journal of peace RESEARCH

© 2005 Journal of Peace Research,
vol. 42, no. 5, 2005, pp. 523–543
Sage Publications (London, Thousand Oaks, CA and New Delhi) http://jpr.sagepub.com
DOI 10.1177/0022343305056225

The Classical Liberals Were Half Right (or Half Wrong): New Tests of the 'Liberal Peace', 1960–88*

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Classical liberals such as Kant argued that expanding political participation and increasing economic interdependence would promote peace among states. Recent empirical support for both propositions has led to a growing consensus on the power of the 'liberal peace'. This article challenges one pillar of the liberal peace. Using a dataset of international disputes from 1960 to 1988, the authors find that there is no statistical evidence of the pacifying effect of economic interdependence. Findings in the existing literature appear to be due to the improper use of the classic logit (or probit) method despite the existence of the 'simultaneity problem' between the use of force and interdependence (i.e. reciprocal causation). In this study, the authors employ a two-stage probit least squares method to control this problem. Although Kant's prediction with respect to regime type is supported by the analysis, the claim that economic interdependence will decrease conflict is not. The two-stage results reveal that international conflict reduces economic interdependence (rather than interdependence reducing conflict). The findings are robust using five alternative operationalizations of the economic interdependence variable. Finally, a re-analysis of the Russett & Oneal dataset using a two-stage probit model also indicates that the impact of economic interdependence evaporates after correcting for the simultaneity problem.

Introduction

Classical liberals such as Immanuel Kant argued that expanding political participation and increasing economic interdependence would promote peace among states. The first pillar of this claim has been strongly supported by the burgeoning 'democratic peace' literature. While the results strongly support the joint democracy (or dyadic) version of the democratic peace, some findings have also demonstrated that democracies may be more pacific regardless of the nature of their opponent.[1] More recently, focus has shifted to the long-neglected second pillar of the liberal peace: economic interdependence. Do trade and investment between two states suppress the emergence of conflict and dampen the escalation of conflict? Empirical

* Equal authorship implied. We thank Timothy McKeown, Mark Crescenzi, Marco Steenbergen, Edward Mansfield, Patrick McDonald, and several anonymous referees for their comments and suggestions. Datasets, command files, and sensitivity analysis can be found at http://www.prio.no/jpr/datasets and correspondence can be directed to hmkim@email.unc.edu and rousseau@sas.upenn.edu. Statistical analysis is conducted using Stata version 8.

[1] Recent works include Huth & Allee (2002), Bennett & Stam (2004), and Rousseau (2005).

results with respect to this second pillar are more mixed. While some studies have found a strong negative relationship between interdependence and military conflict, others have not.[2]

The purpose of this article is to test the interdependence pillar of the 'liberal peace' by probing for a simultaneity problem. If there is a reciprocal relationship between interdependence and the use of military force, the standard logit and probit models used throughout the literature will produce inconsistent and biased coefficients. That is, if economic interdependence *decreases* the likelihood of using military force *and* the use of military force *decreases* the level of interdependence, the results from the existing analyses will shed little light on the explanatory power of the interdependence variable. We explore this long-neglected 'simultaneity problem' by comparing traditional probit models with two-stage probit models. The results indicate that the statistically significant impact of the interdependence variable evaporates when we control for the simultaneity problem. In contrast, the monadic and dyadic versions of the democratic peace are strongly supported in both types of models.

This article consists of six parts. First, we examine the central hypotheses tested in the study. Second, we explore the simultaneity problem. Third, we describe the dataset of international disputes and the measurement of the independent and dependent variables. Fourth, we present empirical results using two different statistical methods: the standard probit method and the two-stage probit least squares method. Fifth, we re-examine the Oneal & Russett data using our two-stage probit least squares method in order to probe the robustness of our findings. Finally, we summarize the findings and suggest the directions for future research.

Hypotheses

We explore the impact of the simultaneity problem using a model that incorporates 12 of the most common explanations for military conflict in the liberal peace literature. Given that our objective is to demonstrate the danger of model misspecification, we will simply summarize these commonly explored hypotheses. Citations have been provided for those wishing to examine the causal logic of each hypothesis in greater depth.

H1: In an international dispute, the more economically interdependent a state is with its adversary, the less likely it is to use military force to resolve the dispute.

This hypothesis reflects the unconditional liberal belief that economic ties increase the costs of using military force and therefore decrease the probability of using military force. A positive finding (i.e. interdependence *increases* conflict) would support realist arguments by Waltz (1979) and Gaddis (1986).

H2: In an international dispute, the more democratic a state, the less likely it is to use military force to resolve the dispute regardless of the political regime of the adversary.

H3: In an international dispute, the more democratic a state, the less likely it is to use military force to resolve the dispute against other democracies.

[2] For extensive reviews of theory and literature, see Barbieri & Schneider (1999), Mansfield & Pollins (2001, 2003), McMillan (1997), Schneider, Barbieri & Gleditsch (2003), and the special issue of *Journal of Peace Research* 36(4), July 1999. Empirical analyses finding support for the interdependence pillar include Gartzke & Li (2003a,b), Oneal & Russett (1997), and Russett & Oneal (2001). Authors finding no pacifying effect of economic interdependence include Barbieri (2002), Beck, Katz & Tucker (1998), Keshk, Pollins & Reuveny (2004), Goenner (2004), Green, Kim & Yoon (2001). Kant also articulated a third pillar in his essay 'Perpetual Peace': a voluntary federation of free (i.e. republican) states. This pillar is not examined in this article. For details, see Doyle (1986), Kant (1795), Russett, Oneal & Davis (1998), and Russett & Oneal (2001).

These two hypotheses probe the 'democratic peace' pillar of the liberal peace. The first hypothesis (the 'monadic' explanation) argues that democratic states, which are constrained by their democratic institutions and norms, are less likely to resort to the use of military force regardless of the political regime type of its adversary (Rousseau, 2005). The second hypothesis (the 'dyadic' explanation) argues that democratic states tend not to use military force *only when facing other democracies* (Russett & Oneal, 2001).

H4: In an international dispute, non-democracies are more likely to use military force to resolve the dispute against democracies than they are against non-democracies.

The argument posits that authoritarian leaders believe that democracies are more likely to capitulate: this belief leads the authoritarian leaders to attempt to exploit democracies by attacking first (Bueno de Mesquita & Lalman, 1992: 155–160; Rousseau et al., 1996).

In addition to these four main hypotheses of the 'liberal peace', it is also important to include some controls from the literature.

H5: In an international dispute, there is an inverted U-shaped relationship between the balance of military forces and the use of military force.

Many realists (particularly 'balance of force' theorists) argue that if a state enjoys a military advantage over its adversary, it will be more likely to use military force because it is more likely to succeed and the cost of using force is likely to be low. Weaker states will view the initiation of violence as a very risky strategy that is likely to result in substantial costs. However, the relationship may be non-linear. Bueno de Mesquita & Lalman (1992) argue that a selection process is at work. Weaker states are more likely to capitulate in the face of overwhelming military force, implying that very powerful states are likely to get their way without resorting to military force.

H6: In an international dispute, if the actor has any type of military alliance ties with its adversary, then it is less likely to use military force to resolve the dispute.

Realists also claim that shared security interests influence a state's decision to use military force because a state fears losing the security benefit that it gains from alliance ties with the other actor in a dispute (Bennett & Stam, 2004; Huth & Allee, 2002; Russett & Oneal, 2001).

H7: In an international dispute, if the actor is challenging the status quo, then it is more likely to use military force to resolve the dispute.

The challenging state perceives force to be necessary in order to achieve its goals. In contrast, a state that is satisfied with the status quo will tend not to use military force because it does not want to disrupt existing structures that work in its favor (Rousseau et al., 1996; Schultz, 2001).

H8: In an international dispute, if the actor shares a common border with its adversary, then it is more likely to use military force to resolve the dispute.

H9: In an international dispute, the more distant the actor is from its adversary, the less likely it is to use military force to resolve the dispute

H10: In an international dispute, if the actor is a major power, then it is more likely to use military force to resolve the dispute.

These three hypotheses are another set of realist constraints. The first two hypotheses

on geographical proximity are included to test realist arguments that the potential for international violence exists when the actor can reach its adversary with military force (Bennett & Stam, 2004; Russett & Oneal, 2001). The other hypothesis is based on the argument that major powers have been engaged in more international disputes compared to other non-major states, based on their wider-ranging interests (Russett & Oneal, 2001; Schultz, 2001).

H11: In an international dispute, if the actor belongs to a different civilization group from its adversary, then it is more likely to use military force to resolve the dispute.

H12: In an international dispute, if the actor has a conflictual historical relationship with its adversary, then it is more likely to use military force to resolve the dispute.

The first hypothesis is to test the debate between Huntington (1996) and Russett, Oneal & Cox (2000) on the clash of civilizations. Huntington (1996) argues that conflicts will be more likely to occur across civilizational boundaries; Russett, Oneal & Cox (2000) find no evidence of a 'clash of civilizations'. The second hypothesis is based on the argument that the past conflict interaction level influences the subsequent interstate conflict (Crescenzi & Enterline, 2001).

Equation (1) summarizes the model that will be tested below:[3]

$$\begin{aligned} \textit{use of force}_t = {} & \beta 0 + \beta 1 * \textit{economic interdependence}_t + \beta 2 * \textit{actor's democracy}_t + \beta 3 * \textit{opponent's democracy}_t + \beta 4 * \textit{actor's democracy} * \textit{dummy opponent's democracy}_t + \beta 5 * \textit{balance of forces}_t \\ & + \beta 6 * \textit{balance of forces squared}_t + \beta 7 * \textit{shared alliance ties}_t + \beta 8 * \textit{satisfaction with the status quo}_t \\ & + \beta 9 * \textit{contiguity}_t + \beta 10 * \textit{distance}_t + \beta 11 * \textit{major power}_t + \beta 12 * \textit{different civilization group}_t + \beta 13 * \textit{conflict interaction level}_{t-1} \\ & + \beta 14 * \textit{peace year}_t + \beta 15 * \textit{spline 1}_t + \beta 16 * \textit{spline 2}_t + \beta 17 * \textit{spline 3}_t + e \end{aligned} \quad (1)$$

The Simultaneity Problem

It is at this point that our approach makes a major deviation from most empirical analyses of interdependence, democracy, and military conflict. Given the dichotomous nature of the military conflict dependent variable, many researchers have plunged directly into estimating models similar to Equation (1) using a logit or probit method. We argue that such an approach can lead to erroneous conclusions because it does not control for the reciprocal relationship between the *use of force* dependent variable and the *economic interdependence* independent variable. While high levels of economic interdependence with an opponent may decrease incentives to resort to violence, it is also plausible that a state's decision to use military force will affect its existing economic ties with the opponent (Mansfield, 1994; Pollins, 1989). For instance, while US–Cuban trade was extensive in the 1950s, it collapsed with the rise of Castro in 1959, the trade embargo of 1960, and the use of force by the United States in the Bay of Pigs in 1961. Declining interdependence did not cause conflict; rather, conflict caused a decline in interdependence.

[3] We estimate the simultaneous equations of current year's *economic interdependence* causing current year's *use of force* and of current year's *use of force* causing current year's *economic interdependence*. In other words, we do not use a lagged *economic interdependence* variable for this Equation (1). The peace years variable and cubic splines are included to control for temporal dependence (Beck, Katz & Tucker, 1998).

Gujarati (1995: 647) explains that simultaneity problems occur when the endogenous variable in one equation (e.g. *use of force* in our Equation (1) above) appears as an explanatory variable in another equation of the system (e.g. *economic interdependence* in our Equation (2) below). As a result, such an endogenous explanatory variable becomes stochastic and is correlated with the disturbance term of the equation where it appears as an explanatory variable. In this situation, Gujarati argues that the classical OLS will produce estimators that are not consistent, regardless of the size of the sample (see also Greene, 1997: ch. 16). The rationale for avoiding the classical OLS (ordinary least squares) method in the presence of the simultaneity problem also applies to the case of the classical logit or probit method, because key assumptions of the OLS method (such as non-stochasticity and the independent distribution of the explanatory variables) are also incorporated into logit and probit analyses. Thus, employing a standard probit model in a situation with reciprocal causation will result in biased coefficients.

There have been a handful of attempts to address the simultaneity problem in the literature. While some of these studies have found a pacifying benefit of international commerce on military conflict (Kim, 1998; Mansfield, 1994; Oneal, Russett & Berbaum, 2003; Polachek, 1997), others have found mixed or non-pacifying effects (Keshk, Pollins & Reuveny, 2004; Reuveny, 2001; Reuveny & Kang, 1998). Two broad types of estimation methods have been used to tackle this 'simultaneity' issue on the topic. First, Keshk, Pollins & Reuveny (2004), Mansfield (1994), Polachek (1997), and Kim (1998) use the simultaneous equations estimation methods. For example, Polachek (1997) tests this simultaneous relationship between the volume of bilateral trade (with data from the International Monetary Fund, IMF) and the bilateral political interactions of conflict and cooperation (with the COPDAB data), employing three-stage least squares regression analysis. On the other hand, Oneal, Russett & Berbaum (2003), Reuveny (2001), and Reuveny & Kang (1998) use the distributed lags or other related estimation methods. For example, Reuveny & Kang (1998) test this simultaneous trade–conflict relationship for 16 individual dyads with the bilateral trade data from the IMF and the United Nations and the conflict data from the COPDAB and WEIS events datasets, using the Granger causality test with distributed lags.

Although the distributed lag approach has a number of advantages (e.g. permits a richer modeling of temporal dependence), we have selected the simultaneous approach for three reasons. First, distributed lag and related models tend to be very sensitive to the length of the lag selected by the modeler (Geweke, 1984). Second, the conclusion drawn from the bilateral Granger causality models may depend on the inclusion of a third variable (Granger, 1980). Third, detrending a series may either change its dynamic properties or lead to different causality conclusions (Kang, 1985).

The 'simultaneous equation' model used to test our hypotheses is instrumental variables, limited information two-stage probit least squares estimation method.[4] The first step in resolving the simultaneity problem involves specifying the interrelationship between economic interdependence and military conflict. This is accomplished by incorporating a second equation in which *economic interdependence* is the dependent

[4] Not only do the two equations to be estimated in this article satisfy the rank condition (the sufficient condition for identification of a simultaneous equation model), but also the order condition based on the exclusion restrictions reveals that our two equations are overidentified, which makes it impossible to recover unique structural parameters using the indirect estimation method.

variable and *use of force* is an independent variable into the original model (Equation 1).

$$\begin{aligned} &\textit{economic interdependence}_t = \\ &\beta 0 + \beta 1 * \textit{use of force}_t + \\ &\beta 2 * \textit{actor's democracy}_t + \\ &\beta 3 * \textit{opponent's democracy}_t + \\ &\beta 4 * \textit{actor's democracy} * \textit{dummy} \\ &\textit{opponent's democracy}_t \\ &+ \beta 5 * \textit{shared alliance ties}_t \\ &+ \beta 6 * \textit{non-communist countries}_t \\ &+ \beta 7 * \textit{distance}_t + \beta 8 * \textit{GDPs}_t \\ &+ \beta 9 * \textit{populations}_t + \\ &\beta 10 * \textit{shared PTA membership}_t \\ &+ \beta 11 * \textit{former colonial relationship}_t \\ &+ \beta 12 * \textit{shared OECD membership}_t \\ &+ \beta 13 * \textit{shared regional membership}_t + e \end{aligned} \tag{2}$$

While military conflict is expected to decrease interdependence, we predict that democratic states are more likely to trade than non-democratic states (Morrow, Siverson & Tabares, 1998). Moreover, in cases where both states are democratic, this effect should be accelerated (Mansfield, Milner & Rosendorff, 2000). Allies are more likely to trade with each other for strategic reasons (Gowa, 1994). We also expect that pairs of non-communist countries are more likely to trade with each other. The centrally planned communist states are much less likely to integrate their economies into the global market system because their rejection of price mechanisms to allocate resources makes valuing goods on the international market more difficult. Based on the economists' standard 'gravity model' to explain trade, we expect that distant states are less likely to trade, that a state with high gross domestic product (GDP) is more likely to trade, and that a state with large population is less likely to be involved in the international trade (Leamer & Stern, 1970; Russett & Oneal, 2001). We expect also that states that share preferential trading agreement(s), have a former colonial relationship, belong to the Organization for Economic Cooperation and Development, or are within the same region are more likely to trade.

The instrumental variables, limited information two-stage probit least squares estimation method to test our hypotheses is accomplished with the following steps. First, we regress the endogenous explanatory variables (*use of force* in Equation (1) and *economic interdependence* in Equation (2)) on all of the predetermined variables in the whole system to eliminate the likely correlation between those endogenous explanatory variables and the stochastic disturbance terms in each equation, which violates the assumptions of the classical OLS and probit methods. This first step provides us a 'proxy' for each endogenous explanatory variable – called an instrumental variable – that is uncorrelated with the disturbance term in each equation. Second, we regress our two original endogenous variables on these proxies (or instrumental variables) plus the other independent variables in each equation (Gujarati, 1995: 686–688). This two-stage probit least squares method gives us an unbiased and efficient estimator of each parameter in the equations (Amemiya, 1978; Heckman, 1978; Maddala, 1983).[5]

Data and Measurement

We test our hypotheses using a set of international disputes from 1960 to 1988 developed by Rousseau (2005). The primary source for the identification of each international dispute is a dataset developed by Sherman (1994) that identifies all domestic quarrels and international disputes from 1945 to 1988. Rousseau has modified Sherman's dataset in a number of ways. First, he has restricted his dataset to the period

[5] We employ the CDSIMEQ procedure in STATA to estimate the simultaneous equations (http://www.stata-journal.com/software/sj3-2/st0038/). The procedure implements all the necessary procedures for obtaining consistent estimates for the coefficients, as well as their corrected standard errors (Keshk, 2003; see also Keshk, Pollins & Reuveny, 2004, for the application of the procedure for the trade–conflict relationship).

1960–88. Second, he has removed all domestic quarrels because the main focus of his research is on a state's decision to use military force against other states. Third, he has eliminated several categories of dispute cases in order to focus on political-security conflicts that have some probability of escalating to military conflict between internationally recognized sovereign states. Fourth, he has aggregated types of disputes (e.g. USA vs. Cuba territorial dispute in 1962 and USA vs. Cuba regime type dispute in 1962) into a single dyadic dispute because these disputes are not independent events.

The final dataset consists of 223 international disputes between pairs of countries.[6] The disputes vary in length from 1 to 29 years. The directed dyad data structure includes observations for both states in order to isolate the behavior of each party in the dispute. As Bennett & Stam (2000a: 655) explain, 'a directed dyad study easily allows for behavioral choices and dyadic outcomes to be different in the two directions and hence allows simultaneous testing of varied theories and hypotheses'. In our model, testing monadic and dyadic hypotheses using a conflict initiation dependent variable (see below) requires the use of a directed dyad structure. The cross-sectional, pooled time-series, directed-dyad dataset contains 5,770 observations.[7]

The use of this dispute dataset differentiates our research from most other scholarly work on the 'liberal peace' hypothesis. First, most international disputes do not escalate into crises in which one or both parties threaten or use military force and, by the same logic, most international crises do not escalate into wars in which one or both parties use large military forces to resolve the crisis.[8] Therefore, most previous empirical studies that have focused on crises or wars capture only a small subset of the population of international conflicts. The issue is important with respect to the liberal peace because if democracies or highly interdependent states choose not to escalate a political dispute into a militarized crisis or war, then analyses restricted to the subset of crises and wars will underestimate the pacifying impact of each pillar of the liberal peace.

Second, many other scholarly works on the 'liberal peace' hypothesis use a state's conflict involvement rather than conflict initiation as their dependent variable (Barbieri, 2002; Barbieri & Peters, 2003; Gartzke & Li, 2003a,b; Oneal, 2003; Oneal & Russett, 1997; Russett & Oneal, 2001). Conflict involvement is a poor dependent variable because it groups victims of aggression (e.g. Belgium 1914) with the aggressors (e.g. Germany 1914). Owing to the rarity of initiation in the time-series dataset, we focus on the 'aggressive use of force', which we define as the use of military force by regular troops or through third parties *on* the territory of another state. While Germany used aggressive force in 1914, democratic Belgium did not.

Third, much of the most cited work on the interdependence and conflict relationship employs non-directed dyad structures (e.g. Russett & Oneal, 2001). This data structure makes it impossible to test monadic arguments and encourages the use of

[6] For a list of the cases in the dataset, see Rousseau (2005).

[7] In order to illustrate the directed-dyad structure, consider one of the 223 disputes in the dataset: the Tunisian–France dispute from 1960 until 1963. The time-series data include four years for each state. This allows the dependent variable (described below) to be coded on a state-by-state basis. For example, Tunisia used aggressive force three times (1960–62) and France used aggressive force only once (1961). A non-directed dyadic analysis would not capture this detail and would provide an inferior test of the theoretical arguments. Finally, the ongoing crisis years were included in the analysis because state officials made a conscious decision to use aggressive force to resolve the dispute during each year. In this case, the use of force by Tunisia contributed to the decline in interdependence in subsequent years. Deleting ongoing crisis years (e.g. 1961–62 in the Tunisia–France case) would undermine our ability to explore the reciprocal relationship between interdependence and conflict.

[8] War is typically defined as a conflict resulting in more than 1,000 battle-deaths among all participants (see Small & Singer, 1982, for further details).

imprecise dependent variables such as conflict involvement. In order to distinguish the monadic effect of democracies from the dyadic effect of two democracies, we employ the directed dyad design (Bennett & Stam, 2004).

We now turn to the measurement of the variables used in the model, beginning with the two dependent variables: the *use of force* and *economic interdependence*. This dichotomous *use of force* dependent variable is defined as the use of military force on the territory of another sovereign state. If a state uses military force during the dispute, the dependent variable is coded as 1; otherwise it is coded 0. Given that we are coding both sides independently, it is possible for both sides to use aggressive force during a dispute. The use of force includes both regular military troops and third-party proxies (Cohen, 1994).

Economic interdependence has been operationalized in a variety of ways in the literature (for the recent debate, see Barbieri & Peters, 2003; Gartzke & Li, 2003a,b; Oneal, 2003). Although all operationalizations of interdependence have both strengths and weaknesses, we believe that imports plus exports divided by GDP nicely captures interdependence. Three strengths of this operationalization stand out. First, the fact that the operationalization has been used extensively in the literature facilitates comparisons with previous research (Oneal & Russett, 1997; Russett, Oneal & Davis, 1998; Russett & Oneal, 2001; Oneal, 2003). Second, using the ratio of trade to the size of the economy allows the measure to capture the importance of trade to the economy. Third, the operationalization captures the broad connectedness the two states in a dyad have with the world market (Gartzke & Li, 2003a).

In terms of weakness, three have been discussed in the literature. First, the operationalization captures only trade interdependence (Gartzke, Li & Boehmer, 2001). Unfortunately, this is true of virtually all measures of interdependence, because supplemental measures, such as investment flows, are not available for all states across the years of interest. Second, if we want to capture the extent to which states are dominant trading powers in the system, this operationalization might be inappropriate (Barbieri, 2003: 215). Third, Mansfield & Pollins (2003: 13) question this operationalization's validity as an indicator of vulnerability interdependence (the costs associated with the disruptions of the trading relations). Thus, while our preferred interdependence operationalization is better than most, it still suffers from potential problems. In order to probe the robustness of our findings, we test the two-stage probit model with five alternative operationalizations for trade interdependence. As the results (available at the website identified in the authors' note) demonstrate, the interdependence variable fails to achieve statistical significance with any of the six operationalizations. The data for all six measures (such as bilateral trades, total trades, and GDPs) are taken from the Expanded Trade and GDP Data Version 3.0 by Gleditsch (2002). The final measures were transformed using natural logarithms (Gartzke & Li, 2003a).[9]

Actor's Democracy and Opponent's Democracy These independent variables are constructed by subtracting the Polity IV autocracy index from the democracy index to produce a variable that ranges from –10 to 10. Then, this variable is rescaled from 0 to 20 in order to simplify interpretation of the statistical results. The value of 0 in the final product indicates the fully autocratic state, and that of 20 indicates the fully democratic state.

[9] We transform zero values into ($1/e^{21}$) to avoid missing values.

Actor's Democracy*Dummy Opponent's Democracy This interaction term composed of the *actor's democracy* score multiplied by a dummy version of the *opponent's democracy* score – if the latter is 17 or greater, the dummy version is coded 1 – is introduced in order to isolate the effect of the *actor's democracy* variable when facing a democratic opponent (the 'dyadic' explanation in the 'democratic peace' hypothesis). Therefore, this interaction variable takes the value of the *actor's democracy* score when the opponent is democratic and it takes the value of 0 when the opponent is non-democratic.[10]

Balance of Forces This variable measures each state's military capability relative to its opponent. Each state's military capability is the average of three components – number of troops, military expenditures, and military expenditures per soldier – from the National Material Capabilities Data (ICPSR 9903, Singer & Small, 1993). The final product ranges from 0 to 1. A value greater than 0.50 indicates that the state's military capability is superior to its opponent, while a value less than 0.50 indicates military inferiority. The model also includes a *balance of forces squared* term to probe for the existence of a curvilinear relationship.

Shared Alliance Ties This dummy variable takes the value of 1 when the two states in the dispute share a defense pact, neutrality pact, or an entente (CoW Alliance v3.03).

Satisfaction with the Status Quo This variable is coded 1 if a state is satisfied with the status quo regarding the issue at stake in the dispute at the time the crisis begins. Otherwise, it is coded 0. This variable is coded by examining policy statements of each state in a dispute. If a state accepted the status quo as the settlement of the dispute, it is coded as satisfied; if a state viewed the current situation as unacceptable or was actively seeking immediate change, it is coded as unsatisfied. In several disputes, both states are dissatisfied (e.g. India versus China in 1962).

Contiguity, Distance and Major Power If the two states in a dispute share a boundary on land or are separated by less than 150 miles of water, either directly or through their colonies or other dependencies, the variable *contiguity* is coded 1; otherwise, it is coded 0. The variable *distance* is the natural logarithm of the great circle distance between the two states in a dispute. Finally, the variable *major power* is coded as 1 if a state is a major power identified by the Correlates of War (CoW) project: for the entire time period of our analysis, the United States, France, Great Britain, the Soviet Union, and China qualify as major powers. The data for all three variables are taken from EUGene (Expected Utility Generation and Data Management program) Version 2.40 by Bennett & Stam (2000b).

Different Civilization Group If the two states do not belong to the same civilization group, the variable *different civilization group* is coded 1; otherwise, it is coded 0. The data for the variable are based on the classification of states by civilization group from Russett, Oneal & Cox (2000).

Conflict Interaction Level We use the dyad's conflict interaction level measured by Crescenzi & Enterline (2001); their measure ranges from –1 to +1, indicating the values close to –1 as the strong enemies, the value of 0 as neutrality, and the values close to +1 as the strong friendships.

[10] Sensitivity analysis demonstrates that using two continuous variables produces similar results.

Peace Year, Spline 1, Spline 2 and Spline 3 To control for temporal dependences in dyads, we constructed variables for the length and three natural cubic splines associated with non-eventual binary spells (Beck, Katz & Tucker, 1998).

Non-Communist Countries This dummy variable is included for the additional equation – with *economic interdependence* as the dependent variable – in the structural equation system. The dummy *non-communist countries* variable is coded as 1 if both states in a dispute are non-communist countries defined by *Encyclopedia of Government and Politics: Volume I* (Holmes, 1992).

GDPs and Populations The two 'gravity model' of trade variables are states' GDP in current US dollars and total populations in the unit of thousands for states in a dispute. The data for these variables are taken from Expanded Trade and GDP Data Version 3.0 by Gleditsch (2002). The two variables were transformed using natural logarithms, following the specification of 'gravity model'.

Shared PTA Membership, Former Colonial Relationship, Shared OECD Membership, and Shared Regional Membership The dummy *shared PTA membership* variable is coded as 1 if both states in a dispute share at least one preferential trading agreement taken from Pevehouse & Mansfield (2003). The variable of *former colonial relationship* is coded as 1 if one state in a dispute is the former colony of the other state; the data are taken from Correlates of War 2 Colonial/Dependency Contiguity, 1816–2002 (v3.0). If both states belong to the OECD, the variable *shared OECD membership* is coded as 1; otherwise, it is coded 0. The data for the OECD membership are taken from the OECD website. Finally, if both states belong to the same region (Europe, Middle East, Africa, Asia, and North or South America), the variable *shared regional membership* is coded as 1; the data are taken from EUGene Version 2.40 by Bennett & Stam (2000b).

Data Analysis

The statistical results for our model are presented in Table I. The classical probit model that is typically used in statistical analysis is presented in Model 1; the two-stage probit least squares model that is designed to correct for the simultaneity problem is presented in Model 2.[11] Table II displays the marginal impact analysis for both models. The marginal analysis calculates the change in the predicted probability of using force for an *X* unit change in the independent variable of interest (while holding all other independent variables at their means or modes).

Hypothesis 1 predicts that the coefficient on the *economic interdependence* will be negative. This hypothesis implies that if a state is economically interdependent with its opponent in a dispute, it is less likely to use military force because it fears losing the benefits of trade. The results using the classical probit method displayed in Model 1 support this assertion. The estimated coefficient for *economic interdependence* is negative (–0.026) and statistically significant at better than the 0.001 level. The marginal impact analysis in Table II indicates that increasing the level of interdependence from one standard deviation below the mean (–16.42) to the mean of the variable (–10.17) *decreases* the probability of using aggressive force by 2.16%. Increasing the change from the mean to one standard deviation above the mean (–3.92) triggers an additional drop of 1.70%. Specifically, the predicted probability of using aggressive force drops from 8.27% to 4.41%. The

[11] We focus on the 'liberal peace' hypotheses here. Appendix A provides statistical results and brief comments on the second equation.

Table I. Estimated Coefficients for the Liberal Peace Model, 1960–88

Variables	*Model 1* *Probit method*	*Model 2* *Two-stage probit method*
Economic interdependence	–0.026***	–0.012
	(0.005)	(0.018)
Actor's democracy	–0.011*	–0.011*
	(0.005)	(0.005)
Opponent's democracy	0.016**	0.016**
	(0.006)	(0.006)
Actor's democracy*	–0.051***	–0.051***
dummy opponent's democracy	(0.012)	(0.012)
Balance of forces	2.034***	2.139***
	(0.518)	(0.526)
Balance of forces squared	–1.541**	–1.614**
	(0.507)	(0.520)
Shared alliance ties	0.032	–0.055
	(0.086)	(0.108)
Satisfaction with the status quo	–0.646***	–0.654***
	(0.075)	(0.076)
Contiguity	–0.190*	–0.199*
	(0.083)	(0.089)
Distance	0.089**	0.086**
	(0.031)	(0.032)
Major power	–0.451***	–0.445***
	(0.121)	(0.124)
Different civilization group	–0.108	–0.143+
	(0.073)	(0.078)
Conflict interaction level	–0.371***	–0.363***
	(0.085)	(0.093)
Peace year	–1.332***	–1.337***
	(0.073)	(0.075)
Spline 1	–0.131***	–0.132***
	(0.011)	(0.011)
Spline 2	0.029***	0.029***
	(0.003)	(0.003)
Spline 3	–0.001*	–0.001*
	(0.001)	(0.001)
Constant	–1.022***	–0.831*
	(0.317)	(0.410)
χ^2	1,836.89***	1,811.11***
N	5,476	5,476

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, ***p <= 0.001.

finding with the classical probit method therefore supports the work of Oneal & Russett and their colleagues who also use a classic logit method to test the liberal peace (Oneal & Russett, 1997; Russett, Oneal & Davis, 1998; Russett & Oneal, 2001).

However, when controlling for the simultaneity problem by employing a two-stage

Table II. Marginal Impact Analysis for the Liberal Peace Model

	Probit method		*Two-stage probit method*	
Variables	*Predicted probability*	*Percentage point change*	*Predicted probability*	*Percentage point change*
Baseline	6.11		6.34	
Economic interdependence				
Below 1 standard deviation (–16.42)	8.27		n.s.	
Mean (–10.17)	6.11	–2.16	n.s.	n.s.
Above 1 standard deviation (–3.92)	4.41	–1.70	n.s.	n.s.
Total		–3.86		n.s.
Actor's democracy				
0	7.27		7.57	
10	5.85	–1.42	6.07	–1.50
20	4.66	–1.19	4.81	–1.26
Total		–2.61		–2.76
Opponent's democracy				
0	4.71		4.89	
10	6.48	1.77	6.73	1.84
20	8.74	2.26	9.06	2.33
Total		4.03		4.17
Actor's democracy dummy opponent's democracy*				
0	7.38		7.66	
10	2.51	–4.87	2.61	–5.05
20	0.68	–1.83	0.71	–1.90
Total		–6.70		–6.95
Balance of forces				
0	2.04		1.99	
0.2	4.44	2.40	4.53	2.54
0.4	6.95	2.51	7.24	2.71
0.6	8.36	1.41	8.80	1.56
0.8	7.98	–0.38	8.41	–0.39
1	6.01	–1.97	6.29	–2.12
Shared alliance ties				
No	n.s.		n.s.	
Yes	n.s.	n.s.	n.s.	n.s.
Satisfaction with status quo				
No	6.11		6.34	
Yes	1.42	–4.69	1.46	–4.88
Contiguity				
No	8.76		9.21	
Yes	6.11	–2.65	6.34	–2.87

continued

Table II. Continued

	Probit method		*Two-stage probit method*	
Variables	*Predicted probability*	*Percentage point change*	*Predicted probability*	*Percentage point change*
Distance				
Below 1 standard deviation (5.56)	4.87		5.10	
Mean (6.82)	6.11	1.24	6.34	1.24
Above 1 standard deviation (8.07)	7.57	1.46	7.80	1.46
Total		2.70		2.70
Major power				
No	6.11		6.34	
Yes	2.29	–3.82	2.43	–3.91
Different civilization group				
No	7.53		8.31	
Yes	6.11	–1.42	6.34	–1.97
Conflict interaction level				
Minimum (–0.99)	9.93		10.16	
Mean (–0.29)	6.11	–3.82	6.34	–3.82
Maximum (0)	4.92	–1.19	5.14	–1.20
Total		–5.01		–5.02

The table displays the substantive significance of the variables. The marginal impact displays the change in the predicted probability of using force caused by a shift in the independent variable of interest from X_1 to X_2. All other variables are held at their means or modes.

probit least squares method, the negative impact of interdependence evaporates. The estimated coefficient for *economic interdependence* is negative, but statistically insignificant. Sensitivity analysis using the five alternative measures of interdependence indicates that this result is not due to our operationalization decision.[12] In every case, while the classical probit model indicates that interdependence decreases the use of military force, this finding evaporates when we shift to a two-stage probit model. The overall pattern is quite clear: interdependence does not reduce military conflict after controlling for the reciprocal relationship between interdependence and military conflict.[13]

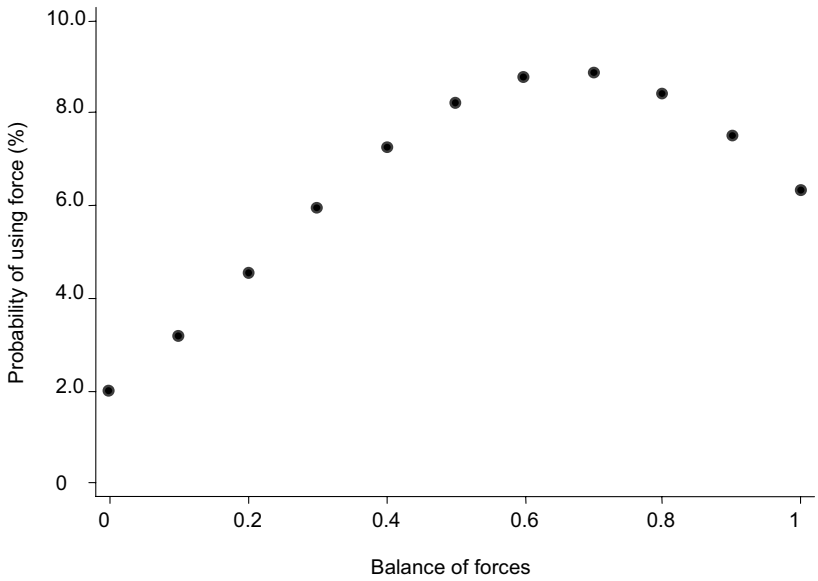
What is striking about the remaining variables is their robustness. The coefficients and standard errors remain relatively stable across both of the two methods displayed in Table I. The simultaneity problem, which was so important with respect to the *economic interdependence* variable, does not appear to influence the remainder of the model. For this reason, we will restrict our description of the remaining independent variables to the two-stage probit model displayed in the second column of Table I.

The 'democratic peace' pillar of the liberal peace is strongly supported by the data. The

[12] The five alternative operationalizations include the following: (1) $(export_{ij,t} + import_{ij,t})/total\ trade_{i,t}$ (Barbieri, 2002); (2) $salience\ of\ trade\ dependence_{ij,t} * symmetry\ of\ trade\ dependence_{ij,t}$ (Barbieri, 2002); (3) $salience\ of\ trade\ share_{ij,t} * symmetry\ of\ trade\ share_{ij,t}$ (Barbieri, 2002); (4) the lower of ('$trade\ dependence'_{i,t}$ and '$trade\ dependence'_{j,t}$) (Oneal & Russett, 1997); and (5) $export_{ij,t} + import_{ij,t}$ (Keshk, Pollins & Reuveny, 2004). Sensitivity analysis is available on the website identified in the authors' note.

[13] The fact that the estimated coefficient for the interdependence variable is indistinguishable from zero in all six two-stage probit models undermines the realist claim that interdependence will increase military conflict.

Figure 1. Non-Linear Balance of Forces Model



actor's democracy variable is negative as expected and statistically significant. A shift from totally autocratic (i.e. 0 on the 0–20 scale) to fully democratic (20) decreases the predicted probability of using force by 2.76%. This strong monadic effect of democracy, which is explored in detail in Rousseau (2005), is due to the use of a broader 'dispute' dataset that captures both militarized crises and non-militarized disputes. The dyadic *actor's democracy* dummy opponent's democracy*, which isolates the behavior of democracies with each other, is also negative and statistically significant at better than the 0.001 level. While democracies are more pacific in general, this influence dramatically increases when facing another democracy. The marginal impact of a shift from 0 to 20 when facing a democratic opponent is –6.95%, making it the largest marginal impact in the model. Finally, the positive coefficient on the *opponent's democracy* implies that a non-democratic state is more likely to use military force against democracies than against non-democracies.

Hypothesis 5 argues that there is a non-linear relationship between the balance of power and the use of military force. The results strongly support this argument. The coefficient on the *balance of forces* is positive and statistically significant at better than the 0.001 level and the coefficient on the *balance of forces squared* is negative and statistically significant at better than the 0.01 level. This curvilinear relationship is more easily grasped by examining Figure 1. While more powerful states are more likely to use force up to a point (about 0.70 in Figure 1), the probability of using force declines after this peak because (1) weak states are more likely to give in on the issue and/or (2) strong states feel so secure that there is no pressing security reason to force a change.

Hypothesis 6 predicts that the coefficient on the *shared alliance ties* will be negative. The results with our two-stage probit least

squares model in Table I do not support the hypothesis. Even though the coefficient for the variable is negative, it fails to achieve statistical significance. In the sensitivity analysis with alternative measures of interdependence, it is statistically insignificant in all five two-stage probit models. Hypothesis 7 argues that if a state is satisfied with the status quo it is less likely to use military force to resolve the dispute. The results strongly supports this hypothesis; the coefficient on this variable is negative and statistically significant at better than the 0.001 level. A shift from 'dissatisfied' to 'satisfied' decreases the predicted probability of using aggressive force from 6.34% to 1.46% – a 4.88% decline.

Hypotheses 8 and 9 are not supported by the regression analysis. Contrary to our expectations, the coefficient on *contiguity* is negative and statistically significant at better than the 0.05 level; the marginal impact analysis in Table II indicates that a shift from 'non-contiguous' to 'contiguous' decreases the predicted probability of using aggressive force from 9.21% to 6.34% – a 2.87% decline. Similarly, the coefficient on *distance* is unexpectedly positive and statistically significant. These findings are due to the convergence of three factors. First, 84% of the cases in the 'dispute' dataset are contiguous. Thus, a small number of particular conflictual non-contiguous dyads are responsible for the findings. Second, the dependent variable codes for the use of force through third parties. Unlike in many studies, US support of the Afghani Mujahedeen rebels through Pakistan constitutes a non-contiguous use of force. Third, the contiguity and distance findings are not robust to alternative specifications. For example, the United States accounts for a large number of the non-contiguous uses of force. While dropping US cases from the dataset does not alter the major findings of the model, it does make the contiguity coefficient insignificant.

Hypothesis 10 predicts that a major power will be more likely to use military force. However, Table I indicates that the *major power* estimated coefficient is negative and statistically significant; the marginal impact analysis in Table II indicates that a shift from 'non-major power' to 'major power' *decreases* the predicted probability of using aggressive force from 6.34% to 2.43% – a 3.91% decline. This last finding is not particularly surprising because other empirical analyses have also revealed that great power dyads are less likely to use military force (Schultz, 2001: 152).

Hypothesis 11 predicts that conflicts will be more likely to occur across the civilizational boundaries. As with Russett, Oneal & Cox (2000), we find no support for Huntington's clash of civilization claim. In fact, the coefficient on *different civilization group* is negative and statistically significant; the marginal impact analysis in Table II indicates that a shift from 'same civilization' to 'different civilizations' *decreases* the predicted probability of using aggressive force from 8.31% to 6.34% – a 1.97% decline. Finally, the results confirm Hypothesis 12 that strong friendships decrease the probability of conflict. The estimated coefficient on *conflict interaction level* is negative and statistically significant.

Generalizing the Findings

Are the findings using this dispute dataset generalizable? An ideal test would involve identifying a body of work supporting the interdependence hypothesis, obtaining the data used in the analysis, and re-examining the data using the two-stage probit least squares method. Oneal & Russett have been leading proponents of the interdependence pillar of the liberal peace and they have been

generous enough to provide us with the dataset from Oneal (2003) and Oneal, Russett & Berbaum (2003).

We employ their operationalizations for the variables with the following two equations:

$$\begin{aligned} \textit{dispute onset}_t = {} & \beta 0 + \beta 1^* \textit{ lower dependence}_t \\ & + \beta 2^* \textit{ lower democracy}_t + \beta 3^* \textit{ capability} \\ & \textit{ratio}_t + \beta 4^* \textit{ allies}_t + \beta 5^* \textit{ contiguity}_t \\ & + \beta 6^* \textit{ distance}_t + \\ & \beta 7^* \textit{ major power}_t \\ & + \beta 8^* \textit{ peace year}_t + \beta 9^* \textit{ spline } 1_t \\ & + \beta 10^* \textit{ spline } 2_t + \beta 11^* \textit{ spline } 3_t \end{aligned} \tag{3}$$

$$\begin{aligned} \textit{lower dependence}_t = {} & \beta 0 + \beta 1^* \textit{ dispute onset}_t \\ & + \beta 2^* \textit{ lower democracy}_t \\ & + \beta 3^* \textit{ allies}_t + \beta 4^* \textit{ distance}_t + \\ & \beta 5^* \textit{ GDPs}_t + \beta 6^* \textit{ populations}_t \end{aligned} \tag{4}$$

In Table III, the first column presents the results from the classic probit method and the second column presents those from the two-stage probit least squares method. What is immediately clear is that the *lower dependence* variable is negative and statistically significant with the classical probit method but not with the two-stage probit least squares method. In fact, the coefficient on *lower dependence* is positive and statistically significant at better than the 0.001 level. The remaining variables maintain their signs and statistical significance with the two-stage probit least squares method. Although drawing a firm conclusion is difficult, owing to numerous differences between our model and data and Russett & Oneal's (e.g. their non-directed dyad data structure and their use of a conflict involvement dependent variable), we believe that the evidence strongly suggests that there is no pacifying effect of economic interdependence.

Conclusion and Directions for Future Research

Our study departs from existing empirical literature in two ways. First, the international dispute dataset is substantially different from the two most commonly used datasets in the literature (the Correlates of War Militarized Interstate Dispute [MID] dataset and the International Crisis Behavior [ICB] dataset) because it includes both disputes which have escalated to the militarized crisis level and those which have not. This is important because those studies that have focused on crises (or even wars) can capture only a small part of a state's external behavior pattern (Rousseau, 2005).

Second, and most important, we employ instrumental variables, limited information two-stage probit least squares estimation method rather than the classical logit (or probit) method used throughout the literature. The use of a standard probit method in the face of a simultaneity problem results in biased and inconsistent estimators. We believe prior empirical analysis that produced evidence in support of the economic interdependence pillar may have erred by not explicitly addressing the simultaneity problem. By controlling for the simultaneity problem with the two-stage probit least squares method, our study produces unbiased and consistent estimators that capture the impact of interdependence more accurately. A brief examination of the Oneal & Russett data indicates that the failure to address the simultaneity problem may also account for their findings.

Is there a liberal peace? Clearly, the results in Tables I and II support the democratic peace pillar of the liberal peace argument. The results also indicate that the unconditional liberals who argue that international interdependence promotes peace are incorrect. This raises the question: Is the impact of interdependence conditional? We believe that the conditional arguments put forward by Keohane & Nye (1977), Copeland (1996), and Ripsman & Blanchard (1996/97) must be examined more thoroughly. While the asymmetric interdependence proposition proposed by Keohane & Nye can be

Table III. Estimated Coefficients for the Liberal Peace Model Using Oneal & Russett's Dataset (1885–1992)

Variables	*Model 3* *Probit method*	*Model 4* *Two-stage probit method*
Lower dependence	–0.004^{+}	0.040***
	(0.002)	(0.004)
Lower democracy	–0.021***	–0.033***
	(0.002)	(0.002)
Capability ratio	–0.029***	–0.017*
	(0.008)	(0.008)
Allies	–0.199***	–0.180***
	(0.029)	(0.029)
Contiguity	0.963***	0.923***
	(0.030)	(0.030)
Distance	–0.108***	–0.054***
	(0.013)	(0.013)
Major power	0.487***	0.380***
	(0.049)	(0.051)
Peace year	–0.028***	–0.024***
	(0.001)	(0.001)
Spline 1	–0.000***	–0.000***
	(0.000)	(0.000)
Spline 2	0.000***	0.000***
	(0.000)	(0.000)
Spline 3	–0.000***	–0.000***
	(0.000)	(0.000)
Constant	–1.566***	–1.603***
	(0.099)	(0.100)
χ^2	6,549.82***	6,673.07***
N	368,061	368,061

Each column consists of the coefficient estimator (first line) and the standard error (second line) of each variable. All significance tests are two-tailed: $^{+}p <= 0.10$, $^{*}p <= 0.05$, $^{**}p <= 0.01$, $^{***}p <= 0.001$.

readily tested (see Barbieri, 2002), the 'future expectations' model proposed by Copeland and the 'strategic goods' model proposed by Ripsman & Blanchard will require innovative research designs and extensive data collection.

Two additional areas of future research stand out. First, the dispute dataset needs to be extended both forward and backward in time. In particular, the addition of the 1990s to the dataset will ensure that the unique and complex nature of the Cold War, in which the most advanced industrialized democracies were also allies against a formidable military threat, is not unduly influencing the results. Second, the strength of our model depends on the power of the instrumental variables. While our instruments explain a good portion of the observed variance, the debate will be settled only when the field develops more powerful models of interstate trade. Although the field has identified a large number of statistically significant factors influencing trade, much of the observed variance remains unaccounted for in existing models.

Appendix A. Two-Stage Probit Model with Economic Interdependence Dependent Variable

Variable	*Coefficient*	*Standard error*
Use of force	–0.707***	0.078
Actor's democracy	–0.056***	0.012
Opponent's democracy	0.035*	0.014
Actors' democracy* dummy opponent's democracy	0.023	0.025
Shared alliance ties	3.830***	0.207
Non-communist countries	1.208***	0.196
Distance	–0.524***	0.082
GDPs	0.304***	0.042
Populations	0.230***	0.052
Shared PTA membership	0.745***	0.201
Former colonial relationship	3.588***	0.695
Shared OECD membership	1.051*	0.478
Shared regional membership	–2.560***	0.213
Constant	–15.245***	0.858

N = 5,476. All significance tests are two-tailed: $^{+}p <= 0.10$, $^{*}p <= 0.05$, $^{**}p <= 0.01$, $^{***}p <= 0.001$.

Overall, the results support the hypotheses. As expected, the *use of force* by a state decreases a state's economic interdependence with its adversary in a dispute. The relationship between regime type and interdependence is more complex. The more democratic a state, the *less* interdependent it is with its adversary. However, if the opponent in the dispute is a democracy, then the relationship is reversed – interdependence increases. If states are allies or non-communist, interdependence increases. In terms of the 'gravity model' of trade, as expected, a state that is geographically more distant from its opponent is less likely to be interdependent with its adversary, and a state with a large economy is more likely to be interdependent with its adversary; however, contrary to our expectation, a state with a large population tends to be more interdependent with its opponent. We also find that states that share preferential trading agreement(s), have a former colonial relationship, or belong to the Organization for Economic Co-operation and Development are more likely to be interdependent with each other; but, economic interdependence is higher between states across regions rather than within regions.

However, the most important finding regarding this equation is that use of military force diminishes a state's economic interdependence with its adversary in a dispute. This result from the two-stage probit least squares method supports the argument that there is a possible reciprocal causation between the *use of force* and *economic interdependence* variables. This finding is robust using the five alternative measures of interdependence. The *R*-squared measure and the *F*-statistics for the *interdependence* instrument variables from the first stage of the two-stage probit least squares estimation range from 0.20 to 0.24 and from 58.51 to 75.81, respectively, across the six operationalizations; this indicates that the instrument is good but not outstanding (Stock & Watson, 2003: ch. 10). Unfortunately, it is difficult to compare our instrument with others because the goodness of fit of the instrument is rarely

reported in this literature. The pseudo *R*-squares for the *use of force* instrument variables are 0.48.

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