict	Trade
Log Trade	-0.045*** (0.01)			
MID with Fatalities		-0.574*** (0.10)		
Log Trade (I)			-0.040** (0.01)	
MID with Fatalities (I)				0.297*** (0.04)
Lower Democracy	-0.030*** (0.00)		-0.031*** (0.00)	
Higher Democracy	0.014*** (0.00)		0.015*** (0.00)	
Contiguity	0.427*** (0.09)	1.080*** (0.02)	0.427*** (0.09)	0.931*** (0.04)
SQRT Distance	-0.015*** (0.00)	-0.032*** (0.00)	-0.015*** (0.00)	-0.027*** (0.00)
Probability of Win	-0.453** (0.15)		-0.458** (0.15)	
Allies	0.002 (0.06)	0.189*** (0.01)	-0.008 (0.06)	0.225*** (0.02)
Major Power	0.382*** (0.06)		0.389*** (0.06)	
Higher Population	0.100*** (0.02)	-0.545*** (0.00)	0.102*** (0.02)	-0.553*** (0.01)
Lower Population	0.151*** (0.02)	-0.315*** (0.00)	0.153*** (0.02)	-0.402*** (0.01)
Joint Dem		0.269*** (0.01)		0.525*** (0.03)
Smaller GDP		1.127*** (0.00)		1.146*** (0.01)
Higher GDP		1.296*** (0.00)		1.296*** (0.01)
System Size	-0.339** (0.10)	-0.207*** (0.02)	-0.342** (0.11)	-0.069 (0.04)
Peace Year	-0.094*** (0.01)	-0.006 (0.00)	-0.096*** (0.01)	0.029*** (0.01)
Spline 1	-0.000*** (0.00)	-0.000*** (0.00)	-0.000*** (0.00)	0.000 (0.00)
Spline 2	0.000** (0.00)	0.000*** (0.00)	0.000** (0.00)	0.000 (0.00)
Spline 3	-0.000 (0.00)	-0.000*** (0.00)	-0.000 (0.00)	-0.000*** (0.00)
Constant	-3.716*** (0.25)	-13.737*** (0.04)	-3.751*** (0.26)	-12.733*** (0.19)
N	294,718	294,718	294,718	294,718
Weak ID	25.810	8100		
Sargan	3.587	1.122		

Data from Hegre, Oneal and Russett (2010)
Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table VI displays the results from the new model. The strength of the new specifications is that there is no problem with weak instruments, and more importantly, the instruments from both equations are no longer correlated with the error term. Although the model is not ideal since it was necessary to drop the PTAs and alliance portfolios, these results are much more robust than the original HOR model. The results are also more consistent with the expectation that the effects of trade would be dampened due to endogeneity, to the degree that conflict would reduce the amount of trade. However, the effect of trade remains substantially significant. Even with the changes made to the model, the effect of trade on the probability of conflict in this two stage probit least squares model remains very close to the estimates from the conflict probit model, which are displayed in Table V.

This analysis establishes that in a properly specified two stage probit least squares model where the probability of conflict is regressed on trade, economic interdependence does have a substantial and statistically significant negative relationship with the probability of being involved in a militarized dispute with fatalities. It has also demonstrated the necessity of investigating the appropriateness and quality of the instruments to ensure that the results are robust and unbiased. Failure to do so can result in outcomes that are more biased than the endogeneity it is attempting to correct for. Thus researchers relying on this model are encouraged to report the results of the first stage and the instruments tests so that the reader can be aware of any potential problems in the model⁷⁷.

⁷⁷ Sovey & Green, 2011

Conclusion

Applying the latest insights of identification theory on two stage estimators, this paper has firmly established that an increase in total trade between a dyad will reduce the probability that the dyad will engage in a conflict with fatalities. Unlike HOR, however, I do not believe that this result provides validation for the liberal thesis that trade reduces conflict. An alternative interpretation is that trade could also be acting as a signal of a state's resolve, thus, reducing informational uncertainty. It is this informational uncertainty which bargaining theorists insist is the cause of costly conflicts.

It is unlikely that quantitative studies alone will be able to determine which theory about trade and conflict is superior. Therefore quantitative analyses need to become better integrated into the theoretical literature along with qualitative case studies to gain a better understanding of how commercial interests might impact foreign policy decisions. That being said, recent quantitative studies are suggestive of how statistical analysis may further the development of a theory of the state. For example, the study by Li and Reuveny⁷⁸ discussed earlier presents an intriguing argument that the sectors of trade seen as most related to a state's security may actually increase the probability of conflict. While the disaggregation of trade is promising, greater understanding of the data limitations and how they might bias the results is needed before any general conclusions can be drawn.

It would also be worthwhile to pursue more interactional models to better comprehend under what circumstances the effect of trade may be enhanced or negated. Not only should Gelpi and Grieco's 2003 and 2008 studies on the interaction of regime type and trade be updated to

⁷⁸ 2011

reflect current model specifications, but other potential variables that might interact with economic integration should be investigated.

As difficult as it might be to fully comprehend the interlocking processes of trade and conflict, continuing this investigation is crucial in a world of increasing economic interdependence. The liberal intuition that trade leads to greater peace has been used by politicians to support foreign policy decision ranging from the Marshall Plan for the reconstruction of Europe after WWII to the establishment of the World Trade Organization to current Free Trade Agreements. While this study affirms that there is a negative relationship between trade and conflict, it also reveals that the research is still too underdeveloped to be used for policy prescriptions. By weighing in on the decades long debate on the relationship of economic interdependence and militarized disputes, this study has also pointed the way to fruitful future research on this topic.

Bibliography

- Barbieri, Katherine. 1995. *Economic Interdependence and Militarized Interstate Conflict: 1870-1985*.
- . 1996. Economic Interdependence: A Path to Peace or a Source of Interstate Conflict? *Journal of Peace Research* 33 (1): 29-49.
- . 2003. "Models and Measures in Trade-Conflict Research." In *Economic Interdependence and International Conflict: New Perspectives on an Enduring Debate*, eds. Edward Mansfield and Brian Pollins. Ann Arbor: The University of Michigan Press. 207-221.
- Barbieri, Katherine, and Gerald Schneider. 1999. Globalization and Peace: Assessing New Directions in the Study of Trade and Conflict. *Journal of Peace Research* 36 (4): 387-404.
- Bartels, L.M. 1991. Instrumental and "quasi-instrumental" variables. *American Journal of Political Science* 35 (3): 777-800.
- Baum, Christopher F. 2006. *An introduction to modern econometrics using stata*. College Station, Tex.: Stata Press.
- Cragg, J.G., and S.G. Donald. 1993. Testing Identifiability and Specification in Instrumental Variable Models. *Econometric Theory*: 222-240.
- Gartzke, Erik. 2003. "The Classic Liberals Were Just Lucky: A Few Thoughts about Interdependence and Peace." In *Economic Interdependence and International Conflict: New Perspectives on an Enduring Debate*, eds. Edward Mansfield and Brian Pollins. Ann Arbor: The University of Michigan Press. 96-110.
- Gartzke, Erik, Quan Li, and Charles Boehmer. 2001. Investing in the Peace: Economic Interdependence and International Conflict. *International Organization* 55 (2): 391-438.

- Gelpi, Christopher, and Joseph M. Grieco. 2003. "Economic Interdependence, the Democratic State, and the Liberal Peace." In *Economic Interdependence and International Conflict: New Perspectives on an Enduring Debate*, eds. Edward Mansfield and Brian Pollins. Ann Arbor: The University of Michigan Press. 44-59.
- . 2008. Democracy, interdependence, and the sources of the liberal peace. *Journal of Peace Research* 45 (1): 17.
- Hegre, H., John Oneal, and Bruce Russett. 2010. Trade does promote peace: New simultaneous estimates of the reciprocal effects of trade and conflict. *Journal of Peace Research* 47 (6): 763.
- Keshk, O.M.G., B.M. Pollins, and Rafael Reuveny. 2004. Trade still follows the flag: The primacy of politics in a simultaneous model of interdependence and armed conflict. *Journal of Politics* 66 (4): 1155-1179.
- Li, Quan, and Rafael Reuveny. 2011. Does trade prevent or promote interstate conflict initiation? *Journal of Peace Research* 48 (4): 437-453.
- Long, A.G. 2008. Bilateral trade in the shadow of armed conflict. *International Studies Quarterly* 52 (1): 81-101.
- Mansfield, E.D., and B.M. Pollins. 2003. *Economic interdependence and international conflict: New perspectives on an enduring debate*. Univ of Michigan Pr.
- . 2003. "Interdependence and Conflict: An Introduction." In *Economic Interdependence and International Conflict: New Perspectives on an Enduring Debate*, eds. Edward Mansfield and Brian Pollins. Ann Arbor: The University of Michigan Press. 1-28.
- McDonald, Patrick. 2007. The Purse Strings of Peace. *American Journal of Political Science* 51 (3):

569-582.

Mesquita, Bruce Bueno de, James D. Morrow, Randolph M. Siverson, and Alastair Smith. 1999a.

An Institutional Explanation of the Democratic Peace. *The American Political Science Review* 93 (4): 791-807.

———. 1999b. Policy Failure and Political Survival: The Contribution of Political Institutions. *The Journal of Conflict Resolution* 43 (2): 147-161.

Oneal, John. 2003. "Empirical Support for the Liberal Peace." In *Economic Interdependence and International Conflict: New Perspectives on an Enduring Debate*, eds. Edward Mansfield and Brian Pollins. Ann Arbor: The University of Michigan Press. 189-206.

Oneal, John, Frances Oneal, Zeev Maoz, and Bruce Russett. 1996. The Liberal Peace: Interdependence, Democracy, and International Conflict, 1950-85. *Journal of Peace Research* 33 (1).

Oneal, John, and Bruce Russett. 1997. The Classical Liberals Were Right: Democracy, Interdependence, and Conflict, 1950-1985. *International Studies Quarterly* 41 (2): 267-293.

———. 1999. Assessing the Liberal Peace with Alternative Specifications: Trade Still Reduces Conflict. *Journal of Peace Research* 36 (4): 423-442.

———. 2005. Rule of three, let it be? When more really is better. *Conflict Management and Peace Science* 22 (4): 293-310.

Reuveny, Rafael. 2003. "Measuring Conflict and cooperation: An Assessment." In *Economic Interdependence and International Conflict: New Perspectives on an Enduring Debate*, eds. Edward Mansfield and Brian Pollins. Ann Arbor: The University of Michigan Press.

254-269.

Russett, Bruce. 2003. "Violence and disease: trade as suppressor of conflict when suppressors matter." In *Economic Interdependence and International Conflict: New Perspectives on an Enduring Debate*, eds. Edward Mansfield and Brian Pollins. Ann Arbor: The University of Michigan Press. 159-186.

Signorino, C.S., and J.M. Ritter. 1999. Tau b or Not Tau b: Measuring the Similarity of Foreign Policy Positions. *International Studies Quarterly* 43 (1): 115-144.

Simmons, Beth. 2003. "Pax Mercatoria and the Theory of the State." In *Economic Interdependence and International Conflict: New Perspectives on an Enduring Debate*, eds. Edward Mansfield and Brian Pollins. Ann Arbor: The University of Michigan Press. 31-43.

Singer, J.D., S. Bremer, and J. Stuckey. 1972. "Capability distribution, uncertainty, and major power war, 1820-1965." In *Peace, War, and Numbers*, ed. Bruce Russett. Beverly Hills: Sage. 19-48.

Sovey, A.J., and D.P. Green. 2011. Instrumental Variables Estimation in Political Science: A Readers' Guide. *American Journal of Political Science*.

Staiger, Douglas, and James H. Stock. 1997. Instrumental Variables Regression with Weak Instruments. *Econometrica* 65 (3): 557-586.

Stein, Arthur A. 2003. "Trade and Conflict: Uncertainty, Strategic Signaling, and Interstate Disputes." In *Economic Interdependence and International Conflict: New Perspectives on an Enduring Debate*, eds. Edward Mansfield and Brian Pollins. Ann Arbor: The University of Michigan Press. 111-125.

Stock, J.H., and M. Yogo. 2005. Testing for weak instruments in linear IV regression.

Timpone, Richard J. 2003. "Concerns with endogeneity in statistical analysis: modeling the interdependence between economic ties and conflict." In *Economic interdependence and international conflict : new perspectives on an enduring debate*, eds. Edward D. Mansfield and Brian Pollins. Ann Arbor: University of Michigan Press. 298-318.

Wallensteen, Peter, and Margareta Sollenberg. 2001. Armed Conflict, 1989-2000. *Journal of Peace Research* 38 (5): 629-644.