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Trade and Peace Revisited

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Abstract The existing literature on trade and peace has not definitively established whether bilateral trade reduces the probability of militarized conflict. While estimated effects remain highly sensitive to empirical specifications, a commonly overlooked aspect within this literature is the insufficient consideration of potential heterogeneous relationships across country pairs and the temporal dependence of conflicts. In this paper, we present supportive evidence of the pacifying effect of trade when both heterogeneity and temporal dependence are simultaneously taken into account. By applying the Arellano-Bond model to datasets from Keshk, Pollins, and Reuveny (2004) and Hegre, Oneal, and Russett (2010), which respectively indicated no and negative effects of trade on conflict, we find that bilateral trade significantly reduces the likelihood of conflict in both datasets. This finding adds further support to liberal claims regarding the interconnected nature of economic interdependence and conflict.

Keywords: trade, peace, militarized conflict, dynamic panel

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I. Introduction

Research on the relationship between economic interdependence and peace can be traced back to Immanuel Kant's concept of 'perpetual peace,' which posited that liberal states exhibit pacifism in their international relations. The pacifying effect of democracy and the detrimental impact of militarized conflicts on trade have garnered empirical support (Polachek and Seiglie 2007; Dunne 2020). However, the existing literature presents mixed results on whether trade reduces the probability of militarized disputes. Specifically, the results are highly sensitive to specification and measurement choices (Schultz 2015). While the literature has explored a variety of specifications, a commonly neglected feature is the failure to address potential heterogeneous relationships across country pairs that simultaneously affect both variables, as well as the temporal dependence of the conflict. Making the erroneous assumption that militarized disputes occur independently over time, or neglecting to adequately address unobserved factors unique to each country pair, can ultimately lead to flawed conclusions.

This paper revisits the impact of bilateral trade on militarized conflicts by incorporating

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a more realistic specification of the determinants of such conflicts. Specifically, we reexamine Keshk, Pollins, and Reuveny (2004) (hereafter KPR) and Hegre, Oneal, and Russett (2010) (hereafter HOR), which respectively reported null and negative impacts of bilateral trade on militarized disputes. Our econometric model explicitly accounts for both dyad-level heterogeneity and the potential temporal interdependence of disputes. The simultaneous consideration of these two factors poses a challenge, as differencing both the dependent and independent variables to eliminate dyad-level fixed effects introduces endogeneity in the lagged dependent variable due to its correlation with the differenced error term. To address this econometric concern, we employ the Arellano-Bond model, which provides consistent estimates while accommodating both dyad-level fixed effects and the lagged dependent variable.

We find supportive evidence of the pacifying effect of bilateral trade. In our replication of KPR, which reported a null effect of bilateral trade on militarized conflicts, we introduce dyad-level fixed effects and a first-order autoregressive term into their specification. Our estimation result now provides substantial support for the notion of a pacifying effect of trade. Notably, the regression coefficient of trade on disputes has now turned significantly negative. We also replicate HOR, which demonstrated the adverse effect of trade on fatal disputes. We show that their empirical results are robust to the inclusion of dyad-level fixed effects and a first-order autoregressive term; the regression coefficient of trade on disputes remains significantly negative.

We contribute to the existing body of literature on economic interdependence and peace (Oneal and Russet 1997; Gartzke, Li, and Boehmer 2001; Russett and Oneal 2001; Barbieri 2002; Mansfield and Pollins 2003; Keshk, Pollins, and Reuveny 2004; Kim and Rousseau 2005; Hegre, Oneal, and Russett 2010). Recent studies have introduced a simultaneous equation model that addresses the reciprocal relationship between trade and peace (Keshk, Pollins, and Reuveny 2004; Kim and Rousseau 2005; Hegre, Oneal, and Russett 2010). To mitigate potential temporal dependence, Hegre, Oneal, and Russett (2010) follow Beck, Katz, and Tucker (1998)'s estimation approach, which include the variable of peace duration between the respective country pairs and spline variables. However, one of the original authors of the paper calls this strategy an "old-fashioned fix" and advocates for directly modeling the dynamics as the "best solution" (Beck 2001). Moreover, as discussed, incorporating (functions of) lagged dependent variables introduces endogeneity concerns when attempting to control for dyad-level fixed effects. Keshk, Pollins, and Reuveny (2004) explicitly incorporate the lagged dependent variable to address potential temporal dependence, but they do not explicitly account for dyadic heterogeneity. We overcome these challenges by utilizing a dynamic panel data model for estimation. The estimation results provide supportive evidence of the pacifying effect of bilateral trade.

The rest of the paper is organized as follows. Section 2 and 3 describe KPR and HOR's specification and data, respectively. Section 4 concludes.

II. KPR's Specification and Results

KPR employs the following simultaneous equation model to explore the reciprocal relationship between trade and peace:

$$\ln(Total\_Trade_{AB,t}) = \gamma_{11}(Dispute_{AB,t}) + \alpha_1 \ln(Total\_Trade_{AB,t-1}) + X'_{1,AB,t}\beta_1 + \epsilon_{1,AB,t} \quad (1)$$

$$Dispute_{AB,t} = \gamma_{21}\ln(Total\_Trade_{AB,t}) + \alpha_2 Dispute_{AB,t-1} + X'_{2,AB,t}\beta_2 + \epsilon_{2,AB,t} \quad (2)$$

where $\ln(Total\_Trade_{AB,t})$ is the total value of exports and imports in t, quantified in real dollars, exchanged between states A and B. $Dispute_{AB,t}$ is a binary indicator of whether A and B were engaged in a Militarized Interstate Dispute (MID) in t. This simultaneous equation model incorporates both trade and dispute variables as independent variables in the dispute and trade equations, respectively, allowing for the reciprocal relationship between economic interdependence and militarized conflicts. Each equation also includes first-order autoregressive terms, namely $\alpha_1\ln(Total\_Trade_{AB,t-1})$ and $\alpha_2 Dispute_{AB,t-1}$, intended to capture potential temporal dependencies.

To ensure identification of the model, control variables $X_{1,AB,t}$ and $X_{2,AB,t}$ for the trade and dispute equations should include specific variables that are distinct for each equation. The variables exclusively present in either of the equations serve as instrumental variables, influencing solely the corresponding dependent variable and not the other. For instance, the independent variables found exclusively in the trade equation act as instruments for the trade variable, since they do not influence the likelihood of a dispute.

In the trade equation, the following independent variables are exclusively included in $X_{1,AB,t}$, not $X_{2,AB,t}$: $\ln(GDPA_t)$, $\ln(GDPB_t)$, $\ln(PopulationA_t)$, $\ln(PopulationB_t)$, and $\ln(Distance_{AB})$. $GDPA_t$ and $GDPB_t$ stand for the gross domestic product (GDP) of country A and B in t, and $PopulationA_t$ and $PopulationB_t$ are their populations. $Distance_{AB}$ measures the distance between the capitals of states A and B. In the conflict equation, the following independent variables are exclusively included in $X_{2,AB,t}$, not $X_{1,AB,t}$: $Higher\_Trend\_Dependence_{AB,t}$ $Lower\_Growth_{AB,t}$, $Capability\_Ratio_{AB,t}$, $Contiguity_{AB,t}$, and $\ln(Higher\_GDP_{AB,t})$. $Higher\_Trend\_Dependence_{AB,t}$ is the increase in trade share (total trade divided by its GDP) from $t-4$ to $t-1$. $Lower\_Growth_{AB,t}$ denotes the minimum of the average growth rate of real GDP for the two countries over the last three years. $Capability\_Ratio_{AB,t}$ measures the

Composite Index of National Capacity (CINC) of countries A and B, and $Contiguity_{AB,t}$ is an indicator variable of whether states A and B share a border.[1] $\ln(Higher\_GDP_{AB,t})$ denotes the maximum GDP within a dyad.

Both equations include the following two independent variables in $X_{1,AB,t}$ and $X_{2,AB,t}$: $\ln(Lower\_Democracy_{AB,t})$ and $Alliances_{AB,t}$. $Lower\_Democracy_{AB,t}$ records the minimum democracy scores of states A and B in t. The scores are derived from Jaggers and Gurr (1995)'s Polity III, which spans from 1 (most autocratic) to 21 (most democratic). $Alliances_{AB,t}$ is a binary variable of whether states A and B are allied in t.

If our primary focus is on assessing the impact of trade on militarized disputes while incorporating dyad-level and yearly fixed effects, a suitable approach involves estimating the following single-equation model instead:

$$Dispute_{AB,t} = \gamma_{21}\ln(Total\_Trade_{AB,t}) + \alpha_2 Dispute_{AB,t-1} + X'_{2,AB,t}\beta + \delta_{2,AB} + \eta_{2,t} + \epsilon_{2,AB,t} \tag{3}$$

where $\delta_{2,AB}$ and $\eta_{2,t}$ represent dyad-level and yearly-level fixed effects, respectively. This single-equation model offers greater flexibility, as any potential misspecification of the trade equation, as in equation 1, does not affect the estimates of the dispute equation. Note that while KPR utilize the method described by Maddala (1983) for the simultaneous equation model (equations 1 and 2), where one endogenous variable is continuous and the other is binary, we employ a linear probability model to leverage an econometric method that directly accounts for both heterogeneity and temporal dependence.

The standard fixed-effects estimator is not applicable to equation 3. The first-difference estimator is biased because

$$Cov(\Delta Dispute_{AB,t-1}, \Delta\epsilon_{2,AB,t}) = Cov(Dispute_{AB,t-1}, -\epsilon_{2,AB,t-1}) \neq 0.$$

That is, the inclusion of the lagged dependent variable becomes problematic due to the endogeneity introduced by $\epsilon_{2,AB,t-1}$ affecting $Dispute_{AB,t-1}$. However, the Arellano-Bond estimator overcomes this endogeneity by using the historical values $Dispute_{AB}^{t-2} = \{Dispute_{AB,1}, \ldots, Dispute_{AB,t-2}\}$ as instruments for the differentiated lagged dependent

1) The assumption that $Contiguity_{AB,t}$ solely influences the likelihood of a dispute, rather than the trade variable, may be questionable. Nevertheless, this assumption does not impact our main results, as $Contiguity_{AB,t}$ is included as a control variable in a single-equation linear probability model of a dispute, irrespective of whether we presume it affects trade or not.

variable in the differentiated equation. These historical values are influenced by past error terms up to $t-2$, not at $t-1$.

The instruments for trade variable $X_{1,AB,t} \setminus X_{2,AB,t}$ can also serve as instruments for $\varDelta \ln(Total\_Trade_{AB,t})$ since they exhibit correlation with $\ln(Total\_Trade_{AB,t})$. In addition, unless both the trade and dispute equations are entirely static ($\alpha_1 = \alpha_2 = 0$), $\ln\left(Total\_Trade_{AB}^{t-2}\right) = \{\ln(Total\_Trade_{AB,1}), \ldots, \ln(Total\_Trade_{AB,t-2})\}$ can also be employed as instruments for $\varDelta \ln(Total\_Trade_{AB,t})$. In sum, $Dispute_{AB}^{t-2}$, $\ln\left(Total\_Trade_{AB}^{t-2}\right)$, and $X_{1,AB,t} \setminus X_{2,AB,t}$ are used as instruments for $\varDelta Dispute_{AB,t-1}$ and $\ln(Total\_Trade_{AB,t})$ in the differentiated equation.[2)]

Table 1 presents the estimation results for the regression equations 2 and 3. In column (1), the replicated results of Table 2 of KPR are displayed, providing the estimation outcomes for the simultaneous equation model (equations 1 and 2). Column (2) shows the estimation results from the single equation model, equation 3. The trade variable is instrumented by the independent variables exclusively included in the trade equation: $X_{1,AB,t} \setminus X_{2,AB,t}$. However, dyad-level fixed effects are not included.

It is important to highlight that both models yield quantitatively similar estimation results, and the effect of bilateral trade on disputes is estimated to be statistically insignificant in both cases. Nevertheless, it is noteworthy that despite its lack of significance, the direction of the estimated effect aligns more with our intuition in the single equation model. In column (1), the sign is positive, whereas in column (2), it is negative. This supports the utilization of our single-equation model 3.

Column (3) of Table 1 displays fixed-effect regression results, where only the trade variable is treated as endogenous and subsequently instrumented. Across columns (1)-(3), trade does not appear to exhibit any pacifying effect at the 10% significance level.

However, in column (4) of Table 1, it is demonstrated that the escalation in trade volume significantly reduces the likelihood of militarized disputes. The significance of this effect is particularly remarkable, as underscored by the trade variable's coefficient achieving significance at the 0.1% level. Moreover, when compared with the results in column (3), the estimated impact of bilateral trade volume is more pronounced in absolute terms.

2) Note that $\ln(Distance_t)$ is omitted as an instrument when accounting for dyad-level fixed effects due to its time-invariant nature.

Table 1. *Replication of Keshk, Pollins, and Reuveny (2004) and New Results*

	(1)	(2)	(3)	(4)
$\ln(Total\_Trade_{AB,t})$	0.0063 (0.0040)	-0.0000 (0.0001)	-0.0002 (0.0003)	-0.0043*** (0.0005)
$Dispute_{AB,t-1}$	1.9632*** (0.0501)	0.4227*** (0.0276)	0.2525*** (0.0230)	0.2448*** (0.0032)
$Higher\_Trend\_Dependence_{AB,t}$	-45.2697 (45.3436)	-0.7184 (0.9354)	-1.8731** (1.0342)	1.8678 (1.3679)
$Lower\_Growth_{AB,t}$	-0.0091*** (0.0046)	-0.0001 (0.0001)	-0.0001** (0.0001)	0.0002 (0.0001)
$Lower\_Democracy_{AB,t}$	-0.1305 (0.0218)	-0.0011*** (0.0002)	0.0006 (0.0005)	0.0008 (0.0008)
$Alliances_{AB,t}$	0.0116 (0.0415)	-0.0016 (0.0014)	-0.0035 (0.0037)	-0.0031 (0.0040)
$Capability\_Ratio_{AB,t}$	-0.0002** (0.0001)	-0.0000*** (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)
$Contiguity_{AB,t}$	1.2175*** (0.0404)	0.0395*** (0.0039)	0.0321*** (0.0143)	-0.0006 (0.0091)
$\ln(Higher\_GDP_{AB,t})$	0.0974*** (0.0133)	0.0009*** (0.0003)	-0.0040*** (0.0018)	-0.0118*** (0.0039)
Single equation model?		X	X	X
Dyadic fixed effects?			X	X
Yearly fixed effects?			X	X
$Dispute_{AB,t-1}$ considered endogenous?				X
Observations	143,792	143,792	143,792	136,671

Notes. The regression results are based on KPR's dataset, which covers dyad-years from 1950-1992. The dependent variable indicates whether a dyad is involved in a Militarized Interstate Dispute (MID). "AB" represents dyad of states A and B, and "t-1" corresponds for for the lagged variable. Column (1) estimates Maddala (1983)'s simultaneous equation model, where one endogenous variable (trade) is continuous and the other (dispute) is binary. Columns (2)-(4) estimate a single-equation linear probability model. In all columns, $\ln(Total\_Trade_{AB,t})$ is treated as endogenous and instrumented. "$Dispute_{AB,t-1}$ considered endogenous?" indicates whether Arellano-Bond model is used. For columns (2)-(4), standard errors in parentheses are clustered at the dyad level. Significance levels are *10%, **5%, and ***1%.

Under the linear probability model, specifically when dyadic fixed effects are included, Beck (2020) recommends that researchers present regression results using both the entire dataset and the subset of data where variations occur in the dependent variable, to be comparable with logit or probit model. However, the empirical analysis in KPR employs an all-inclusive dataset from 1950-1992, which deviates slightly from this recommendation. We conduct a robustness check using a subset of dyads with both fatal dispute and peace records. Table 2 displays the robustness check results. The trade coefficient exhibits significantly negative values across all columns. Remarkably, even in column (1), aligning with KPR's original specification, a significant negative impact of trade on militarized conflicts is evident. It demonstrates the robustness of our main findings, presented in Table 1, across diverse data compositions.

Table 2. *Replication of Keshk, Pollins, and Reuveny (2004) and New Results, Limited to the Dyads with Varied Fatal Disputes*

	(1)	(2)	(3)	(4)
$\ln(Total\_Trade_{AB,t})$	-0.0186*** (0.0049)	-0.0026*** (0.0009)	-0.0014 (0.0025)	-0.0100*** (0.0028)
$Dispute_{AB,t-1}$	1.3533*** (0.0507)	0.3749*** (0.0266)	0.2441*** (0.0226)	0.2240*** (0.0121)
$Higher\_Trend\_Dependence_{AB,t}$	-85.9252 (66.1461)	-8.6709 (6.2448)	-9.8870 (6.3677)	9.6103 (11.4862)
$Lower\_Growth_{AB,t}$	-0.0127** (0.0053)	-0.0018*** (0.0008)	-0.0016 (0.0010)	0.0007 (0.0012)
$Lower\_Democracy_{AB,t}$	0.0026 (0.0275)	-0.0004 (0.0042)	0.0100 (0.0100)	0.0108 (0.0115)
$Alliances_{AB,t}$	-0.0875* (0.0476)	-0.0171** (0.0096)	-0.0257 (0.0231)	-0.0131 (0.0346)
$Capability\_Ratio_{AB,t}$	-0.0000 (0.0001)	-0.0000 (0.0000)	-0.0001 (0.0001)	0.0000 (0.0001)
$Contiguity_{AB,t}$	0.5149*** (0.0482)	0.0689*** (0.0104)	0.0846*** (0.0369)	0.0399 (0.0463)
$\ln(Higher\_GDP_{AB,t})$	0.0565*** (0.0154)	0.0080*** (0.0032)	-0.0519** (0.0283)	-0.1329*** (0.0418)
Single equation model?		X	X	X
Dyadic fixed effects?			X	X
Yearly fixed effects?			X	X
$Dispute_{AB,t-1}$ considered endogenous?				X
Observations	8,929	8,929	8,929	8,577

Notes. The regression results are based on KPR's dataset, which covers dyad-years from 1950-1992. The dyads are limited to those with both fatal disputes and peaceful interactions. The dependent variable indicates whether a dyad is involved in a Militarized Interstate Dispute (MID). "AB" represents dyad of states A and B, and "t-1" corresponds for for the lagged variable. Column (1) estimates Maddala (1983)'s simultaneous equation model, where one endogenous variable (trade) is continuous and the other (dispute) is binary. Columns (2)-(4) estimate a single-equation linear probability model. In all columns, $\ln(Total\_Trade_{AB,t})$ is treated as endogenous and instrumented. "$Dispute_{AB,t-1}$ considered endogenous?" indicates whether Arellano-Bond model is used. For columns (2)-(4), standard errors in parentheses are clustered at the dyad level. Significance levels are *10%, **5%, and ***1%.

III. HOR's Specification and Results

HOR uses the following static simultaneous equation model to investigate the nexus between trade and peace:

$$\ln(Trade_{AB,t}) = \gamma_{11} Fatal\_Dispute_{AB,t} + X'_{1,AB,t}\beta_1 + \epsilon_{1,AB,t} \tag{4}$$

$$Fatal\_Dispute_{AB,t} = \gamma_{21}\ln(Trade_{AB,t}) + X'_{2,AB,t}\beta_2 + \epsilon_{2,AB,t} \tag{5}$$

where $\ln(Trade_{AB,t})$ is the logarithm of the real value of trade in t, expressed in 1996 dollars. $Fatal\_Dispute_{AB,t}$ is a binary indicator of whether A and B were involved in a fatal dispute in t. Similar with KPR, this simultaneous equation model introduces both trade and fatal dispute variables as independent variables within the fatal dispute and trade equations, respectively. This structure facilitates an exploration of the simultaneous connection between economic interdependence and the occurrence of militarized conflicts. This model maintains a static nature; lagged dependent variables such as $\ln(Trade_{AB,t-1})$ and $Fatal\_Dispute_{AB,t-1}$ are not included as independent variables. Instead, HOR follow Beck, Katz, and Tucker (1998) and include (a spline function of) the years of peace since the last fatal dispute involving the corresponding country pair as common control variables in both $X_{1,AB,t}$ and $X_{2,AB,t}$. Similar to KPR, HOR also employ the method described by Maddala (1983) for the simultaneous equation model, where one endogenous variable is continuous and the other is binary.

Benefiting from the linearity exhibited in the trade equation, KPR consider an alternative specification that includes country fixed effects $\delta_{1A}+\delta_{1B}$ and year fixed effects $\eta_{1,t}$ within that equation in an attempt to ensure the robustness of their results. However, such fixed effects were not included in the dispute equation. Also note that country fixed effects are more restrictive than dyadic fixed effects δ_{1AB}. Unlike KPR, we will include dyadic and year fixed effects in both dispute and trade equations, as discussed below.[3)]

In the trade equation, the following independent variables are exclusively included in $X_{1,AB,t}$, not $X_{2,AB,t}$: joint democracy score, preferential trade agreement (PTA), and similarity of alliance portfolios. Joint democracy score and preferential trade agreement (PTA) are binary indicators denoting whether both states A and B are jointly democratic and possess PTA in t, respectively. In the conflict equation, the following independent variables are exclusively included in $X_{2,AB,t}$, not $X_{1,AB,t}$: log capabilities of larger country, largest's share of total capabilities, lower and higher democracy scores. The terms larger and higher pertain to the state with the correspondingly greater value.

Both equations include the following two independent variables in $X_{1,AB,t}$ and $X_{2,AB,t}$: Contiguity, log distance, shared alliance ties, and system size. Contiguity and log distance serve as measures of proximity between states A and B; the former is binary, while the latter is a continuous variable. System size is the logarithm of the number of countries in t.[4)]

3) Note that in long panel data where $T\to\infty$, also called as time-series-cross-section data (Beck 2001), country fixed effects entered in a nonlinear model can be identified by conducting separate estimations for each country pair. However, the year fixed effects may not be identified due to the incidental parameters problem; the number of year fixed effects to be identified also increases as $T\to\infty$ (Wooldridge 2010).

4) Note that, in this dataset, log distance is time-varying due to the unification of Germany in 1990. HOR's dataset covers dyads from 1950-2000, offering a more comprehensive temporal scope compared to KPR's dataset. KPR's dataset, on the other hand, covers dyads from 1950-1992 and excludes the German Federal Republic from 1990.

Similar to Section 1, we estimate the following single-equation model:

$$Fatal\_Dispute_{AB,t} = \gamma_{21}\ln(Trade_{AB,t}) + \alpha_2 Fatal\_Dispute_{AB,t-1} + X'_{2,AB,t}\beta + \delta_{2,AB} + \eta_{2,t} + \epsilon_{2,AB,t} \qquad (6)$$

where $\delta_{2,AB}$ and $\eta_{2,t}$ represent dyad-level and yearly-level fixed effects, respectively. Instead of utilizing peace year variables suggested by Beck, Katz, and Tucker (1998), we include lagged dependent variable $Fatal\_Dispute_{AB,t-1}$ to directly accommodate potential temporal dependence. As discussed in Section 1, Beck (2001) advocates for directly modeling the dynamics as the "best solution," contrasting with an "old-fashioned fix" which involving the peace duration variable.

It is noteworthy that controlling for the peace year introduces an additional complication when dyadic fixed effects are included. Because it is a function of lagged dependent variables $Fatal\_Dispute^{t-1}_{AB} = \{Fatal\_Dispute_{AB,1}, \ldots, Fatal\_Dispute_{AB,t-1}\}$, it is correlated with lagged error term $\epsilon^{t-1}_{2,AB} = \{\epsilon_{2,AB,1}, \ldots, \epsilon_{2,AB,t-1}\}$, thereby creating endogeneity between the demeaned peace year and error term.

Table 3 presents the estimation results for the regression equations 5 and 6. In column (1), the replicated results of Table 3 of KPR are displayed, providing the estimation outcomes for the simultaneous equation model (equations 4 and 5). Column (2) shows the estimation results from the single equation model, equation 6. The trade variable is instrumented by the independent variables exclusively included in the trade equation: $X_{1,AB,t} \setminus X_{2,AB,t}$. Spline functions of the years of peace are also included in columns (1) and (2). In both cases, the estimation suggests that bilateral trade significantly reduces the probability of fatal disputes. Moreover, both models provide quantitatively similar estimation results.

Column (3) of Table 3 presents fixed-effect regression results, where the lagged dependent variable $Fatal\_Dispute_{AB,t-1}$ is also included. Despite the potential bias introduced by the endogeneity of the lagged dependent variable, the trade variable's significance remains intact. Bilateral trade is estimated to consistently decrease the likelihood of fatal militarized disputes. In column (4), which treats the lagged dependent variable as endogenous, the trade variable is still negatively significant. Across all columns of Table 3, it is evident that HOR's main conclusion — trade promotes peace — remains robust under alternative specifications.

The dataset used for empirical analysis in HOR does not precisely align with Beck (2020)'s suggestion, as they exclude states that were never involved in fatal disputes from 1950-2000. Appendix Table A1 displays the regression results including all dyads. Appendix Table A2 shows the results when the included observations are limited to dyads with both fatal dispute

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Tables 3 and 4 reveal that the significance of the log distance variable diminishes when dyadic fixed effects are controlled for, as seen in columns (3) and (4).

and peace records. Both results demonstrate the robustness of the main findings across different data compositions.

Table 3. *Replication of Hegre, Oneal, and Russett (2010) and New Results*

	(1)	(2)	(3)	(4)
$\ln(Trade_{AB,t})$	-0.0875*** (0.0163)	-0.0007*** (0.0002)	-0.0008*** (0.0002)	-0.0009*** (0.0002)
$Fatal\_Dispute_{AB,t-1}$			0.0976*** (0.0233)	0.0100*** (0.0024)
Log capabilities of larger country	0.3369*** (0.0262)	0.0021*** (0.0004)	0.0005 (0.0007)	-0.0000 (0.0008)
Largest's share of total capabilities	-1.7210*** (0.1627)	-0.0107*** (0.0021)	-0.0050** (0.0029)	0.0106*** (0.0046)
Contiguity	0.5379*** (0.0702)	0.0188*** (0.0028)	-0.0298 (0.0211)	-0.0870*** (0.0086)
Log distance	-0.3718*** (0.0267)	-0.0024*** (0.0006)	-0.0038 (0.0052)	0.0034 (0.0145)
Lower democracy score	-0.0277*** (0.0046)	-0.0001*** (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0001)
Higher democracy score	0.0200*** (0.0033)	0.0001*** (0.0000)	0.0000 (0.0000)	-0.0002*** (0.0000)
Shared alliance ties	-0.0426 (0.0581)	-0.0032*** (0.0009)	-0.0019** (0.0011)	-0.0021 (0.0015)
System size	-0.3066*** (0.0868)	-0.0006 (0.0005)	0.0048 (0.0060)	-0.1156*** (0.0062)
Peace year	-0.0821*** (0.0102)	-0.0011*** (0.0002)		
Spline 1	-0.0003*** (0.0001)	-0.0000*** (0.0000)		
Spline 2	0.0002*** (0.0001)	0.0000*** (0.0000)		
Spline 3	-0.0000 (0.0000)	-0.0000*** (0.0000)		
Single equation model?		X	X	X
Dyadic fixed effects?			X	X
Yearly fixed effects?			X	X
$Fatal\_Dispute_{AB,t-1}$ considered endogenous?				X
Observations	279,343	279,343	271,272	262,436

Notes. The regression results are based on HOR's dataset, which covers dyad-years from 1950-2000. The states are limited to those with both fatal disputes and peaceful interactions, aligning with HOR's selection criteria. The dependent variable indicates whether a dyad is involved in a Militarized Interstate Dispute (MID). "AB" represents dyad of states A and B, and "t-1" corresponds for for the lagged variable. Column (1) estimates Maddala (1983)'s simultaneous equation model, where one endogenous variable (trade) is continuous and the other (dispute) is binary. Columns (2)-(4) estimate a single-equation linear probability model. In all columns, $\ln(Total\_Trade_{AB,t})$ is treated as endogenous and instrumented. "$Dispute_{AB,t-1}$ considered endogenous?" indicates whether Arellano-Bond model is used. For columns (2)-(4), standard errors in parentheses are clustered at the dyad level. Significance levels are *10%, **5%, and ***1%.

HOR also explore an alternative specification by utilizing Long (2008)'s trade equation. In this equation, the logarithms of both smaller and larger populations are replaced by the logarithms of smaller and larger GDP per capita. Additionally, the trade equation includes additional variables: strategic rivals, domestic armed conflict, interstate conflict with thrd party, and internal and external conflict risk variables. System size variable is not included in both the trade and conflict equations. As a robustness check, we consider an alternative set of instruments for the trade variable: the variables only included in the trade equation in this specification. Combining Long (2008) and HOR's datasets restricts our analayis to 1984-1997, as the former dataset exclusively covers this period.

Table 4 displays the regression results when this alternative set of instruments is used. Remarkably, across all columns, it is evident that bilateral trade significantly diminishes the likelihood of fatal disputes with a statistical significance level of 0.1%. This shows that the pacifying influence of trade is robust to alternative specifications. To further enhance the robustness of our conclusions, we perform an additional check by restricting our analysis to dyads with both fatal dispute and peace records. Appendix Table A3 provides quantitatively similar results when the sample is confined to these diverse dyads, reaffirming the robustness of our findings.

Table 4. *Replication of Hegre, Oneal, and Russett (2010) Using Long (2008)'s Instruments and New Results*

	(1)	(2)	(3)	(4)
$\ln(Trade_{AB,t})$	-0.1566*** (0.0308)	-0.0005*** (0.0001)	-0.0099*** (0.0021)	-0.0010*** (0.0003)
$Fatal\_Dispute_{AB,t-1}$			0.0283 (0.0453)	-0.0043 (0.0041)
Log capabilities of larger country	0.5207*** (0.0646)	0.0016*** (0.0003)	0.0098*** (0.0021)	-0.0060*** (0.0014)
Largest's share of total capabilities	-2.3253*** (0.3888)	-0.0081*** (0.0014)	-0.0300*** (0.0088)	0.0108 (0.0066)
Contiguity	0.5971*** (0.1250)	0.0110*** (0.0019)	0.0060 (0.0044)	0.0308*** (0.0095)
Log distance	-0.4222*** (0.0618)	-0.0010*** (0.0003)	0.0167 (0.0184)	0.0067 (0.0109)
Lower democracy score	-0.0249*** (0.0095)	-0.0000 (0.0000)	0.0001*** (0.0000)	-0.0003*** (0.0000)
Higher democracy score	0.0266*** (0.0081)	0.0001*** (0.0000)	-0.0001 (0.0000)	-0.0003*** (0.0001)
Shared alliance ties	0.4034 (0.1120)	0.0008 (0.0007)	0.0014 (0.0018)	0.0028** (0.0017)
Peace year	0.0063 (0.0301)	-0.0019*** (0.0007)		

Table 4. *Continued*

	(1)	(2)	(3)	(4)
Spline 1	0.0004** (0.0002)	-0.0000*** (0.0000)		
Spline 2	-0.0004** (0.0001)	0.0000** (0.0000)		
Spline 3	0.0001*** (0.0000)	0.0000 (0.0000)		
Single equation model?		X	X	X
Dyadic fixed effects?			X	X
Yearly fixed effects?			X	X
$Fatal\_Dispute_{AB,t-1}$ considered endogenous?				X
Observations	100,630	100,630	100,287	92,494

Notes. The regression results are based on HOR and Long (2008)'s data, which cover dyad-years from 1950-2000. The dependent variable indicates whether a dyad is involved in a Militarized Interstate Dispute (MID). "AB" represents dyad of states A and B, and "t-1" corresponds for for the lagged variable. Column (1) estimates Maddala (1983)'s simultaneous equation model, where one endogenous variable (trade) is continuous and the other (dispute) is binary. Columns (2)-(4) estimate a single-equation linear probability model. In all columns, $\ln(Total\_Trade_{AB,t})$ is treated as endogenous and instrumented. "$Dispute_{AB,t-1}$ considered endogenous?" indicates whether Arellano-Bond model is used. For columns (2)-(4), standard errors in parentheses are clustered at the dyad level. Significance levels are *10%, **5%, and ***1%.

IV. Conclusions

We examined the impact of bilateral trade on the probability of militarized disputes, considering both the potential temporal dependence of disputes and the heterogeneity of dyads.. By applying the Arellano-Bond model to specifications and datasets from KPR and HOR, which respectively indicated no and negative effects of trade on conflict, we observed the pacifying effect in both cases. Future studies could address potential nonlinearity when dealing with a binary dependent variable, consider alternative instruments for the trade variable, and extend the analysis to trilateral or more complex economic interdependence.

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Appendix

Table A1. *Replication of Hegre, Oneal, and Russett (2010) and New Results, All States are Included*

	(1)	(2)	(3)	(4)
$\ln(Trade_{ABt})$	-0.0837*** (0.0154)	-0.0005*** (0.0001)	-0.0006*** (0.0001)	-0.0006*** (0.0002)
$Fatal\_Dispute_{ABt-1}$			0.0978*** (0.0234)	0.0091*** (0.0020)
Log capabilities of larger country	0.3497*** (0.0239)	0.0014*** (0.0003)	0.0003 (0.0005)	-0.0000 (0.0006)
Largest's share of total capabilities	-1.9261*** (0.1581)	-0.0080*** (0.0015)	-0.0033 (0.0021)	0.0051** (0.0031)
Contiguity	0.4939*** (0.0691)	0.0151*** (0.0023)	-0.0294 (0.0202)	-0.0767*** (0.0066)
Log distance	-0.3703*** (0.0258)	-0.0015*** (0.0004)	-0.0033 (0.0045)	-0.0018 (0.0112)
Lower democracy score	-0.0317*** (0.0044)	-0.0001*** (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)
Higher democracy score	0.0163*** (0.0031)	0.0001*** (0.0000)	0.0000 (0.0000)	-0.0002*** (0.0000)
Shared alliance ties	-0.0333 (0.0543)	-0.0021*** (0.0007)	-0.0015** (0.0009)	-0.0018** (0.0011)
System size	-0.3692*** (0.0846)	-0.0005 (0.0003)	0.0039 (0.0048)	-0.1028*** (0.0045)
Peace year	-0.0822*** (0.0100)	-0.0006*** (0.0001)		
Spline 1	-0.0003*** (0.0001)	-0.0000*** (0.0000)		
Spline 2	0.0002*** (0.0001)	0.0000*** (0.0000)		
Spline 3	-0.0000 (0.0000)	-0.0000*** (0.0000)		
Single equation model?		X	X	X
Dyadic fixed effects?			X	X
Yearly fixed effects?			X	X
$Fatal\_Dispute_{ABt-1}$ considered endogenous?				X
Observations	432,524	432,524	419,299	405,129

Notes. The regression results are based on HOR's dataset, which covers dyad-years from 1950-2000. All dyad-years are included for analysis. The dependent variable indicates whether a dyad is involved in a Militarized Interstate Dispute (MID). "AB" represents dyad of states A and B, and "t-1" corresponds for for the lagged variable. Column (1) estimates Maddala (1983)'s simultaneous equation model, where one endogenous variable (trade) is continuous and the other (dispute) is binary. Columns (2)-(4) estimate a single-equation linear probability model. In all columns, $\ln(Total\_Trade_{ABt})$ is treated as endogenous and instrumented. "$Dispute_{ABt-1}$ considered endogenous?" indicates whether Arellano-Bond model is used. For columns (2)-(4), standard errors in parentheses are clustered at the dyad level. Significance levels are *10%, **5%, and ***1%.

Table A2. *Replication of Hegre, Oneal, and Russett (2010) and New Results, Limited to the Dyads with Varied Fatal Disputes*

	(1)	(2)	(3)	(4)
$\ln(Trade_{ABt})$	-0.1299*** (0.0212)	-0.0141*** (0.0036)	-0.0151*** (0.0042)	-0.0069*** (0.0022)
$Fatal\_Dispute_{ABt-1}$			0.0881*** (0.0232)	0.0289*** (0.0124)
Log capabilities of larger country	0.2042*** (0.0308)	0.0231*** (0.0058)	0.0053 (0.0115)	0.0986*** (0.0158)
Largest's share of total capabilities	-0.8504*** (0.1984)	-0.0930*** (0.0330)	-0.1166** (0.0612)	-0.0943 (0.0901)
Contiguity	0.1347 (0.0926)	0.0205 (0.0133)	-0.0822 (0.0609)	-0.2260*** (0.0638)
Log distance	-0.1625*** (0.0305)	-0.0191*** (0.0071)	-0.0572 (0.0618)	0.2033 (0.1900)
Lower democracy score	0.0145** (0.0065)	0.0016*** (0.0008)	-0.0003 (0.0010)	-0.0012 (0.0012)
Higher democracy score	0.0118*** (0.0041)	0.0013*** (0.0007)	0.0010 (0.0007)	0.0005 (0.0009)
Shared alliance ties	-0.0008** (0.0687)	-0.0027 (0.0070)	-0.0180** (0.0108)	-0.0493*** (0.0193)
System size	-0.2995** (0.1212)	-0.0132 (0.0146)	-0.0136 (0.0235)	-0.1559*** (0.0524)
Peace year	-0.0792*** (0.0128)	-0.0115*** (0.0025)		
Spline 1	-0.0004*** (0.0001)	-0.0001*** (0.0000)		
Spline 2	0.0002*** (0.0001)	0.0000*** (0.0000)		
Spline 3	-0.0000 (0.0000)	-0.0000*** (0.0000)		
Single equation model?		X	X	X
Dyadic fixed effects?			X	X
Yearly fixed effects?			X	X
$Fatal\_Dispute_{ABt-1}$ considered endogenous?				X
Observations	10,311	10,311	9,732	9,235

Notes. The regression results are based on HOR's dataset, which covers dyad-years from 1950-2000. The dyads are limited to those with both fatal disputes and peaceful interactions. The dependent variable indicates whether a dyad is involved in a Militarized Interstate Dispute (MID). "AB" represents dyad of states A and B, and "t-1" corresponds for for the lagged variable. Column (1) estimates Maddala (1983)'s simultaneous equation model, where one endogenous variable (trade) is continuous and the other (dispute) is binary. Columns (2)-(4) estimate a single-equation linear probability model. In all columns, $\ln(Total\_Trade_{ABt})$ is treated as endogenous and instrumented. "$Dispute_{ABt-1}$ considered endogenous?" indicates whether Arellano-Bond model is used. For columns (2)-(4), standard errors in parentheses are clustered at the dyad level. Significance levels are *10%, **5%, and ***1%.

Table A3. *Replication of Hegre, Oneal, and Russett (2010) Using Long (2008)'s Instruments and New Results, Limited to the Dyads with Varied Fatal Disputes*

	(1)	(2)	(3)	(4)
$\ln(Trade_{ABt})$	-0.2379*** (0.0442)	-0.0164*** (0.0037)	-0.0613*** (0.0212)	-0.0062*** (0.0029)
$Fatal\_Dispute_{ABt-1}$			-0.0278** (0.0528)	0.0204 (0.0240)
Log capabilities of larger country	0.4190*** (0.0801)	0.0289*** (0.0065)	0.2278*** (0.0958)	0.0497** (0.0290)
Largest's share of total capabilities	-1.6223*** (0.4766)	-0.1121*** (0.0350)	-0.6338*** (0.2762)	0.0676 (0.1408)
Contiguity	0.5600*** (0.1725)	0.0347*** (0.0120)	-0.1076 (0.0755)	-0.0074 (0.0729)
Log distance	-0.1751** (0.0739)	-0.0120*** (0.0058)	0.7066*** (0.0878)	0.3637 (0.2444)
Lower democracy score	0.0304** (0.0141)	0.0022*** (0.0011)	0.0061*** (0.0026)	-0.0026 (0.0018)
Higher democracy score	0.0169 (0.0111)	0.0012 (0.0010)	0.0016 (0.0023)	-0.0007 (0.0016)
Shared alliance ties	0.3977*** (0.1407)	0.0310*** (0.0126)	-0.0317 (0.0396)	-0.0460** (0.0270)
Peace year	0.0023 (0.0342)	-0.0012 (0.0036)		
Spline 1	0.0002 (0.0003)	0.0000 (0.0000)		
Spline 2	-0.0002 (0.0002)	-0.0000 (0.0000)		
Spline 3	0.0001** (0.0000)	0.0000 (0.0000)		
Single equation model?		X	X	X
Dyadic fixed effects?			X	X
Yearly fixed effects?			X	X
$Fatal\_Dispute_{ABt-1}$ considered endogenous?				X
Observations	2,772	2,772	2,692	2,435

Notes. The regression results are based on HOR and Long (2008)'s data, which cover dyad-years from 1950-2000. The dyads are limited to those with both fatal disputes and peaceful interactions. The dependent variable indicates whether a dyad is involved in a Militarized Interstate Dispute (MID). "AB" represents dyad of states A and B, and "t-1" corresponds for for the lagged variable. Column (1) estimates Maddala (1983)'s simultaneous equation model, where one endogenous variable (trade) is continuous and the other (dispute) is binary. Columns (2)-(4) estimate a single-equation linear probability model. In all columns, $\ln(Total\_Trade_{ABt})$ is treated as endogenous and instrumented. "$Dispute_{ABt-1}$ considered endogenous?" indicates whether Arellano-Bond model is used. For columns (2)-(4), standard errors in parentheses are clustered at the dyad level. Significance levels are *10%, **5%, and ***1%.