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Abstract

We present a monopolistic competition model to analyze the effects of own nation and neighboring nation terrorism on a nation's imports. The theoretical analysis shows that own nation terrorism may leave relative price of imports unaffected, but neighboring nation terrorism must raise the relative price, reducing imports. We find that a 10% increase in terrorist attacks in a neighboring nation reduces a country's imports from the rest of the world by approximately $320 million USD, on average. Mediation analysis shows that trading delays is a potential channel of transmission of trade costs of terrorism to a neighbor.

Keywords: Terrorism; Spillovers; Bilateral imports.

JEL codes: F14, D74, H56.

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1. Introduction

How does terrorism affect international trade? Gaibulloev and Sandler (2019), among others, note that higher costs of doing business in a terrorism-plagued environment (e.g., through higher insurance and wage premiums) may depress trade. The empirical literature traditionally found modest negative effects of terrorism on trade, but some recent studies find mixed results.[1] The ambiguity can stem from both trade and production cost effects or general equilibrium effects. We explore the cost channels in this paper, while abstracting from the general equilibrium effects highlighted by Bandyopadhyay and Sandler (2014), where terror can either raise or reduce trade through resource allocation effects. Our exploration of trade costs of an importing nation involves analysis of the effects of terrorism in that nation, and of terrorism in its neighbors. For example, terrorism in a neighboring nation can make the whole region risky for a potential exporter from outside the region. Such cross-border spillovers provide a policy challenge for the affected nation because it cannot unilaterally contain terror incidents in its neighbors. Accounting for this neighboring nation terror effect on imports is a first step in recognizing the magnitude of the problem, which can in turn drive the incentives for cooperation among the neighboring nations.

Among an emerging group of studies on spillovers from terrorism, De Sousa et al. (2018) is closest to our paper.[2] Their focus, however, is on terror networks and transnational terrorism in exporters, which cause an importing nation to raise security directed at both the source nation of terror and its neighbors, potentially reducing exports of both. Our paper differs in three important dimensions. First, our focus is on the extent to which a country's imports are influenced by terror in its neighbors, whether nationals of these neighbors perpetrate terror against the exporters (to the home nation) or not. That is, we focus on the

[1] Nitsch and Schumacher (2004), Mitra et al. (2018), among others, find that terrorism reduces trade. Egger and Gassebner (2015) and Bandyopadhyay et al. (2018) suggest that this relationship is more nuanced.
[2] Also, see Neumayer and Plümper (2016).

spillover effect of terror in an importer's neighbors. Accordingly, the security provisions directly affecting these trade flows are policy choices of these terror afflicted nations. Second, the theoretical motivation is quite different, and more along the lines of gravity models based on monopolistic competition as in Helpman et al. (2008). The terror effects on trade are driven by increases in transportation and production costs that are passed on to output prices. Finally, in recent years, an overwhelmingly large fraction of terrorism incidents has been domestic in nature.[3] Such incidents also raise the costs of trade (see Bandyopadhyay et al. 2018) and affect trade through both income and substitution channels. Therefore, we use data on total terrorism, transnational and domestic, and cover a longer and more recent period compared to De Sousa et al. (2018) to investigate the effect of terrorism on trade.[4]

In our model, terrorism in a nation raises effective production costs of that nation and raises international transportation costs for its neighboring nations. The latter costs reflect higher shipping and insurance costs for exporters to the home nation who have to route their shipments through a potentially risky neighborhood. For example, United Arab Emirates may be relatively terror-free, but because of its location in a high-risk area like the Persian Gulf, it is likely to suffer higher trading costs. A main finding of the analysis is that while home nation terror raises costs, it does so for both domestic goods and imports, potentially leaving the relative price of imports unaffected. However, terror in a neighbor does not affect the home nation's production costs, but raises the home nation's trade costs, and therefore the relative price of imports. Thus, after controlling for income, terrorism in a neighboring nation can lead to a stronger effect on home's import demand compared to home's own terrorism incidence.

[3] Between 2002 and 2016 there were 2,477 transnational and 57,687 domestic incidents (Gaibulloev and Sandler, 2019).
[4] We assess 104,230 (transnational and domestic) terrorist attacks during 1976 to 2014. De Sousa et al. (2018) analyze 9,645 transnational terror incidents during 1993-2006.

The empirical approach is based on the standard gravity framework, which, as explained in Helpman et al. (2008) is consistent with a heterogeneous cost monopolistically competitive model. We look at bilateral trade data of a large sample of nations, with the dependent variable being imports of a particular nation (say *A*) from another nation (*B*). The central explanatory variables are terrorism incidents in nation *A* and terrorism incidents in its neighbors. Controlling for several potential explanatory variables including GDP, Conflict, membership of trading bloc, we find that terrorism in the home nation does not have a significant import reducing effect, although terrorism in neighboring nations has a significant negative effect. Although surprising at first glance, this finding is consistent with the relative price effect discussed in the preceding paragraph. These central findings are robust to several alternate specifications. Turning to identification of a possible channel through which terror affects trade, we find trading delays and associated time costs to be significant determinants.

Section 2 presents the theoretical model and derives some observable implications. Section 3 describes the data and the econometric methodology. Section 4 presents the estimation results. Section 5 identifies a potential channel through which terrorism may be hindering trade. Section 6 concludes.

2. Model: Effects of Own and Neighboring Nation Terrorism on Imports

Increasing insecurity due to terrorism can disrupt trade (Anderson and Marcouiller, 2002). In addition to insurance and wage premiums, trading costs also increase due to delays in receiving funds because of requirements for businesses to report suspicious transactions. Djankov et al. (2010) show that each additional day that trade is delayed reduces trade by more than 1 percent. De Sousa et al. (2018) show that the presence of terror networks may cause neighboring countries to affect a nation's trade. Bandyopadhyay et al. (2018) show that terror has different effects on trade of manufacturing and primary products. Building on the

insights of the extant literature, we present a simple model that analyzes how own and neighbor terrorism may affect trade and production costs and thereby affect imports of a nation.

We adapt a version of the standard monopolistic competition model of Helpman et al. (2008) used in Bandyopadhyay et al. (2018). There are *J* nations trading in differentiated products. Consumers in nation *i* consume a continuum of products, indexed by k, where the set of available products is B^i. The utility function that characterizes consumers' preferences in nation *i* is:

$$U^i = \left[\int_{k \in B^i} x^i(k)^{\frac{\varepsilon-1}{\varepsilon}} dk \right]^{\frac{\varepsilon}{\varepsilon-1}}, \quad \varepsilon > 1, \tag{1}$$

where ε is a constant elasticity of substitution between products, while $x^i(k)$ is the consumption of product *k* in nation *i*. Utility maximization yields the demand function,

$$x^i(k) = \frac{p^i(k)^{-\varepsilon} Y^i}{\left(P^i\right)^{1-\varepsilon}}, \tag{2}$$

where Y^i is nation *i*'s total expenditure (income) and P^i is its aggregate price index, such that

$$P^i = \left[\int_{k \in B^i} p^i(k)^{1-\varepsilon} dk \right]^{\frac{1}{1-\varepsilon}}. \tag{3}$$

Producers in nation *i* have input cost $\tilde{c}^i$, and productivity of firm *k* is $a(k)$. Terrorism in nation *i*, T^i, raises transaction costs of inputs and magnifies the marginal input cost of production by a factor $t^i = t^i(T^i); t^i(0) = 1; t^{i\prime}(T^i) > 0$. Thus, the effective marginal cost of firm *k* of nation *i* is $\tilde{c}^i t^i(T^i)/a(k)$. In addition, there is a standard iceberg transportation cost of trade $\tau^{ji}\left(>1, i \neq j; \tau^{ii} = 1\right)$ for importing a unit of a good from nation *j* to nation *i*. This

transportation cost is increasing in incidence of terrorism in both the exporting nation and the importing nation. In addition, transportation networks are often connected in ways such that terror in neighboring nations can also raise trading costs, as in the case of United Arab Emirates in the Persian Gulf region. Thus, we postulate that $\tau^{ji} = \tau^{ji}\left(T^i, T^j, T^{ji\theta}\right) \equiv \tau^{ji\theta}$, where T^j is terror incidence in nation *j*, and $T^{ji\theta}$ is the vector of terror incidence from neighboring nations of the trading partners *i* and *j*.

Following Melitz (2003) assume that there is a fixed cost, F^{ji} for a nation *j* firm to export to nation *i*.[5] The profit π^{ji} of a firm in nation *j* from its exports to nation *i* is:

$$\pi^{ji} = p^i(k)x^i(k) - \frac{\tilde{c}^j t^j\left(T^j\right)\tau^{ji}\left(T^i, T^j, T^{ji\theta}\right)}{a(k)}x^i(k) - F^{ji}, \tag{4}$$

where $x^i(k)$ is the sales of this firm in nation *i*'s market. The first-order condition for the choice of profit-maximizing output yields:

$$p^i(k) = \frac{\varepsilon\tilde{c}^j t^j\left(T^j\right)\tau^{ji}\left(T^i, T^j, T^{ji\theta}\right)}{(\varepsilon - 1)a(k)}\ . \tag{5}$$

2.1 Intensive Margin: Firms that remain in the market after rise in terrorism.

As in Helpman et al. (2008), zero fixed costs for domestic firms ensure that all domestic firms make positive profits and stay in the market. However, foreign firms may drop out of the market in response to a rise in trade costs. First, we consider the intensive margin of firms that stay in the market before and after the rise in the terrorism index. Later we consider the extensive margin where imports may change as some foreign firms drop out of the market. Using Eq.(2), the revenue of firm *k* in nation *i*'s market is:

[5] There is no fixed cost for selling in the domestic market, therefore $F^{ii} = 0$.

$$R^{ji}(k) = p^i(k)\,x^i(k) = \left[\frac{p^i(k)}{P^i}\right]^{1-\varepsilon} Y^i. \tag{6}$$

Now, consider the revenue $\rho(k,k';j,\lambda)$ of firm k of nation *j* relative to another firm k' from nation λ selling in nation *i*'s market,

$$\rho(k,k';j,\lambda) = R^{ji}(k) / R^{\lambda i}(k') = \left[\frac{p^i(k)}{p^i(k')}\right]^{1-\varepsilon}. \tag{7}$$

Using Eq.(5) in Eq.(7) we get:

$$\frac{p^i(k)}{p^i(k')} = \frac{\tilde{c}^j t^j\left(T^j\right)\tau^{ji}\left(T^i,T^j,T^{ji\theta}\right)a(k')}{\tilde{c}^\lambda t^\lambda\left(T^\lambda\right)\tau^{\lambda i}\left(T^i,T^\lambda,T^{\lambda i\theta}\right)a(k)}. \tag{8}$$

Now, consider the case where λ is the home nation, while nation *j* is foreign, such that $\lambda = i \neq j$. In this case, Eq.(8) reduces to:

$$\frac{p^i(k)}{p^i(k')} = \frac{\tilde{c}^j t^j\left(T^j\right)\tau^{ji}\left(T^i,T^j,T^{ji\theta}\right)a(k')}{\tilde{c}^i t^i\left(T^i\right)a(k)}, \text{ because } \tau^{ii} = 1. \tag{9}$$

Notice that sales of *k* are imports for nation *i*, while sales of k' are domestic. Using Eq.(9) in Eq.(7) we obtain the revenue of a foreign firm relative to the revenue of a domestic firm in nation *i*. Terrorism in neighbors $T^{ji\theta}$ only affects the numerator of the right-hand-side of Eq.(9), raising the relative price of imports and reducing the relative import revenue. Now consider the effect of a rise in terror in nation *i* (i.e., T^i). This affects relative sales by raising both the numerator and the denominator, with some potential offset. If the offset is complete, then relative imports become independent of T^i. This can be seen clearly in a special case we describe next. Suppose that nation *j* and its neighbors are free of terror, as may be the case for some developed nations. In this scenario, $T^j = 0$, such that $t^j\left(T^j\right) = t^j(0) = 1$, and $T^{ji\theta} = T^{i\theta}$.

Furthermore, assume that the iceberg cost takes the form $\tau^{ji} = t^i\left(T^i\right)\psi\left(T^{i\theta}\right)$, where $\psi'\left(T^{i\theta}\right) > 0$. Eq.(9) reduces to: $\frac{p^i(k)}{p^i(k')} = \frac{\tilde{c}^j\psi\left(T^{i\theta}\right)a(k')}{\tilde{c}^i a(k)}$, and imports relative to domestic sales in nation *i* become independent of terrorism T^i. This suggests that controlling for market size, terrorism in nation *i* may not have a significant import reducing effect. Notice however, that imports relative to domestic goods' sales must decline as neighbor's terror $T^{i\theta}$ increases because of a rise in the iceberg cost. This contrast of the effect on imports of a rise in home terrorism compared to a rise in neighboring nation terrorism arises due to the following reason. Terrorism at home raises both domestic production costs and international transportation costs - potentially leaving the relative price of imports unaffected. On the other hand, terrorism in a neighbor does not affect domestic production costs and therefore unambiguously raises the relative price of imports and reduces import revenues relative to revenues of domestic firms.

2.2 Extensive Margin: Exit of some foreign firms

A foreign firm from nation *j* sells in nation *i*'s market only if it makes positive profit. This requires that its productivity exceeds a threshold level $\tilde{a}^{ji}$ defined by:

$$\pi^{ji} \geq 0 \text{ iff } a > \tilde{a}^{ji} = \mu(\varepsilon)\left(\frac{F^{ji}}{Y^i}\right)^{\frac{1}{\varepsilon-1}} \frac{\tilde{c}^j t^j \tau^{ji}}{P^i}, \text{ where } \mu(\varepsilon) = \frac{\varepsilon^{\frac{\varepsilon}{\varepsilon-1}}}{(\varepsilon-1)}. \qquad (10)$$

For given Y^i, and for the special case of a terror-free nation *j* we discussed above, Eq.(10) reduces to $a > \tilde{a}^{ji} = \mu(\varepsilon)\left(\frac{F^{ji}}{Y^i}\right)^{\frac{1}{\varepsilon-1}} \frac{\tilde{c}^j t^i\left(T^i\right)\psi\left(T^{i\theta}\right)}{P^i}$. Notice that P^i is a price index derived from prices of all goods in nation *i*'s market. Using Eq.(5) it is clear that a rise in T^i will raise prices of the domestic goods as well as those of the imports, raising P^i. Turning to

Eq.(10), this means the denominator on the right-hand-side of the inequality rises. At the same time, the term $t^i\left(T^i\right)$ in the numerator of the right-hand-side also rises. This may partially offset the effect of terrorism in nation *i* on the critical productivity level $\tilde{a}^{ji}$. Put simply, the home terrorism induced effect of a rise in price of imports (on demand for imports) is partially offset by the rise in home's general price level. Now, consider terrorism in a neighbor of nation *i*. When $T^{i\theta}$ rises, prices of domestic goods are not affected, although price of imports rise. If the price index is heavily biased towards domestically produced goods, which is often the case (and which is also consistent with fixed costs of trade of this model), then the numerator of the right-hand-side of Eq.(10) rises more sharply than the denominator, leading potentially to a marked rise in the required critical productivity $\tilde{a}^{ji}$. This will lead to a fall in the number of foreign firms in nation *i*'s market. In other words, the extensive margin analysis suggests that terror in neighboring nations depress nation *i*'s imports more than terror in nation *i* itself.

2.3 Summary Implications:

Considering both intensive and extensive margins of trade we find that for a given market size of nation *i*, terror in the neighbor(s) is likely to depress imports more sharply than terror in the home nation itself. An empirical implication of this finding is that when we control for GDP, we are more likely to get a significant import reduction due to terror in the neighbor than due to terror in the home nation itself.

3. Data and Econometric Methodology[6]

Our empirical analysis draws upon annual data on bilateral trades from 1976 to 2014 from the UN COMTRADE Database.[7] We measure trade as bilateral imports, e.g., imports from Canada to the USA and imports from the USA to Canada. We focus on the effects of terrorism on importing countries with at least one contiguous neighbor. There are in total more than 2,000 pairs of trading partners for which a trading nation has a common border with at least one other country.

It is important to note that most of the observations in our data relate to bilateral imports between non-contiguous trading partners. That is, while we focus on the impact of terrorism in neighboring nations on a given nation's bilateral imports, we consider the impact on trade between the affected nation and *all* other trading partners whether they are contiguous or not. For example, we trace whether a terrorist event in the USA affects the bilateral trade of neighboring Canada, taking into account the impact on bilateral trade between Canada and the USA, and all other bilateral trading pairs involving Canada.

Data on terrorism are constructed using the Global Terrorism Database (GTD), University of Maryland. This database includes systematic data on domestic, transnational, and international terrorist incidents occurring during the period 1970 to 2014. For our purpose, we only use data on incidents that the GTD can identify with certainty as terrorist incidents. This definition of terrorist incidents avoids overlap between terrorism and other forms of crime and political violence such as insurgency/guerilla action, other types of crime, inter/intra-group conflict, and terrorist incidents by state actors (GTD codebook 2017).[8]

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[6] An online Appendix presents details of data used and information necessary to replicate all findings. Also, this appendix provides regression tables for all models and robustness checks.

[7] The use of annual data rather than monthly data shifts emphasis from the immediate impact of terror to longer-term effects on trade. For example, the immediate effect of terror may be felt through delays in shipping/delivering imports that were already arranged. Annual data enables investigation beyond these immediate effects.

[8] Identification of incidents by state actors commenced in 2012. There are 200 such incidents out of 170,350 terrorist incidents for the period 1970-2016.

Merging the trade data with terrorism data, we have 169 exporters and 142 importers. The countries included are listed in the Online Appendix Tables A2 and A3. Data on armed conflicts are obtained from the UCDP/PRIO Armed Conflict Dataset.[9] Armed conflict is defined as "a contested incompatibility that concerns government 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".[10]

Data on standard gravity model variables, such as bilateral distance between the exporter and importer, whether trading partners share a common border, a common language, and a common colonial relationship are available from CEPII's gravity dataset. Data on whether the pair of trading partners has a common currency or a common free trade agreement are extracted from the De Sousa et al. (2009) database. Descriptive statistics for the variables are reported in Table 1.[11]

Figure 1 depicts the evolution of terrorism across the globe over the period 1970 to 2014, for three categories of the flow of terrorism; the associated raw data are presented in Online Appendix Table A1. The three series are: the number of terrorist incidents (*Incidents)*, the number of terrorist incidents with use of biological or chemical weapons or explosives/bombs or firearms (*Wartypes*), and the number of terrorist attacks involving the use of bombs (*Bombings*), respectively. Each series is constructed by summing all the terrorist incidents of each category, taking place in all countries for each year. Figure 1 shows that terrorist events have reached unprecedented levels in recent years. This escalation can be largely attributed to the increased intensity of conflict in Iraq, Afghanistan, Pakistan, Nigeria,

[9] The links to those databases are: http://www.correlatesofwar.org/, https://www.sipri.org/databases/milex, and https://www.prio.org/Data/Armed-Conflict/.
[10] For more detailed information on how an armed conflict is defined see Gleditsch et al. (2002) and the UCDP/PRIO Armed Conflict Dataset Codebook: https://www.prio.org/Data/Armed-Conflict/UCDP-PRIO/.
[11] The GTD data can be found at: http://www.start.umd.edu/gtd/about/. The CEPII data can be found at: http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=8. The De Sousa et al. (2009) data can be found at: http://jdesousa.univ.free.fr/data.htm.

and Syria. The Online Appendix, Figure A1 illustrates the global distribution of the average number of terrorist incidents; most terrorist events occurred in the Middle East and North Africa.

3.1 Measures of Terrorism

Our main explanatory variables of interest, $Incidents_{jt}$ and $NeighborIncidents_{jt}$, measure the total number of terrorist incidents occurring in the *j*th nation and in *neighboring* countries in year *t*, respectively. For each measure and each country, we calculate the number of incidents to derive an annual series.

We use alternatively the *flow* measure and the *stock* measure of terrorist incidents. The flow measure corresponds to the value of $NeighborIncidents_{jt}$ in year *t*, while the stock measure is the sum of terrorist incidents during the five years prior to year *t,* with greater weight assigned to years that are more recent. A stock based measure of terrorism enables investigation of the longer-term effects of terrorism, consistent with sustained effects on imports. The stock of terrorism is calculated as follows:

$$Incidents^{S}_{j(t-1)} = \sum_{i=1}^{5} (1.2 - 0.2 * i) Incidents_{j(t-1)} . \quad (11)$$

$$NeighborIncidents^{S}_{j(t-1)} = \sum_{i=1}^{5} (1.2 - 0.2 * i)\, NeighborIncidents_{j(t-1)} . \quad (12)$$

An annual discount rate of 20% is used to assign greater weight to recent terrorist incidents on the ground that events that are more recent are likely to have a greater impact.[12] However, we also explore the sensitivity of the results to alternate measures of the stock of terrorism.

3.2 Econometric specification

The gravity equation has been used successfully in numerous studies to investigate the determinants of bilateral export or import flows. Here we use the gravity equation to

[12] Egger and Gassebner (2015) assign equal weight to all data when they compute their stock measure of terrorism. However, these authors use monthly data compared to our annual data.

investigate the effects of terrorism on bilateral imports. Specifically, we use the following augmented gravity model to estimate the effects of terrorist incidents/attacks occurring in the *j*th. neighboring country:

$$Log\left(Imports_{ijt}\right) = \beta_0 + \beta_{it} + \beta_1 Log\left(Gdp_{jt}\right) + \beta_2 Log\left(Distance_{ij}\right) + \beta_3 Border_{ij} + \beta_4 Colony_{ij}$$
$$+\beta_5 Language_{ij} + \beta_6 FTA_{ijt} + \beta_7 Currency_{ijt} + \beta_8 Conflict_{jt} + \beta_9 NeighborConflict_{jt}$$
$$+\beta_{10} Log\left(Incidents_{jt}\right) + \beta_{11} Log\left(NeighborIncidents_{jt}\right) + \varepsilon_{1ijt}, \quad (13)$$

where the dependent and explanatory variables are defined as follows. $Imports_{ijt}$ is the real value of imports by importer *j* from exporter *i*, in period *t*. Recall that we consider *all* bilateral combinations of importers and exporters. $Incidents_{jt}$ is the number of terrorist incidents taking place in importer *j*. $NeighborIncidents_{jt}$, our main variable of interest, is the number of terrorist incidents taking place in the *j*th importer's contiguous neighbors. We control for the GDP of the importer (GDP_{jt}), whether the importer experiences armed conflict $\left(Conflict_{jt}\right)$, and at least one of its neighbors experiences armed conflict $\left(NeighborConflict_{jt}\right)$. To the extent that terrorism is often part of a larger conflict, the inclusion of both $Conflict_{jt}$ and $NeighborConflict_{jt}$ as control variables addresses concerns of omitted variable bias. However, excluding the conflict variables does not alter our findings.

For all contiguous and non-contiguous trading pairs, we consider the bilateral distance between the exporter and the importer (*Distance*); whether the exporter and the importer share a common border (*Border*); share a common colonial relationship (*Colony*); speak the same language (*Language*); are members of a free trade agreement (*FTA*); and members of a common currency area (*Currency*). We also include exporter-year dummies $\left(\beta_{it}\right)$ to control for unobservable factors that determine bilateral imports between the two countries and that are

specific to the exporter *and* year. In the gravity equation literature these dummies account for multilateral resistance, measuring the bilateral trade costs between countries *i* and *j* in relation to the rest of the world.

Standard errors are corrected for clustering at the importer level. All the standard errors are smaller and *t*-statistics are larger if we correct standard errors by clustering by exporter-importer pairs.

3.3 Endogeneity

The specification of the gravity model includes a measure of terror within a trading nation $Log\left(Incidents_{jt}\right)$, and a measure of terror in its neighboring nations $Log\left(NeighborIncidents_{jt}\right)$. However, we are primarily interested in the effects of terrorism occurring in the importer's neighbors. The coefficient estimate on $Log\left(Incidents_{jt}\right)$ may be biased because of two sources of endogeneity in the relationship between the measure of terror in the importer $Log\left(Incidents_{jt}\right)$ and its imports $Log\left(Imports_{ijt}\right)$. On the one hand, terrorists may have a greater incentive to attack countries for which international trade is an important component of national output. Consequently, the higher (lower) are imports, the higher (lower) is the incidence of terrorism. Hence, this source of endogeneity results in a downward bias of the coefficient estimate of $Log\left(Incidents_{jt}\right)$. A second source of endogeneity arises if countries that are more engaged with international trade also allocate more funds toward counter-terrorism to reduce the threat of terrorism. This source of endogeneity may result in an upward bias in the coefficient estimate of $Log\left(Incidents_{jt}\right)$. Hence, the direction of the net bias can go either way depending on which of these two factors dominates.

The focus of our paper, the coefficient estimate of terror in neighboring states $Log\left(NeighborIncidents_{jt}\right)$, is arguably less prone to endogeneity. We deem that terrorists

are less likely to attack a country for reasons relating to imports from its neighbors and that it is less likely that a country's imports will be a determinant of its neighbors' counter-terrorism effort. Nevertheless, while it is less likely, these two sources of endogeneity cannot be ruled out entirely. If terrorists seek to create spillover effects by attacking the importer's neighbors, then the coefficient estimates of $Log\left(NeighborIncidents_{jt}\right)$ will provide a lower bound (i.e. downwardly biased) estimate of the true underlying value. Endogeneity may also emerge if a country's counter-terrorism effort is a function of its neighbors' trade. This source of endogeneity is likely to bias our estimates in the direction of finding an adverse effect of terrorism. We address these concerns in three ways. First, we use lags in $Log\left(NeighborIncidents_{jt}\right)$ to mitigate reverse causality. Second, we apply our gravity specification to a subsample of non-contiguous states. Third, as a robustness check we also control for the possibility that a country's counter-terrorism effort is a function of its neighbors' trade.

4. Estimation Results

Table 2 reports estimates of the gravity model, Eq. (13), which includes the flow (Columns 1 and 2) or the stock (Columns 3 and 4) measures of terrorism in the trading nation $Log\left(Incidents_{jt}\right)$ and its neighbors $Log\left(NeighborIncidents_{jt}\right)$. The gravity model performs in line with prior findings in the literature. Specifically, we find that bilateral distance between an exporting and the importing nation reduces trade, while GDP, sharing a common border and a common language, being a past colony, and having a FTA agreement, all increase bilateral trade. Being members of a common currency union however does not have a significant effect on bilateral trade. We also find that armed conflict in the importer

significantly reduces its bilateral imports, while armed conflict in at least one of the importer's neighbors does not have any impact on its bilateral imports.

Table 2 presents the results using the flow and stock measure of terrorism in its columns 1 to 4. The results show that terrorism in the trading nation has no effect on bilateral imports. De Sousa et al. (2018) also report a similar own terror effect. However, terrorism in the importer's neighbors significantly reduces bilateral imports. A 10% increase in the number of terrorist attacks in a neighboring country reduces imports by 0.65% (equivalently a $3.62 million USD reduction in bilateral imports). The average nation imports from 88 exporters. Hence, a 10% increase in the number of terrorist attacks in a neighboring country reduces a country's imports from the rest of the world by approximately $320 million USD, on average. This is economically significant. If we apply these estimates to the specific case of US exports to Canada or Japan's exports to the US, a 1% increase in the number of terrorist incidents will, on average, reduce bilateral trade between these two pairs of nations by approximately 128 million and 80 million USD, respectively.[13]

Accumulated terrorist incidents (the stock of terrorist events) also significantly reduce bilateral imports in the current year; see Columns (3) and (4). That is, both contemporaneous terrorism and accumulated terrorism over time have a significant adverse spillover effect on bilateral trade.

At first glance it may appear counterintuitive that own terror $Log\left(Incidents_{jt}\right)$ has no effect on imports but the neighbor's terror has a significant impact $Log\left(NeighborIncidents_{jt}\right)$. We have two comments about this. First, this is in line with our theoretical prediction that home nation terror may have lower relative price effects on imports. Second, as in Bandyopadhyay and Sandler (2014), home nation terror may

[13] We evaluate the impact of terrorism on bilateral trade at sample means. Note that, on average, each year the US exports to Canada about 158 billion USD, while each year Japan exports to the US 125 billion USD, on average.

reallocate resources in ways that counteract the trade reducing effect of higher transaction costs. This potentially offsetting resource reallocation effect is missing when terror occurs in the neighboring nation.

Reverse causality may arise if terrorists are aware of the spillover effects of their actions and they seek to disrupt trade by attacking neighbors. This will cause a downward bias in our estimates for $Log\left(NeighborIncidents_{jt}\right)$. A second potential source of endogeneity may arise when a given country's counter-terrorism effort is a function of its neighbors' trade. This source of endogeneity is likely to bias our estimates in the direction of finding an adverse effect of terrorism. We address these concerns in three ways. First, we use five-year lags; terrorist attacks five years ago in neighboring countries are less likely to be influenced by current bilateral trade. The results using five year lags presented in columns 5 of Table 2 also confirm that past terrorist incidents have long lasting effects. Second, we use a subsample of non-contiguous states that is less susceptible to endogeneity. This is because a country's counter-terrorism effort is less likely to be a function of non-contiguous countries (though not completely independent, as non-contiguous nations may also coordinate their counter-terrorism efforts). Third, we include military spending as a share of GDP as a proxy for counter-terrorism efforts that may be a function of the extent to which a given economy is linked to its neighbors. These results are presented in columns 6 and 7 of Table 2 and confirm the adverse impact of terrorism on bilateral imports.

Table 3 presents the first set of robustness checks. Specifically, we use alternative flow and stock measures of terrorism in the importer and terrorism in its contiguous neighbours. These measures are the number of terrorist incidents with use of biological or chemical weapons or explosives/bombs or firearms (*Wartypes*), and the number of terrorist attacks involving the use of bombs (*Bombings*). The new results are in line with the results

obtained earlier in this paper. Terrorism in a nation has no statistically significant effect on its imports, while terrorism in its neighbors adversely impacts the nation's imports.

In addition to the robustness checks outlined above, we perform the following robustness checks, details of which we report in the online appendix (Tables A5 through A9). First, we extend the length of the stock measure to include terrorist attacks occurring over a 10-year period, compared to the 5-year span used in Tables 2 and 3. Second, per capita GDP, $LogGDPC_{jt}$, is included as an added explanatory variable in addition to $Log\left(GDP_{jt}\right)$. In the empirical literature, the inclusion of per capita GDP in the gravity equation tests whether the level of development influences trade. This variable is not statistically significant for our sample. Third, we remove countries that have experienced most of the terrorist attacks in recent years: Afghanistan, Iraq, Iran, Nigeria, Libya, Pakistan, and Syria. Aside from exploring the robustness of our results to these countries as potential outliers, there is also the issue of whether our results are driven by terrorist attacks that are part of much larger conflicts. Hence, it is prudent to explore the sensitivity of our results to the exclusion of these countries from the data. Fourth, we compare the spillover effects of terrorism before and after 9/11. For this purpose, we include in the gravity equation the interaction between the measure of terrorism in neighboring nations and a pre- 9/11 dummy. Fifth, we follow De Sousa et al. (2018) and estimate the gravity model using data only for the 1993-2006 period. This shorter time span is chosen because it excludes three crises that occur after this period.[14] Tables A5 through A9 of the Appendix confirm: the long-lived negative spillover effects from terrorism; that the baseline results are not driven by a handful of countries, or particular time periods; and that there are broadly comparable negative spillover effects in the pre- and post-9/11 periods.

[14] The three crises mentioned by De Sousa et al. (2018) are: the food and oil price crisis (2007-2008), the financial and economic crisis (2009-2010), and the Arab Spring revolutions (2010-2012).

We also investigate whether the adverse spillover effects of terrorism on bilateral trade are apparent in *aggregate* imports. The results are presented in Table 4. While conflict and terrorism might reduce bilateral trade between neighbors as we already show, it may also divert trade to third parties (Feldman and Sadeh, 2016; De Sousa et al., 2018). To analyze this issue, we estimate the following gravity equation for aggregate imports:

$$Log\left(AggregateImports_{jt}\right)$$

$$= \beta_0 + \beta_t + \beta_1 Log\left(Gdp_{jt}\right) + \beta_2 Landlocked_j + \beta_3 Conflict_{jt} + \beta_4 Log\left(Terrorism_{jt}\right)$$

$$+ \beta_5 Log\left(NeighborTerrorism_{jt}\right) + \beta_6\left(Log\left(NeighborTerrorism_{jt}\right) * Log\left(Gdpc_{jt}\right)\right) + \varepsilon_{4jt}. \quad (14)$$

Note that we include an interaction of terrorism measure in the neighboring countries and the GDP per capita in log of the importer to allow for the possibility that the effect of terrorism depends on the level of income of the importer. Moreover, the interaction in gravity specification (4) accounts for an important empirical finding by Enders et al. (2016) of a non-linear relationship between income and terrorism. Specifically, they find that terrorism peaked at lower per capita level of the perpetrators' country then for the venue country. Since most of terrorist incidents occurred in the country of the perpetrators we expect that terror has much more adverse effects on imports of low GDP per capita countries. The results are presented in Table 4 and clearly show that regardless of the trade measure used, terrorism reduces trade. This adverse effect, however, is found to be decreasing in the GDP per capita of the importer.

5. Identifying Channel

As discussed in Section 2, the effects of terrorism on bilateral trade may operate via regulatory burden. Our baseline estimates (Table 2) control for income and trade reform. Hence, one interpretation of the negative trade spillovers in the baseline results is that they

quantify the impact of channels other than income and trade reform, such as increased trade insecurity, time costs to trade, and psychological effects arising from terrorism. However, they may also quantify the impact of trade reform and regulatory burden not captured by our measures. To address this issue, this section investigates trading delays as a potential channel through which terrorism affects trading costs and bilateral imports. For this purpose, we apply mediation analysis (Baron and Kenny, 1986; MacKinnon et al., 1995). Mediation analysis allows us to draw deeper insights into the nature of the spillover impact of terrorism on bilateral trade. While mediation analyses is often employed in psychology and medicine in order to study the mechanisms by which an intervention/treatment achieves its effects, the formal application of mediation analysis to the empirics of international trade is uncommon. Comparing direct and indirect effects is, however, common. Here we extend this practice by formally testing channels through mediation analysis and by applying the Sobel test (MacKinnon et al., 1995).[15]

Terrorism can depress trade by raising the time costs of international trade, as exporters and importers need to satisfy extra procedural requirements and stricter trade and financial procedures. To measure the time burden of procedures faced by importers, we use a time to import variable, *Time*, using data from the World Bank's "Doing Business" project. [16] This data is available since 2005. If terrorism adversely affects imports by increasing regulatory burden, then the coefficient estimates on the terrorism variables will decrease when we control for *Time*. The results presented in Table 5. Note that in columns 1 and 2 we do not control for terrorism in the importer while we control for it in columns 3 and 4. The new

[15] Specifically, we use the *t*-statistic for the Sobel test: $ab / \sqrt{\left(a^2 s_b^2 + b^2 s_a^2\right)}$, where a and b are, respectively, the coefficient estimates on the effect of the independent variable, $Log\left(NeighborTerror_{jt}\right)$, on a mediating variable (e.g. trading time, $Time_j$), and the coefficient estimate on the effect of the mediating variable ($Time_j$) on the dependent variable $Log\left(Imports_{ijt}\right)$. Also, s_a and s_b are the respective standard errors. For details, see Sobel (1982) and MacKinnon et al. (1995).

[16] Further details can be found at: http://www.doingbusiness.org/.

set of results show that time delays significantly reduce bilateral imports. With the inclusion of time delay, $Log\left(NeighborTerror_{jt}\right)$ has a smaller coefficient and is no longer statistically significant. The Sobel *t*-test confirms a statistically significant partial mediation effect. The effect of terrorism on bilateral imports is *partially* mediated by increasing the time to import due to increasing regulatory burden. Stricter trade-related counter-terrorism regulations depress trade through increased time delays.

6. Conclusions

We consider the impact of terrorism in a nation and in its neighbors on the nation's imports. Quantifying these spillovers is important to understanding the overall impact of terrorism. We document robust evidence that terrorism in a neighboring country reduces bilateral imports. Spillovers are relatively long lasting; on average, a terrorist attack in a neighboring nation affects bilateral imports up to five years after the event.

We find that terrorism in a nation does not significantly affect its imports, but significantly reduces its neighboring nations' imports. We offer two potential explanations for these results, where the first explanation is derived from our model, while the second is based on Bandyopadhyay and Sandler (2014). First, terrorism in the home nation raises prices of both domestic goods and of imports, leaving the relative price of imports unaffected. In contrast, terrorism in a neighboring nation does not affect prices of domestic goods, but raises prices of imported goods because of a rise in transportation costs. The consequent rise in the relative price of imports leads to a significant decline in imports. Second, terrorism in a nation can cause general equilibrium resource reallocations that can raise or reduce its trade. However, terrorism in a neighboring nation does not have a first-order effect on home resource allocation, and therefore the spillover effect working through trade costs dominates. In particular, our empirical analysis shows that the adverse spillover effect can operate

through higher trade costs associated with increased time to trade. The latter arises from stricter trade and financial procedures, greater compliance and regulatory burden.

Our results confirm the existence of significant cross-border spillovers arising from terrorism. In turn, this suggests benefits from collaboration between neighboring nations in counter-terrorism policies. The magnitude of the spillover effects provides estimates of possible gains from cooperative counterterrorism policies. Future studies must also consider the potential costs of such policies, including budgetary costs and trade costs. The latter can arise from stricter regulations at the border designed to reduce terrorism.

References

Anderson, J.E., Marcouiller, D. "Insecurity and the pattern of trade: an empirical investigation." *Review of Economics and Statistics*, 2002, 84(2), 342-352.

Bandyopadhyay, S., Sandler, T. "The effects of terrorism on trade: a factor supply approach." *Federal Reserve Bank of St. Louis Review*, 2014, 96, 229-241.

Bandyopadhyay, S., Sandler, T., Younas, J. "Trade and terrorism: a disaggregated approach." *Journal of Peace Research*, 2018, 55(5), 656–670.

Baron, R. M. and Kenny, D. A. "The moderator-mediator variable distinction in social psychological research – conceptual, strategic, and statistical considerations." *Journal of Personality and Social Psychology*, 1986, 51(6), 1173–82.

De Sousa, J., Mirza, D. and Verdier, T. "Trade and the Spillovers of transnational terrorism." *Swiss Journal of Economics and Statistics*, 2009, 145(4), 453-61.

De Sousa, J., Mirza, D., Verdier, T. "Terrorism networks and trade: does the neighbor hurt?" *European Economic Review*, 2018, 107, 27-56.

Djankov, S., Freund, C., Pham, C.S. "Trading on time." *Review of Economics and Statistics*, 2010, 92(1), 166-173.

Egger, P., Gassebner, M. "International terrorism as a trade impediment?" *Oxford Economic Papers*, 2015, 67(1), 42-62.

Enders, W., Hoover, G. A. and Sandler, T. "The Changing Nonlinear Relationship between Income and Terrorism." *Journal of Conflict Resolution*, 2016, 60(2), 195-225.

Feldman, N. and Sadeh, T. "War and Third-Party Trade". *Journal of Conflict Resolution*, 2016, 62(1): 119-142.

Gaibulloev, K., Sandler, T. "What we have learned about terrorism since 9/11." *Journal of Economic Literature*, 2019, 57(2), 275-328.

Gleditsch, N. P., Wallensteen, P., Eriksson, M., Sollenberg, M. & Strand, H. "Armed Conflict 1946–2001: A New Dataset." *Journal of Peace Research*, 2002, 39(5): 615–637.

Global Terrorism Database Codebook. 2017. Available online from the following link: https://www.start.umd.edu/gtd/downloads/Codebook.pdf.

Helpman, E., Melitz, M.J. and Rubinstein, Y. "Estimating Trade Flows: Trading Partners and Trading Volumes." *Quarterly Journal of Economics*, 2008, 123(2), 441-487.

MacKinnon, D.P., Warsi, G., Dwyer, J.H. "A simulation study of mediated effect measures." *Multivariate Behavioral Research*, 1995, 30(1), 41-62.

Melitz, M.J. "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity." *Econometrica*, 2003, 71(6), 1695-1725.

Mitra, D., Pham C.S., Bandyopadhyay, S. "Terrorism and air travel: a gravity approach." *The World Economy*, 2018, 41(11), 2852-2882.

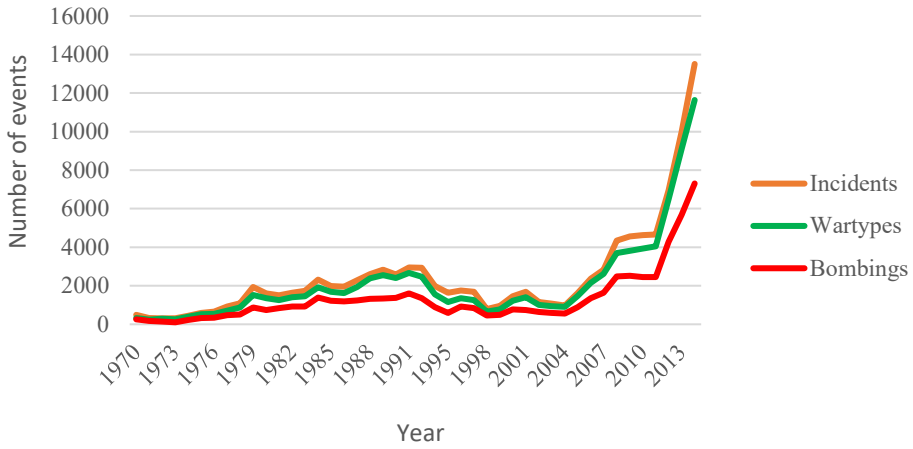
Neumayer, E., Plümper, T. "Spatial spillovers from terrorism on tourism: Western victims in Islamic destination countries." *Public Choice*, 2016, 169(3-4), 195-206.

Nitsch, V., Schumacher, D. "Terrorism and international trade: an empirical investigation." *European Journal of Political Economy*, 2004, 20(2), 423-433.

Sobel, M. E. "Asymptotic Confidence Intervals for Indirect Effects in Structural Equation Models." *Sociological Methodology*, 1982, 13, 290–312.

UCDP/PRIO Armed Conflict Dataset Codebook. 2009. Available online at: https://www.prio.org/Global/upload/CSCW/Data/UCDP/2009/Codebook_UCDP_PRIO%20Armed%20Conflict%20Dataset%20v4_2009.pdf.

FIGURE 1:
Global terrorist events, 1970-2014



Notes: Data compiled by the authors from the Global Terrorism Database. The figure illustrates global patterns. *Incidents* denotes the number of terrorist incidents/attacks. *Wartypes* denotes the number of terrorist incidents with use of biological or chemical weapons or explosives/bombs or firearms. *Bombings* denotes the number of terrorist attacks involving the use of bombs.

TABLE 1
Descriptive Statistics

Variable	Obs	Mean	Std. dev.	Min	Max
$Log(Imports_{ijt})$	336,600	15.4754	3.606783	6.907755	26.51594
$Imports_{ijt}$	336,600	5.66E+08	5.03E+09	1000	3.28E+11
$Log(GDP_{jt})$	336,600	24.4588	2.201159	18.054	30.28901
$Log(Distance_{ij})$	336,600	8.577424	0.82655	4.741773	9.885839
FTA_{ijt}	336,600	0.124911	0.330618	0	1
$Currency_{ijt}$	336,600	0.017917	0.132652	0	1
$Border_{ij}$	336,600	0.030461	0.171851	0	1
$Language_{ij}$	336,600	0.155113	0.362013	0	1
$Colony_{ij}$	336,600	0.022576	0.148547	0	1
$Conflict_{jt}$	336,600	0.161661	0.36814	0	1
$NeighborConflict_{jt}$	336,600	1.479646	1.947671	0	13
$Log(Incidents_{jt})$	336,600	1.139866	1.540329	0	7.826044
$Log(NeighborIncidents_{jt})$	336,600	3.23742	2.136786	0	9.330698
$Log(Incidents^{S}_{jt})$	334,826	2.312275	1.919009	0	8.699164
$Log(NeighborIncidents^{S}_{jt})$	334,826	4.899042	2.115373	0	10.15697
$Log(Wartype_{jt})$	336,600	1.031664	1.482571	0	7.81843
$Log(NeighborWartypes_{jt})$	336,600	3.045093	2.136809	0	9.295876
$Log(Wartype^{S}_{jt})$	334,826	2.128212	1.89001	0	8.683876
$Log(NeighborWartypes^{S}_{jt})$	334,826	4.677841	2.139016	0	10.09471
$Log(Bombings_{jt})$	336,600	0.827899	1.346168	0	7.557473
$Log(NeighborBombings_{jt})$	336,600	2.595526	2.106958	0	8.918516
$Log(Bombing^{S}_{jt})$	334,826	0.915044	0.703486	0	1.88707
$Log(NeighborBombings^{S}_{jt})$	334,826	2.41244	1.046787	0	4.477337

TABLE 2

Spillover Effect of Terrorism on Bilateral Imports

	Flow	Flow	Stock	Stock	5-year lag (Flow)	Non-contiguous countries (Flow)	Controlling for military spending (Flow)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$Log(Incidents_{jt})$	0.012	0.031	0.018	0.032	0.034	0.030	0.022
	(0.029)	(0.029)	(0.027)	(0.028)	(0.026)	(0.029)	(0.029)
$Log(NeighborIncidents_{jt})$		-0.065**		-0.050*	-0.046*	-0.064**	-0.065***
		(0.028)		(0.027)	(0.027)	(0.028)	(0.024)
$Log(GDP_{jt})$	0.908***	0.916***	0.904***	0.909***	0.914***	0.931***	0.753***
	(0.032)	(0.031)	(0.033)	(0.032)	(0.032)	(0.031)	(0.060)
$Log(Distance_{ij})$	-1.285***	-1.300***	-1.286***	-1.292***	-1.291***	-1.302***	-1.297***
	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)	(0.046)	(0.041)
FTA_{ijt}	0.601***	0.607***	0.601***	0.609***	0.608***	0.585***	0.598***
	(0.081)	(0.079)	(0.081)	(0.079)	(0.079)	(0.084)	(0.073)
$Currency_{ijt}$	0.168	0.163	0.172	0.156	0.148	0.198	0.177
	(0.159)	(0.158)	(0.160)	(0.158)	(0.156)	(0.155)	(0.166)
$Border_{ij}$	0.947***	0.945***	0.946***	0.956***	0.949***	--	0.947***
	(0.114)	(0.114)	(0.113)	(0.114)	(0.115)	--	(0.119)
$Language_{ij}$	0.886***	0.867***	0.885***	0.871***	0.876***	0.888***	0.854***
	(0.087)	(0.085)	(0.087)	(0.084)	(0.086)	(0.086)	(0.086)
$Colony_{ij}$	1.071***	1.061***	1.063***	1.037***	1.050***	1.166***	1.040***
	(0.125)	(0.117)	(0.123)	(0.117)	(0.119)	(0.105)	(0.122)
$Log(Milspending_{jt})$							0.173***
							(0.058)
$Conflict_{jt}$	-0.164**	-0.201**	-0.177**	-0.206***	-0.193***	-0.209***	-0.256***
	(0.084)	(0.078)	(0.085)	(0.078)	(0.075)	(0.081)	(0.082)
$NeighborConflict_{jt}$	-0.021	0.019	0.018	-0.035	0.001	0.016	0.013
	(0.022)	(0.023)	(0.028)	(0.096)	(0.023)	(0.024)	(0.022)
Constant	4.069***	4.111***	4.133***	4.259***	4.068***	3.788***	4.427***
	(0.851)	(0.809)	(0.872)	(0.833)	(0.831)	(0.839)	(0.731)
Exporter-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	336,600	336,600	334,826	334,826	325,804	326,347	296,532
Adjusted R^2	0.72	0.72	0.72	0.72	0.72	0.72	0.74

Notes: Parentheses report standard errors adjusted for clustering at the importer level.
*** denote 10%, 5% and 1% level of statistical significance, respectively.

TABLE 3
Spillover Effect of Terrorism on Bilateral Imports,
Alternative Measures of Terrorism

Variables	Flow (1)	Stock (2)		Flow (3)	Stock (4)
$Log(Wartypes_{jt})$	0.025		$Log(Bombings_{jt})$	0.024	
	(0.029)			(0.031)	
$Log(NeighborWartypes_{jt})$	-0.061**		$Log(NeighborBombings_{jt})$	-0.063***	
	(0.028)			(0.027)	
$Log(Wartypes^{S}_{jt})$		0.027	$Log(Bombings^{S}_{jt})$		0.091
		(0.027)			(0.080)
$Log(NeighborWartypes^{S}_{jt})$		-0.046*	$Log(NeighborBombings^{S}_{jt})$		-0.141**
		(0.027)			(0.055)
$Conflict_{jt}$	-0.186**	-0.192***	$Conflict_{jt}$	-0.181***	-0.157*
	(0.082)	(0.080)		(0.082)	(0.082)
$NeighborConflict_{jt}$	-0.017	-0.042	$NeighborConflict_{jt}$	-0.015	-0.034
	(0.022)	(0.095)		(0.022)	(0.101)
Constant	4.137***	4.222***	Constant	4.020***	4.133***
	(0.822)	(0.829)		(0.809)	(0.807)
Gravity equation includes:					
Exporter-year fixed effects	Yes	Yes		Yes	Yes
Other control variables	Yes	Yes		Yes	Yes
N	334,826	334,826		334,826	334,826
Adjusted R^2	0.72	0.72		0.72	0.72

Notes: *Wartypes* denotes the number of terrorist incidents/attacks in which either biological or chemical weapon or explosives/bombs or firearms are used. *Bombings* denotes the number of terrorist incidents with use of bombs and explosives. Columns (1) and (3) use flow measures of terrorist incidents. Columns (2) and (4) use stock measures of terrorist incidents. N denotes the number of observations. Parentheses report standard errors adjusted for clustering at the importer level. See Table 1 for the list of other control variables. *, **, and *** denote 10%, 5% and 1% level of statistical significance, respectively.

TABLE 4
Spillover Effects of Terrorism on Aggregate Imports

	(1)	(2)	(3)
$Log(GDP_{jt})$	0.836***	0.838***	0.838***
	(0.026)	(0.025)	(0.026)
$Landlocked_j$	-0.519***	-0.517***	-0.519***
	(0.114)	(0.114)	(0.110)
$Conflict_{jt}$	-0.211***	-0.224***	-0.248***
	(0.078)	(0.079)	(0.076)
$NeighborConflict_{jt}$	-0.162**	-0.158*	-0.159*
	(0.081)	(0.083)	(0.085)
$Log(Incidents_{jt})$	-0.025		
	(0.023)		
$Log(NeighborIncidents_{jt})$	-0.172***		
	(0.059)		
$Log(NeighborIncidents_{jt})*Log(Gdpc_{jt})$	0.023***		
	(0.007)		
$Log(Wartypes_{jt})$		-0.022	
		(0.024)	
$Log(NeighborWartypes_{jt})$		-0.176***	
		(0.061)	
$Log(NeighborWartypes_{jt})*Log(GDPc_{jt})$		0.024***	
		(0.007)	
$Log(Bombings_{jt})$			-0.013
			(0.024)
$Log(NeighborBombings_{jt})$			-0.197***
			(0.071)
$Log(NeighborBombing_{jt})*Log(GDPc_{jt})$			0.027***
			(0.008)
Year fixed effects	Yes	Yes	Yes
N	4,246	4,266	4,266
Adjuster R^2	0.90	0.90	0.90

Notes: Parentheses report standard errors adjusted for clustering at the importer level. See Table 1 for the list of other control variables. *, **, and *** denote 10%, 5% and 1% level of statistical significance, respectively.

Table 5: Spillover Effects of Terrorism, Required Time to Import

	Without time to import (1)	With time to import (2)	Without time to import (3)	With time to import (4)
$Log(Incidents_{jt})$			-0.026	-0.002
			(0.039)	(0.037)
$Log(NeighborIncidents_{jt})$	-0.051*	-0.035	-0.050*	-0.037
	(0.026)	(0.025)	(0.027)	(0.024)
$Log(Time_{jt})$		-0.011***		-0.011***
		(0.003)		(0.002)
Sobel's *t*-test		1.98**		1.71*
Exporter-year fixed effects	Yes	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes	Yes
Adjusted R^2	0.73	0.74	0.73	0.74
Period	2005-2014	2005-2014	2005-2014	2005-2014
N	126,934	126,934	126,934	126,934

Notes: Parentheses report bootstrapped standard errors adjusted for clustering at the importer level. Table 1 lists the other control variables. *, **, and *** denote 10%, 5% and 1% level of statistical significance, respectively.

Online Appendix

Effects of Neighboring Nation Terrorism on Imports

Subhayu Bandyopadhyay, Hristos Doucouliagos, and Cong S. Pham

February 3, 2020

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1. DATA USED IN THE ANALYSIS

1.1 Data sources

Data on terrorism are constructed using the Global Terrorism Database (GTD), University of Maryland. This database includes systematic data on domestic, transnational, and international terrorist incidents occurring during the period 1970 to 2014. For our purpose we only use data on incidents that the GTD can identify with certainty as terrorist incidents. This definition of terrorist incidents avoids overlap between terrorism and other forms of crime and political violence such as insurgency/guerilla action, other types of crime, inter/intra-group conflict, and terrorist incidents by state actors (GTD codebook 2017).[1] We match these data with trade data that commence from 1976. The final data includes 169 exporters and 142 importers, listed below in Tables A2 and A3.

Data on armed conflicts are obtained from the UCDP/PRIO Armed Conflict Dataset.[2] Armed conflict is defined as "a contested incompatibility that concerns government 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".[3]

Data on standard gravity model variables, such as bilateral distance between the exporter and importer, whether they share a common border, a common language, and a common colonial relationship are available from CEPII's gravity dataset. Data on whether the pair of trading partners has a common currency or a common free trade agreement are extracted from the De Sousa et al. (2009) database. Descriptive statistics for the variables are reported in the Table A4.[4]

1.2 Stock of terrorism

A stock based measure of terrorism enables investigation of the longer-term effects of terrorism, consistent with sustained effects on imports from the channels discussed above. The stock of terrorism is calculated as follows:

$$(1)\ Incidents^{S}_{j(t-1)} = \sum_{i=1}^{i=5}(1.2 - 0.2 * i)Incidents_{j(t-i)}$$

$$(2)\ NeighbourIncidents^{S}_{j(t-1)} = \sum_{i=1}^{i=5}(1.2 - 0.2 * i)NeighbourIncidents_{j(t-i)}$$

An annual discount rate of 20% is used to assign greater weight to recent terrorist incidents on the ground that more recent events are likely to have a greater impact.[5] However, we also explore the sensitivity of the results to alternate measures of the stock of terrorism.

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[1] Identification of incidents by state actors commenced in 2012. There are 200 such incidents out of 170,350 terrorist incidents for the period 1970-2016.

[2] The links to those databases are: http://www.correlatesofwar.org/, https://www.sipri.org/databases/milex, and https://www.prio.org/Data/Armed-Conflict/.

[3] For more detailed information on how an armed conflict is defined see UCDP/PRIO Armed Conflict Dataset Codebook: https://www.prio.org/Data/Armed-Conflict/UCDP-PRIO/.

[4] The GTD data can be found at: http://www.start.umd.edu/gtd/about/. The CEPII data can be found at: http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=8. The De Sousa et al. data can be found at: http://jdesousa.univ.free.fr/data.htm.

[5] Egger and Gassebner (2015) assign equal weight to all data when they compute their stock measure of terrorism. However, these authors use monthly data compared to our annual data.

Table A1: Global Terrorism Data, 1970 to 2014

Year	Incidents	Wartypes	Bombings
1970	489	327	256
1971	323	243	183
1972	315	287	140
1973	313	262	104
1974	440	391	233
1975	586	522	330
1976	663	544	338
1977	925	702	476
1978	1097	874	503
1979	1940	1517	876
1980	1610	1358	741
1981	1507	1261	832
1982	1638	1402	925
1983	1736	1456	926
1984	2314	1928	1390
1985	1989	1683	1225
1986	1960	1625	1197
1987	2293	1944	1245
1988	2608	2380	1324
1989	2829	2553	1346
1990	2592	2395	1370
1991	2953	2659	1606
1992	2926	2468	1359
1994	1989	1554	896
1995	1638	1149	596
1996	1756	1350	922
1997	1691	1247	845
1998	783	663	451
1999	952	768	490
2000	1452	1216	779
2001	1682	1404	732
2002	1151	999	642
2003	1078	933	585
2004	980	902	556
2005	1627	1470	890
2006	2371	2156	1362
2007	2834	2610	1636
2008	4342	3705	2480
2009	4560	3818	2516
2010	4631	3937	2452
2011	4659	4045	2451
2012	6953	6495	4279
2013	10011	9113	5683
2014	13510	11639	7309

Notes: We use the number of incidents that the GTD database can classify with certainty as terrorist incidents and construct the series by summing the alternate measures of terrorism for all countries for each year. *Incidents* denotes the number of terrorist incidents/attacks. *Wartypes* denotes the number of terrorist incidents/attacks in which either biological or chemical weapon or explosives/bombs or firearms are used. Bombings denotes the number of terrorist attacks with use of bombs. The raw data are derived from Global

Terrorism Database of the University of Maryland. The online link to the database is: https://www.start.umd.edu/gtd/.

Figure A1: World Map of Terrorism Intensity

Average number of annual terrorist incidents, 1970-2014

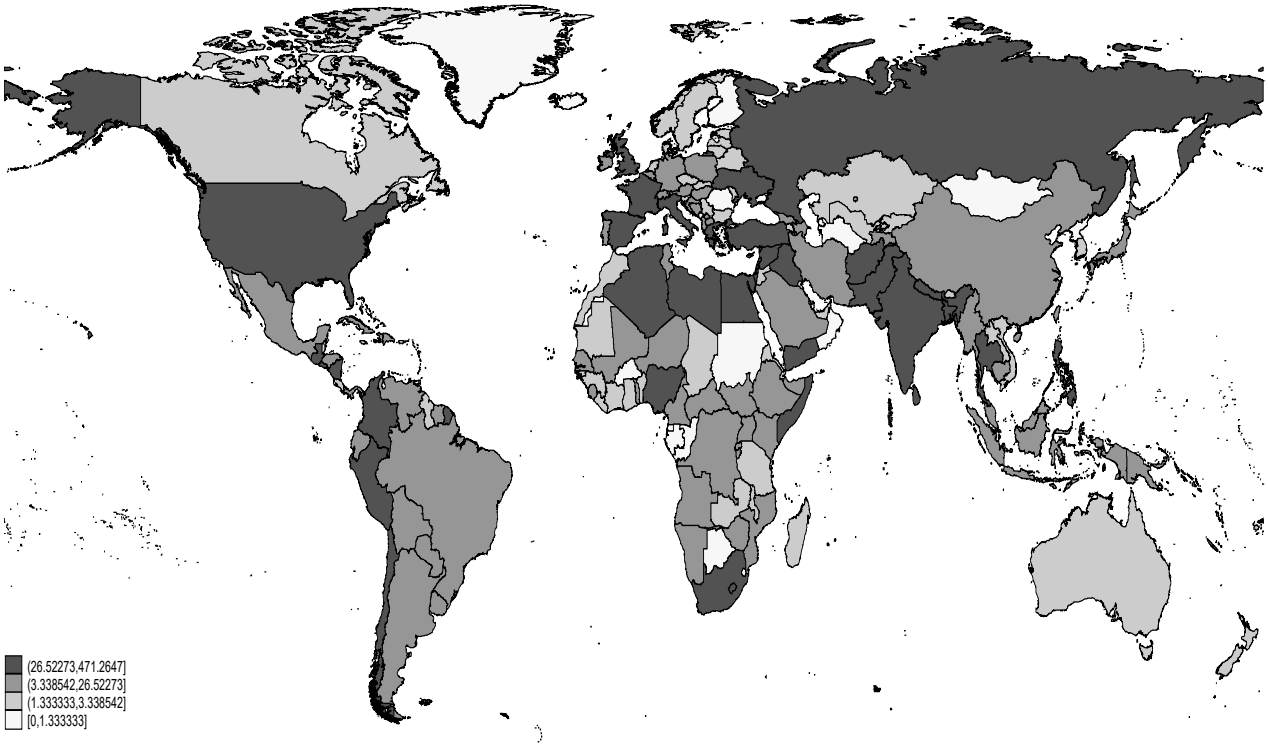

Table A2: List of Exporting Countries in the Sample

Afghanistan, Albania, Algeria, Andorra, Antiqua and Barbuda, Argentina, Armenia, Australia, Austria, Azerbaijan, Bangladesh, Barbados, Belarus, Belgium, Belize, Benin, Bhutan, Bolivia, Bosnia Herzegovina, Botswana, Brazil, Brunei Darussalam, Bulgaria, Burkina Faso, Burundi, Cabo Verde, Cambodia, Cameroon, Canada, Central African Republic, Chile, China, Colombia, Comoros, Congo, Cook Islands, Costa Rica, Croatia, Cuba, Cyprus, Czech Republic, Denmark, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Ethiopia, Faeroe Islands, Fiji, Finland, France, Gabon, Gambia, Georgia, Germany, Ghana, Greece, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana, Honduras, Hungary, Iceland, India, Indonesia, Iran, Iraq, Ireland, Israel, Italy, Ivory Coast, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kiribati, Kuwait, Kyrgyzstan, Latvia, Lebanon, Lesotho, Libya, Lithuania, Luxembourg, Madagascar, Malawi, Malaysia, Maldives, Mali, Malta, Mauritania, Mauritius, Mexico, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Norway, Oman, Pakistan, Palau, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Republic of Korea, Republic of Moldova, Russian Federation, Rwanda, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Sao Tome and Principe, Saud Arabia, Senegal, Seychelles, Singapore, Slovakia, Slovenia, Solomon Islands, South Africa, Spain, Sri Lanka, Sudan, Suriname, Swaziland, Sweden, Switzerland, Syria, TFYR of Macedonia, Thailand, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkey, Tuvalu, USA, Uganda, Ukraine, UAE, United Kingdom, United Republic of Tanzania, Uruguay, Vanuatu, Venezuela, Vietnam, Yemen, Zambia, Zimbabwe.

Table A3: List of Importing Countries in the Sample

Afghanistan, Albania, Algeria, Andorra, Angola, Argentina, Armenia, Austria, Azerbaijan, Bangladesh, Belarus, Belgium, Belize, Benin, Bhutan, Bolivia, Bosnia Herzegovina, Botswana, Brazil, Brunei Darussalam, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Canada, Central African Republic, Chad, Chile, China, Colombia, Congo, Costa Rica, Croatia, Czech Republic, Denmark, Djibouti, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Eritrea, Estonia, Ethiopia, Finland, France, Gabon, Gambia, Georgia, Germany, Ghana, Greece, Guatemala, Guinea, Guinea-Bissau, Guyana, Honduras, Hungary, India, Indonesia, Iran, Iraq, Ireland, Israel, Italy, Ivory Coast, Jordan, Kazakhstan, Kenya, Kuwait, Kyrgyzstan, Lao People's Democratic Republic, Latvia, Lebanon, Lesotho, Liberia, Libya, Lithuania, Luxembourg, Malawi, Malaysia, Mali, Mauritania, Mexico, Mongolia, Morocco, Mozambique, Namibia, Nepal, Netherlands, Nicaragua, Niger, Nigeria, Norway, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Poland, Portugal, Qatar, Republic of Korea, Republic of Moldova, Russian Federation, Rwanda, Saud Arabia, Senegal, Sierra Leone, Singapore, Slovakia, Slovenia, South Africa, Spain, Sudan, Suriname, Swaziland, Sweden, Switzerland, Syria, TFYR of Macedonia, Tajikistan, Thailand, Togo, Tunisia, Turkey, Turkmenistan, USA, Uganda, Ukraine, UAE, United Kingdom, United Republic of Tanzania, Uruguay, Uzbekistan, Venezuela, Vietnam, Yemen, Zambia, Zimbabwe.

Table A4: Descriptive Statistics

Variable	Observations	Mean	Std. dev.	Min	Max
$Log(Imports_{ijt})$	336,600	15.4754	3.606783	6.907755	26.51594
$Imports_{ijt}$	336,600	5.66E+08	5.03E+09	1000	3.28E+11
$Log(GDP_{jt})$	336,600	24.4588	2.201159	18.054	30.28901
$Log(Distance_{ij})$	336,600	8.577424	0.82655	4.741773	9.885839
FTA_{ijt}	336,600	0.124911	0.330618	0	1
$Currency_{ijt}$	336,600	0.017917	0.132652	0	1
$Border_{ij}$	336,600	0.030461	0.171851	0	1
$Language_{ij}$	336,600	0.155113	0.362013	0	1
$Colony_{ij}$	336,600	0.022576	0.148547	0	1
$Conflict_{jt}$	336,600	0.161661	0.36814	0	1
$NeighborConflict_{jt}$	336,600	1.479646	1.947671	0	13
$Log(Incidents_{jt})$	336,600	1.139866	1.540329	0	7.826044
$Log(NeighborIncidents_{jt})$	336,600	3.23742	2.136786	0	9.330698
$Log(Incidents^{S}_{jt})$	334,826	2.312275	1.919009	0	8.699164
$Log(NeighborIncidents^{S}_{jt})$	334,826	4.899042	2.115373	0	10.15697
$Log(Wartype_{jt})$	336,600	1.031664	1.482571	0	7.81843
$Log(NeighborWartypes_{jt})$	336,600	3.045093	2.136809	0	9.295876
$Log(Wartype^{S}_{jt})$	334,826	2.128212	1.89001	0	8.683876
$Log(NeighborWartypes^{S}_{jt})$	334,826	4.677841	2.139016	0	10.09471
$Log(Bombings_{jt})$	336,600	0.827899	1.346168	0	7.557473
$Log(NeighborBombings_{jt})$	336,600	2.595526	2.106958	0	8.918516
$Log(Bombing^{S}_{jt})$	334,826	0.915044	0.703486	0	1.88707
$Log(NeighborBombings^{S}_{jt})$	334,826	2.41244	1.046787	0	4.477337

Notes: S denotes a stock measure.

2. ALTERNATIVE REGRESSIONS AND ROBUSTNESS CHECKS

Table A5: Spillover Effect of Terrorism on Bilateral Trade, 10-year stock measure of terrorism

	(1)	(2)	(3)
$Log(GDP_{jt})$	0.907***	0.908***	0.914***
	(0.032)	(0.031)	(0.030)
$Conflict_{jt}$	-0.209***	-0.194***	-0.161*
	(0.080)	(0.082)	(0.084)
$NeighborConflict_{jt}$	-0.047	-0.053	-0.036
	(0.096)	(0.094)	(0.101)
$Log(Incidents_{jt})$	0.036		
	(0.028)		
$Log(NeighborIncidents_{jt})$	-0.050*		
	(0.027)		
$Log(Wartypes_{jt})$		0.029	
		(0.028)	
$Log(NeighborWartypes_{jt})$		-0.045*	
		(0.027)	
$Log(/Bombing_{jt})$			0.102
			(0.080)
$Log(NeighborBombing_{jt})$			-0.143**
			(0.056)
Constant	4.313***	4.263***	4.217***
	(0.837)	(0.832)	(0.813)
Gravity equation includes:			
Exporter-year fixed effects	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes
N	334,826	334,826	334,826
Adjusted R^2	0.72	0.72	0.72

Notes: N denotes the number of observations. Parentheses report standard errors adjusted for clustering at the importer level. See Table 1 in the text for the list of other control variables. *, **, and *** denote 10%, 5% and 1% level of statistical significance, respectively.

Table A6: Spillover Effect of Terrorism on Bilateral Imports, Alternative Measures of Terrorism

Variables	Flow (1)	Stock (2)		Flow (3)	Stock (4)
$Log(Wartypes_{jt})$	0.025		$Log(Bombings_{jt})$	0.024	
	(0.029)			(0.031)	
$Log(NeighborWartypes_{jt})$	-0.061**		$Log(NeighborBombings_{jt})$	-0.063***	
	(0.028)			(0.027)	
$Log(Wartypes^{S}_{jt})$		0.027	$Log(Bombings^{S}_{jt})$		0.091
		(0.027)			(0.080)
$Log(NeighborWartypes^{S}_{jt})$		-0.046*	$Log(NeighborBombings^{S}_{jt})$		-0.141**
		(0.027)			(0.055)
$Conflict_{jt}$	-0.186**	-0.192***	$Conflict_{jt}$	-0.181***	-0.157*
	(0.082)	(0.080)		(0.082)	(0.082)
$NeighborConflict_{jt}$	-0.017	-0.042	$NeighborConflict_{jt}$	-0.015	-0.034
	(0.022)	(0.095)		(0.022)	(0.101)
Constant	4.137***	4.222***	Constant	4.020***	4.133***
	(0.822)	(0.829)		(0.809)	(0.807)
Gravity equation includes:					
Exporter-year fixed effects	Yes	Yes		Yes	Yes
Other control variables	Yes	Yes		Yes	Yes
N	334,826	334,826		334,826	334,826
Adjusted R^2	0.72	0.72		0.72	0.72

Notes: *Wartypes* denotes the number of terrorist incidents/attacks in which either biological or chemical weapon or explosives/bombs or firearms are used. *Bombings* denotes the number of terrorist incidents with use of bombs and explosives. Columns (1) and (3) use flow measures of terrorist incidents. Columns (2) and (4) use stock measures of terrorist incidents. N denotes the number of observations. Parentheses report standard errors adjusted for clustering at the importer level. See Table 1 for the list of other control variables. *, **, and *** denote 10%, 5% and 1% level of statistical significance, respectively.

Table A7: Lagged Spillover Effect of Terrorism on Bilateral Import

Variables	Flow measure		
	One-year lag	Three-year lag	Five-year lag
	(1)	(2)	(3)
$Log(GDP_{jt})$	0.917***	0.916***	0.914***
	(0.031)	(0.032)	(0.032)
$Log(Distance_{ij})$	-1.298***	-1.292***	-1.291***
	(0.044)	(0.044)	(0.044)
FTA_{ijt}	0.613***	0.611***	0.608***
	(0.079)	(0.079)	(0.079)
$Currency_{ijt}$	0.162	0.149	0.148
	(0.158)	(0.157)	(0.156)
$Border_{ij}$	0.948***	0.939***	0.949***
	(0.114)	(0.114)	(0.115)
$Language_{ij}$	0.866***	0.873***	0.876***
	(0.085)	(0.085)	(0.086)
$Colony_{ij}$	1.064***	1.052***	1.050***
	(0.119)	(0.118)	(0.119)
$Conflict_{jt}$	-0.187**	-0.188**	-0.193***
	(0.079)	(0.077)	(0.075)
$NeighborConflict_{jt}$	0.014	0.006	0.001
	(0.022)	(0.023)	(0.023)
$Log(Incidents_{j(t-1)})$	0.026		
	(0.029)		
$Log(NeighborIncidents_{j(t-1)})$	-0.059**		
	(0.027)		
$Log(Incidents_{j(t-3)})$		0.029	
		(0.028)	
$Log(NeighborIncidents_{j(t-3)})$		-0.052*	
		(0.027)	
$Log(Incidents_{j(t-5)})$			0.034
			(0.026)
$Log(NeighborIncidents_{j(t-5)})$			-0.046*
			(0.027)
Constant	4.081***	4.042***	4.068***
	(0.828)	(0.823)	(0.831)
Gravity equation includes:			
Exporter-year fixed effects	Yes	Yes	Yes
N	328,157	326,518	325,804
Adjusted R^2	0.72	0.72	0.72

Notes: Terrorist events are lagged one year in Column (1), three years in Column (2), and five years in Column (3). N denotes the number of observations. Parentheses report standard errors adjusted for clustering at the importer level. *, **, and *** denote 10%, 5% and 1% level of statistical significance, respectively.

Table A8: Spillover Effect of Terrorism on Bilateral Trade, Excluding 7 Most Terrorism Prone non-OECD Countries

	Flow Measure			Stock Measure		
	(1)	(2)	(4)	(4)	(5)	(6)
$Log(GDP_{jt})$	0.937***	0.938***	0.939***	0.923***	0.927***	0.932***
	(0.040)	(0.040)	(0.039)	(0.041)	(0.041)	(0.040)
$Log(GDPC_{jt})$	-0.041	-0.042	-0.039	-0.036	-0.039	-0.039
	(0.055)	(0.056)	(0.056)	(0.053)	(0.053)	(0.055)
$Conflict_{jt}$	-0.222**	-0.209**	-0.213**	-0.226**	-0.211***	-0.204**
	(0.087)	(0.089)	(0.087)	(0.088)	(0.089)	(0.087)
$NeighborConflict_{jt}$	0.006	0.004	0.003	-0.106	0.019	-0.096
	(0.026)	(0.026)	(0.025)	(0.097)	(0.026)	(0.106)
$Log(Incidents_{jt})$	0.021			0.027		
	(0.029)			(0.027)		
$Log(NeighborIncidents_{jt})$	-0.062**			-0.043		
	(0.029)			(0.027)		
$Log(Wartypes_{jt})$		0.014			0.019	
		(0.029)			(0.026)	
$Log(NeighborWartypes_{jt})$		-0.057**			-0.038	
		(0.029)			(0.026)	
$Log(/Bombing_{jt})$			0.016			0.065
			(0.032)			(0.072)
$Log(NeighborBombing_{jt})$			-0.061**			-0.126**
			(0.028)			(0.053)
Constant	3.928***	3.904***	3.864***	4.176***	4.115	4.094
	(0.849)	(0.849)	(0.849)	(0.873)	(0.864)	(0.849)
Gravity equation includes:						
Exporter-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Other control variables	Yes	Yes	Yes	Yes	Yes	Yes
N	309,036	309,036	309,036	307,262	307,262	307,262
Adjusted R^2	0.72	0.73	0.72	0.72	0.72	0.72

Notes: Top 10 non-OECD most terrorism-intensive countries are Iraq, Pakistan, India, Colombia, Afghanistan, Peru, El Salvador, Philippines, Thailand and Sri Lanka. N denotes the number of observations. Parentheses report standard errors adjusted for clustering at the importer level. *, **, and *** denote 10%, 5% and 1% level of statistical significance, respectively.

Table A9: Spillover Effect of Terrorism on Bilateral Imports, 1993-2006

Variables	Flow measure		Stock measure	
	(1)	(2)	(3)	(4)
$Log(Incidents_{jt})$		0.019		0.042
		(0.034)		(0.031)
$Log(NeighborIncidents_{jt})$	-0.072**	-0.079**	-0.062*	-0.073**
	(0.032)	(0.033)	(0.036)	(0.036)
$Log(GDP_{jt})$	0.914***	0.914***	0.911***	0.900***
	(0.029)	(0.032)	(0.029)	(0.034)
$Log(Distance_{ij})$	-1.286***	-1.295***	-1.273***	-1.283***
	(0.047)	(0.047)	(0.046)	(0.047)
FTA_{ijt}	0.652***	0.671***	0.661***	0.684***
	(0.091)	(0.093)	(0.091)	(0.093)
$Currency_{ijt}$	0.173	0.151	0.167	0.156
	(0.174)	(0.177)	(0.174)	(0.176)
$Border_{ij}$	1.027***	1.037***	1.044***	1.053***
	(0.111)	(0.113)	(0.112)	(0.113)
$Language_{ij}$	0.924***	0.896***	0.939***	0.908***
	(0.086)	(0.084)	(0.087)	(0.085)
$Colony_{ij}$	1.060***	1.066***	1.056***	1.038***
	(0.117)	(0.114)	(0.119)	(0.114)
$Conflict_{jt}$	-0.142*	-0.181**	-0.132	-0.225**
	(0.086)	(0.084)	(0.087)	(0.088)
$NeighborConflict_{jt}$	0.025	0.029	0.013	0.014
	(0.020)	(0.021)	(0.020)	(0.021)
Constant	3.943***	4.043***	4.032***	4.325***
	(0.740)	(0.793)	(0.743)	(0.812)
Gravity equation includes:				
Exporter-year fixed effects	Yes	Yes	Yes	Yes
N	168,593	157,303	168,593	157,303
Adjusted R^2	0.73	0.73	0.73	0.72

Notes: Results use only the data for the period 1993-2016. N denotes the number of observations. Parentheses report standard errors adjusted for clustering at the importer level. *, **, and *** denote 10%, 5% and 1% level of statistical significance, respectively.

3. Mediation analysis

We use mediation analysis to investigate trading delays as a channel that may drive trade spillovers from terrorism (Baron and Kenny, 1986). Mediation analysis allows us to draw deeper insights into the nature of the spillover impact of terrorism on bilateral trade. While mediation analyses is often employed in psychology and medicine in order to study the mechanisms by which an intervention/treatment achieves its effects, application of mediation analysis in the empirics of international trade is less common.

We use the Sobel *t*-test for statistical inference (see Sobel 1982, and MacKinnon et al. 1995). The Sobel test is: $ab/\sqrt{(a^2 s_b^2 + b^2 s_a^2)}$, where *a* and *b* are respectively, the coefficient estimates on the effect of *Log(NeighborTerror)* on a mediating variable (e.g. *Time*) and the coefficient estimate on the effect of the mediating variable ($Time_j$) on the dependent variable (*Log(Imports)*). s_a and s_b are their respective standard errors.

References

Baron, R.M., Kenny, D.A. 1986. The moderator-mediator variable distinction in social psychological research – conceptual, strategic, and statistical considerations. *J. Per. Soc. Psy.* 51(6): 1173–1182.

MacKinnon, D.P., Warsi, G., Dwyer, J.H. 1995. A simulation study of mediated effect measures. *Multivariate Behavioral Research, 30:* 41-62.

Sobel, M.E. 1982. Asymptotic confidence intervals for indirect effects in structural equation models. *Sociological Methodology 13:* 290-312.