The Ties that Bind: Bilateral Gains from Trade and Interstate Conflicts

Nicolas Wesseler*

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Abstract

Do countries that become more dependent upon each other engage in more or less conflict? This study investigates the relationship between trade and conflict taking into account industry-specific trade as well as domestic production networks. I define dependence between countries based on a country's individual contribution to another country's real wages which in turn are derived from a multi-industry trade model with input-output linkages. Exploiting exogenous variation in bilateral trade costs based on air and sea distances I show that larger bilateral gains from trade lead to greater political alignment. I furthermore provide evidence that bilateral dependence is associated with fewer bilateral sanctions and fewer interstate military disputes.

1 Introduction

> ”If our opponent needs something badly, then that something is strategic and that is something we should keep him from getting.”
>
> *US President Eisenhower, 1953*

The relationship between international trade and interstate conflict has been studied extensively in the literature both theoretically and empirically. The predominant notion is that trade reduces the probability of conflict since trade raises opportunity costs.[1] Significantly less attention has been devoted to the role of *industry*-specific trade. Trade in particular sectors, however, may be of paramount importance for whether a conflict between two countries escalates. Goods in certain industries are more difficult to substitute, account for a larger share of inputs in domestic production or exhibit greater scarcity at home than goods in other industries. Thus, heterogeneity in the sector composition of bilateral trade makes some partners more important for domestic welfare than others, even if aggregate trade shares are similar. Studying this important nuance in trade relations and its impact on interstate conflicts is the focus of this study.

To motivate this argument further, Germany's reluctance in 2022 to undertake more rigorous measures against Russia as a consequence of its invasion in Ukraine is often explained by its large import share of Russian gas and oil, although aggregate trade between the two countries is low. Similarly, India refused to support sanctions against Russia predominantly due to substantial imports of Russian military supply.[2] More systematically, studies show that oil importing countries tend to be less hostile toward oil exporters (Park et al., 1976; Polachek, 1980). While energy imports and military supply have the most obvious strategic importance, the question arises, what characterizes critical industries, how do they shape interstate dependencies and can they add to our understanding of the determinants of interstate conflicts?

In this study, I develop a bilateral dependence measure inspired by the gains from trade literature. In particular, I study how real wages change in response to cutting off trade with a partner country. While the gains from trade are conventionally

*UBC Sauder Business School, nicolas.wesseler@sauder.ubc.ca

[1] Important distinctions have been made that differentiate between bilateral and multilateral trade where the former reduces the incentive for military conflict with a partner country while the latter increases the probability of war with any one particular country due to the ease of substituting imports through other trading partners.

[2] In 2017, about two percent of all German exports and two percent of all imports went to/came from Russia. The same applies to India whose exports to Russia accounted for only about 0.9% of total Indian exports while imports from Russia accounted for two percent of all imports.

defined as changes in real wages when moving from current levels of trade to autarky (Arkolakis et al., 2012), I study how real wages change when moving from trade with N countries to trade with $N-1$ countries. Previous studies have shown that gains from trade are substantially larger once industry-specific trade elasticities, industries' roles in domestic production networks and their share in final consumption are explicitly taken into account (Costinot and Rodríguez-Clare, 2014; Ossa, 2015). Therefore, while overall trade may not matter too much, trade in certain industries can be vital for the economy as a whole. Following this spirit, I derive a partner-specific gains from trade measure based on a multi-sector trade model with input-output linkages that takes into account these amplifying factors. Equipped with this measure, I evaluate to what extent bilateral dependence affects political alignment, the imposition of sanctions as well as the outbreak of interstate wars.

From an identification perspective, bilateral dependence may suffer from endogeneity bias. For example, while bilateral dependence may affect political alignment, two countries that start to align more politically may start to increase bilateral trade, too, consciously trying to avoid dependencies on trade partners they do not share common values with. Reverse causality may thus be one source of endogeneity that could distort simple OLS results by biasing them upward. I address this identification challenge by employing an instrumental variable strategy that exploits the sharp decline in air travel costs between 1955 and 2004 first introduced by Feyrer (2019). The main idea is that country pairs that have smaller air to sea distance ratios benefit from the reduction in trade costs relatively more than other country pairs, leading to variation in "effective" bilateral distance over time. Using this quasi-experimental variation allows me to purge bilateral trade flows of their endogeneity.

I find that bilateral dependence increases political alignment. A one standard deviation increase in my bilateral gains from trade measure increases political alignment by 0.76 standard deviations. The effect size is thus sizable and it is robust to different political alignment measures. Moreover, I present evidence that bilateral dependencies are associated with the imposition of fewer trade related sanctions as well as fewer military disputes of moderate hostility level.

I furthermore find that a frequently used, yet simpler, measure of bilateral dependence, bilateral import shares, is inadequate to capture the full extent of bilateral dependence. While it turns out to be a good approximation for the importance of trade partners from the perspective of a reporting country, it does a poor job in picking up variation in the importance of one partner for a reporter relative to that same partner for another reporter. For example, the importance of China for Thailand is well approximated by the share of Chinese imports in total Thai imports. However, how crucial trade with China is for Thailand relative to how important trade with China is for Vietnam, Japan or Mexico is not well approximated by import shares alone. Regressions of various outcomes on bilateral gains from trade controlling for bilateral import shares prove that the former has explanatory power beyond simple trade relationships.

A study most closely related to my paper is Kleinman et al. (2020). The authors are interested in the effects of bilateral dependence on political alignment and find that a one standard deviation increase in their bilateral dependence measure causes a 0.09 standard deviation increase in United Nations General Assembly (UNGA) voting correlation. However, two important differences between our studies are the following. First, Kleinman et al. (2020) derive bilateral dependence via exposure to foreign productivity shocks rather than emphasizing the role of industry-specific trade flows and their elasticities and second, the authors are primarily interested in the effect on political alignment and diplomatic tensions rather than the escalation of conflicts into the imposition of sanctions and the outbreak of war.[3] I argue that policymakers may be more knowledgeable of the status of trade relationships rather than how productivity shocks transmit through international supply chains. The fact that I measure an effect of greater magnitude compared to the authors yields some credibility for this hypothesis.

My study contributes to different strands of the literature. First, it adds to the gains from trade literature by introducing a new thought experiment that differs from what is conventionally studied. Gains from trade are traditionally measured via the percentage difference in real wages when moving from current levels of trade to autarky. Such changes correspond to the equivalent variation associated with a foreign shock (expressed as a share of expenditure before the shock). Therefore, the counterfactual scenario imagines a world in which bilateral trade is shut down entirely, comparable to removing a node from the international trade network.[4] This thought experiment was first introduced by Arkolakis et al. (2012) and has since then

[3] The authors examine the effect on political alignment, countries' preferences relative to the US-led liberal order, strategic rivalries and formal alliances.

[4] Here, nodes represent countries and edges represent trade relationships.

been popularized in numerous studies. Similar in nature, in this paper, I compute the effect on real wages when removing an edge between two nodes in the international trade network.This allows me to determine the impact of shutting down trade with an individual partner country rather than shutting down trade with all partners at once.

Important contributions to the gains from trade literature have been made, among others, by Costinot and Rodríguez-Clare (2014) and Ossa (2015). Ossa (2015) derives an expression for the gains from trade that takes into account industry-specific trade elasticities. Using this expression he argues that gains from trade are substantially larger than previously thought once four elements are explicitly modeled: the industry-specific trade elasticity, how dependent a country is on trade in that upstream industry, how dependent that country is on the industry in question for producing final output in downstream industries and finally, how important those downstream industries are to final consumers. He concludes that, while imports in the average industry do not matter too much, imports in some industries are critical to the functioning of the economy.

Similarly, relying upon industry-specific trade elasticities and imports' transmission through domestic input-output networks, Bachmann et al. (2022) and Baqaee et al. (2022) examine the implications of import stops of Russian oil and gas for countries of the European Union. The authors argue that the core aspects to determine are the magnitude of the shock, the share of that input in the economy's national income, the elasticity of substitution between this input and all the other inputs as well as the extent to which a country can substitute domestic intermediates, that heavily rely on foreign inputs, through foreign intermediates. Being very similar in spirit to the previously discussed Ossa (2015) study, it reemphasizes the need to take into account industry-level trade elasticities to fully capture the severity of the shock.

Gains from trade and their sensitivity to goods-specific characteristics are also investigated in another recent study by Fally and Sayre (2018). The authors are primarily interested in the role of international trade in commodities and find that ignoring key features of commodities such as low price elasticities of demand, low price elasticities of supply, and high dispersion of natural resources across countries will lead to an understated estimate of the gains from trade.

A study relying on import and final consumption shares when determining critical industries is Hinz and Leromain (2020). Interested in the effect of diplomatic tensions on trade in critical industries, the authors use WIOD data to determine the value of imported inputs per sector and divide it by the value of domestic inputs per sector. This fraction is then multiplied with final consumption shares of each sector to capture the required value of a foreign input for a 1-unit value of final consumption in the domestic economy.[5]

My bilateral dependence measure will be derived based on a rationale similar to these studies in that it accounts for industry specific trade elasticities as well as domestic input-output linkages.

A second strand of literature focuses particularly on bilateral dependence based on industry-specific trade and its impact on interstate conflicts. Park et al. (1976) and Polachek (1980) provide early evidence that oil-exporting countries become more hostile toward oil importers if the amount of trade increases. Although light on empirical work , Marlin-Bennett et al. (1992), Borrus and Zysman (1991) and Tyson (1993) all examine trade conflicts in high-technology industries and how they may impact national security.

Gasiorowski and Polachek (1982) measure the effect on war for a few different goods. They compute correlations between U.S. trade with the entire Warsaw Pact and conflict between the U.S. and each Warsaw Pact member. They find high correlations for U.S. exports of capital goods and imports of raw materials. Reuveny and Kang (1998) investigate Granger causality between political conflict/cooperation and bilateral trade for ten commodity groups as well as aggregate trade from the 1960s to the early 1990s for 16 dyads. They find that conflict/cooperation tends to Granger-cause bilateral trade in minerals, iron and steel, fuels, basic manufactures and control and scientific equipment, whereas bilateral trade somewhat more frequently Granger-causes conflict/cooperation in food and live animals, beverages and tobacco, and machines and transport equipment. Dorussen (2006) uses dyadic UN trade data on 12 different industries from 1970 to 1997 and finds that trade overall reduces the likelihood of conflict. However, the relationship is weaker for commodities that are more easily appropriable by force, and stronger for manufactured goods with the exceptions of chemical and metal industries and the high-technology sector. Li and Reuveny (2011), build a theoretical model which, incorporating variations across sectors, predicts that if a country expects conflict toward a target to reduce the price of its import from or increase the price of its export to a target, it has

[5] A similar definition of critical industries (high industry-level import shares) was applied in 'Ofa and Karingi (2014).

an economic incentive to initiate conflict. They undertake an empirical test for 140 countries on the effects of increases in exports and imports in five sectors on military conflict initiation between 1970 and 1997. The results largely support their hypothesis. Studying wars post World War II, Peterson and Thies (2012) find that horizontal intra-industry trade is associated with reduced conflict propensity within dyads while inter-industry trade can provoke vulnerabilities to trade partners and hence has potential to increase the likelihood of war.

The special role of natural resources has been investigated as well. Caselli et al. (2015) establish a theoretical and empirical framework to assess the role of resource endowments and their geographic location in interstate conflict. They empirically test their prediction that oil reserves in close proximity to the border make interstate wars more likely and find that they indeed serve as reliable predictors of military disputes. Using the Global Energy Relations Dataset, Gökçe et al. (2021) study the pacifying effect of energy dependence on interstate conflict finding that energy flows decrease the propensity for militarized conflict between two states. Interestingly, imports in natural gas and electricity tend to pacify states more than imports in coal and oil. The authors hypothesize that this could be an artifact of potentially high import demand elasticities of coal and oil. This argument is a notable bridge to the gains from trade literature where the gains from trade decrease with a rise in import demand elasticities (see, among others, Fally and Sayre (2018) for a discussion of this argument).

Studies that undertake a more systematic approach focus on various economic parameters to determine critical industries. Polachek (1999) states that what matters for the measurement of the true effect of bilateral trade on conflict is "the degree of competition in the international market for the goods in question, the domestic production possibilities for these goods, the availability of substitute commodities, as well as other factors".

An early study in this regard is Polachek and McDonald (1992) who employ data on bilateral trade elasticities for 14 OECD countries and three industries (manufacturing, agricultural goods and raw materials), finding that conflict increases with bilateral import elasticity. However, elasticities of substitution among all goods are set to one, no comparisons are made among goods and no aspects of exports are included in their analyses. Goenner (2010) empirically examines whether the pattern of trade is relevant to conflict for the period 1962–2000. Bilateral trade in energy, non-ferrous metals, and electronics are found to increase conflict, whereas for chemicals and arms it reduces conflict. Although not explicitly included in his regressions, the author argues with varying levels of trade elasticities for the industries under investigation. Using import demand and export supply elasticities from Broda and Weinstein (2006) and Broda et al. (2008), he shows that chemicals and arms indeed have low trade elasticities which may explain the pacifying effects obtained in the empirical analysis. Another interesting argument is being made in this study which is that large bilateral dependencies could also incentivize countries to attack each other to avoid those dependencies in the future. Thus, the relationship between trade in goods of low elasticity of substitution and conflict may not be as clear-cut as it seems.

Abstracting from trade elasticities and instead measuring the importance of industry-specific valued added, Morelli and Sonno (2017) provide evidence that including foreign value added over total exports (i.e., a country's upstream dependence) can significantly alter the sign and precision of conflict predictors. The authors' motivation for this exercise is to encourage researchers to employ the UNCTAD/Eora Trade in Value Added dataset for the study of war and trade and hence do not provide further analyses in this context.[6]

Lastly, referring to an argument first made by Rauch (1999), that trade in differentiated products should generate more interactions between traders and therefore more information flows, Martin et al. (2008) suggest that one should study the impact of trade on war through the information channel by following Rauch's distinction between differentiated and homogeneous products. They do not, however, pursue that thought further.

Overall, the amount of research that systematically targets the role of industry-specific trade elasticities and elasticities of substitution between goods for interstate military disputes is surprisingly small. The studies above have either used elasticity estimates purely as a means of motivating the distinction between industries or applied them in samples limited in the number of countries and years. Given the amount of available elasticity estimates and their level of disaggregation, a comprehensive study measuring their importance for the onset of interstate conflicts appears missing. The following sections will provide an

[6]The authors write: "There is no theoretical nor empirical study yet using these data in relation to conflict incentives, thus the goal of the following considerations is to convince the readers that this possibility is very promising for future research."

attempt on closing the identified gap.

The rest of the paper is organized as follows. Section 2 develops a bilateral gains from trade measure derived from international trade theory. Section 3 describes the data sets employed in the analysis, followed by Section 4 which presents descriptive evidence on countries' bilateral dependence. Section 5 conducts the empirical analysis while section 6 concludes.

2 Theory

To study the role of bilateral economic dependence on the probability of interstate conflicts, I derive a measure that is closely related to the conventional gains from trade literature. In the conventional sense, trade economists define the gains from trade as the change in a country's real wages when moving from current levels of trade to autarky. Arkolakis et al. (2012) has shown that gains from trade can be calculated as

$$G_j = (\lambda_j)^{-\frac{1}{\epsilon}} \tag{1}$$

where λ_j is the observed share of a country's trade with itself and ϵ is the elasticity of aggregate trade flows with respect to trade costs. Using this equality, gains from trade are surprisingly low (16.5% o.a.). However, Ossa (2015), using a simple Armington model in which consumers have CES preferences within industries and goods are differentiated by country of origin, has shown that gains from trade should account for *cross-industry variation* in trade elasticities, $\sigma_t - 1$, and instead be calculated as

$$\frac{\hat{w}_j}{P_j} = \lambda_j^{-\sum_{s=1}^{S}\sum_{t=1}^{S}\alpha_{js}\delta_{jt}^{s}\frac{ln\lambda_{jt}}{ln\lambda_j}\frac{1}{\sigma_t-1}} \tag{2}$$

where the exponent in equation 2 is a weighted average of the inverse of industry-specific trade elasticities. The weights capture how dependent country j is on trade in industry t, $\frac{ln\lambda_{jt}}{ln\lambda_j}$, how dependent country j is on upstream industry t for producing final output in downstream industry s, δ_{jt}^{s}, and how important industry s is to final consumers in country j, α_{js}. Using this equality, gains from trade are much larger (55.9% o.a.) Thus, while imports in the average industry do not matter too much, imports in some industries are critical to the functioning of the economy and therefore generate much larger gains from trade. Ossa's formula is immediately relevant for the study of the trade conflict nexus as it captures more holistically the true dependence of a country on international trade and emphasizes the role that trade in specific industries can play for overall welfare.

Very similar in spirit, my bilateral dependence measure represents the change in real wages when shutting down trade with a single partner country. Thus, where trade economists move to an extreme scenario when calculating the gains from trade, I focus instead on a counterfactual change driven by the exclusion of trade with only one country, explicitly taking into account the role of industry-specific trade.

2.1 Model Setup

Following Ossa (2015), I derive an expression for real wages from a multi-sector Armington model of trade in final and intermediate goods. The setup is as follows. There exist N countries indexed by i or j and S industries indexed by s or t. Consumers demand a final good C_j^F that is a Cobb-Douglas combination of industry-specific final goods C_{js}^F,

$$C_j^F = \prod_{s=1}^{S}\left(\frac{C_{js}^F}{\alpha_{js}}\right)^{\alpha_{js}} \tag{3}$$

The same applies to industries that demand an aggregate intermediate good that is comprised of industry-specific intermediate goods as follows,

$$C_j^{I,t} = \prod_{s=1}^{S} \left(\frac{C_{js}^{I,t}}{\gamma_{js}^t} \right)^{\gamma_{js}^t} \tag{4}$$

Industry-specific goods are themselves CES aggregates of industry-specific traded varieties,

$$C_{js} = \left(\sum_{i=1}^{N} C_{ijs}^{\frac{\sigma_s - 1}{\sigma_s}} \right)^{\frac{\sigma_s}{\sigma_s - 1}} \tag{5}$$

where σ_s represents the elasticity of substitution between varieties. The aggregate final good directly translates into utility such that,

$$U_j = C_j^F \tag{6}$$

while the aggregate intermediate good is combined with labor in a Cobb-Douglas fashion to produce country-industry-specific traded varieties Q_{is} such that,

$$Q_{is} = A_{is} \left(\frac{L_{is}}{\beta_{is}} \right)^{\beta_{is}} \left(\frac{C_i^{I,s}}{1 - \beta_{is}} \right)^{1 - \beta_{is}} \tag{7}$$

Here A_{is} stands for total factor productivities. I assume perfect competition and iceberg trade costs $\tau_{ijs} > 1$. Solving the model by combining utility and profit maximization with the market clearing condition, we obtain a gravity equation of the following form,

$$X_{ijs} = p_{ijs}^{1-\sigma_s} P_{js}^{\sigma_s - 1} E_{js} \tag{8}$$

Furthermore, the price of sector s variety coming from country j can be written as follows,

$$p_{ijs} = A_{is}^{-1} w_i^{\beta_{is}} \prod_{t=1}^{S} P_{it}^{\gamma_{it}^s (1 - \beta_{is})} \tau_{ijs} \tag{9}$$

Combining equations 8 and 9 we can rewrite the gravity equation,

$$X_{ijs} = \left(A_{is}^{-1} w_i^{\beta_{is}} \prod_{t=1}^{S} P_{it}^{\gamma_{it}^s (1 - \beta_{is})} \tau_{ijs} \right)^{1 - \sigma_s} P_{js}^{\sigma_s - 1} E_{js} \tag{10}$$

This gives rise to a price index of the following form,

$$P_{js} = A_{js}^{-1} \lambda_{js}^{\frac{1}{\sigma_s - 1}} w_j^{\beta_{js}} \prod_{t=1}^{S} P_{jt}^{\gamma_{jt}^s (1 - \beta_{js})} \tag{11}$$

where I define $\lambda_{js} \equiv X_{jjs}/E_{js}$ as the share of domestic consumption in total expenditure of country j. Taking logs of

P_{js} and rewriting in vector-matrix form we obtain,

$$\underbrace{\begin{bmatrix} lnP_{js} \\ \vdots \\ lnP_{jS} \end{bmatrix}}_{lnP_j} = -\underbrace{\begin{bmatrix} lnA_{js} \\ \vdots \\ lnA_{jS} \end{bmatrix}}_{lnA_j} + \underbrace{\begin{bmatrix} \frac{1}{\sigma_s - 1} \\ \vdots \\ \frac{1}{\sigma_S - 1} \end{bmatrix}}_{\frac{1}{\sigma - 1}} \circ \underbrace{\begin{bmatrix} ln\lambda_{js} \\ \vdots \\ ln\lambda_{jS} \end{bmatrix}}_{ln\lambda_j} + \underbrace{\begin{bmatrix} lnw_j \\ \vdots \\ lnw_j \end{bmatrix}}_{lnw_j} \circ \underbrace{\begin{bmatrix} \beta_{js} \\ \vdots \\ \beta_{jS} \end{bmatrix}}_{\beta_j} + \underbrace{\begin{bmatrix} \gamma^s_{jt}(1-\beta_{js}) & \cdots & \gamma^s_{jT}(1-\beta_{js}) \\ \vdots & \ddots & \vdots \\ \gamma^S_{jt}(1-\beta_{jS}) & \cdots & \gamma^S_{jT}(1-\beta_{jS}) \end{bmatrix}}_{B_j} \circ \underbrace{\begin{bmatrix} lnP_{jt} \\ \vdots \\ lnP_{jT} \end{bmatrix}}_{lnP_j}$$

$$lnP_j = -lnA_j + \frac{1}{\sigma - 1} ln\lambda_j + lnw_j\beta_j + B_j lnP_j$$

which we can solve for P_j as follows,

$$P_j = (I - B_j)^{-1}\left[-A_j + \frac{1}{\sigma - 1}\lambda_j + w_j\beta_j\right] \tag{12}$$

This matrix-vector form yields a final expression for P_{js} of,

$$P_{js} = w_j \prod_{t=1}^{S} \left(A_{jt}^{-1} \lambda_{jt}^{\frac{1}{\sigma_t - 1}}\right)^{\delta^s_{jt}} \tag{13}$$

where δ^s_{jt} is element s, t of the transpose of the Leontief inverse matrix $(I - B_j)^{-1}$.

2.2 Real Wages

Equipped with an expression for P_{js} we can derive an expression for real wages in country j, $\frac{w_j}{P_j}$. Note that the price index P_j is a Cobb-Douglas combination of sector-specific prices and hence,

$$\begin{aligned} P_j &= \prod_{s=1}^{S} P_{js}^{\alpha_{js}} \\ &= \prod_{s=1}^{S} \left(w_j \prod_{t=1}^{S} \left(A_{jt}^{-1} \lambda_{jt}^{\frac{1}{\sigma_t - 1}}\right)^{\delta^s_{jt}}\right)^{\alpha_{js}} \end{aligned} \tag{14}$$

This yields a final expression for real wages,

$$\frac{w_j}{P_j} = \prod_{s=1}^{S} \prod_{t=1}^{S} \left(A_{jt}^{-1} \lambda_{jt}^{\frac{1}{\sigma_t - 1}}\right)^{-\alpha_{js}\delta^s_{jt}} \tag{15}$$

Thus, real wages only depend on trade shares and technology parameters. Furthermore, we can easily derive an expression for how real wages change with respect to a trade shock as follows,

$$\begin{aligned} dln\frac{w_j}{P_j} &= dlnw_j - dlnP_j \\ &= -\sum_{s=1}^{S} \alpha_{js} \sum_{t=1}^{S} \delta^s_{jt} dln(A_{jt}^{-1} \lambda_{jt}^{\frac{1}{\sigma - 1}}) \end{aligned} \tag{16}$$

Equation 16 shows that the change in (log) welfare from any foreign shock can be expressed as a weighted average of the change in the (log) openness of the location. Since $dln\frac{w_j}{P_j}$ represents the response of real wages to an infinitesimal trade shock, integrating this expression allows me to express the change in welfare from any foreign shock which looks as follows,

$$\frac{\hat{w}_j}{P_j} = \prod_{s=1}^{S}\prod_{t=1}^{S} \hat{\lambda}_{jt}^{-\alpha_{js}\delta_{jt}^{s}\frac{1}{\sigma_t - 1}} \tag{17}$$

where for any variable v I define $\hat{v} \equiv \frac{\dot{v}}{v}$ and $\dot{v}$ being the new level of v after a foreign shock. With this expression at hand I can now obtain solutions for welfare changes when shutting down trade with partner countries. Importantly, notice that, given estimates on trade elasticities, $\sigma_t - 1$, final consumption shares, α_{js}, and input-output linkages, δ_{jt}^{s}, all that is needed to pin down changes in real wages is the change in the own trade share λ_{jt}.

In the following, I differentiate between short- and long-term effects on real wages as described in the next two subsections. The reason for this is that in the short term, countries will likely have little scope to adjust domestic production networks and bilateral trade relationships. The short-term effect of shutting down bilateral trade may thus be more severe than what will be observed in the long run. Furthermore, policy-makers may be more sensitive with respect to these severe short-term effects [need reference here]. Still, in the long run, real wages may partially recover once the economy arrives at a new equilibrium. Whether policymakers take this into account or not is an open question that I will address in the empirical section of this paper.

2.3 Short Term Effects of Bilateral Trade Shocks

In the short term, I assume that severing bilateral trade flows with country k leaves everything else unchanged. In this case, changes in the own trade share, $\hat{\lambda}_{jt}$, look as follows,

$$\begin{aligned}
\hat{\lambda}_{jt} &= \frac{\dot{\lambda}_{jt}}{\lambda_{jt}} \\
&= \frac{X_{jjt}}{\sum_{i\neq k}^{N} X_{ijt}} / \frac{X_{jjt}}{\sum_{i=1}^{N} X_{ijt}} \\
&= \frac{\sum_{i=1}^{N} X_{ijt}}{\sum_{i\neq k}^{N} X_{ijt}} \\
&= 1 + \frac{X_{kjt}}{\sum_{i\neq k}^{N} X_{ijt}}
\end{aligned} \tag{18}$$

Plugging equation 18 back into equation 17 then yields an expression for short-term changes in real wages due to cutting off trade with country k,

$$\left(\widehat{\frac{w_j}{P_j}}\right)_k = \prod_{s=1}^{S}\prod_{t=1}^{S}\left(1 + \frac{X_{kjt}}{\sum_{i\neq k}^{N} X_{ijt}}\right)^{-\alpha_{js}\delta_{jt}^{s}\frac{1}{\sigma_t - 1}} \tag{19}$$

Notice that the larger X_{kjt}, this is, the larger the ex-ante trade flows from country k to country j in industry t, the larger $\hat{\lambda}_{jt}$ and hence the smaller $\frac{\hat{w}_j}{P_j}$, given that $\alpha_{js}\delta_{jt}^{s}\frac{1}{\sigma_t - 1}$ is strictly positive. Intuitively, tighter trade connections thus yield more severe reductions in real wages when shutting down these trade relationships. This effect is stronger the more dependent country j is on upstream industry t for producing final output in downstream industry s, δ_{jt}^{s}, the more important industry s is to final consumers in country j, α_{js} as well as the less elastic the sector level import demand, $\sigma_t - 1$.

2.3.1 Numerical Example

To convince the reader that equation 19 captures the loss in real wages due to a lack of trade with a particular partner country and to obtain a better idea for individual country contributions to overall welfare, I present a short numerical example.

Suppose there exist three countries, Germany, Russia and Qatar and two sectors, gas and machinery. Germany produces gas worth 10 billion USD while it imports gas worth 5 billion USD from Russia and worth 1 billion USD from Qatar. It also produces machinery worth 10 billion USD and imports machinery worth 1 billion USD from Russia and worth 5 billion USD from Qatar. The trade flows are depicted in Table 1. Furthermore, let the elasticity of substitution for gas and machinery be 2 and 4, respectively. I choose arbitrary values of 0.8 and 0.2 for $\delta^{machinery}_{GER,gas}$ and $\delta^{gas}_{GER,machinery}$ such that 0.8 USD worth of gas is needed to meet 1 USD of final demand for machinery and 0.2 USD vice versa. Finally, I choose values of 0.6 and 0.4 for $\alpha_{GER,gas}$ and $\alpha_{GER,machinery}$ such that a representative consumer spends 60% of her wealth on gas and 40% on machinery. While admittedly over-simplified and ad-hoc, this set-up helps to prove a general point. Namely that trade in certain industries matters for the extent of bilateral dependence.

Using equation 2 from Ossa (2015) and plugging in the numbers above, one obtains an overall gain from trade for Germany of approximately 168.2%. Plugging in the numbers into equation 2 once more but this time omitting Russia, the gains from trade are only 119.2%. Finally, repeating the exercise this time omitting Qatar, the gains from trade for Germany would amount to 146.0%.

To confirm that equation 19 mirrors these differences in the gains from trade, I plug in the numbers into equation 19. Doing so for $k = Russia$, I obtain a value of -0.29. This equals precisely the percentage difference in the gains from trade obtained above namely $\frac{1.192-1.682}{1.682} = -0.29$. Repeating the exercise for $k = Qatar$, the value amounts to -0.13 which again equals the percentage difference in the gains from trade $\frac{1.460-1.682}{1.682} = -0.13$.

Table 1: Value and Origin of German Imports in bn. USD

	Gas	Machinery	Total
Germany	10	10	20
Russia	5	1	6
Qatar	1	5	6

This numerical example proves two points previously made. First, equation 19 accurately captures the importance of a particular country for the overall welfare and second, industry specific trade matters for the extent of bilateral dependence. Note that both Russia and Qatar have the exact same bilateral import share. Both countries export goods to Germany worth 6 billion USD. Thus, previous studies employing bilateral import shares would have considered imports from Russia and Qatar to be equally important for Germany. Yet, the decline in real wages when excluding Russia are relatively bigger compared to excluding Qatar. This is due to differences in sector-level import shares combined with differences in sector-level trade elasticities as well as their role in national production and consumption. It therefore appears necessary to take into account industry-level trade patterns when examining the impact of bilateral trade on the probability of conflict.

2.4 Long Term Effects of Bilateral Trade Shocks

In the long term, countries will likely adjust their expenditure on domestic goods in response to a shock to bilateral trade relationships. To account for this, I allow countries to adjust their expenditure shares on domestic products, λ_{jt}, after excluding trade with partner country k. To do so, I use exact hat algebra to determine how a shock to bilateral trade relationships affects domestic expenditure shares. I simulate shutting down trade with a partner country by increasing bilateral trade costs between countries j and k, τ_{kjs}, to infinity. To derive an expression for $\hat{\lambda}_{jt}$ note that,

$$
\begin{aligned}
\lambda_{ijs} &= \frac{X_{ijs}}{E_{js}} \\
&= \left(A_{is}^{-1} w_i^{\beta_{is}} \prod_{t=1}^{S} P_{it}^{\gamma_{it}^{s}(1-\beta_{is})} \tau_{ijs} \right)^{1-\sigma_s} \quad P_{js}^{\sigma_s - 1} \\
&= \frac{\left(A_{is}^{-1} w_i^{\beta_{is}} \prod_{t=1}^{S} P_{it}^{\gamma_{it}^{s}(1-\beta_{is})} \tau_{ijs} \right)^{1-\sigma_s}}{\sum_{l=1}^{n} \left(A_{ls}^{-1} w_l^{\beta_{ls}} \prod_{t=1}^{S} P_{lt}^{\gamma_{lt}^{s}(1-\beta_{ls})} \tau_{ljs} \right)^{1-\sigma_s}}
\end{aligned} \tag{20}
$$

Now let,

$$
\hat{c}_{is} \equiv \hat{w}_i^{\,\beta_{is}} \prod_{t=1}^{S} \hat{P}_{it}^{\,\gamma_{it}^{s}(1-\beta_{is})} \tag{21}
$$

Then we can write,

$$
\hat{\lambda}_{ijs} = \frac{\left(\hat{c}_{is} \hat{\tau}_{ijs} \right)^{1-\sigma_s}}{\sum_{l=1}^{n} \lambda_{ljs} \left(\hat{c}_{ls} \hat{\tau}_{ljs} \right)^{1-\sigma_s}} \tag{22}
$$

Furthermore,

$$
\hat{P}_{it} = \left(\sum_{l=1}^{n} \lambda_{lit} \left(\hat{c}_{lt} \hat{\tau}_{lit} \right)^{1-\sigma_t} \right)^{\frac{1}{1-\sigma_t}} \tag{23}
$$

Now we derive an expression for changes in income levels. Note that since trade in goods is balanced by assumption,

$$
Y_i = \sum_{s=1}^{S} (1 - \beta_{is}) R_{is} \tag{24}
$$

and since total expenditure equals total producer revenues, we obtain,

$$
Y_i = \sum_{s=1}^{S} (1 - \beta_{is}) \sum_{j=1}^{n} \lambda_{ijs} E_{js} \tag{25}
$$

Finally, rewriting E_{js} we obtain,

$$
Y_i = \sum_{s=1}^{S} (1 - \beta_{is}) \sum_{j=1}^{n} \lambda_{ijs} \left[\alpha_{js} Y_j + \sum_{k=1}^{S} \gamma_{js}^{k} (1 - \beta_{js}) R_{jk} \right] \tag{26}
$$

where the last term in the parentheses represents a combination of final and intermediate demand for industry s. Now, rewriting everything in log changes we obtain,

$$\hat{Y}_i Y_i = \sum_{s=1}^{S} (1-\beta_{is}) \hat{R}_{is} R_{is} \tag{27}$$

$$\hat{R}_{is} R_{is} = \sum_{j=1}^{n} \lambda_{ijs} \hat{E}_{js} E_{js} \tag{28}$$

$$\hat{E}_{js} E_{js} = \alpha_{js} \hat{Y}_j Y_j + \sum_{k=1}^{S} \gamma_{js}^{k} (1-\beta_{js}) \hat{R}_{jk} R_{jk} \tag{29}$$

We thus end up with $n \times S + n \times S + n \times n \times S + n \times S + n \times S + n$ unknowns $\left(\hat{c_{is}}, \hat{P_{is}}, \hat{\lambda_{ijs}}, \hat{E_{js}}, \hat{R_{is}}, \hat{Y_i},\right)$. At the same time, equations 21,22,23,27,28,29 provide a system of $n \times S + n \times S + n \times n \times S + n \times S + n \times S + n$ independent equations which allows us to solve for all parameters.

The empirical implementation of long-term effects will be part of a future version of this working paper. As of now, all empirical results that follow are based on the short term effects on real wages.

3 Data

The primary data source employed in this study is global input-output data from the Global Trade Analysis Program (GTAP). GTAP is a a fully documented, publicly available global data base which contains domestic production and consumption data, complete bilateral trade information as well as transport and protection linkages. I use the eighth version for the year 2007 which includes 134 countries and 57 industries spanning agriculture, mining, and manufacturing.

I use UN Comtrade data when disaggregating to finer industry levels and when extending the analysis to multiple years. I calculate parameters α_{js}, λ_{js},λ_j, γ_{js}^t as well as β_{js} following Ossa (2015)[7]. The analysis is conducted at the SITC Rev.3 3-digit level which allows me to differentiate between 260 different industries. I use industry-level trade elasticities provided by Ossa (2015). The correlation between my calculations of country-level gains from trade and Ossa's final results is 98% as shown in Figure 1.

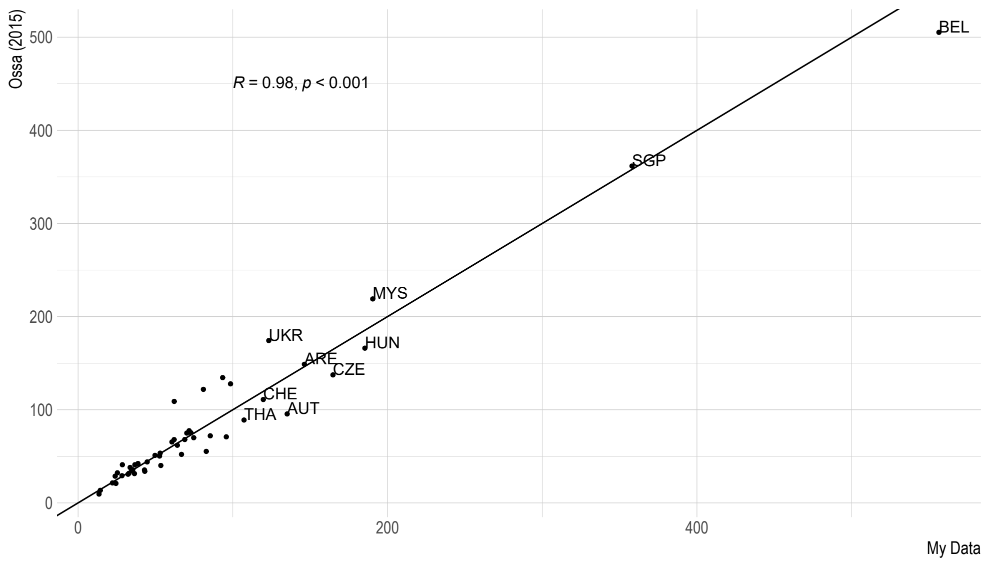
Data on bilateral political alignment is retrieved from an R package called *peacesciencer* developed by Steven V. Miller (2021) sourcing data from Häge (2011). I use three different scores that each individually measure voting correlations between two countries. First, I use the S-score originating from Signorino and Ritter (1999). It equals one minus the sum of the squared actual deviation between a pair of countries' votes divided by the sum of the squared maximum possible deviations between their votes. Although often relied upon in the literature, the S-score does not account for the underlying empirical distribution of country or country-pair votes. This is, country votes may align by chance merely due to the number of times an individual country or a country pair vote(s) "yes", "no" or "abstain". Two measures that correct for this source of mechanical correlation are the κ and the π scores from Cohen (1960) and Scott (1955), respectively. The former adjusts the observed variability of the countries' voting similarity based on the variability of each country's own votes around its own average vote. The latter undertakes an adjustment based on the variability of each country's own votes around the average vote for the two countries taken together.

Data on economic sanctions stem from the Global Sanctions Database (GSDB).[8] Data on interstate military conflicts was

[7] I follow Ossa (2015) whenever possible. In case of ambiguities I follow my own reasoning. This applies predominantely when constructing concordances between GTAP industries and SITC industry classifications (available upon request).

[8] The paper that accompanies the first version of the data is Felbermayr et al. (2020) and the paper prepared to go with the first update is Kirikakha et al. (2021).

Figure 1: Sanity Check: Country-Level Gains from Trade



Note: The figure illustrates the correlation between my own calculation of the country-level gains from trade and the final results obtained in Ossa (2015).

retrieved from the Correlates of War Project Militarized Interstate Disputes (v5.0) (COW)[9].

To construct my instrument, I use data on bilateral air distance from the CEPII Geodist dataset. Bilateral air distance is measured as the population-weighted average of the bilateral distances between countries' largest cities. Data on bilateral sea distances stem from Feyrer (2019) and constitute the least-cost path distances by sea between two countries' largest ports. Finally, I employ CEPIIs Gravity Database for information on countries' languages, colonial histories and democracy indices.

4 Bilateral Gains from Trade - Descriptive Evidence

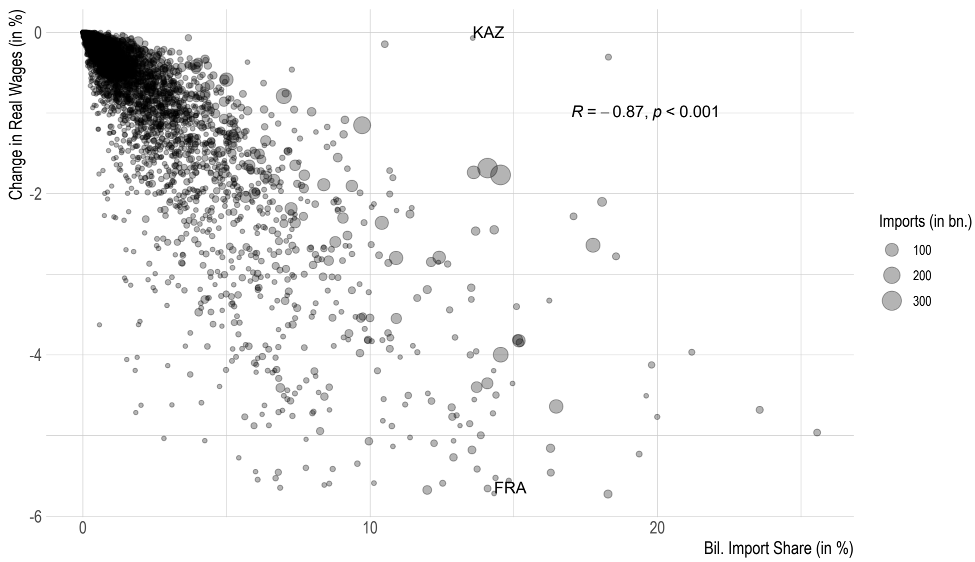
Before moving on to the empirical analysis, it is worthwhile to study bilateral gains from trade exclusively and how they differ between country pairs. To provide a first glimpse of the underlying distribution, I construct my measure from equation 19 for the year 2007 and plot it against bilateral import shares of the same year. The question of interest is: how much more can bilateral gains from trade tell us about bilateral dependencies than import shares alone? The result is depicted in Figure 2.

A first thing to note is that, as far as the bilateral gains from trade are concerned, the overwhelming majority of country pairs lie between 0 and -2 percent. This is, for most countries, losing a particular trade partner amounts to a loss in real wages of somewhere between 0 and 2 percent. Import shares in 2007 range between 0 and 27 percent. Second, the correlation between these two measures is substantial and highly significant (0.86). However, while overall import shares seem to mimic bilateral dependencies well, substantial variation between certain country pairs remains. The figure shows that two countries with the exact same bilateral import share can have vastly different levels of bilateral dependencies once domestic production networks as well as differences in trade elasticities between industries are accounted for (see Kazakhstan and France depicted in the figure). The same applies when analyzing the relationship in the opposite direction. Two country pairs that rely upon each other to the same extent may substantially differ in their respective import shares.

Although this figure provides a helpful first glance, it also hides country-level and regional patterns due to the mass of data being plotted. In the following, I thus analyze two country case studies, the USA and China, to highlight trends visible

[9] For details see Palmer et al. (2022)

Figure 2: Change in the Gains from Trade vs. Import Share 2007



Note: The figure illustrates the relationship between bilateral gains from trade (vertical axis) and bilateral import shares (horizontal axis). Bilateral gains from trade are computed according to equation 19. Bubble sizes correspond to bilateral imports in bn. USD. The figure depicts the bottom 99% of the data.

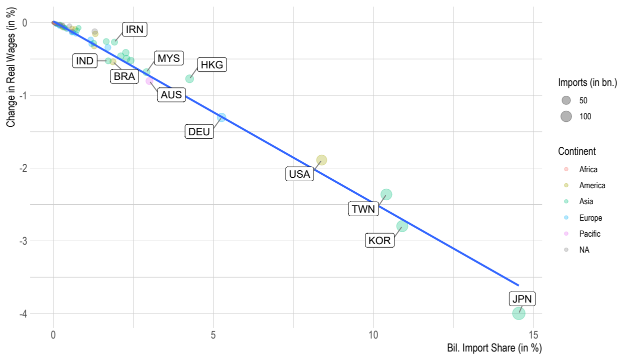
only at lower levels of aggregation.

Figure 3 panel (a) shows the relationship between bilateral import shares between China and the rest of the world (ROW) and the bilateral gains from trade for China upon trading with the ROW in the year 2007. Thus, the horizontal axis plots the bilateral import share of various countries in total Chinese imports while the vertical axis shows a country's contribution to China's welfare. We witness a strong and positive correlation, with bilateral import shares being able to almost perfectly predict the gains that China enjoys from trading with other countries. Perhaps not surprisingly, countries that contribute most to China's real wages are Japan, Korea, Taiwan, USA and Germany, each accounting for about 1.3 to 4.1 percent. All other countries range in between 0 and 1 percent with a significant fraction adding very little to the overall welfare. Asian countries tend to contribute more to China's real wages relative to all other regions.

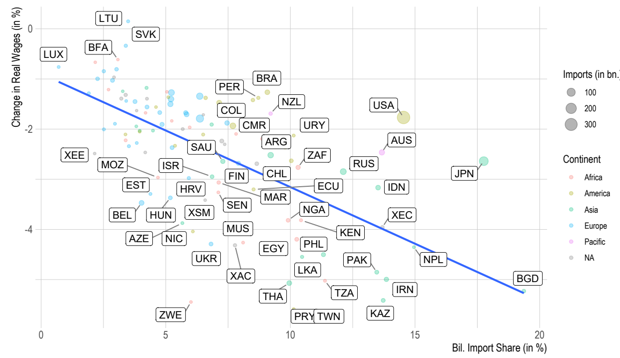
While panel (a) thus suggests a negligible role of industry-specific trade flows for the dependency of China on the ROW, panel (b) clearly shows that the import share alone explains very little of the variation in bilateral dependencies once the question of interest is rephrased. Where panel (a) asks "How important is the ROW to China?", panel (b) illustrates the results when one asks "How important is China to the ROW?" The figure shows that the bilateral import share does a poor job in answering this question. Two countries with the exact same Chinese import share can be vastly different in terms of the gains they obtain from trading with China. For example, China's share in total Brazilian imports was about 8% in 2007 and stopping trade with China would lower Brazil's real wages by approximately 1.2%. Thailand, instead, having a comparable Chinese import share in overall Thai imports of about 10%, sees its real wages decline by more than 5% due to a lack of trade with China. Thus, after taking into account industry specific trade and domestic production networks, Chinese imports tend to be more than four times more important for Thailand than they are for Brazil, keeping import shares nearly constant.

Lastly, panel (c) plots panel (b) once more this time omitting country labels and instead depicting region-specific linear regression lines. Although the relationship between bilateral import shares and the bilateral gains from trade may in fact be non-linear, differences in the slopes suggest varying levels of correlation between world regions with American countries showing the weakest co-movement.

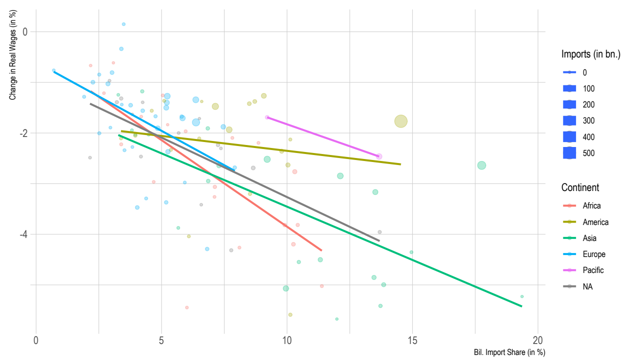
Figure 4 conducts the same analysis for the US where largely the same trends emerge. First, how important countries of the ROW are to the US (panel (a)) is almost fully captured by bilateral import shares. China, Canada and Mexico were the most



(a) Importance of ROW to China



(b) Importance of China to ROW



(c) Importance of China to ROW - Linear Regressions

Figure 3: Bilateral Gains from Trade 2007 - China

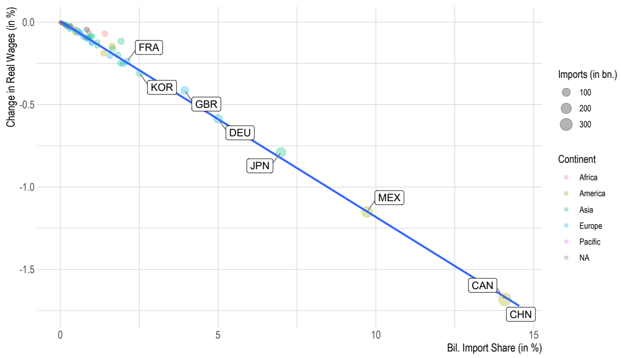
Note: The figure illustrates the bilateral gains from trade for China from trading with the ROW (a), the bilateral gains from trade for the ROW from trading with China (b) and region-specific linear regressions of the bilateral gains from trade for the ROW from trading with China on bilateral import shares (c). Blue lines in panel (a) and (b) illustrate linear regressions.

important trade partners for the US in 2007, followed by Japan, Germany and Great Britain. Furthermore, a large fraction of countries add very little to the overall US welfare. Second, the importance of the US for countries of the ROW (panel (b)) varies greatly and is inadequately measured through bilateral import shares once industry specific trade and national production shares are taken into account. Lastly, trends in the relationship between bilateral gains from trade and import shares (panel (c)) vary between world regions.

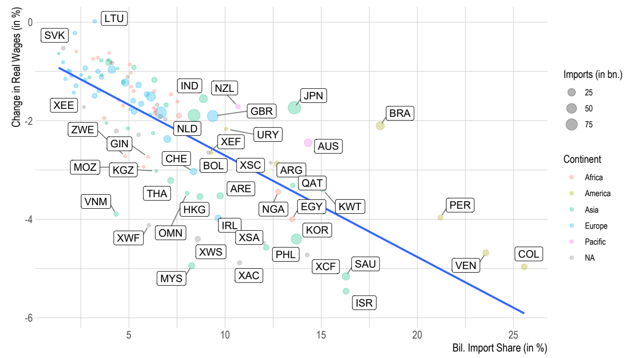
Table 2 depicts countries most relied upon and most dependent in both 1987 and 2017 based on the median dependency across all trade partners. I extend the bilateral gains from trade measure to more years by keeping all parameters in equation 19 fixed at their 2007 levels but using updated trade data for the year of interest to re-construct $\frac{X_{kjt}}{\sum_{i\neq k}^{N} X_{ijt}}$.[10] As far as the countries that are most relied upon are concerned, the most notable change during the 30 year time period is the rising importance of China. Not being among the top-5 countries in 1987, in 2017 it is the country most relied upon. Great Britain is no longer part of the top-5 in 2017 while Germany has surpassed Japan ranking third in the world after the US. Italy became slightly more important as trade partner, stepping up from fifth to fourth place.

The most dependent country both in 1987 and 2017 was Belgium. This mirrors Belgium's unique position in Figure 1, illustrating an overall gains from trade of over 500%. While the most dependent countries in 1987 were all European countries, this no longer holds up in 2017. The United Arab Emirates, Vietnam and countries in Western Africa emerged as those most dependent upon imports from the ROW. Interestingly, Germany and Italy were both among the countries most

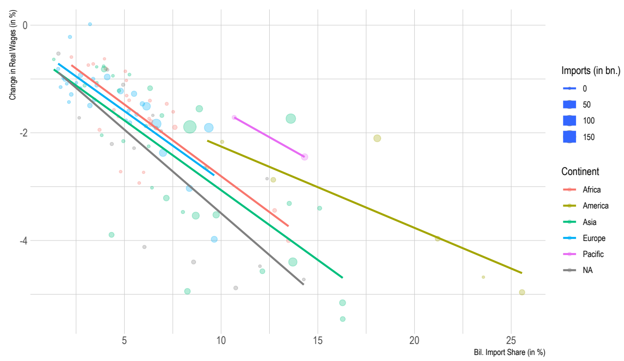
[10] Note that domestic production levels are currently kept at their 2007 value due to missing production data at the country-year-industry level. Going forward I will address this arguably problematic shortcoming.



(a) Importance of ROW to the US



(b) Importance of the US to ROW



(c) Importance of the US to ROW - Linear Regressions

Figure 4: Bilateral Gains from Trade 2007 - US

Note: The figure illustrates the bilateral gains from trade for the US from trading with the ROW (a), the bilateral gains from trade for the ROW from trading with the US (b) and region-specific linear regressions of the bilateral gains from trade for the ROW from trading with the US on bilateral import shares (c). Blue lines in panel (a) and (b) illustrate linear regressions.

relied upon as well as those most dependent in 1987, underscoring the countries' deep integration into global value chains.

China's unique rise to global importance is further emphasized in Figure 5. The map shows how countries' dependence on China changed (measured by a change in the change of the bilateral gains from trade) between 1987 and 2017. Countries that raised their dependencies the most are primarily Asian, African, South American and East-European. West- and Central-Europe as well as the US, Canada and Japan (including the G7 countries) have only become moderately more dependent in comparison (although all countries became more dependent overall).

5 Empirical Analysis

This section measures the effect of a change in the bilateral gains from trade on interstate conflict. I start by examining how bilateral dependence affects political alignment measured through UNGA vote correlation. I then replace vote alignment by the imposition of sanctions and, lastly, by the onset of militarized interstate disputes.

5.1 Political Alignment

The reason I employ political alignment variables as outcomes is twofold. First, political alignment is strongly correlated with interstate military conflicts, as I will demonstrate below, and second, political alignment allows for the exploitation of substantially greater variation. When using war onset or imposition of sanctions as dummy variables on the left hand side of a

Table 2: Country Comparison

Countries most relied upon		Most dependent countries	
1987	2017	1987	2017
1. USA	1. China	1. Belgium	1. Belgium
2. Japan	2. USA	2. Germany	2. Western Africa
3. Germany	3. Germany	3.France	3. Vietnam
4. Great Britain	4. Italy	4. Netherlands	4. United Arab Emirates
5. Italy	5. Japan	5. Italy	5.Netherlands

Note: The table lists countries most relied upon as well as those most dependent both in 1987 and 2017. Rankings for reliance and dependence are based on the median level across all trade partners.

regression equation, one imposes a very demanding identification challenge due to the infrequent nature of these phenomena. According to the Correlates of War data, between 1950 and 2000, only about 0.45% of all country-country-year observations have two countries engaged in a conflict, even after widening the definition of war to include levels of hostility that fall below the conventional definition of war. Political alignment measured through UNGA vote correlation exhibits annual variation and hence facilitates the identification of an effect.

To convince the reader that UNGA vote correlation is strongly associated with interstate wars, I conduct an empirical analysis for the years 1950 - 2015 running the following logistic regression,

$$W_{jkt} = \beta V_{jkt} + \gamma X_{jkt} + \nu_j + \xi_k + \lambda_t + \epsilon_{jkt} \tag{30}$$

where W_{jkt} is a dummy variable for whether countries j and k are at war with each other in year t, V_{jkt} represents UNGA vote correlation and X_{jkt} is a vector of commonly employed control variables including logged distance, whether an alliance is active in year t, the sum of democracy indexes as measured by the PolityIV dataset, the number of years since the last war between two countries occurred, contiguity, common language and whether two countries were ever in a colonial relationship with each other.[11] ν_j, ξ_k and λ_t stand for country and year fixed effects and ϵ_{jkt} is a stochastic error. I measure UNGA vote correlation using the S score described in section 3. To mitigate endogeneity concerns, I lag the explanatory variable by 4 years. The results are shown in Table 3.

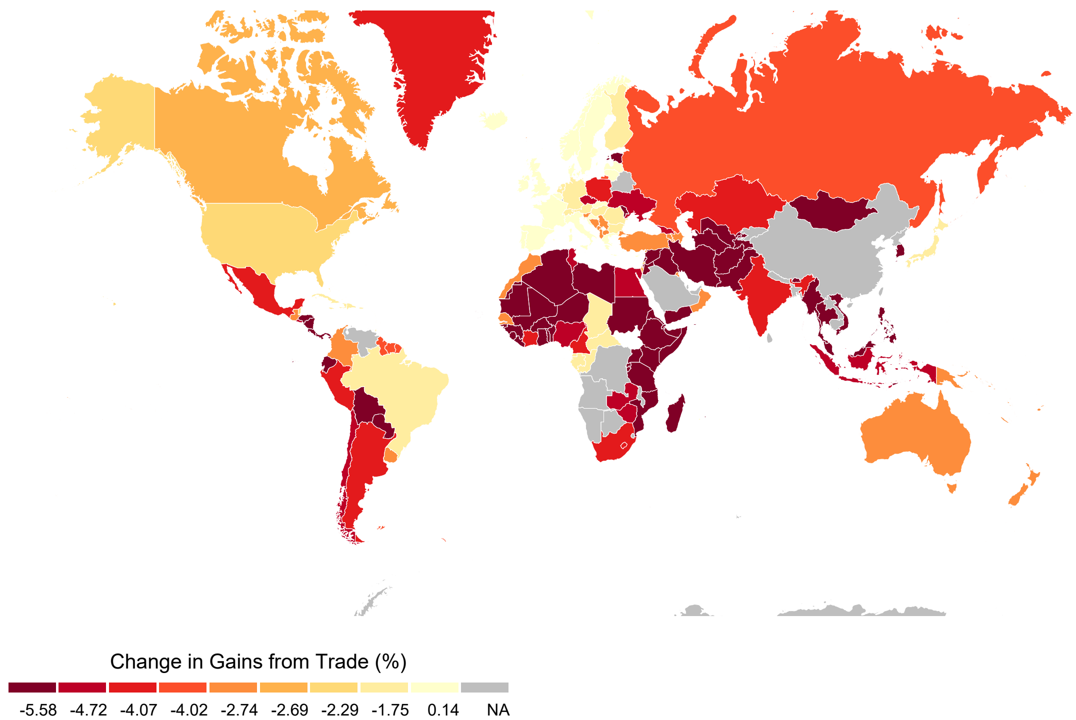
Column (1) identifies a war when the hostility level in the COW data exceeds 2 on a range from 1 to 5 (1 = No militarized action, 2 = Threat to use force, 3 = Display of force, 4 = Use of force, and 5 = War). A hostility level of 3 or higher is usually relied upon in the conflict literature. As the table shows, positive UNGA vote correlation four years prior to a war onset is associated with reduced probability of interstate conflict. The estimated coefficient is highly significant and substantial in magnitude. The latter becomes more apparent when comparing it to the rest of the predictor variables in columns (2) - (6). These columns vary the level of hostility to examine the robustness of the results. Throughout all specifications, the negative correlation remains large and precisely estimated. While the size of the effect shrinks continuously with the rise in hostility level, it tends to be on average about 3 times as large as the coefficient of any other predictor variable apart from contiguity. Interestingly, contiguity tends to be about just as important as UNGA vote correlation except when interstate conflicts are defined most conservatively using the maximum hostility level of 5. In that case, contiguity does not seem to explain any of the variation significantly although UNGA vote correlation remains a strong and significant predictor.

Importantly, this analysis makes no attempt in establishing causality flowing from a rise in UNGA vote correlation to changes in the probability of interstate wars. In fact, omitted variable bias as well as reverse causality are two potential sources of endogeneity that persist even after lagging the variable of interest by four years, controlling for a range of factors that potentially affect both war onset and political alignment and including a range of fixed effects. However, it shows that political alignment does tend to be strongly and significantly correlated with interstate conflicts and hence UNGA vote correlation seems to be an effective proxy for interstate conflict.

Next, I examine the association between my measure of bilateral dependence and UNGA vote correlation. To provide

[11] Compare for example to Martin et al. (2008).

Figure 5: Change in the importance of China for the ROW between 1987 and 2017



Note: The figure illustrates changes in bilateral dependence between countries of the ROW on China between 1987 and 2017. Gray countries have missing data for 1987 in the UN Comtrade database. China is omitted since dependence on itself is not well defined.

Table 3: Political alignment is associated with reduced probability of interstate conflicts (1950-2015)

	Dependent variable:					
	Host. Lev. ≥ 3	Host. Lev. ≥ 1	Host. Lev. ≥ 2	Host. Lev. ≥ 3	Host. Lev. ≥ 4	Host. Lev. ≥ 5
	(1)	(2)	(3)	(4)	(5)	(6)
UNGA vote align. $t-4$	$-1.67^{(a)}$	$-2.21^{(a)}$	$-2.16^{(a)}$	$-2.08^{(a)}$	$-1.77^{(a)}$	$-1.69^{(a)}$
	(0.07)	(0.08)	(0.09)	(0.09)	(0.12)	(0.26)
ln distance		$-0.61^{(a)}$	$-0.59^{(a)}$	$-0.56^{(a)}$	$-0.68^{(a)}$	$-1.01^{(a)}$
		(0.04)	(0.04)	(0.04)	(0.05)	(0.12)
Alliance active in t		$0.36^{(a)}$	$0.25^{(a)}$	$0.26^{(a)}$	-0.12	-0.08
		(0.07)	(0.08)	(0.08)	(0.09)	(0.25)
Sum of democ. index		-0.002	$-0.005^{(c)}$	-0.005	$-0.01^{(b)}$	$-0.04^{(a)}$
		(0.003)	(0.003)	(0.003)	(0.004)	(0.01)
Years since last war		$-0.14^{(a)}$	$-0.16^{(a)}$	$-0.16^{(a)}$	$-0.16^{(a)}$	$-0.19^{(a)}$
		(0.004)	(0.005)	(0.005)	(0.01)	(0.02)
Conitguity		$2.01^{(a)}$	$2.03^{(a)}$	$2.05^{(a)}$	$2.18^{(a)}$	-0.04
		(0.08)	(0.09)	(0.09)	(0.12)	(0.26)
Common langage		$0.23^{(a)}$	$0.27^{(a)}$	$0.26^{(a)}$	$0.51^{(a)}$	$0.78^{(a)}$
		(0.06)	(0.07)	(0.07)	(0.08)	(0.21)
Colonial Hist.		$0.66^{(a)}$	$0.57^{(a)}$	$0.56^{(a)}$	$0.36^{(a)}$	-0.18
		(0.09)	(0.10)	(0.10)	(0.13)	(0.52)
Fixed effects		i+j+t	i+j+t	i+j+t	i+j+t	i+j+t
Observations	674,164	478,102	478,102	478,102	478,102	478,102

Note: Significance levels: 1% (a), 5% (b), and 10% (c).

reduced form evidence I run the following regression specification,

$$V^s_{jkt} = \beta G_{jkt} + \gamma ln X_{jkt} + \delta D_{jk} + \nu_{jk} + \xi_{jt} + \lambda_{kt} + \epsilon_{jkt} \quad (31)$$

Here, V^s_{jkt} represents UNGA vote alignment between countries j and k in year t where $s = \{S, \pi, \kappa\}$. I thus conduct the analysis using all three measures of political alignment in the UNGA introduced in Section 3 to establish robustness. G_{jkt} is the bilateral gains from trade measure. Importantly, I multiply the measure with (-1) to ease interpretation of the coefficients. Thus, a positive coefficient would indicate that a rise in bilateral dependence is associated with a rise in political alignment. Moreover, lnX_{jkt} captures logged bilateral imports. I control for the latter to contrast the association of my measure with the one established by a simpler measure of bilateral trade.[12] D_{jk} is a dummy for whether both countries are full democracies as measured by the PolityIV data. I additionally control for reporter-partner (dyadic), reporter-time, and partner-time fixed effects. Thus, my results are not driven by macroeconomic shocks affecting all trade partners or by differences between one pair of partners to another. Whether both countries are democracies is supposed to pick up dyadic-time varying effects that I can otherwise not fully control for since this is the level at which variation takes place. Note that since the indicator for democracies is highly correlated with bilateral trade, I include either or in my specifications, never both. The results are shown in Table 4.

Table 4: Panel Regression

	Dependent variable:					
	V^{κ}_{jkt}	V^{S}_{jkt}	V^{π}_{jkt}	V^{κ}_{jkt}	V^{S}_{jkt}	V^{π}_{jkt}
	(1)	(2)	(3)	(4)	(5)	(6)
$\hat{G_{jkt}}$	$1.071^{(a)}$	$-0.242^{(b)}$	$0.946^{(a)}$	$0.885^{(a)}$	0.026	$0.818^{(a)}$
	(0.168)	(0.122)	(0.177)	(0.143)	(0.108)	(0.156)
lnX_{jkt}				$0.006^{(a)}$	$-0.006^{(a)}$	$0.004^{(a)}$
				(0.0002)	(0.0002)	(0.0003)
Both Democracies	$0.092^{(a)}$	$-0.037^{(a)}$	$0.073^{(a)}$			
	(0.003)	(0.003)	(0.004)			
Estimation	OLS	OLS	OLS	OLS	OLS	OLS
Fixed effects	jk+jt+kt	jk+jt+kt	jk+jt+kt	jk+jt+kt	jk+jt+kt	jk+jt+kt
Observations	39,089	39,089	39,089	48,819	48,819	48,819
R^2	0.025	0.020	0.011	0.020	0.039	0.010

Note: Significance levels: 1% (a), 5% (b), and 10% (c).

Column (1) uses the κ score to measure political alignment and controls for the democracy status of trade partners. The association with bilateral gains from trade is strongly positive and significant. The observed coefficient suggests that a one standard deviation increase in bilateral dependence is associated with a 0.16 standard deviation increase in political alignment. The effect is very similar in size and just as significant when replacing the κ score with the π score in column (3). While the association remains significant at the conventional 5% level when using the S score in column (2), the sign of the effect is flipped, suggesting a negative relationship between political alignment and bilateral dependence as measured by industry specific trade.

Columns (4)-(6) repeat the analysis this time controlling for bilateral trade instead of democracy status. Again, both the κ as well as the π score suggest a strong an positive correlation between political alignment and bilateral gains from trade. Moreover, this time, the S score specification agrees on the sign of the effect although not significant at the conventional level. Therefore, a simpler measure such as bilateral imports does not render the bilateral dependence measure obsolete.

While Table 4 presents suggestive evidence of a positive association between the variables of interest, it suffers from potential endogeneity concerns. On the one hand, it may be that two countries that start to align more politically also start trading more with each other which would affect the measure of bilateral gains from trade and hence bias the OLS results upward through reverse causality. On the other hand, bilateral political alignment may be more likely to respond to long-term shifts that affect bilateral trade rather than to shocks that affect imports in the short run. Thus, the variation in bilateral trade which causes the gains from trade measure to vary in the short run may be inadequate to pick up the true effect on UNGA vote correlation which may be more sensitive to long term shifts. This source of endogeneity was first formulated by Kleinman et al. (2020) and would bias the OLS results downward. To address these sources of distortion I adopt an instrumental variable strategy introduced by Feyrer (2019) which purges bilateral trade from its endogeneity exploiting the decline in the costs of

[12] I follow Kleinman et al. (2020) in contrasting my measure in this way.

air shipping over time.

The idea is as follows. Air shipping costs declined between 1955 and 2004 by a factor of 10 (Hummels, 2007). Country pairs that are closer to each other by air than by sea relative to other country pairs benefit more from this reduction in costs. Thus, bilateral air and sea distances create an exogenous source of variation in trade costs as long as all country pairs are equally exposed to this shift. A great advantage of this instrument is that, since it exploits variation in "effective" bilateral distance over time, it allows for the inclusion of dyadic fixed effects in addition to country-time and partner-time fixed effects similar to equation 31. Hence, controlling for a range of bilateral factors that may affect both, the outcome of interest as well as trade, such as common language or colonial ties, and which almost certainly suffers from omitted variable bias and potentially measurement error, becomes obsolete.

To construct an instrument for my bilateral gains from trade measure based on bilateral air and sea distances, I mostly follow Kleinman et al. (2020). First, I estimate the following log linear gravity equation to purge bilateral imports of their endogeneity,

$$lns^i_{jkt} = \sum_{t=1}^{T}\sum_{i=1}^{I}\mathbb{1}_{ti}(\gamma^a_{ti}ln(airdist_{jk}) + \gamma^s_{ti}ln(seadist_{jk})) + \delta D_{jk} + \nu^i_{jk} + \xi^i_{jt} + \lambda^i_{kt} + \epsilon^i_{jkt} \tag{32}$$

Here, $s^i_{jkt} = \frac{X_{kjt}}{\sum_{i=1}^{N} X_{ijt}}$ is the expenditure share of country k in country j's overall expenditure (imports plus domestic production) of industry i in year t. Moreover, γ^a_{ti} and γ^s_{ti} are industry-time varying coefficients capturing the effect of air and sea distances on bilateral trade. Air distance represents the population weighted average distance between two countries' largest cities retrieved from CEPII's gravity database while sea distance is obtained from Feyrer (2019) and represents the least-cost path by sea between the major ports of both countries. The rest of the parameters match their definitions from equation 31.

After obtaining estimates on all parameters, I use the fitted values to predict bilateral expenditure shares and use those predicted values to reconstruct my bilateral gains from trade measure where $G_{jkt} = f(s^i_{jkt})$. I then use the newly constructed measure, which I call G^*_{jkt}, to instrument for the endogenous measure G_{jkt}.

In particular, the first stage looks as follows,

$$G_{jkt} = \alpha G^*_{jkt} + \delta D_{jk} + \nu_{jk} + \xi_{jt} + \lambda_{kt} + \epsilon_{jkt} \tag{33}$$

with all parameters matching definitions assigned above. The second stage mirrors equation 31 but employing instrumented values for G_{jkt}. In specifications that include bilateral imports I instrument for imports in the same way I instrument for the bilateral expenditure shares.[13]

The results when running the second stage regression are depicted in Table 5. The sign of the coefficients are identical to those obtained in the OLS regression in Table 4, and the precision of the estimates is even slightly higher. However, the effect size rises in magnitude by a factor of about 5 on average. This suggests that the source of endogeneity was the responsiveness of political alignment to long-term trends that affect bilateral trade relationships rather than short-term idiosyncratic shocks. Column (1) implies that a one standard deviation increase in bilateral dependence taking into account domestic production networks and industry specific trade flows raises political alignment by approximately 0.78 standard deviations. The F-statistic exceeds the conventional threshold of 10 and hence suggests that predicted bilateral gains from trade based on bilateral sea and air distances are a strong instrument for actual bilateral gains from trade. Furthermore, bilateral trade again turns out to be an inadequate measure of bilateral dependence given its small effects size in columns (4)-(6).

Therefore, exploiting reductions in the costs of air travel over time, I find that countries that become more dependent upon each other also start to align more politically, where political alignment is a strong predictor for interstate conflicts. The effect size is furthermore substantial implying that critical trade relationships that are vital for the economy as a whole are among the major determinants of political orientation in foreign policy.

[13] This is, I use fitted values from a regression of log imports on air and sea distance, predict bilateral imports and use them as an instrument for actual bilateral imports.

Table 5: Panel Regression - IV

	Dependent variable:					
	V^{κ}_{jkt}	V^{S}_{jkt}	V^{π}_{jkt}	V^{κ}_{jkt}	V^{S}_{jkt}	V^{π}_{jkt}
	(1)	(2)	(3)	(4)	(5)	(6)
$G^{\hat{*}}_{jkt}$	$5.163^{(a)}$	$-1.557^{(a)}$	$4.615^{(a)}$	$3.278^{(a)}$	-0.069	$3.068^{(a)}$
	(0.891)	(0.406)	(0.833)	(0.667)	(0.317)	(0.667)
lnX^{*}_{jkt}				$0.012^{(a)}$	$-0.009^{(a)}$	$0.010^{(a)}$
				(0.001)	(0.0004)	(0.001)
Both Democracies	$0.104^{(a)}$	$-0.038^{(a)}$	$0.086^{(a)}$			
	(0.004)	(0.004)	(0.005)			
Estimation	IV	IV	IV	IV	IV	IV
Weak instruments	63.72	63.72	63.72	421.34	421.34	421.34
Fixed effects	jk+jt+kt	jk+jt+kt	jk+jt+kt	jk+jt+kt	jk+jt+kt	jk+jt+kt
Observations	23,789	23,789	23,789	23,789	23,789	23,789

Note: Significance levels: 1% (a), 5% (b), and 10% (c).

5.2 Sanctions

While the previous chapter has provided evidence with respect to the effect of bilateral dependence on political alignment, this section focusses on a more extreme version of bilateral relationships, the imposition of sanctions. To do so, I employ data from the Global Sanctions Data Base (GSDB). The GSDB covers 1101 publicly traceable, multilateral, plurilateral, and purely bilateral sanction cases over the 1950-2019 time period. I study the 30 year time period between 1987-2017 and focus on bilateral sanction cases only since my bilateral dependence measure is unlikely to be suitable when studying multilateral sanctions imposed by a group of countries onto one or more other countries.[14]

Importantly, the GSDB differentiates between five different classes of sanctions including trade, arms, military, financial and travel related sanctions. This disaggregation allows me to explore whether the relationship between my bilateral dependence measure and sanctions is sensitive with respect to the type of sanction being imposed.[15]

To study the relationship of interest, I run a regression of the following form,

$$S^{T}_{jk} = \beta \bar{G_{jk}} + \gamma X_{jk} + \phi_j + \xi_k + \epsilon_{jk} \quad (34)$$

where S^{T}_{jk} is the number of years between 1987 and 2017 that country j has put sanctions of type $T \in \{Trade, Arms, Mil-itary, Financial, Travel\}$ on country k. Moreover, $\bar{G_{jk}}$ is the *average* value of the bilateral dependence measure during the period of investigation. As before, X_{jk} represents a vector of control variables including whether two countries share a border, share a common language, have a colonial history, are both democracies as well as the logged distance between them. ϕ_j and ξ_k are country fixed effects and ϵ_{jk} represents a stochastic error term.

Importantly, a dyadic dataset that counts the number of years a country has imposed sanctions on another features an abundance of zeros. Most countries have never imposed sanctions upon each other and even those who did, did so for a limited amount of years. Furthermore, when differentiating between different types of sanctions, the number of zero-sanction-years grows even larger. Given this feature of the data, I employ a negative binomial regression that is suitable for over-dispersed count data.

The results of equation 34 are displayed in Table 6. Column (1) pools all types of sanctions and thus examines the relationship between bilateral dependence and the imposition of sanctions overall. The result shows that sanctions are not significantly associated with bilateral dependence as measured through industry-specific trade. While the relationship is negative, suggesting that greater dependence is associated with less years of sanctions, it is not precisely estimated. This changes once we examine different types of sanctions in columns (2) - (6). Interestingly, as opposed to sanctions targeting arms, military and financial transactions, trade as well as travel related sanctions are significantly and negatively related

[14] I do not study years before 1987 since UN Comtrade data becomes less reliable at the country-industry level.

[15] According to the developers, the GSDB is particularly "...well-suited to address issues related to bilateral and multilateral linkages in trade relations and the intricate structure of applied sanctions.", which is precisely the aim of this analysis.

Table 6: Sanctions

	Dependent variable:					
	Overall	Trade	Arms	Military	Financial	Travel
	(1)	(2)	(3)	(4)	(5)	(6)
$\bar{G_{jk}}$	−0.134	−0.210$^{(b)}$	−0.473$^{(c)}$	0.104	−0.236$^{(c)}$	−0.492$^{(b)}$
	(0.090)	(0.091)	(0.283)	(0.093)	(0.138)	(0.213)
Contiguity	2.598$^{(a)}$	6.000$^{(a)}$	−0.054	−0.227	0.928	1.947$^{(b)}$
	(0.705)	(0.871)	(1.183)	(1.207)	(0.733)	(0.967)
Common language	1.195$^{(a)}$	0.141	1.306$^{(b)}$	2.002$^{(a)}$	1.397$^{(a)}$	0.169
	(0.350)	(0.464)	(0.544)	(0.596)	(0.362)	(0.497)
Colonial history	−2.888$^{(a)}$	−4.202$^{(a)}$	−3.316$^{(a)}$	−2.794$^{(a)}$	−3.262$^{(a)}$	−1.449$^{(b)}$
	(0.417)	(0.915)	(0.729)	(0.776)	(0.489)	(0.578)
Logged distance	0.183	0.505$^{(a)}$	0.481$^{(b)}$	0.248	0.071	−0.497$^{(b)}$
	(0.144)	(0.183)	(0.226)	(0.244)	(0.148)	(0.206)
Both democracies	−0.419$^{(c)}$	−0.397	−0.550$^{(c)}$	0.223	−0.255	−1.966$^{(a)}$
	(0.218)	(0.269)	(0.331)	(0.367)	(0.221)	(0.322)
Fixed effects	j+k	j+k	j+k	j+k	j+k	j+k
Observations	12,486	12,486	12,486	12,486	12,486	12,486
Note:			Significance levels: 1% (a), 5% (b), and 10% (c).			

to bilateral dependence, suggesting heterogeneity in the relationship between bilateral dependence and different types of sanctions. In particular, the fact that it is the trade related sanctions that seem to be sensitive with respect to the degree of bilateral trade dependence makes intuitive sense.

The analysis in this subsection suggests that bilateral dependence does predict whether two countries impose sanctions upon each other. However, I do not claim that this relationship is causal. Results from equation 34 should be interpreted as correlations since no particular identification strategy is employed. The instrument applied in the previous section appears invalid once average dependencies over a 30-year time period are calculated. Thus, to minimize endogeneity concerns, I control for a range of factors and include country fixed effects. However, endogeneity concerns are still valid and hence these relationships should be interpreted with caution. Still, finding evidence for a connection between dependencies between two states and their motivation to place bilateral sanctions upon each other is of importance given that scholars, even after 3 decades of research on economic sanctions, have not reached a consensus on what are the key determinants of sanction imposition [citation needed].

5.3 Militarized Interstate Disputes

This section investigates the relationship between economic dependence as measured through industry-specific bilateral trade and the escalation of conflicts into military disputes and full blown interstate wars. I use data from the COW on Militarized Interstate Disputes (MID) and differentiate between levels of hostility similar to Table 3. The empirical specification mirrors the one from the previous section (equation 34) in that I regress the number of years two countries faced a MID between 1987 and 2017 against my bilateral dependence measure. In particular, the regression specification looks as follows,

$$M_{jk}^{T} = \beta \bar{G_{jk}} + \gamma X_{jk} + \phi_j + \xi_k + \epsilon_{jk} \tag{35}$$

where all variables have the same meaning as before except for the dependent variable M_{jk} which now measures the number of MID years where I distinguish between three different types of MIDs, $T \in \{Host.Lev. \geq 3, Host.Lev. \geq 4, Host.Lev. \geq 5\}$. As mentioned before, hostility levels beyond 3 are conventionally considered war-like escalations and employed as dependent variable in conflict studied. However, according to the COW, only conflicts that exceed a hostility level of 5 are truly considered interstate wars.

Again, due to substantial dispersion in the dependent variable (few MID years), I use negative binomial regressions. The results are shown in Table 7.

Column (1) measures the relationship between economic dependence and bilateral MIDs as measured by hostility levels exceeding category 2 (the conventional approach). I obtain a negative association which turns out to be highly significant at the 1% level. Thus, a high economic dependence suggests to predict a small number of MID years.

The effect size shrinks a little when increasing the threshold for MIDs to including only those that exceed hostility level 3 in column (2). Still, the sign of the coefficient as well as the significance remain unchanged, re-emphasizing a precisely estimated negative association between bilateral dependence and the number of years two countries are engaged in a MID.

Interestingly, the relationship turns insignificant once I exclusively examine full blown interstate wars as measured by hostility levels exceeding category 4. While the regression coefficient remains negative in sign, it shrinks substantially and is no longer precisely estimated. Two reasons could potentially drive this outcome. The first one is related to what was emphasized in the beginning of section 5.1. Wars between two countries are luckily very infrequent and hence the number of years that two countries were at war with each other, especially during the more peaceful years between 1987 and 2015, is very small, making the identification of a relationship relatively demanding. This motivated the analysis of political alignment in the first place. A more conceptual explanation is that the decision to escalate a conflict into a war may be driven by a range of factors, some of which may be of greater importance than bilateral trade relationships. This may be true since wars often represent the final escalation of a long sequence of bilateral tensions. The final decision of going to war may then be unconditional of trade relationships, even if economic dependencies did play a role in the escalation steps before.

Table 7: Interstate War

	Dependent variable:		
	Host. Lev. ≥ 3	Host. Lev. ≥ 4	Host. Lev. ≥ 5
	(1)	(2)	(3)
$\bar{G_{jk}}$	$-0.019^{(a)}$	$-0.014^{(a)}$	-0.001
	(0.003)	(0.002)	(0.001)
Contiguity	$0.843^{(a)}$	$0.627^{(a)}$	$0.019^{(b)}$
	(0.038)	(0.029)	(0.007)
Common language	0.013	0.025	$0.019^{(a)}$
	(0.021)	(0.016)	(0.004)
Colonial history	0.002	-0.004	$-0.012^{(a)}$
	(0.024)	(0.019)	(0.005)
Logged distance	$-0.043^{(a)}$	-0.010	-0.003
	(0.010)	(0.008)	(0.002)
Both democracies	$-0.045^{(c)}$	0.012	0.004
	(0.027)	(0.021)	(0.005)
Fixed effects	j+k	j+k	j+k
Observations	12,372	12,372	12,372
R^2	0.112	0.095	0.110
Note:	Significance levels: 1% (a), 5% (b), and 10% (c).		

6 Conclusion

This paper develops a novel method of measuring bilateral economic dependencies based on industry-specific trade relationships and domestic production networks. I show that differences in sector-level trade elasticities can give rise to heterogenous economic dependencies that remain hidden when studying aggregate trade flows alone. Equipped with this new bilateral dependence measure I examine its association with political alignment, the imposition of sanctions as well as interstate military disputes. Exploiting exogenous variation in effective air and sea distances over time, I find that a one standard deviation increase in my dependence measure leads to a 0.76 standard deviations increase in political alignment as measured through UNGA vote alignment. Bilateral dependencies are furthermore associated with the imposition of fewer trade related sanctions as well as fewer military disputes that fall below the hostility level threshold of full blown interstate wars.

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