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THE GRAVITY OF HOMICIDE: INTERPERSONAL VIOLENCE AND INTERNATIONAL TRADE

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I. Introduction

Does interpersonal violence diminish international trade? Answering that question is the purpose of this paper. Looking at trade between pairs of nations over the period 2000-2016, we find a negative, clinically and statistically significant relationship between homicide rates and the volume of international trade. If, in the given time period, the average homicide rate of the exporting country changed from the level found in Philippines (8 per 100,000 individuals) to that found in Russia (20 per 100,000 individuals), our baseline estimates predict a decrease in exporter market access of 5.3 percent. If the same change occurred on the importer side, there would be a decrease in importer market access of 8.3 percent.

In this paper we make several contributions. First, to our knowledge, we are the first to examine how interpersonal or civil violence (in contrast to war and other larger scale violence) is capable of disrupting the volume of international trade. Using homicide as our indicator of interpersonal violence, we find a strong association between the two variables, one that is robust to how the gravity model is estimated. Our results, if correct, show an important and previously overlooked economic cost of such violence.

Second, we are able to break out the trade data into differentiated manufactures, undifferentiated manufactures, services, mining, and agriculture. As such we are able to document the relationship between civil violence and trade across a spectrum of industries. Interestingly, each sector shows a negative relationship between homicides and international trade, though that relationship varies by sector.

Third, we are able to estimate a separate effect, by sector, of violence on exports and violence on imports. In each sector we see important differences. For example, service exports are diminished by civil violence; service imports are not. The relationship is reversed for

manufactures (differentiated and nondifferentiated), where civil violence affects exports but not imports.

Fourth, we use new methodological techniques to re-evaluate the effect on trade of inter-state war and inter-ethnic fighting. The literature on trade and these types of violence (what might be called "high-level" violence because of its state and organized non-state sponsors) relies heavily on standard panel-data techniques. Using recently available advances in gravity-model estimation, we find little consistent evidence that high-level violence diminishes international trade. We suspect that this is the result of two factors. The first is the relatively rare occurrence of wars between states and inter-ethnic fighting within states in our time period (2000-2016). The second is the very limited amount of trade occurring in states that experience such high-level violence.

Fifth, we are able to contribute to the literature on violence and development. Homicide rates generally rise as income per capita falls, and there is a small but growing literature that seeks to measure the effect of inter-personal violence on economic development. As growth through trade is an oft-recommended strategy for development, we offer a new reason to consider the consequences of low-level violence.

The literature to date documents how violence can substantially reduce the level of international trade. Glick and Taylor (2010) find that WWI and WWII each had a huge trade reducing effect (including on neutral countries). Though the human carnage of those conflicts is rightly viewed as the most important consequence by far, their calculations show large and persistent economic losses as well. For the entire world, they calculate a loss of trade of about 10 percent, and a loss of GDP of about 5 percent. Blomberg and Hess (2006) examine a much more expansive list of violent events including terrorism, revolutions, and inter-ethnic fighting as

well as inter-state war. They find that such high-level violence, taken together, is equivalent to a 30 percent tax on all trade.

The literature offers a set of intuitive mechanisms linking high-level violence and trade. The effect of wars is perhaps the most intuitive; embargoes and the additional costs to traders add to war-based loss of infrastructure to reduce trade.[1] Terrorism redirects economic activity away from investment and toward government spending on security. More broadly, high-level violence of all kinds raises the costs of doing business with a country where such events occur.[2] The link between interpersonal violence and trade is not immediately apparent, which may help account for the literature's silence on the topic. On the surface it may seem an unlikely linkage; there is little surprise or "shock value" generated by most countries' annual reporting on homicide rates, in contrast to the attention given to high-level violence. And as much of the crime that makes up civil violence is perpetrated on the relatively vulnerable in society, it is not immediately obvious that trading firms would be less successful in exporting or importing when such low-level violence increases. Indeed, our initial results could reflect correlation and not causation. For example, perhaps violence does not affect trade directly, and instead violence is a proxy for the quality of state governance. Governments that are not able to provide safety for their citizens may be similarly unable to provide needed inputs for trading firms, inputs like secure credit markets and a stable regulatory regime.

We suspect, however, that the linkages are real, and there are a number of possible cause-and-effect channels. For example, Fukuyama (1995) argues that violence lowers generalized social trust and as a result may confine trust to extended family networks, stunting growth of

[1] Glick and Taylor (2010), p. 102.
[2] Blomberg and Hess (2006), p. 599.

professional management and medium-to-large-scale enterprises.[3] We address this and several possible additional mechanisms linking interpersonal violence to trade, in the literature review.

Looked at more broadly, there is a growing awareness that too little attention has been devoted to the role interpersonal violence plays in economic outcomes. Anke Hoeffler has made important contributions here. In her 2018 article she notes the scale of interpersonal violence—in 2015 there were 624,000 persons killed violently, 75 percent of whom were killed in interpersonal violence.[4] Moreover, she finds strong negative correlations between violence against women and real income per capita and between violence against children and real income per capita. These correlations intrigue us and inspire our efforts.

However, to find a causal linkage between interpersonal violence and trade, we require a careful estimation strategy. Among the advances in gravity model estimation over the past two decades, perhaps the most significant is the use of Poisson Pseudo Maximum Likelihood techniques to estimate structural gravity models. By employing this approach, we side-step three important problems with standard double-log, panel-data gravity techniques. We control for multilateral resistance, as analyzed in Anderson and van Wincoop (2003). We include the information in zero-value trade flows between particular pairs of nations. And we correct for the bias-creating heteroskedasticity inherent in double-log gravity estimation, as analyzed by Santos Silva and Tenreyro (2006). As Yotov, Piermartini, Monteiro and Larch (2016) exposit, each of these problems is successfully addressed with the structural approach taken in this paper.

[3] Bates (2001) makes a related argument that familistic societies can generate civil violence as a means of defending family networks.

[4] Data from the WHO, as reported by Hoeffler (2018), p. 12.

II. Literature Review

We discuss here some of the literature relevant to understanding the effect of different kinds of violence on trade. Recent decades have seen a burst of work in this regard. Glick and Taylor (2010) helpfully categorize the effect of violence on trade as a concern about "collateral damage"—damage over and above its cost in human life.

We begin with the first of our "high-level" violence metrics, inter-state external war. In this regard, Glick and Taylor use a comprehensive dataset for the period between 1870 and 1997 and find huge losses in trade because of inter-state conflict.[5] On average, wars reduce trade between belligerents by 80-90 percent, and between belligerents and neutral countries by 5-12 percent (or to 42-65 percent in major wars).[6] Lagged effects, and effects on third parties, are pronounced, with trade, on average, needing 10 years to recover to pre-war levels. The main mechanisms for this damage, they argue, are the direct restrictions of blockades and embargoes common between combatants, and the increased transactions costs of engaging in international exchange during war.

Blomberg and Hess (2006) include terrorism, revolutions, and inter-ethnic fighting alongside inter-state war. These additional violence metrics are then considered both individually as well as in an aggregated index in a standard gravity model. Based on 30 years of data from the late 20th century (up to 1999) and including most countries of the world, they estimate that the

[5] The authors employ a gravity model with country-pair fixed effects.
[6] Glick and Taylor (2010), p. 109.

combined effect of all their violence measures is equivalent to a 30 percent across-the-board tariff on trade.[7]

Blomberg and Hess argue that violence affects trade through "domestic" and "globalization" channels. The domestic channel is the mechanism whereby, in the face of conflict, a government spends more money on military or police enforcement, crowding out both consumption and investment.[8] Long-term decreases in investment, in turn, hinder opportunities for development and likely continue cycles of internal violence. The authors' globalization channel is another version of a transactions-cost story – trade is reduced when internal or external violence raises the cost of doing business with a country.

A closely related literature on violence within individual countries examines how organized armed conflict both diminishes growth and creates post-conflict risks of various kinds. Most of this literature ignores the violence-trade nexus, though Collier and Duponchel (2012) and Bayer and Rupert (2004) are exceptions. These small-sample studies consider the effects of internal violence on domestic output and bilateral trade, and they find large effects.

More recently, the literature on internal violence in developing countries has begun to include studies of the effect of interpersonal violence on health and social development. This important thread has examined violence types like criminal violence, intra-household or domestic violence (the brunt of which often falls on women), and violence against children, which collectively we can refer to as civil interpersonal violence. Anke Hoeffler (2017, 2018), and Fearon and Hoeffler (2018) exemplify this pivot. Our study picks up on this emphasis to

[7] Anderton and Brauer (2019) also find significant effects of terrorism on trade. Didier (2019) finds significant effects of violence on global services trade; finance, insurance, and travel services are most significantly negatively affected.

[8] Blomberg and Hess (2006), p. 599; see also Goulas (2015).

examine the effect of interpersonal violence on trade, using annual national homicide rates as a proxy for interpersonal violence of all kinds.

There are several mechanisms that may connect higher levels of homicide within a country to adverse international trade effects. First, and clearly foremost in the literature on collective, national-level violence, is the real but prosaic connection between violence and increased transactions costs, which acts as a tax on all kinds of economic activity. High national homicide rates, likewise, will diminish international trade to the extent they raise transaction costs, such as security costs. Relatedly, by diverting state resources, high homicide rates also diminish the state's ability to enforce contracts and provide the public goods infrastructure necessary for trade.

Second, as mentioned in the introduction, there is a potential relationship between interpersonal violence and social capital (in the form of generalized social trust), that may affect the trajectory of firms' growth and management in ways that reduce trade. Fukuyama (1995) argues that violence may be one among several factors that erode generalized social trust and thus (again, among multiple factors) confine trust to extended family networks, stunting growth of professional management and medium-to-large-scale enterprises. We know that trading firms are different from those that sell only domestically; they are typically larger and have higher productivity. The hypothesis here is that there is a fixed cost to international trade, and therefore we should expect to see only high-productivity firms, those able to pay the fixed cost, selling abroad. If a rise in violence stunts the growth of professional management, we should expect firm-level productivity to fall and, along with it, engagement in international trade.

Hoeffler (2017) argues that interpersonal violence is costly in human capital terms. It leads to earnings losses and reduced labor force participation. Families suffer direct losses in

human capital when lives are lost, and also when they divert resources away from human capital acquisition toward security. Uncertainty about future returns also reduces incentives to invest in human capital. All these family outcomes affect firms' productivity. Further, Goulas (2015) argues that significant reductions in labor force participation arise from the fact that "some individuals are inclined to believe that income can be earned through illegal activities while others deliberately reject certain job types or job locations due to the fear of criminal victimization." Singhal (2016) enumerates similar consequences. All of these point to lower prospects for trade.

Finally, the negative effects of increased homicide are not limited to locations where rates are high; they also spill over into nearby areas. Nino (2015) considered the effects of increased organized crime-related homicide on economic activity in El Paso and Ciudad Juarez, just across the US-Mexico border from each other. Increased homicide in Ciudad Juarez negatively affected El Paso's business cycle index in the first month, and then positively after five months, which the authors attribute to shoppers preferring, and some household relocating to, the relatively safer city. The cumulative effect of increased organized-crime-related homicides on the whole region was negative, suggesting that in the face of increased homicide, particularly organized-crime related homicide which can escalate rapidly, few areas are safe from such negative spillover effects. In this paper we examine the effect of violence in a country on that same country's trade volumes, and we leave to subsequent work the examination of how regional violence affects trade.

In summary, the past two decades of research on the effect of collective and state directed violence, including war, on trade has found large effects. Though it is reasonable to think that interpersonal violence, as opposed to collective violence, may have consequences for trade, the

literature to date has not examined the effect of interpersonal violence on trade. Our work steps into that opening.

III. Methodology

Our work is also distinguished by the use of a new theoretical and empirical framework for estimating gravity models. We employ the high dimensional fixed effects structural gravity model of Yotov *et. al.* (2016) which offers several advantages for this application. First, by using a series of fixed effects it allows us to take into account bilateral trade costs and inward and outward multilateral resistances (Anderson and van Wincoop, 2003). To estimate the effect of key explanatory variables on trade, the following general equation can be defined:

$$(1) \qquad X_{ijt} = \exp(\mathbf{V}_{ijt}\beta + \ldots + \mu_{it} + \pi_{jt} + \gamma_{ij} + \delta_{ii} + \epsilon_{ijt})$$

Here X_{ijt} represents directional trade flows—say, in manufactured goods exports—from country i, the origin and exporter, to country j, the destination and importer—in period t. $\mathbf{V_{ijt}}$ denotes a vector of independent variables. μ_{it}, π_{jt}, γ_{ij} and δ_{ii} respectively symbolize exporter-time, importer-time, and exporter-importer and country-specific fixed effects. The first two account for multilateral resistances, the third absorbs all bilateral trade costs, and the fourth stands in for all factors relevant to intra-country trade flows. As (1) shows, then, only time-variant and dyadic (i.e. not specific just to the exporter or the importer) variables can remain in the estimation; anything else will be collinear with the fixed effects.

We employ a two-stage procedure. In the first stage, we use the Poisson Pseudo Maximum Likelihood (PPML) estimator to regress export values on two dummies—whether the trading pair have a free trade agreement (FTA) and a currency union (CU)—and our set of high-dimensional fixed effects, clustering standard errors by exporter-importer pairs. The specific equation is as follows:

$$(2) \quad X_{ijt}=\exp(\beta_1 FTA_{ijt} + \beta_2 CU_{ijt} + \mu_{it} + \pi_{jt} + \gamma_{ij} + \delta_{ii} + \epsilon_{ijt}).$$

PPML has come to dominate the gravity literature in recent years for the way it can account for zero or missing trade flows. An OLS estimator would merely drop such observations, but PPML treats them as statistical zeroes, or zeroes occurring randomly (Head and Mayer, 2014). In addition, as Santos Silva and Tenreyro (2006) show, PPML avoids the heteroskedasticity present in double-log estimation of (hitherto) standard gravity models.

We extract the importer-time and exporter-time fixed effects from the first stage and use them as dependent variables for two distinct OLS regressions in the second stage—one on the side of the importer and one on that of the exporter. In these, we regress the logged importer-time and exporter-time fixed effect estimates against homicide rates (H), binary variables for inter-state war (W) and inter-ethnic fighting (IF), a vector of gravity variables (G, described later), and importer or exporter and year fixed effects:

$$(3) \quad \ln\pi_{jt} = \beta_0 + \beta_1 H_{jt} + \beta_2 W_{jt} + \beta_4 IF_{jt} + \beta_3 G_{jt} + \theta_j + \omega_t + \tau_{jt}$$

$$(4) \quad \ln\mu_{it} = \beta_0 + \beta_1 H_{it} + \beta_2 W_{it} + \beta_4 IF_{it} + \beta_3 G_{it} + \eta_i + \omega_t + \lambda_{it}$$

The estimated coefficients for the indicator variables in the first stage can be interpreted as trade elasticities, while the coefficients in the second stage represent the effect on market access (in (3) for importers, and in (4) for exporters). Two-stage estimations such as this are widely used.[9] To implement the first stage we use Stata's "ppmlhdfe" command, authored recently by Sergio Correia, Paulo Guimaraes and Tom Zylkin.[12]

All violence variables (for each country their homicide rate, whether they have experienced a war or an inter-ethnic conflict) enter in the second stage. That reflects our assumption about the nature of the variables that represent those forms of violence. We consider external war and inter-ethnic fighting and homicide to all be specific to the exporter or the importer, that is, to be monadic—time-varying and specific to the exporter or the importer. External war, inter-state war, would seem to be intrinsically dyadic (and therefore potentially used in the first stage equation (2)), and so some explanation here is required.

In our time period the nature of many inter-state conflicts makes it very unlikely that each country involved suffers similar trade consequences. Many of the examples of war involve a developed country fighting in a distant low-income country. The U.S., the U.K., and Australia all sent troops to Afghanistan and Iraq, for example. In these cases we should expect Afghanistan and Iraq to see diminished international trade—with all countries and not just with the foreign belligerents. The U.S, and other distant participants, by contrast, are able to conduct trade without interruption, and without significant changes in the cost to trading firms. As such we measure *where* an inter-state takes place, that is, where the fighting occurs. So, for example, our inter-state war variable takes on a value of 1 for Afghanistan during the conflict fought in

[9] See Head and Mayer (2014), Egger and Nigai (2015), Yotov et al. (2016), and Kinzius (2019).
Correia, Guimaraes, and Zylkin (2019).

that country against the Taliban government, and the value for the U.S., U.K. and Australia is a 0. By contrast, when a war is between a pair of neighboring countries where both countries see fighting on their territory, for example the Armenia - Azerbaijan conflict, both participants are coded as being, in that year, in a war.

IV. Data

We use annual data, 2000 to 2016, from 168 countries, for their trade, a variety of economic variables, and violence. Consider first the violence measures. Controlling for the effects of external war and inter-ethnic fighting is a crucial part of our strategy to identify the effects of interpersonal violence.

Our war variable (W) is adapted from a dataset maintained by the Uppsala Conflict Data Program (UCDP) and the UCDP/PRIO Armed Conflict Dataset, a joint project of the Uppsala Conflict Data Program (at the Department of Peace and Conflict Research, Uppsala University) and the Centre for the Study of Civil War (at the International peace Research Institute in Oslo, PRIO).[10] The definition of conflict in this dataset is "a contested incompatibility that concerns governments and/or territory where the use of armed force between two parties, of which at least one is the government of a state, results in at least 25 battle-related deaths in a calendar year." As this definition of war includes both state and non-state actors, we refine the data to include only conflicts between states, and then assign a value of 1 to the country within which the war is fought.

[10] Information about the UCDP/PRIO Armed Conflict Dataset can be found in Pettersson (2020) and Pettersson and Oberg (2020).

Inter-Ethnic Fighting (IF) is adapted from the Political Instability Task Force (PITF) State Failure Problem Set.[11] IF draws from the PITF Ethnic War dataset. Ethnic Wars are defined as "episodes of violent conflict between governments and national, ethnic, religious, or other communal minorities (ethnic challengers) in which the challengers seek major changes in their status." The criterion for including an ethnic fighting event in this dataset includes two thresholds: a mobilization threshold in which each party mobilizes at least 1,000 people (armed agents, demonstrators, troops), and a conflict intensity threshold where there must be at least 1,000 direct conflict-related deaths across the conflict duration and at least one year when the annual conflict-related death toll is greater than 100 fatalities.[12] We create a dummy variable for Inter-ethnic Fighting which equals 1 when a state experiences an inter-ethnic conflict event in a given year with a conflict intensity threshold greater than 1000 fatalities.

Our homicide data comes from the United Nations Office on Drugs and Crime (UNODC) Database.[13] Homicide rates are reported annually as the number of homicides per 100,000 people for individual countries and regions. The data are collected through the United Nations Crime Trends Survey (UN-CTS). In our 2000-2016 sample, the mean rate per country per year is approximately 8, with a standard deviation of 12. There is considerable variance between countries and within countries over time.

Figure 1 illustrates. It displays examples of countries around or below the 25th percentile (approximately 1.2) and the median (approximately 3.0) homicide rates. The countries in the lowest quartile in this figure are Germany (DEU), Hong Kong (HKG), Japan (JPN), and Qatar (QAT), whose homicide rates can barely be distinguished from zero. Countries around the

[11] See http://www.systemicpeace.org/inscrdata.html.
[12] See http://www.systemicpeace.org/inscrdata.html.
[13] https://dataunodc.un.org/content/data/homicide/homicide-rate.

median include the Philippines (PHL), Argentina (ARG), and the United States (USA). They seem significantly more violent with homicide rates around 8 per 100,000. However, adding more countries to the table makes these countries' homicide rates seem small in comparison: Figure 2, which adds to Figure 1 several examples of countries with much higher homicide rates, shows how the latter dwarf the former. El Salvador (SLV) has the highest homicide rate across every year in our sample. Its peak, around 2014-15, was shockingly high.

The "gravity variables" in our study include information on FTA and CU membership, population, and GDP (in current dollars). These variables were obtained from the United States International Trade Commission's (USITC) Dynamic Gravity Dataset.[14]

The trade data are from the USITC's International Trade and Production Database for Estimation (ITPD-E). The ITPD-E contains bilateral international trade and domestic trade for many countries, and industries and spans the years 2000 to 2016. The data are divided into industries (agriculture, mining and energy, manufacturing, and services), with data from 120 countries.[15] We use the importing country's record of the shipment from origin to destination.

Table 1 provides descriptive statistics for our estimating sample.

V. Results

Tables 2, 3, 4, 5, and 6 present, respectively, the results for differentiated manufactures, nondifferentiated manufactures, services, agriculture, and mining. In each table we present the results from our two-stage estimation of equations (2), (3), and (4). As all tables are laid out in

[14] Available at gravity.usitc.gov and described in Gurevich and Herman (2018).
[15] See https://www.usitc.gov/data/gravity/itpde_guide/ .

exactly the same manner, we can use Table 2 to illustrate. Column 1 contains the result of the first stage, the estimation of equation (2). The dependent variable is the value of exports of differentiated manufactured goods from country i to country j. The right-hand side includes only time-varying dyadic variables, dummy variables for whether the country pair were both members of a free-trade agreement (FTA) or both were members of a customs union (CU).

Columns 2, 3, and 4 present the results of estimating equation (2), where the dependent variable is the value of the exporter-time fixed effect (from column 1). In columns 2, 3, and 4 we have measures of violence: homicide rate (Homicide Rate), inter-state war (W), and inter-ethnic fighting (IF). In addition we have a standard set of gravity variables, the population (Population) of the exporter, GDP of the exporter, and dummy variables for whether the exporter is a member of the World Trade Organization (WTO) or the European Union (EU).
Columns 5, 6, and 7 show the results of estimating equation (3), where the dependent variable is the value of the importer-time fixed effect estimated in equation (2), and the independent variables take on take on importers' values. [16]

Looking across Tables 2 – 6, several things emerge about the effect of civil violence, homicide, on international trade. For each sector either exports, or imports, show the expected negative sign on homicide. The effect is negative and statistically significant for the exports of differentiated manufactures, services, agriculture, and mining. The effect is negative and statistically significant for the imports of differentiated and undifferentiated manufactures, and for agriculture.[17]

[16] The number of observations in column 1 is substantially larger than that in columns 2-7. In 2-7 the data are no longer dyadic; each country has one value for its fixed effect per time period.
[17] We also find negative though statistically insignificant results for the exports of undifferentiated manufactures, and for imports of services, agriculture, and mining.

Moreover, these results bear clinical significance. For the purpose of comparison we point the reader to columns 4 and 7 in each table (second stage results that use our full set of controls including membership in the WTO and the EU). For differentiated manufactures in Table 2 consider columns (4) and (7). A one standard deviation increase in the homicide rate (approximately a change of 12 homicides per 100,000 of population) predicts a 6.9 percent decrease in exports (that is, -0.00565 x 12.296 x 100, where the first number is the estimated coefficient). In imports, the similarly-constructed prediction is for a 12.8 percent decrease. These are both sizeable effects.

The same calculation in Table 3 for undifferentiated manufactures shows a more modest effect for exports, and a larger one for imports. A one standard deviation change in the homicide rate predicts a 1.4 percent decrease in exports, and a 10.4 percent decrease in imports.

Services trade, Table 4, also shows important clinical effects. A one standard deviation increase in the homicide rate predicts a 45 percent decrease in exports, and a 14 percent decline in imports. Agriculture and mining, Tables 5 and 6, using the same methodology show again large effects: in agriculture a 11.5 percent decline in exports, and a 9.6 percent decline in imports, and in mining 19 percent and 12 percent, respectively.

Table 7 presents initial results, for differentiated manufactures goods, where we do several new things: first, we include a one-year lag on homicide for both the exporter and the importer regressions. Lagged effects are quite plausible; for example if violence acts as a tax on trading firms then homicide rates in the previous year could affect the incentive to create trade contracts in the upcoming year.

Second, Table 7 includes an additional gravity variable, a measure of the country's remoteness calculated as the GDP-weighted distance between a country and the other countries

in the sample. It is typically the case that countries will trade more if they are close to each other and mutually remote from other countries. In these estimates we measure how remoteness, across all bilateral pairs, affects the level of exports and imports.

Finally, we also modify the estimation of the standard errors; in Tables 2 – 6 we employ a heteroskedasticity correction; in Table 7 we cluster the standard errors by exporting (or importing) country.

There are broad similarities, and a couple differences, between the results in Table 7 and in Table 2. We again find negative coefficients on the homicide variables, in this case both contemporary and lagged homicide. The coefficients are strongly statistically significant in the importer regression, but not for the exporter regression. We attribute the difference in the significance to how the standard errors are estimated; when we replicate Table 2 regressions with the same cluster approach as in Table 7 we find the same lack of significance in the exporter regressions.

The coefficient on lagged homicide rates is in absolute terms about twice the size of the coefficient on contemporaneous homicide. This fits our intuition, stated above, that the effects of homicide may be felt only slowly on international trade. These particular results are suggestive only, and one puzzle we face is in thinking about the appropriate lag structure on homicide and, for that matter, the other variables in the equation.

The remoteness variables are both positive and statistically significant. We expect remoteness to be positive in regressions of dyadic trade, but what is expected in a monadic regression?

Looking across the tables there are a handful of other results are also worthy of notice. Inter-state war and inter-ethnic fighting often have a positive sign in our second-stage

regressions. These results are puzzling, and we suspect that the very rare nature of these events may be behind the finding. For example, only 0.5 percent of our sample has an inter-state war and less than 5 percent has an inter-ethnic conflict. As such our variables may not be good measures of these types of conflict *per se*, and may instead act as a dummy variable for the trade of a particular small set of countries. Another possible explanation is reverse causality. High trade volumes may be a measure of the value of winning a conflict, which may in turn induce wars between states or between ethnic groups.

Finally, and surprisingly to us, we find that broadly across our results the market access of importers goes down more than the market access for exporters for a standard deviation increase in homicide rates (something that shows very clearly in Table 2 with differentiated manufactures). If this result holds up in subsequent refinements of this work, it will indicate that personal-level violence in some sense affects the behavior of a nation's importers more than it does external buyers (or local sellers) on the export side of the economy. In terms of the mechanisms discussed earlier for how violence affects trade we have no ready explanation for this phenomenon.

VI. Conclusion

The unique contribution of this paper is to explore how personal-level violence has a negative effect on international trade. This effect, when calculated through our two-stage estimation strategy and understood as a reduction in market access, extends to both the exporter and the importer and is clinically significant.

This is work in progress, and we have several aims in moving forward. We want to explore the theoretical channels by which violence can affect international trade. As discussed earlier our sense is that violence acts as a tax on exporting firms, and we intend to model that relationship. Until that point these results are suggestive only.

Based upon the theoretical channels proposed we will move back to the empirics and the research design. There are a number of options here, IV (unlikely to work given the need for a variable that has no reasonable connection to the unobserved determinants of trade), natural experiments, or perhaps some version of a DiD.

Finally, there are other data sources that we could exploit. The MEPV data (Major Episodes of Political Violence[18]), for example, offers a potentially useful cross check on our current data which we are actively exploring. We hope to investigate other forms of micro-level violence (kidnapping, sexual and other violent assault, etc.) and identify the specific mechanisms through which such violence affects trade. Another goal is to consider estimation techniques that may control more robustly for potential sources of endogeneity in our estimating models.

[18] Available at www.systemicpeace.org.

Figure 1. Sample Homicide Rates: Countries Around 1st Quartile and Median

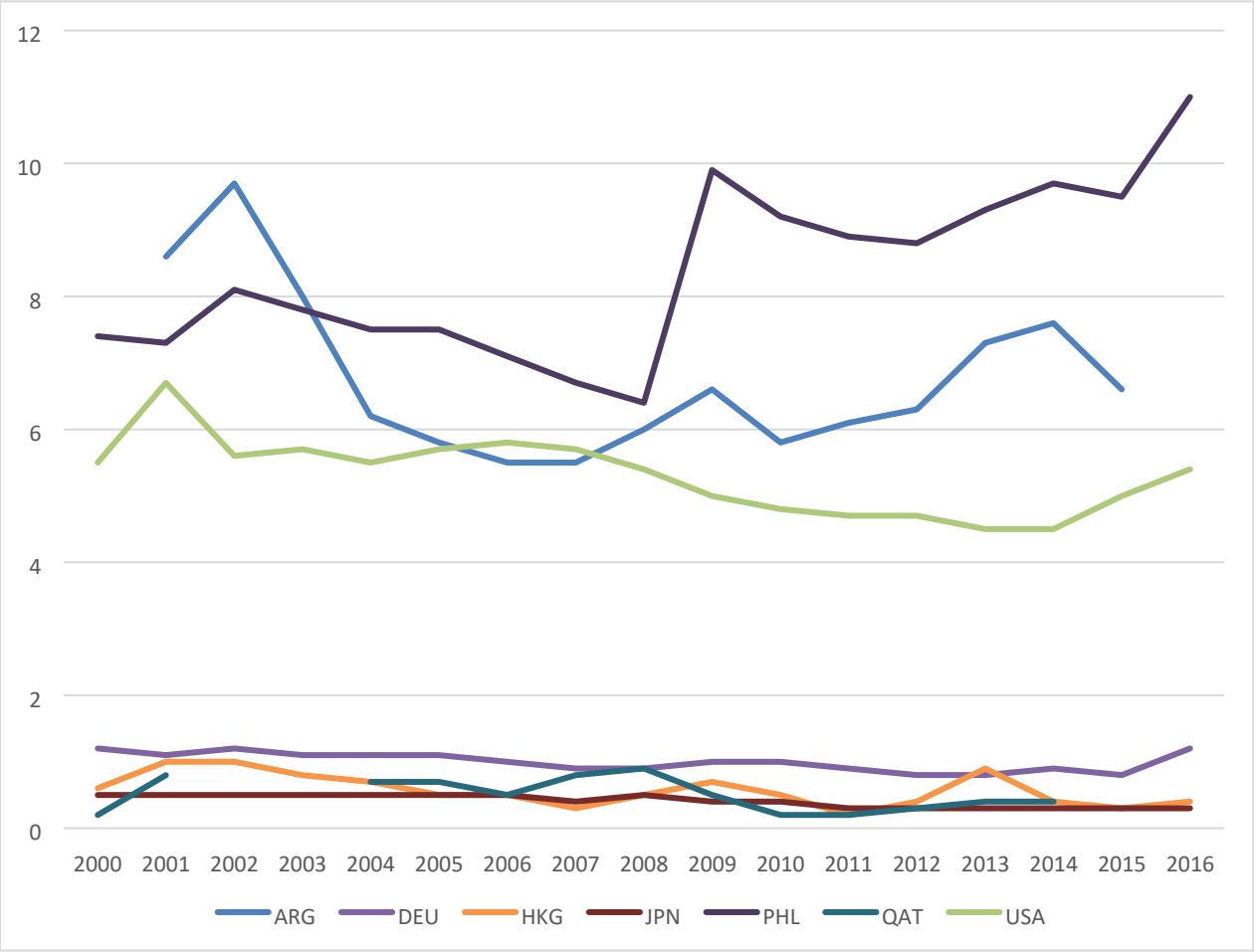

Figure 2. Sample Homicide Rates: Selected Countries from 1st to 4th Quartiles

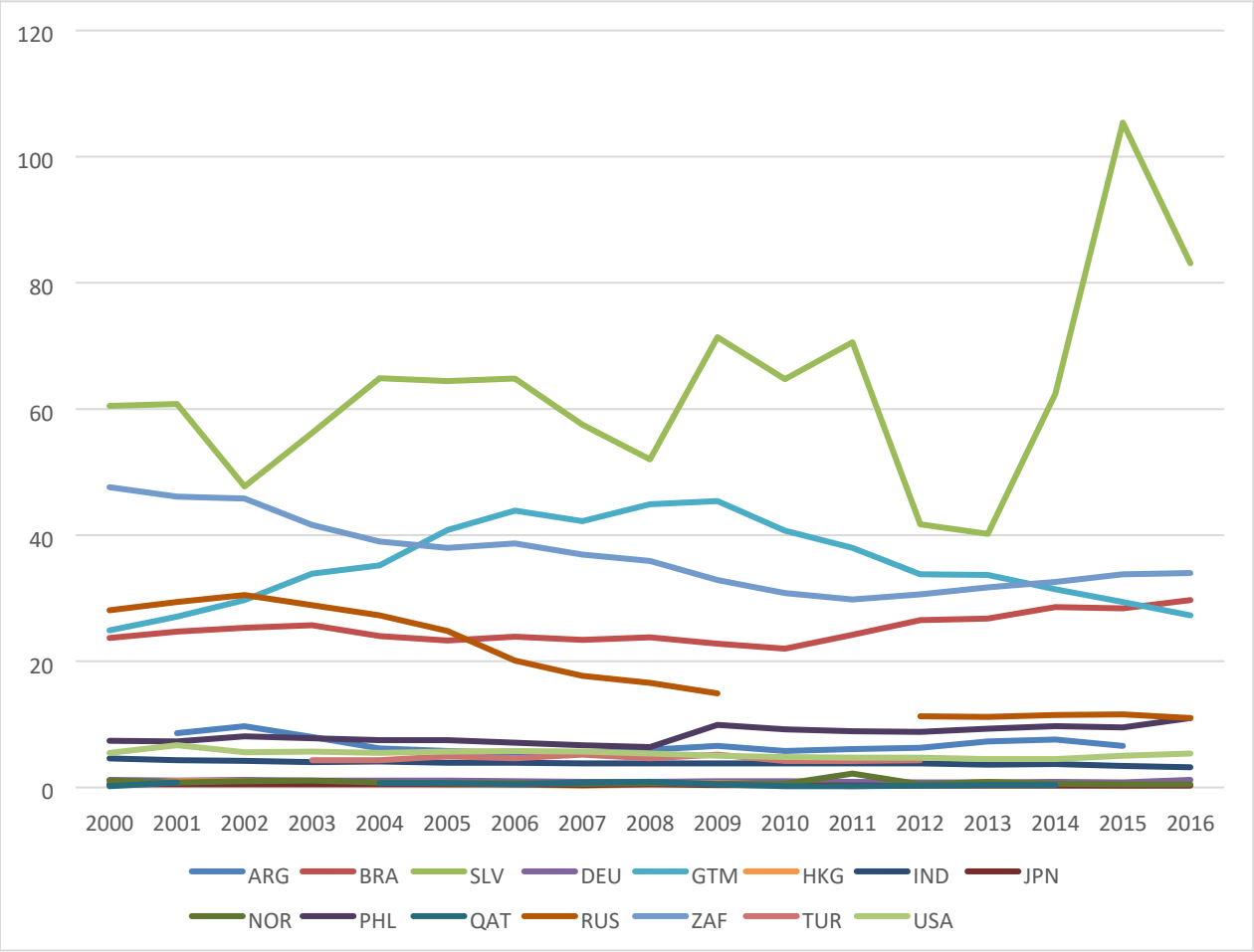

Table 1. Estimating Sample Descriptive Statistics

Annual, 2000-2016
170 unique countries of origin; 170 unique countries of destination; 25,802 unique pairs.
"Origin" refers to exporting country, "destination" to importing country.

Variable	No. Obs.	Mean	Standard Deviation	Minimum	Maximum
Exports, origin to destination, US$ m (dyadic)	436,811	378.7374	11949.56	0	3038829
Member of a currency union (dyadic)	436,811	0.0485061	0.2148333	0	1
Member of an FTA(dyadic)	436,811	0.1394219	0.3463866	0	1
homicide rate per 100,000 people, origin	354,838	7.840607	11.98778	0	105.4
homicide rate per 100,000 people, destination	355,119	7.895749	11.99382	0	105.4
Interethnic fighting, origin	436,811	0.0185526	0.1349388	0	1
Interethnic fighting, destination	436,811	0.0419174	0.2004008	0	1
Nominal GDP, US$ b, origin	418,918	387.1459	1432.251	0.0132	19087
Nominal GDP, US$ b, destination	419,683	386.2863	1431.034	0.0132	19087
International war fought at home, origin	429,338	0.0055923	0.0745726	0	1
International war fought at home, destination	438,194	0.00597	0.0770346	0	1
EU member, origin	429,338	0.1603003	0.3668847	0	1
EU member, destination	438,194	0.1564239	0.3632571	0	1
WTO member, origin	429,338	0.8196013	0.3845196	0	1
WTO member, destination	438,194	0.8114602	0.391143	0	1
Population, millions, origin	404,622	43.50665	154.0302	0.0044	1403.5
Population, millions, destination	405,968	43.41724	153.7645	0.0044	1403.5

Table 2. Differentiated Manufactures

Dependent variable: noted by column.
Variables are exporter-specific in columns (2)-(4), and importer-specific in columns (5)-(7).

VARIABLES	(1) Exports, o to d	(2) Exporter-time FEs	(3) Exporter-time FEs	(4) Exporter-time FEs	(5) Importer-time FEs	(6) Importer-time FEs	(7) Importer-time FEs
FTA	0.0139						
	(0.0391)						
CU	0.194***						
	(0.0586)						
Homicide rate		-0.00655**	-0.00643**	-0.00565**	-0.0107***	-0.0101***	-0.0104***
		(0.00257)	(0.00257)	(0.00253)	(0.00181)	(0.00177)	(0.00178)
W		-0.00613	-0.0159	-0.00485	0.183**	0.143	0.139
		(0.112)	(0.112)	(0.112)	(0.0892)	(0.0915)	(0.0909)
IF		0.0848*	0.0904*	0.0899*	-0.0141	-0.0174	-0.0168
		(0.0509)	(0.0534)	(0.0539)	(0.0609)	(0.0666)	(0.0665)
Population		0.00485***	0.00489***	0.00521***	0.00406***	0.00416***	0.00404***
		(0.000665)	(0.000671)	(0.000708)	(0.000777)	(0.000768)	(0.000754)
GDP		4.17e-06	3.52e-06	8.18e-06	-1.63e-05	-1.85e-05	-2.03e-05
		(1.19e-05)	(1.17e-05)	(1.18e-05)	(1.74e-05)	(1.66e-05)	(1.68e-05)
WTO			0.0559	0.0741		0.246***	0.239***
			(0.0645)	(0.0638)		(0.0496)	(0.0498)
EU				0.341***			-0.129***
				(0.0416)			(0.0383)
Constant	10.66***	-5.186***	-5.233***	-5.305***	-4.173***	-4.376***	-4.349***
	(0.0435)	(0.0551)	(0.0767)	(0.0761)	(0.0516)	(0.0639)	(0.0640)
Observations	427,282	2,094	2,094	2,094	2,094	2,094	2,094
R-squared		0.986	0.986	0.986	0.986	0.986	0.986
Exporter-Time FEs	YES						
Importer-Time FEs	YES						
Exporter-Importer FEs	YES						
Year FEs		YES	YES	YES	YES	YES	YES
Exporter FEs		YES	YES	YES			
Importer FEs					YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3. Undifferentiated Manufactures

Dependent variable: noted by column.
Variables are exporter-specific in columns (2)-(4), and importer-specific in columns (5)-(7).

VARIABLES	(1) Exports, _o to d	(2) Exporter-time FEs	(3) Exporter-time FEs	(4) Exporter-time FEs	(5) Importer-time FEs	(6) Importer-time FEs	(7) Importer-time FEs
FTA	0.124***						
	(0.0356)						
CU	0.307***						
	(0.0322)						
Homicide rate		-0.0014	-0.0012	-0.0011	-0.0087***	-0.0082***	-0.0085***
		(0.0022)	(0.002)	(0.0022)	(0.0019)	(0.0018)	(0.0018)
W		-0.0014	-0.019	-0.019	0.0182	-0.0163	-0.0198
		(0.106)	(0.109)	(0.109)	(0.0775)	(0.0807)	(0.0803)
IF		-0.098**	-0.088**	-0.088**	0.088	0.085	0.086
		(0.0400)	(0.043)	(0.0429)	(0.0651)	(0.0686)	(0.0681)
POP		0.0017***	0.0017***	0.0018***	0.0035***	0.0036***	0.0035***
		(0.0005)	(0.0005)	(0.0005)	(0.0006)	(0.0006)	(0.0006)
GDP		3.16e-05**	3.05e-05*	3.06e-05*	-1.72e-05	-1.91e-05	-2.05e-05
		(1.59e-05)	(1.57e-05)	(1.57e-05)	(1.35e-05)	(1.31e-05)	(1.32e-05)
WTO			0.100	0.100		0.212***	0.206***
			(0.111)	(0.111)		(0.0510)	(0.0508)
EU				0.012			-0.106***
				(0.031)			(0.0315)
Constant	11.07***	-5.145***	-5.230***	-5.232***	-3.168***	-3.344***	-3.322***
	(0.0357)	(0.0468)	(0.109)	(0.109)	(0.0448)	(0.0601)	(0.0597)
Observations	423,214	2,094	2,094	2,094	2,094	2,094	2,094
R-squared		0.985	0.985	0.985	0.986	0.986	0.986
Exporter-Time FEs	YES						
Importer-Time FEs	YES						
Exporter-Importer FEs	YES						
Year FEs		YES	YES	YES	YES	YES	YES
Exporter FEs		YES	YES	YES			
Importer FEs					YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4. Services

Dependent variable: noted by column.
Variables are exporter-specific in columns (2)-(4), and importer-specific in columns (5)-(7).

VARIABLES	(1) Exports, o to d	(2) Exporter-time_FEs	(3) Exporter-time_FEs	(4) Exporter-time_FEs	(5) Importer-time_FEs	(6) Importer-time_FEs	(7) Importer-time_FEs
FTA	0.110						
	(0.068)						
CU	0.550***						
	(0.067)						
Homicide rate		-0.0369***	-0.0367***	-0.0372***	-0.0114	-0.0108	-0.0115
		(0.014)	(0.014)	(0.014)	(0.008)	(0.008)	(0.008)
W		0.269	0.263	0.253	0.199	0.185	0.166
		(0.473)	(0.475)	(0.476)	(0.467)	(0.471)	(0.472)
IF		0.510**	0.519**	0.520**	0.115	0.108	0.121
		(0.234)	(0.236)	(0.234)	(0.364)	(0.368)	(0.365)
POP		0.011***	0.011***	0.011***	0.003**	0.003**	0.002*
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
GDP		-0.0002***	-0.0002***	-0.0002***	-0.0001***	-0.0001***	-0.0002***
		(3.31e-05)	(3.28e-05)	(3.41e-05)	(4.02e-05)	(3.97e-05)	(4.21e-05)
WTO			0.0920	0.0745		0.223	0.193
			(0.131)	(0.131)		(0.147)	(0.146)
EU				-0.316***			-0.545***
				(0.0800)			(0.100)
Constant	13.93***	-7.534***	-7.615***	-7.556***	-3.835***	-4.024***	-3.927***
	(0.087)	(0.163)	(0.222)	(0.223)	(0.117)	(0.184)	(0.185)
Observations	65,739	1,784	1,784	1,784	1,788	1,788	1,788
R-squared		0.944	0.944	0.944	0.940	0.940	0.940
Exporter-Time FEs	YES						
Importer-Time FEs	YES						
Exporter-Importer FEs	YES						
Year FEs		YES	YES	YES	YES	YES	YES
Exporter FEs		YES	YES	YES			
Importer FEs					YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5. Agriculture

Dependent variable: noted by column.
Variables are exporter-specific in columns (2)-(4), and importer-specific in columns (5)-(7).

VARIABLES	(1) Exports, o to d	(2) Exporter-time FEs	(3) Exporter-time FEs	(4) Exporter-time FEs	(5) Importer-time FEs	(6) Importer-time FEs	(7) Importer-time FEs
FTA	0.132***						
	(0.0318)						
CU	0.954***						
	(0.0527)						
Homicide rate		-0.0099***	-0.0098***	-0.0094***	-0.0072***	-0.0069***	-0.0078***
		(0.00267)	(0.00267)	(0.00266)	(0.00227)	(0.00227)	(0.00228)
W		0.424***	0.412***	0.418***	-0.0226	-0.0476	-0.0610
		(0.0910)	(0.0866)	(0.0869)	(0.114)	(0.119)	(0.118)
IF		-0.0420	-0.0353	-0.0356	0.100**	0.0984*	0.100*
		(0.0429)	(0.0435)	(0.0439)	(0.0479)	(0.0525)	(0.0521)
POP		0.00124*	0.00130*	0.00148**	0.0035***	0.0035***	0.0032***
		(0.000661)	(0.000667)	(0.000688)	(0.000780)	(0.000779)	(0.000745)
GDP		-1.20e-05	-1.28e-05	-1.02e-05	3.9e-05***	3.7e-05***	3.2e-05***
		(1.02e-05)	(1.04e-05)	(1.08e-05)	(1.19e-05)	(1.17e-05)	(1.19e-05)
WTO			0.0671	0.0775		0.154**	0.132**
			(0.0661)	(0.0660)		(0.0611)	(0.0600)
EU				0.194***			-0.407***
				(0.0428)			(0.0399)
Constant	9.623***	-5.133***	-5.190***	-5.231***	-1.387***	-1.514***	-1.428***
	(0.0540)	(0.0548)	(0.0797)	(0.0801)	(0.0532)	(0.0723)	(0.0702)
Observations	295,461	2,094	2,094	2,094	2,094	2,094	2,094
R-squared		0.982	0.982	0.982	0.974	0.974	0.975
Exporter-Time FEs	YES						
Importer-Time FEs	YES						
Exporter-Importer FEs	YES						
Year FEs		YES	YES	YES	YES	YES	YES
Exporter FEs		YES	YES	YES			
Importer FEs					YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6. Mining

Dependent variable: noted by column.
Variables are exporter-specific in columns (2)-(4), and importer-specific in columns (5)-(7).

VARIABLES	(1) Exports, o to d	(2) Exporter-time FEs	(3) Exporter-time FEs	(4) Exporter-time FEs	(5) Importer-time FEs	(6) Importer-time FEs	(7) Importer-time FEs
FTA	-0.0590						
	(0.0696)						
CU	0.592***						
	(0.187)						
Homicide rate		-0.0179**	-0.0158*	-0.0154*	-0.0104	-0.00957	-0.00992
		(0.00864)	(0.00874)	(0.00876)	(0.00916)	(0.00917)	(0.00920)
W		0.544	0.374	0.379	-0.289	-0.348	-0.353
		(0.364)	(0.362)	(0.362)	(0.326)	(0.327)	(0.328)
IF		0.106	0.203	0.203	0.546**	0.542**	0.542**
		(0.148)	(0.166)	(0.166)	(0.270)	(0.274)	(0.273)
POP		-0.0051***	-0.0044***	-0.0042**	0.0106***	0.0108***	0.0106***
		(0.00157)	(0.00163)	(0.00165)	(0.00128)	(0.00128)	(0.00127)
GDP		-8.4e-05***	-9.5e-05***	-9.3e-05***	-9.77e-06	-1.30e-05	-1.51e-05
		(3.11e-05)	(3.40e-05)	(3.41e-05)	(2.99e-05)	(2.96e-05)	(2.99e-05)
WTO			0.969***	0.978***		0.361***	0.353***
			(0.254)	(0.254)		(0.133)	(0.134)
EU				0.170			-0.152
				(0.133)			(0.0987)
Constant	9.952***	-5.604***	-6.426***	-6.462***	-3.092***	-3.391***	-3.359***
	(0.113)	(0.131)	(0.252)	(0.255)	(0.143)	(0.172)	(0.172)
Observations	238,897	2,084	2,084	2,084	2,094	2,094	2,094
R-squared		0.940	0.940	0.940	0.928	0.929	0.929
Exporter-Time FEs	YES						
Importer-Time FEs	YES						
Exporter-Importer FEs	YES						
Year FEs		YES	YES	YES	YES	YES	YES
Exporter FEs		YES	YES	YES			
Importer FEs					YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7. Differentiated Manufactures, Lagged Homicide

VARIABLES	(1) Exports, o to d	(2) Exporter - Time FEs	(3) Exporter - Time FEs	(4) Exporter - Time FEs	(5) Importer - Time FEs	(6) Importer - Time FEs	(7) Importer - Time FEs
FTA	0.0139						
	(0.0391)						
CU	0.194***						
	(0.0586)						
Homicide rate		-0.00238	-0.00237	-0.00214	-0.00383*	-0.00362*	-0.00377*
		(0.00375)	(0.00376)	(0.00375)	(0.00214)	(0.00211)	(0.00211)
Homicide rate, 1 year lag		-0.00132	-0.00132	-0.00112	-0.00689**	-0.00669**	-0.00690**
		(0.00356)	(0.00357)	(0.00355)	(0.00270)	(0.00269)	(0.00271)
W		0.0154	0.0149	0.0262	0.156***	0.140**	0.136**
		(0.0808)	(0.0774)	(0.0797)	(0.0556)	(0.0600)	(0.0594)
IF		0.111	0.112	0.112	-0.00116	0.00656	0.00795
		(0.0867)	(0.0892)	(0.0917)	(0.121)	(0.120)	(0.119)
Population		4.255**	4.263**	4.583**	3.995*	4.070*	3.947*
		(1.692)	(1.704)	(1.795)	(2.112)	(2.129)	(2.082)
GDP		0.0145	0.0145	0.0163	-0.00815	-0.00824	-0.0103
		(0.0228)	(0.0228)	(0.0226)	(0.0462)	(0.0455)	(0.0461)
WTO			0.00601	0.0304		0.181***	0.170**
			(0.121)	(0.120)		(0.0663)	(0.0670)
EU				0.255***			-0.144*
				(0.0750)			(0.0736)
Remoteness		0.964**	0.962**	0.848**	2.884	3.282	3.630
		(0.375)	(0.374)	(0.372)	(3.188)	(3.067)	(3.106)
Constant	10.66***	-6.674***	-6.677***	-6.569***	-4.284***	-4.470***	-4.463***
	(0.0435)	(0.556)	(0.565)	(0.561)	(0.259)	(0.257)	(0.259)
Observations	427,282	1,898	1,898	1,898	1,898	1,898	1,898
R-squared		0.988	0.988	0.988	0.987	0.987	0.987
Exporter-Time FEs	YES						
Importer-Time FEs	YES						
Exporter-Importer FEs	YES						
Year FEs		YES	YES	YES	YES	YES	YES
Exporter FEs		YES	YES	YES			
Importer FEs					YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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