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Terrorism, Trade, and Foreign Direct Investment in Central and Eastern Europe

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Abstract

This paper investigates the impact of terrorism on bilateral trade and on Foreign Direct Investment (FDI) inflows into Central and Eastern Europe. We apply an extended gravity model to panel data, using per capita incomes of Central and Eastern European countries and their internal distance, along with traditional gravity variables. The results show that terrorism hurts imports and FDI flows into these countries. We then perform a comparative analysis across countries with high, medium, and low levels of terrorist activity. The results reveal that the impact is directly related to levels of terrorism. However, there is a disparity in the levels of statistical significance.

Keywords: *gravity model, terrorism, bilateral trade, exchange rate.*

JEL Classification: F02, F14, F18

1. Introduction

International trade plays an important role in sustainable development. However, trade can only flourish if a host country maintains a safe and friendly environment for foreign companies.

The September 11, 2001, terrorist attack in the U.S. adversely affected the U.S. economy and its trade partners, specifically imports from the U.S. into its trade partners. The richer a host country, the more active the terrorist activities. Also, the less secure the host nation, the more negative effects of imports from the U.S.

Regarding Central and Eastern Europe, the war on terrorism adversely affected bilateral trade between the U.S. and these countries.

In this paper, we use data on terrorism in Central and Eastern Europe. The variable of terrorist activities is added to the relative exchange rate, a policy-oriented determinant of imports. In addition to traditional gravity variables, we use data on terrorist activities in host countries and their internal distance, measured as the average distance between any two points within a country. The larger the country's size, the greater the internal distance.

2. Existing Research

Tinbergen (1962), Poyhonnen (1963), and Linneman (1966) were the first authors to apply the gravity model to bilateral trade. Their model was based on Newton's law of physics. This law states that the gravitational force between two objects depends directly on

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their masses and inversely on the square of the distance between them. The above economists then posited that imports between two countries depend directly on both countries' incomes and inversely on the distance between them:

$$M_{ij} = B\frac{Y_i Y_j}{D^{\delta}} \quad (1)$$

where M_{ij} is country j's imports of country i's tradable goods, Y_i and Y_j are aggregate incomes in countries *i* and *j*, respectively, *D* is the distance between the two countries, and *B* is the gravitational constant.

Taking the logarithm of this equation yields the traditional model for bilateral trade. However, economic theory stipulates that the import of country i from country j depends only on country *i's* income.

Anderson (1979) introduced a theoretical justification for the gravity model based on three assumptions: (1) each country specializes in one product; (2) there is no tariff or transportation cost; and (3) trade is always balanced for country *i*. The demand for country *i*'s tradable goods in country *j* (*j's* imports of *i*'s good, or *i*'s exports of these goods to *j*) is written as:

$$M_{ij} = \theta_i \phi_j Y_j \quad (2)$$

where $\phi_j (\text{or } \phi_i)$ is the share of expenditure on all traded goods in the total expenditures of country *j* (or *i*).

The balance-of-trade assumption for country *i* implies that the value of imports plus domestic spending on domestic tradable goods equals the value of exports plus domestic spending on domestic tradable goods:

$$\phi_i Y_i = \theta_i \sum_j \phi_j Y_j \quad (3)$$

Solving Equation (3) for θ_i and substituting it into Equation (2) yields:

$$M_{ij} = \frac{\phi_i Y_i \phi_j Y_j}{\sum_j \phi_j Y_j} \quad (4)$$

Take the log of Equation (4) to obtain:

$\ln M_{ij} = \ln \phi_i + \ln Y_i + \ln \phi_j + \ln Y_j - \ln \sum_j \phi_j Y_j$, and so,

$$\ln M_{ij} = \beta + \ln Y_i + \ln Y_j - \ln \sum_j \phi_j Y_j \quad (5)$$

where $\beta = \ln \phi_i + \ln \phi_j$

Bergstrand (1985) added the costs of distribution, marketing, and dependence of each country's products on their own market conditions into the equation. Bergstrand (1990) introduced monopolistically competitive markets and a production function with increasing returns to scale. Rauch (1999) added several new variables, such as a common border between the two countries, linguistic and colonial links, and trade bloc membership.

Baier and Bergstrand (2001) further improved the model by incorporating trade openness, including transport-cost reductions and tariff liberalization. Feenstra (2004) modified the original equation to account for omitted variable bias. Bergeijk (2010) applied the Feenstra model to estimate trade volume, rather than exports or imports, using data on the real GDP and per capita income of the two trading partners. Fracasso (2014) used per capita income separately in the context of trading water.

All these papers find that incomes or per capita incomes in both countries affect bilateral trade positively.

Nitsch and Schumacher (2003) were the first to provide a paper on bilateral trade and terrorism. The authors examined the effect of terrorism on bilateral trade between more than 200 countries during 1960-1993. They found that terrorist activities reduce the trade volume.

The idea of transnational terrorism as a bilateral activity, which involves a source country where the terrorism originated from and a host country where transnational terrorism occurs, is even newer than that of host-country terrorism. Bell (2004) discusses how terrorists in Canada exported their terrorism worldwide.

Regarding Central and Eastern European countries, Gros and Gonciarz (1996) applied a gravity model to examine the volume and direction of trade during the transition from socialism to capitalism. The results indicate that their trade responded very quickly to the new regimes and was redirected to European Union markets. The authors predicted a big potential for trade in Europe in this transitional period.

Gherghina *et al.* (2019) estimated the impact of FDI inflows on economic growth for 11 Central and Eastern European countries from 2003 to 2016. Applying a panel vector error-correction model, they found a one-way causal association running from FDI to growth in the short run and a two-way causal connection between FDI and growth in the long run.

Mares (2010) discussed terrorism in Eastern and Central Europe, emphasizing that this region has the potential to become a logistical space for international terrorism, such as weapons procurement, housing, and training for terrorists. There are threats of Islamic and Middle Eastern terrorism against the pro-American and pro-Israeli policies of Eastern and Central European countries, especially after 9/11.

The idea of transnational terrorism as a bilateral activity, which involves a source country where the terrorism originated from and a host country where transnational terrorism occurs, is even newer than that of host-country terrorism. Bell (2004) discusses how terrorists in Canada exported their terrorism worldwide.

Blomberg and Rosendorff (2006) were the first to investigate transnational terrorism as an export of violent activities. They examined the impact of bilateral terrorism on two income variables, the distance between the two countries, and several other variables for the economic and political conditions. Their results show that the incomes of both source and host countries have a significantly increasing impact on bilateral terrorism.

Mirza and Verdier (2008) also recommend using bilateral flows of transnational terrorism as a bilateral variable in the gravity model.

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Their idea is an extension of an earlier paper by Mirza and Verdier (2006), who estimated a system of equations and focused on the US as a singular target country. They found feedback effects between bilateral terrorism and trade flows between the US and its trade partners.

Blomberg and Rosendorff (2006) identified the source countries for many transnational terrorists by reading the descriptions of terrorist incidents for the period 1968-2003 reported in Miklous *et al*. (2002), but the identification was based on their own judgment, so it is full of subjectivity

As a result, the other studies have used only data on terrorist activities in host countries and estimated other aspects of terrorism. Blomberg and Mody (2007) found that terrorism in a host country reduces investment. Piazza and Walsh (2009) found that terrorism increases the human rights measures governments impose on host countries. Llorca-Vivero (2013) showed that terrorism reduces tourist flows to a host country, and Berrebi and Ostwald (2015) revealed that terrorism decreases fertility rates in host countries.

Based on this analysis, we also use only data on terrorist activities in the Central and Eastern European countries for our estimation. Unlike the above authors, we investigate terrorist activities in U.S. partners and examine the effects of these attacks on U.S. imports into these partners.

To our best knowledge, no author has examined the nexus between terrorism, imports from the U.S., and inflows of FDI to these countries.

3. Model and Data

Model

We explore the traditional gravity model as written in Equation (5) with the logarithm of distance:

$$IMP_{ij,t} = \alpha_1 + \alpha_2 TER_{j,t-k} + \alpha_3 PCY_{i,t-k} + \alpha_4 PCY_{j,t-k} + \alpha_5 DIS_{ij} + \alpha_6 EXC_{ij,t-k} + \varepsilon_{it},$$

$$FDI_{j,t} = \alpha_1 + \alpha_2 TER_{j,t-k} + \alpha_3 PCY_{i,t-k} + \alpha_4 PCY_{j,t-k} + \alpha_5 DIS_{ij} + \alpha_6 EXC_{ij,t-k} + \varepsilon_{it}$$

$$k = 0,1,2,\ldots n, \text{ with } n \text{ to be decided by the Akaike Information Criteria } (AIC);_6$$

where

$IMP_{ij,t-k}$ = per capita imports from country *i* to country *j* at time *t* – *k*

$FDI_{j,t-k}$ = per capita FDI inflows to country *j* at time *t* – *k*

$TER_{j,t-k}$ = terrorist activities in country *j* at time *t* – *k*

$PCY_{i,t-k}$ = per capita income of country *i* at time *t* – *k*

$PCY_{j,t-k}$ = per capita income of country *j* at time *t* – *k*

DIS_{ij} = distance between countries *i* and country *j*

$EXC_{ij,t-k}$ = exchange rate (country *i*'s currency in terms of country *j*'s)

i = the U.S.

j = each of the trade partners of the U.S.

Data

The dataset on imports of goods by the U.S.'s partners is from the Direction of Trade on the International Monetary Fund (IMF) and Eurostat websites. This dataset is comprehensive for imports of goods by 11 Central and Eastern European countries from the U.S. in the period 1995-2020, totaling 286 observations. These 11 Central and Eastern European countries include Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia. The FDI inflow dataset is from the World Bank's World Development Indicators (WDI) database. We generate binary dummy variables to control for missing observations. For the problem of generating dummy variables in logarithmic functions, see Vu (2018).

The datasets are in current US dollars. We convert to constant 2010 dollars using data on the GDP deflators from the U.S. Department of Agriculture (USDA). Datasets on trade in services are not comprehensive and so are not used in our analysis.

The dataset on the number of terrorist incidents that occurred in the above host countries is from the Global Terrorism Database (GTD) website. Incidents are reported monthly for each country, so we add them up to obtain the yearly data. We use 2002 as the cut point to examine the impact of the 2001 event.

Data for real per capita income and population are from the USDA website. The dataset on imports is then divided by population to obtain per capita measures.

Data on distances are from the Institute for Research on the International Economy website. We also alternate between two models: the first uses the distance between two countries only (DIS), and the second uses the internal distance (*INDIS*) for each country added. The internal distance is the average domestic distance between host region and source region in country *j*, with a land size A_j equal to the radius of a circular area, which is approximately equal to the country's land size A_j:

$$INDIS_{jj} = \sqrt{A_j / \pi} \qquad (7)$$

Datasets on real exchange rates are from the U.S. Department of Agriculture website. They are expressed as the comparative exchange rate between a country and the US real exchange rate, which is normalized to unity. We convert this dataset to the bilateral exchange rate between the U.S. and each of its trade partners by forming the ratio of the two exchange rates. All other data are available for the period from 1995 to 2020.

4. Estimation Results

We first perform the AIC procedures and find that models using one-lag values are the best. Next, we carry out the Granger Causality tests to investigate feedback effects. The results for all models show that imports per capita from the U.S. to its trade partners do not Granger-cause the terrorist activities. Thus, single-equation estimations are appropriate. We then perform the modified Hauman test and find that the models do not have any endogenous problems.

The original Hausman tests performed for model selection indicate that fixed effect (FE) models are more suitable than random effect (RE). Therefore, all estimations are carried out using the fixed effect approach of least squares dummy variables (LSDV) with both country dummies and time dummies added.

All VIF values and the average VIF are between allowable ranges.

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The Ramsey RESET tests show that the models do not have any important omitted variables for all cases (performed without any dummy, or with country and time dummies). Hence, we decide to keep the models parsimonious to avoid the inflated variances of the estimated coefficients.

The White tests reveal that there are heteroskedasticity problems in both models. As a result, the subsequent regressions are performed using the Stata robust commands to obtain corrected standard errors. We also perform the Arellano-Bond (1991) tests on the possible autocorrelations for panel data. The results show that there are no serious autocorrelation problems.

Table 1 reports the aggregate effects of the terrorist activities against U.S. trade partners' imports from the U.S.

Table 1

Aggregate Effects of Terrorism on Imports of Trade Partners from the U.S.

Dependent Variable: Logarithm of Bilateral Imports per Capita

Variable	Model (1) without INDIS	Model (2) with INDIS
$TER_{j,t-1}$	-0.546** (0.019)	-0.665** (0.034)
U.S. $PCY_{i,t-1}$	0.3546** (0.029)	0.3704** (0.025)
Partners' $PCY_{j,t-1}$	1.354*** (0.004)	1.398** (0.022)
$EXC_{ij,t-1}$	0.6288*** (0.002)	0.6309** (0.032)
DIS_{ij}	-0.0465* (0.068)	
$INDIS_{jj}$		-0.0121* (0.095)
$TER_{j,2002}$	-.0127** (0.028)	-.1123*** (0.004)
Prob > F R-squared Root MSE	0.000 0.7725 0.3289	0.000 0.7698 0.3178

Notes: numbers within parentheses are *p*-values; the notations ***, **, and * denote statistical significances at 1, 5, and 10 percent levels, respectively.

The table shows that terrorist activities in host countries adversely affect the per capita imports of trade partners from the U.S. The estimated coefficients are statistically significant for both models.

The effect of the per capita income on imports and exports during 2002 decreased substantially as expected. We also find that the signs of all variables with theoretical foundations are as expected. First, the per capita incomes of both the U.S. and its trade partners affect imports per capita from the U.S. positively, and all estimated coefficients are statistically significant. Second, the exchange rate depreciation has a positive and statistically significant impact on a partner's imports from the U.S.

Since host countries sometimes confuse terrorism with other violent activities when reporting terrorist incidents, readers are encouraged to focus on the direction (positive or negative) of the results rather than the exact magnitude of the estimated coefficients.

We then examine the effects of Terrorism on FDI Inflows to the host countries. Table 2 reports the results.

Table 2

Aggregate Effects of Terrorism on FDI Inflow to Central and Eastern Europe

Dependent Variable: Logarithm of FDI Inflows per Capita

Variable	Model (1) without INDIS	Model (2) with INDIS
$TER_{j,t-1}$	-0.227** (0.035)	-0.154** (0.032)
U.S. $PCY_{i,t-1}$	0.3512** (0.022)	0.3436** (0.028)
Partners' $PCY_{j,t-1}$	1.133** (0.034)	1.301** (0.028)
$EXC_{ij,t-1}$	0.6206** (0.42)	0.6312** (0.037)
DIS_{ij}	-0.0469* (0.078)	
$INDIS_{jj}$		-0.0131* (0.067)
$TER_{j,2002}$	-0.2167** (0.024)	-0.2651*** (0.009)
Prob > F R-squared Root MSE	0.000 0.7845 0.3265	0.000 0.7923 0.3171

Notes: numbers within parentheses are *p*-values; the notations ***, **, and * denote statistical significances at 1, 5, and 10 percent levels, respectively.

The results show that the impact of terrorist activities on FDI inflows in host countries is negative and statistically significant.

We next investigate the effects of terrorist activities in certain groups of countries on their imports from the U.S. and FDI inflows. Countries are divided into three groups: the first comprises countries with a high number of terrorist incidents. The interaction terms of this group with *TER* the high-terrorism variables (*HITE*). The second group comprises countries with an intermediate *TER* (*METE*). The last group is the remaining countries with a low level of *TER* (*LOTE*). The *HITE* is used as the base group. Table 3 displays the estimation results.

Table 3

Group Effects of Terrorism on Partners' Imports from the U.S.

Dependent Variable: Logarithm of Bilateral Imports per Capita

Variable	Model (1) without INDIS	Model (2) with INDIS

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$HITE_{j,t-1}$	-0.757** (-.024)	-0.624** (0.041)
$METE_{j,t-1}$	0.056** (0.045)	0.049** (0.026)
$LOTE_{j,t-1}$	0.015* (0.086)	0.013* (0.091)
U.S.'s $PCY_{i,t-1}$	0.2856** (0.046)	0.3135** (0.033)
Partners' $PCY_{j,t-1}$	1.289** (0.031)	1.287*** (0.001)
$EXC_{ij,t-1}$	0.5752*** (0.005)	0.6308** (0.035)
DIS_{ij}	-0.3959* (0.065)	0.6308** (0.035)
$INDIS_{jj}$		-0.0013* (0.089)
$TER_{j,2002}$	0.1700** (0.025)	0.1680** (0.026)
Prob > F R-squared Root MSE	0.000 0.7203 0.3976	0.000 0.7935 0.3087

Notes: numbers within parentheses are *p*-values; the notations ***, **, and * denote statistical significances at 1, 5, and 10 percent levels, respectively.

The results show that the impact on imports is the most severe for the high-income group. The impact is lower for the middle-income group. The impact on the low-income group is somewhat lower than the high-income group, but only weakly significant.

Table 4 reports the results for the FDI inflows into the host countries.

Table 4

Group Effects of Terrorism on FDI Inflows to Central and Eastern Europe

Dependent Variable: Logarithm of FDI Inflows per Capita

Variable	Model (1) without INDIS	Model (2) with INDIS
$HITE_{j,t-1}$	-0.602*** (0.003)	-0.598** (0.047)
$METE_{j,t-1}$	0.043** (0.041)	0.052** (0.029)
$LOTE_{j,t-1}$	0.217* (0.079)	0.196* (0.078)
U.S.'s $PCY_{i,t-1}$	0.276** (0.043)	0.305** (0.031)
Partners' $PCY_{j,t-1}$	1.302*** (0.005)	1.296** (0.035)
$EXC_{ij,t-1}$	0.5576*** (0.004)	0.602** (0.031)
DIS_{ij}	-0.3758* (0.085)	0.602** (0.031)
$INDIS_{jj}$		-0.021* (0.069)
$TER_{j,2002}$	1.1187*** (0.006)	1.1198*** (0.000)
Prob > F R-squared Root MSE	0.000 0.7367 0.3924	0.000 0.7698 0.3276

Notes: numbers within parentheses are *p*-values; the notations ***, **, and * denote statistical significances at 1, 5, and 10 percent levels, respectively.

The results show that the impact on FDI inflows is also the most severe for the high-income group. The impact is lower for the middle-income group. The impact on the low-income group is lower than the high-income group, but again, only weakly significant.

The weak significance of the variables' distances in all models is understandable: There is no theoretical foundation in economics concerning the relationship between distance and trade.

5. Conclusion

In tis paper, we investigate the impact of terrorist activities in Central and Eastern European countries on their imports from the U.S. and FDI inflow. The results show that terrorism in host countries adversely affects the per capita imports of trade partners from the U.S.

Additionally, the impact is more severe the richer a country. The weak significance of the impact on the low-income group implies that a safe environment is also important for trade. A low-income country attracts fewer terrorist activities, but the host country also has fewer means to guarantee security for a foreign company investing in its trade. The result is an ambiguous impact on trade activities.

Many other determinants of trade and FDI are not discussed in this paper due to our parsimonious approach. These issues are left for future research.

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