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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 1990-2017, 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 7%. If the same change occurred on the importer side, there would be a decrease in importer market access of 8%.

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 manufactures, extractive services, services, 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 – exports see a much larger reply to changes in homicide rates than do imports. For example, service exports are diminished

by 44% by a one-standard deviation change in civil violence; service imports decline by about 20%.

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 (1990-2017). 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 high-level 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%, and a loss of GDP of about 5%. 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% 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 of a single country, 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),

[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).

and Fearon and Hoeffler (2018) exemplify this pivot. Our study picks up on this emphasis to 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:

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

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 United States, the United Kingdom, 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

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

not just with the foreign belligerents. The United States 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 that country against the Taliban government, and the value for the United States, the United Kingdom, 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, 1990-2017, from 168 countries, for trade, other 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

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

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.

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) which also reports data on other major types of crime, though 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.

homicide data is by far the most complete.[14] In our 1990-2017 sample, the mean homicide rate per country per year unweighted by population size is approximately 8, with a standard deviation of 12. There is considerable variance between countries and within countries over time. Figures 1-3 illustrate.

Figure 1 displays population-weighted and unweighted global annual mean homicide rates from 1990 through 2020, the full range of current data. Globally, homicide is falling. In 1994 both measures showed mean global homicide rates at approximately 10 per 100,000 of population, and since then both have trended downward in fits and starts to around 6 per 100,000 in 2020. But there's extraordinary variance in the levels and trends of individual countries.

Figure 2 displays examples of countries around or below the 25th percentile (approximately 1.2) and the median (approximately 3.0) homicide rates. The countries displayed that are around the 25th percentile—Germany (DEU), Hong Kong (HKG), Japan (JPN), and Qatar (QAT)—have homicide rates that can barely be distinguished from zero. Countries around the 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 3, which adds to Figure 2 several examples of countries in the top quartile of 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.

[14] The relation between homicide and "significant assault" and "sexual assault" is highly statistically significant, with correlation coefficients between 0.15 and 0.20, which can be estimated on only a small proportion of the homicide observations.

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.[15]

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 production sectors, spanning the years 1990 to 2019. The data are divided into industries (agriculture, mining and energy, manufacturing, and services), with data from 120 countries.[16] 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 -5, present, respectively, the results for manufactures, services, agriculture, and mining/extractive sectors. 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 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 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).

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

Columns (2) and (3) present the results of estimating equation (2), where the dependent variable is the value of the exporter-time fixed effect (estimated by the column (1) regression). In column (2) we control for war and inter-ethnic fighting using the control variables discussed earlier; in column (3) we present results where observations that include war and inter-ethnic fighting are omitted. These extreme events make measuring homicide (as distinct from ethnic-related and war-related killings) a challenge. In addition, these events are relatively rare in our time period and therefore may tell us more about a small number of countries rather than the violence events per se. Likewise we present in columns (4) and (5) the results for imports, with and without the high-level violence variables. [17]

In all columns 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).

Moreover, these results bear clinical significance. For the purpose of comparison we point the reader to Table 6. Each cell entry is the predicted change in exports or imports for a one standard deviation increase in homicide rates (approximately a change of 12 homicides per 100,000 of population). All of the cell entries are negative, with values that range from -1% to -44%.[18] In manufacturing, the size of the negative effect is roughly equivalent between exports and imports; for all other sectors the impact of homicide on exports is significantly larger than its impact on imports.

[17] The number of observations in column 1 is substantially larger than that in columns (2)-(5). In (2)-(5) the data are no longer dyadic; each country has one value for its fixed effect per time period.

[18] A one standard deviation increase in the homicide rate (approximately a change of 12 homicides per 100,000 of population) predicts a 44 percent decrease in exports of services (that is, -0.0352223 x 12.53 x 100, where the first number is the estimated coefficient).

In agriculture, the effects of homicide are not statistically significant, across the board. Given the strong statistical significance elsewhere this is a puzzle. The rural character of agricultural production (and the separation between producers) may mean that changes in homicide rates have only very local effects.

Manufactures sees very strong effects on both exports and imports; a change in exports or imports of 8% is a sizeable reply to a change in homicide.[19] Mining sees changes of more than 30% for exports, and almost 20% for imports. Services see the strongest reply to changes in homicide, with values more than 40% for exports and about 20% for imports. Exports of education and tourism require visiting and staying in the country, so it is not surprising that these exports are very sensitive to homicide rates.[20]

Taken together, with the exception of agriculture, we find sizeable effects on trade from changes in homicide rates.

Looking across the tables there are a handful of other results 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

[19] In an earlier version of this work, with a smaller data set, we were able to divide manufactures into differentiated and non-differentiated sectors. We found significantly larger effects of inter-personal violence for differentiated goods. In our next iteration with our larger data set we will also do such a breakout.

[20] In results not reported here, we include a one-year lag on homicide in addition to the contemporaneous measure. It is plausible to imagine that—given contract lags and other delays—it may be last year's homicide rate that affects contemporaneous trade. Yet when we included the lag, the combined effect of the lag plus contemporaneous homicide yielded effects very similar to those of the contemporaneous variable alone.

may be a measure of the value of winning a conflict, which may in turn induce wars between states or between ethnic groups.

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, 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 we cannot claim to have proved a causal relationship. Nonetheless, we believe that we have provided the first evidence of a new stylized fact about the global economy: that interpersonal violence within countries—along with its manifest human suffering—brings with it additional costs in the form of trade dis-integration.

Figure 1. Global Average Homicide Rate, 1990-2020

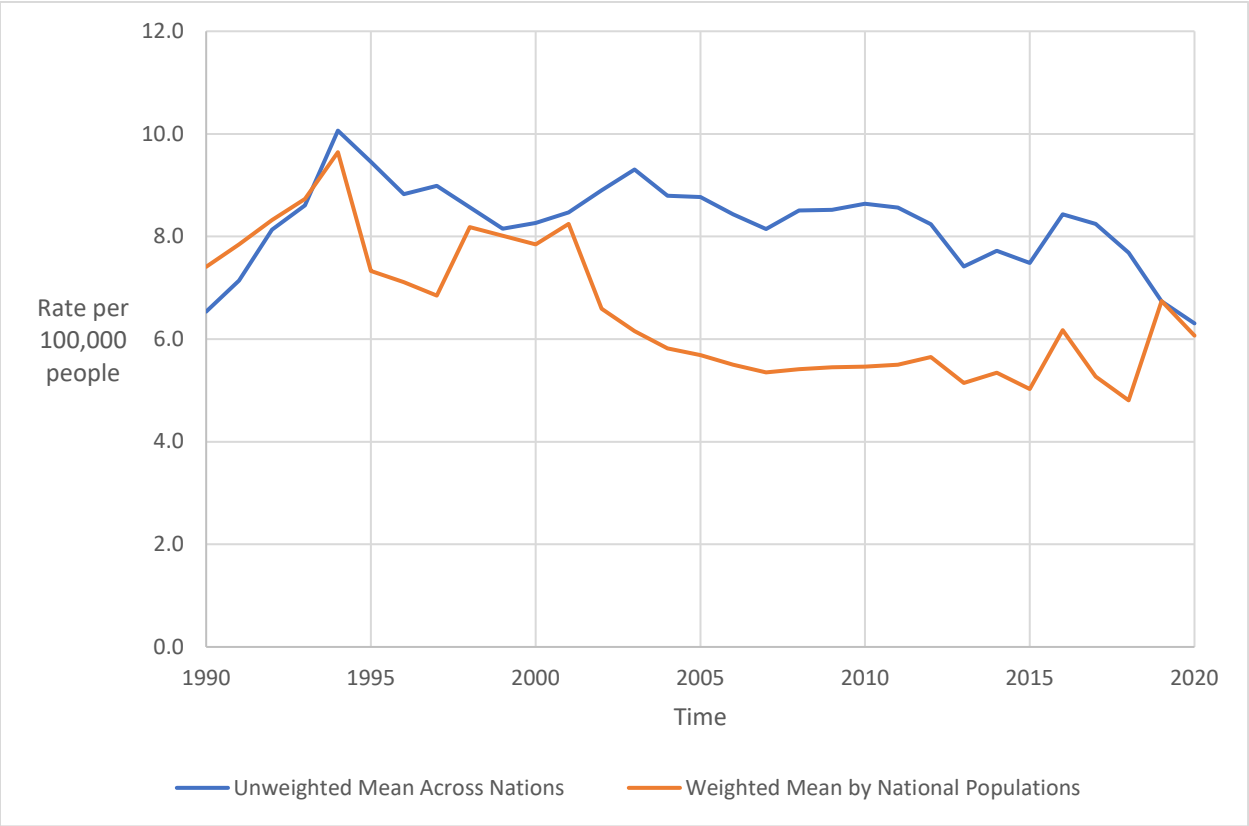

Figure 2. Sample Homicide Rates: Countries Around 1st Quartile and Median

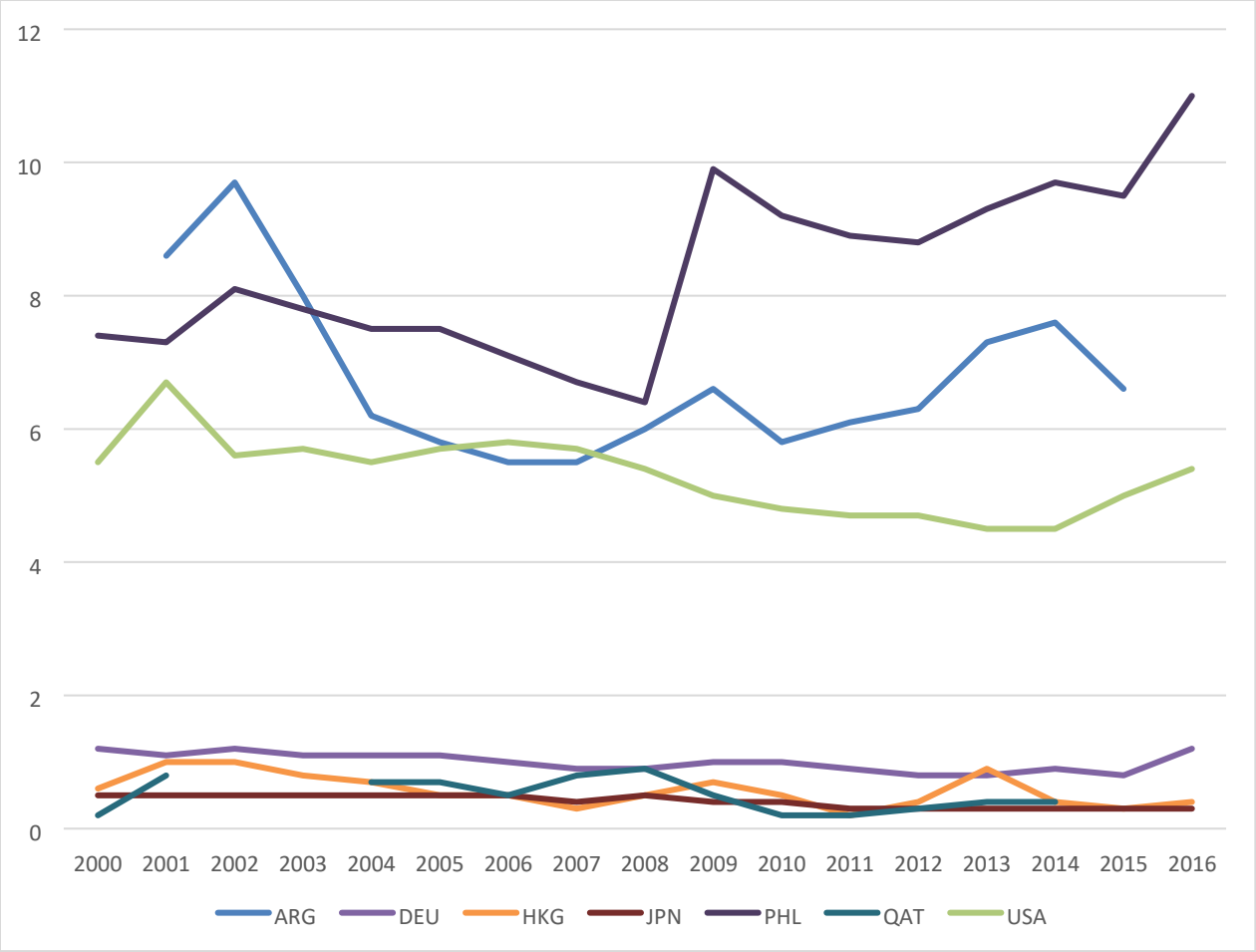

Figure 3. Sample Homicide Rates: Selected Countries from 1st to 4th Quartiles

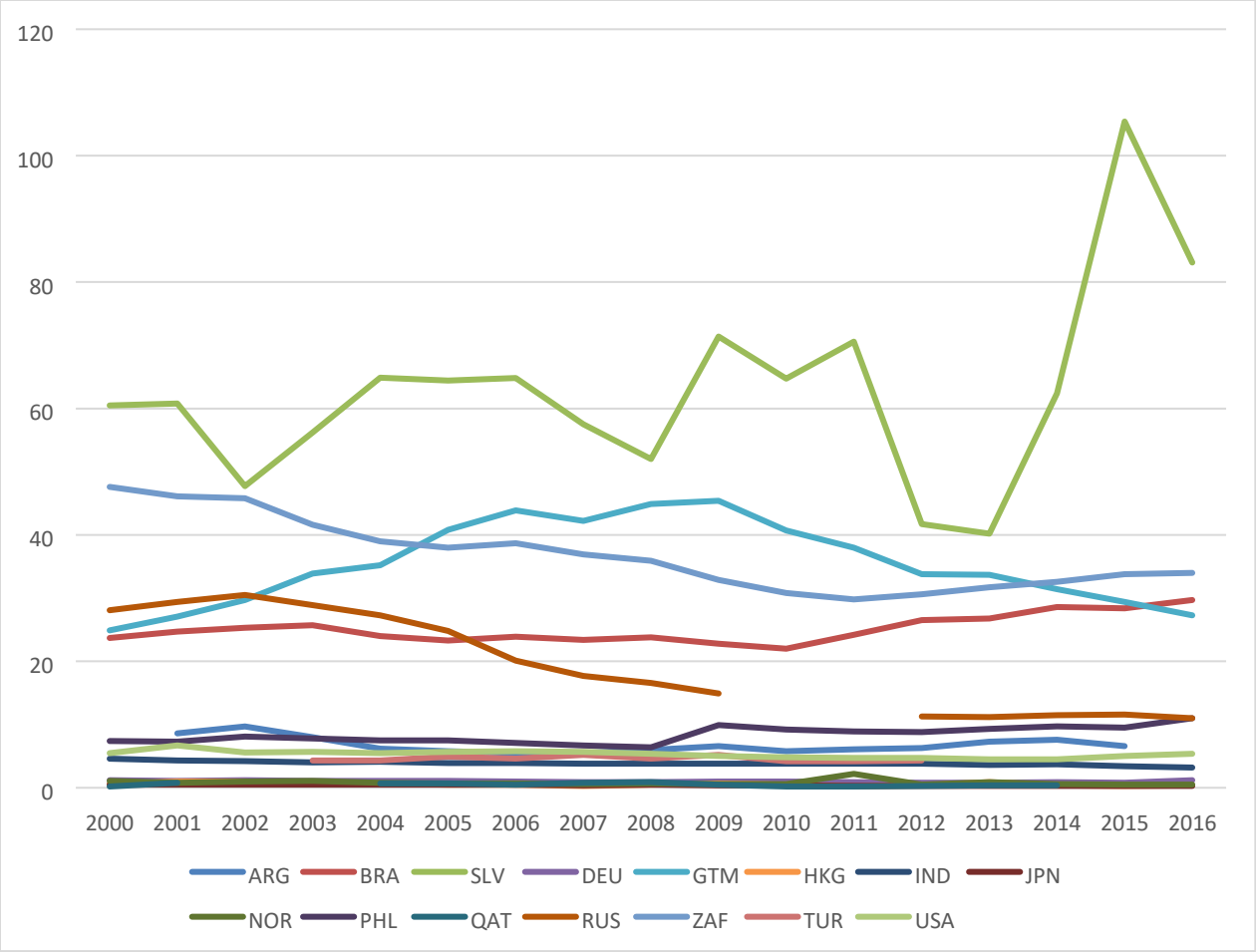

Table 1. Estimating Sample Descriptive Statistics

Annual, 1990-2017
251 unique countries of origin (exporting country) and destination (importing country).

Variable	Obs	Mean	Std. Dev.	Min	Max
Exports, origin to destination, US$ m (dyadic)	1,202,105	515.303	32080.23	0	1.32E+07
Member of a currency union (dyadic)	1,202,105	0.0363446	0.1871461	0	1
Member of an FTA(dyadic)	1,202,105	0.1016409	0.3021756	0	1
Homicide rate per 100,000 people, origin	691,448	7.872305	12.39851	0	141.7226
Homicide rate per 100,000 people, destination	701,194	8.069031	12.63031	0	141.7226
Interethnic fighting, origin	1,158,961	0.0353256	0.1846016	0	1
Interethnic fighting, destination	1,158,961	0.0358166	0.1858326	0	1
Nominal GDP, US$ b, origin	916,273	290.4859	1230.645	0.0088244	20544.34
Nominal GDP, US$ b, destination	916,557	290.2248	1230.421	0.0088244	20544.34
International war fought at home, origin	1,202,105	0.0064104	0.0798081	0	1
International war fought at home, destination	1,202,105	0.0063222	0.0792608	0	1
EU member, origin	1,202,105	0.1127397	0.3162745	0	1
EU member, destination	1,202,105	0.1121882	0.315598	0	1
WTO member, origin	1,202,105	0.6072614	0.4883597	0	1
WTO member, destination	1,202,105	0.6231228	0.4846039	0	1
Population, millions, origin	952,332	38.5345	139.0173	0.004376	1409.517
Population, millions, destination	935,267	39.07827	140.4058	0.004376	1409.517

Table 2. Manufacturing, 1991-2017

VARIABLES	(1) Exports, o to d	(2) Export-Time FEs	(3) Export-Time FEs	(4) Import-Time FEs	(5) Import-Time FEs
FTA	0.218***	-	-	-	-
	(0.0519)	-	-	-	-
Currency Union	0.460***	-	-	-	-
	(0.0433)	-	-	-	-
Homicide Rate	-	-0.00545	-0.00585	-0.00645***	-0.00680**
	-	(0.00350)	(0.00360)	(0.00247)	(0.00265)
War	-	0.246	-	0.0323	-
	-	(0.266)	-	(0.0390)	-
Inter-Ethnic Fighting	-	-0.311	-	-0.205	-
	-	(0.213)	-	(0.154)	-
Population	-	0.00216	0.00265**	0.00257**	0.00303***
	-	(0.00154)	(0.00120)	(0.00105)	(0.000890)
GDP, $b Current	-	-5.74e-05	-5.76e-05	-6.08e-05**	-6.17e-05**
	-	(5.26e-05)	(5.24e-05)	(3.03e-05)	(3.00e-05)
WTO Member	-	-0.208	-0.206	-0.0663	-0.0668
	-	(0.136)	(0.139)	(0.0820)	(0.0853)
EU Member	-	-0.00202	-0.00193	-0.176*	-0.176*
	-	(0.118)	(0.118)	(0.0964)	(0.0963)
Constant	11.60***	-7.186***	-7.201***	-3.586***	-3.604***
	(0.0492)	(0.169)	(0.165)	(0.114)	(0.113)
Observations	1,202,105	2,586	2,586	2,528	2,528
R-squared	-	0.974	0.974	0.978	0.978
Exporter-Time FEs	YES	-	-	-	-
Importer-Time FEs	YES	-	-	-	-
Exporter-Importer FEs	YES	-	-	-	-
Year FEs	-	YES	YES	YES	YES
Exporter FEs	-	YES	YES	-	-
Importer FEs	-	-	-	YES	YES
SEs	Clustered by Country Pair	Clustered by Source	Clustered by Source	Clustered by Destination	Clustered by Destination

*** p<0.01, ** p<0.05, * p<0.1

Table 3. Services, 2000-2017

VARIABLES	(1) Exports, o to d	(2) Exporter-Time FEs	(3) Exporter-Time FEs	(4) Importer-Time FEs	(5) Importer-Time FEs
FTA	0.0864	-	-	-	-
	(0.0585)	-	-	-	-
Currency Union	0.623***	-	-	-	-
	(0.0773)	-	-	-	-
Homicide Rate	-	-0.0352***	-0.0335**	-0.0164	-0.0150
	-	(0.0135)	(0.0134)	(0.0120)	(0.0119)
War	-	-0.315	-	0.190	-
	-	(0.234)	-	(0.679)	-
Inter-Ethnic Fighting	-	0.660	-	0.565**	-
	-	(0.448)	-	(0.234)	-
Population	-	0.0111***	0.00846**	0.00571**	0.00346
	-	(0.00362)	(0.00332)	(0.00224)	(0.00228)
GDP, $b Current	-	-0.000166***	-0.000155**	-0.000155*	-0.000145*
	-	(6.17e-05)	(6.95e-05)	(7.89e-05)	(8.41e-05)
WTO Member	-	-0.112	-0.152	0.299	0.266
	-	(0.239)	(0.243)	(0.222)	(0.230)
EU Member	-	-0.449***	-0.451***	-0.690***	-0.685***
	-	(0.138)	(0.138)	(0.199)	(0.197)
Constant	13.88***	-7.185***	-7.022***	-4.200***	-4.055***
	(0.0887)	(0.312)	(0.296)	(0.247)	(0.249)
Observations	97,178	1,866	1,866	1,860	1,860
R-squared	-	0.947	0.947	0.954	0.953
Exporter-Time FEs	YES	-	-	-	-
Importer-Time FEs	YES	-	-	-	-
Exporter-Importer FEs	YES	-	-	-	-
Year FEs	-	YES	YES	YES	YES
Exporter FEs	-	YES	YES	-	-
Importer FEs	-	-	-	YES	YES
SEs	Clustered by Country Pair	Clustered by source	Clustered by Source	Clustered by Destination	Clustered by Destination

*** p<0.01, ** p<0.05, * p<0.1

Table 4. Mining and Extractive Industry, 1990-2017

VARIABLES	Exports, o to d	Exporter-Time FEs	Exporter-Time FEs	Importer-Time FEs	Importer-Time FEs
FTA	-0.201***	-	-	-	-
	(0.0582)	-	-	-	-
Currency Union	0.240	-	-	-	-
	(0.154)	-	-	-	-
Homicide Rate	-	-0.0252***	-0.0256***	-0.0146	-0.0151
	-	(0.00830)	(0.00840)	(0.00950)	(0.00959)
War	-	0.741	-	0.179*	-
	-	(0.759)	-	(0.101)	-
Inter-Ethnic Fighting	-	-0.375	-	-0.351	-
	-	(0.569)	-	(0.444)	-
Population	-	-0.00339*	-0.00304***	0.00431	0.00508**
	-	(0.00192)	(0.000916)	(0.00284)	(0.00198)
GDP, $b Current	-	-0.000133**	-0.000131**	-4.53e-05	-4.56e-05
	-	(5.50e-05)	(5.25e-05)	(0.000102)	(0.000101)
WTO Member	-	0.276	0.285	-0.462	-0.460
	-	(0.391)	(0.393)	(0.316)	(0.319)
EU Member	-	-0.0840	-0.0837	-0.531**	-0.530**
	-	(0.200)	(0.200)	(0.237)	(0.236)
Constant	10.90***	-7.125***	-7.128***	-3.833***	-3.860***
	(0.112)	(0.253)	(0.252)	(0.297)	(0.289)
Observations	564,296	2,742	2,742	2,756	2,756
R-squared		0.920	0.920	0.884	0.884
Exporter-Time FEs	YES	-	-	-	-
Importer-Time FEs	YES	-	-	-	-
Exporter-Importer FEs	YES	-	-	-	-
Year FEs	-	YES	YES	YES	YES
Exporter FEs	-	YES	YES	-	-
Importer FEs	-	-	-	YES	YES
SEs	Clustered by Country Pair	Clustered by Source	Clustered by Source	Clustered by Destination	Clustered by Destination

*** p<0.01, ** p<0.05, * p<0.1

Table 5. Agriculture, 1990-2017

VARIABLES	(1) Exports, o to d	(2) Exporter-Time FEs	(3) Exporter-Time FEs	(4) Importer-Time FEs	(5) Importer-Time FEs
FTA	0.216***	-	-	-	-
	(0.0358)	-	-	-	-
Currency Union	0.999***	-	-	-	-
	(0.0512)	-	-	-	-
Homicide Rate	-	-0.00591	-0.00617	-0.000470	-0.000595
	-	(0.00524)	(0.00529)	(0.00292)	(0.00291)
War	-	0.0339	-	0.00154	-
	-	(0.159)	-	(0.0236)	-
Inter-Ethnic Fighting	-	-0.174	-	-0.0765	-
	-	(0.138)	-	(0.0686)	-
Population	-	0.000642	0.00100**	0.000951	0.00113**
	-	(0.000687)	(0.000469)	(0.000623)	(0.000569)
GDP, $b Current	-	-1.03e-05	-1.04e-05	-1.92e-05	-1.97e-05
	-	(2.01e-05)	(2.01e-05)	(3.42e-05)	(3.40e-05)
WTO Member	-	0.0155	0.0175	0.0739	0.0752
	-	(0.102)	(0.102)	(0.106)	(0.107)
EU Member	-	0.0762	0.0763	-0.568***	-0.568***
	-	(0.116)	(0.116)	(0.0735)	(0.0735)
Constant	9.161***	-5.452***	-5.461***	-1.381***	-1.387***
	(0.0531)	(0.128)	(0.128)	(0.0963)	(0.0959)
Observations	764,668	2,756	2,756	2,809	2,809
R-squared	-	0.962	0.962	0.963	0.963
Exporter-Time FEs	YES	-	-	-	-
Importer-Time FEs	YES	-	-	-	-
Exporter-Importer FEs	YES	-	-	-	-
Year FEs	-	YES	YES	YES	YES
Exporter FEs	-	YES	YES	-	-
Importer FEs	-	-	-	YES	YES
SEs	Clustered by Country Pair	Clustered by Source	Clustered by Source	Clustered by Destination	Clustered by Destination

*** p<0.01, ** p<0.05, * p<0.1

Table 6. Economic Significance of 1 Standard Deviation Increase from the Mean Homicide Rate

In one-tailed tests: * significant at 10%, ** significant at 5%, and *** significant at 1%, based on the underlying coefficient.

	Exports		Imports	
	Table columns (2)	Table columns (3)	Table columns (4)	Table columns (5)
Manufacturing	**-7% ***	**-7% ***	**-8% *****	**-8% *****
Services	**-44% *****	**-42% *****	**-21% ***	-19%
Extractive Industries	**-33%*****	**-34% *****	**-19% ***	**-19% ***
Agriculture	-8%	-8%	-1%	-1%

Bibliography

Anderson, James, E. and Eric van Wincoop. 2003. "Gravity with Gravitas: A Solution to the Border Puzzle." *American Economic Review*, 93(1), 170-192 (March). https://doi.org/10.1257/000282803321455214.

Anderton, Charles H. and Jurgen Brauer. 2019. "Mass Atrocities and their Prevention." Working Papers 1901, College of the Holy Cross, Department of Economics.

Bates, Robert. 2001. *Prosperity and Violence*, 1st edition. New York: Norton.

Bayer, Resat and Matthew Rupert. 2004. "Effects of Civil Wars on International Trade, 1950-92." *Journal of Peace Research*, 41(6), 699-713. https://doi.org/10.1177/0022343304047433 .

Blomberg, Brock, and G. Hess. 2006. "How Much Does Violence Tax Trade?" *The Review of Economics and Statistics*, 88(4), 599-612. https://doi.org/10.1162/rest.88.4.599.

Borchert, I., Larch, M., Shikher, S., and Yotov, Y. 2020. "The International Trade and Production Database for Estimation (ITPD-E)", *International Economics*, forthcoming. https://www.usitc.gov/data/gravity/itpde.htm.

Borchert, I., Larch, M., Shikher, S., and Yotov, Y. 2022. "The International Trade and Production Database for Estimation—Release 2 (ITPD-E_R02" U.S. International Trade Commission Working Paper 2022-07-A (July).

Collier, Paul and Marguerite Duponchel. 2012. "The Economic Legacy of Civil War: Firm-level Evidence from Sierra Leone." *Journal of Conflict Resolution*, 57(1), 68-88. https://doi.org/10.1177/0022002712464847.

Collier, Paul; V. L. Elliot, Hfivard Hegre, Anke Hoeffler, Marta Reynal-Querol, and Nicholas Sambanis. 2003. *Breaking the Conflict Trap: Civil War and Development Policy*. New York: Oxford University Press and World Bank.

Correia, Sergio, Paulo Guimarães and Thomas Zylkin. 2019. "ppmlhdfe: Fast Poisson Estimation with High-Dimensional Fixed Effects." https://arxiv.org/abs/1903.01690.

Eck, Kristine and Lisa Hultman. 2007. "One-sided violence against civilians in war: insights from new fatality data." *Journal of Peace Research*, 44(2), 233-246. https://ucdp.uu.se/downloads/.

Eggers, Peter H. and Sergey Nigai. 2015. "Structural Gravity with Dummies Only Constrained ANOVAtype Estimation of Gravity Models." *Journal of International Economics,* 97(1), June.https://doi.org/10.1016/j.jinteco.2015.05.004.

Fearon, James and Anke Hoeffler. 2018. "Beyond Civil War: The Costs of Interpersonal Violence," chapter 4 in Lomborg, Bjorn, ed., *Prioritizing Development: A Cost Benefit Analysis of the United Nations' Sustainable Development Goals*. Cambridge: Cambridge University Press, pp. 67-90. https://doi.org/10.1017/9781108233767.006.

Francis Fukuyama. 1996. *Trust. The Social Virtues and the Creation of Prosperity*. New York: The Free Press.

Glick, Reuven and Alan Taylor. 2010. "Collateral Damage: Trade Disruption and the Economic Impact of War." *Review of Economics and Statistics*, 92(1), 102-127 (February). https://doi.org/10.3386/w11565.

Goulas, Eleftherios and Athina Zervoyianni. 2015. "Economic growth and crime: Is there an asymmetric relationship?" *Economic Modeling,* 49 (2015), 286-295.

Gurevich, Tamara and Peter R. Herman. 2018. *The Dynamic Gravity Dataset: 1948-2016.* USITC Working Paper 2018-02-A. https://www.usitc.gov/data/gravity/dgd.htm.

Gurevich, Tamara, Peter R. Herman, Farid Toubal, and Yoto V. Yotov. 2021. "One Nation, One Language? Domestic Language Diversity, Trade and Welfare" U.S. International Trade Commission Working Paper 2021-01-B (January)

Head, Keith and Thierry Mayer. 2013. "Gravity Equations: Workhorse, Toolkit, and Cookbook." *Handbook of International Economics*, 4, January. http://dx.doi.org/10.1016/B978-0-444-54314-1.00003-3.

Herman, Peter. 2020. A Pragmatic Approach to Estimating Nondiscriminatory Non-tariff Trade Costs. USITC Office of Economics Working Paper. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3703002

Hoeffler, Anke. 2017. "What are the costs of violence?" *Politics, Philosophy, & Economics*, 16(4), 422445. https://doi.org/10.1177/1470594X17714270.

Hoeffler, Anke. 2018. "Security and Development: Shifting the Focus to Interpersonal Violence." *The Economics of Peace and Security Journal*, 13(1), 12-23. http://dx.doi.org/10.15355/epsj.13.1.12.

Kinzius, Luisa, Alexander Sandkamp and Erdal Yalcin. 2019. "Trade protection and the role of non-tariff barriers." *Review of World Economics*, 155(1). http://dx.doi.org/10.1007/s10290-019-00341-6.

Marshall, Monty G., Tedd Robert Gurr, and Barbara Harff. 2019. *Political Instability Task Force – Problem Set Codebook version 2018.* http://www.systemicpeace.org/inscr/PITFProbSetCodebook2018.pdf.

Melitz, Marc J, and Stephen J Redding. 2014. "Heterogeneous Firms and Trade," chapter 1 in Gita Gopinath, Elhanan Helpman, and Kenneth Rogoff, eds., *Handbook of International Economics*, Volume 4. Amsterdam: Elsevier.

Nino, Pedro, Roberto Coronado, Tom Fullerton, and Adam Walke. 2015. "Cross-border homicide impacts on economic activity in El Paso." *Empirical Economics*, 49(4).

Pettersson, Therese and Magnus Öberg. 2020. "Organized violence, 1989-2019." *Journal of Peace Research* 57(4). https://doi.org/10.1177/0022343319856046.

Pettersson, Therese. 2020. *UCDP/PRIO Armed Conflict Dataset Codebook* v 20.1. https://ucdp.uu.se/downloads/.

Pettersson, Therese. 2020. *UCDP One-sided Violence Codebook v 20.1.* https://ucdp.uu.se/downloads/.

Santos Silva, J.M.C. and Silvana Tenreyro. 2006. "The Log of Gravity." *The Review of Economics and Statistics*, 88(4), 641-658 (November). https://doi.org/10.1162/rest.88.4.641.

Singhal, Saurabh and Rahul Nilakantan. 2016. "The Economic Effects of a Counterinsurgency Policy in India: A Synthetic Control Analysis." *European Journal of Political Economy*, 45, 1-17. https://doi.org/10.1016/j.ejpoleco.2016.08.012.

United Nations Office on Drugs and Crime. 2020. *Victims of intentional homicide, 1990-2018*. https://dataunodc.un.org/content/data/homicide/homicide-rate.

Yotov, Yoto, Roberta Piermartini, Jose-Antonio Monteiro and Mario Larch. 2016. *An Advanced Guide to Trade Policy Analysis: The Structural Gravity Model*. Geneva: World Trade Organization.