WP/15/225

IMF Working Paper

Fiscal Consequences of Terrorism

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INTERNATIONAL MONETARY FUND

 WP/15/225

IMF Working Paper

Fiscal Affairs Department

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October 2015

ABSTRACT

This paper provides an empirical analysis of how the frequency and severity of terrorism affect government revenue and expenditure during the period 1970–2013 using a panel dataset on 153 countries. We find that terrorism has only a marginal negative effect on tax revenue performance, after controlling for economic and institutional factors. This effect is also not robust to alternative specifications and empirical strategies. On the other hand, we find strong evidence that terrorism is associated with an increase in military spending as a percent of GDP (and a share of total government expenditure). Our estimations reveal that this impact is greater when terrorist attacks are frequent and result in a large number of fatalities. Empirical findings also support the view that public finances in developing and low-income countries are more vulnerable to terrorism than those in countries that are richer and diversified.

JEL Classification Numbers: D74, H20, H56

Keywords: Terrorism, tax revenue, military spending

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* The authors would like to thank Mark De Broeck, Annalisa Fedelino, Vitor Gaspar, Sanjeev Gupta, Daniel Leigh, Edouard Martin, Marco Pani, Christopher Towe, and participants at a seminar at the Fiscal Affairs Department of the International Monetary Fund for their insightful comments and suggestions.

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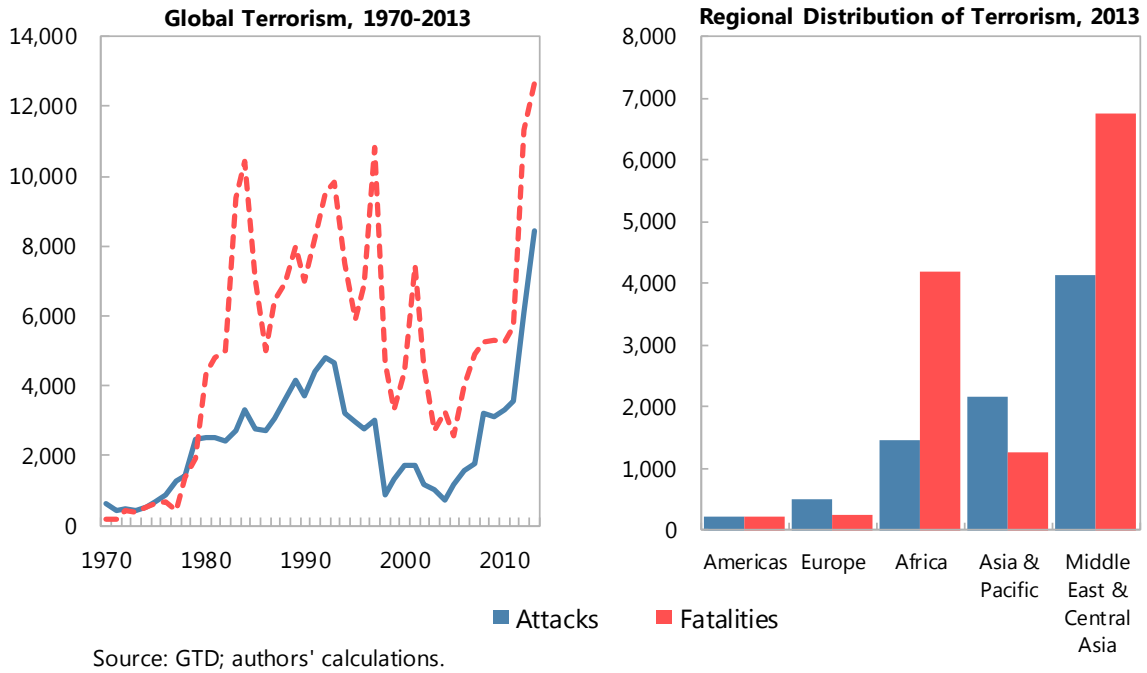
I. INTRODUCTION

The incidence of terrorist attacks across the world increased from 651 in 1970 to 11,952 in 2013, raising the number of terror-related casualties from 171 to 22,178 per annum, according to the Global Terrorism Database (GTD).[1] Terrorism does not only victimize tens of thousands of people across the world, but may also impose economic costs through direct and indirect channels. While the direct costs of loss of life and physical destruction caused by terrorist attacks can be plausibly estimated, the magnitude of indirect effects on consumption, investment, and growth through changes in risk perceptions and utilization of resources is challenging to pinpoint with a reasonable degree of precision. There is a growing literature on the casual relationship between terrorism and economic growth, but scarce research looking at the impact of terrorism on public finances. Accordingly, the objective of this paper is to develop a better understanding of the fiscal dimension of terrorism by empirically exploring the discernible consequences for tax revenue performance and the composition of government spending in a cross-country framework.

Figure 1. Terrorism Across the World



Source: GTD; authors' calculations.

This paper adds to the existing literature in a number of ways. Firstly, we focus on an underdeveloped strand of research and examine the impact of terrorism on tax revenue and military spending as a share of GDP. Secondly, to the best of our knowledge, we are the first to

[1] The sample of countries for the empirical analysis excludes Afghanistan and Iraq. Accordingly, the total number of terrorist attacks and fatalities used in this paper increased from 601 and 161, respectively, in 1970 to 7,592 and 11,424 in 2013.

focus exclusively on terrorism, measured by the number of terrorist attacks and fatalities scaled by population, excluding episodes of civil conflict. Thirdly, we employ an expansive panel dataset of annual observations on a broad set of 153 countries over a long time span running from 1970 to 2013. The empirical analysis controls for demographic, economic, and institutional factors, and employs alternative panel data estimation techniques addressing econometric issues, such as the potential endogeneity of the regressors. Considering the possibility of cross-country heterogeneity in the coefficient estimates, we drop countries with no incidence of terrorism and divide the sample in two groups of countries that experience below or above the median of the sample statistical distribution with respect to terrorist incidents. This approach identifies hidden variability not captured by the full sample estimates, and also provides an implicit assessment of nonlinearities. We also perform numerous robustness checks, including a quasi-experimental approach using the difference-in-differences methodology, to validate our empirical findings.

Our empirical findings reveal that terrorism has only a marginal negative effect on tax revenue, after controlling for economic and institutional factors. This effect is also not robust to alternative specifications and modeling techniques. On the other hand, with regards to the composition of government spending, we find strong evidence that terrorism is associated with an increase in military spending as a percent of GDP (and a share of total government expenditures).[2] The impact of terrorism on military spending appears to be greater when attacks are prevalent and cause a large number of casualties. Finally, the analysis supports the view that public finances in developing and low-income countries are more vulnerable to terrorism than those in countries that are richer and diversified. What conclusions can we draw from these results? The sources of terrorism are beyond the scope of this paper, and may well be linked in part to exogenous factors outside the direct control of policymakers. The empirical evidence presented in this paper, however, indicates that greater economic diversification and openness and institutional development over the longer term can mitigate the potential impact of terrorism on public finances.

The remainder of this paper is organized as follows. Section II provides a brief overview of the literature on terrorism and economy. Section III describes data sources and provides a survey of the historical incidence of terrorist attacks. Section IV describes the salient features of our empirical strategy and econometric results, while concluding remarks are in Section V.

II. TERRORISM AND ECONOMY: WHAT DO WE KNOW?

There is a mounting literature on the interactions between terrorism and economic activity, building formal theoretical models and developing quantitative empirics to understand the channels of transmission.[3] The direct economic costs of terrorism are associated with loss of life

[2] Data constraints limit the empirical analysis to military spending, instead of a broader definition of government expenditure (including extra-budgetary funds) for military, police, and public order and safety within a country's frontiers including security arrangements at public gatherings and border crossings. Available data indicate that the share of spending on law and order has generally been growing faster than military and now accounts for more than half of the total among OECD countries.

[3] Enders and Sandler (2006) provide a comprehensive survey of the literature on terrorism.

and destruction of physical capital. Becker and Murphy (2001) argue that terrorism should not have a large effect on economic activity as long as terrorist attacks destroy an insignificant fraction of a country's capital stock. The objective of terrorism, however, is not simply to cause loss of life and physical destruction, but to inflict an emotional shock with behavioral consequences beyond the direct costs associated with such attacks. Indirectly, therefore, the economic consequences of terrorism emerge from behavioral changes, such as lower consumer confidence, higher cost of borrowing due to perceived risk and uncertainty, decline in domestic and foreign investment, and a shift in the composition of public expenditure away from productive areas (Lenain, Bonturi, and Koen, 2002; Eckstein and Tsiddon, 2004; Gupta and others, 2004; Johnston and Nedelescu, 2005; Sandler and Gaibulloev, 2008).

From an empirical point of view, most studies exploit a single-country time series approach to identify the economic consequences of terrorism. In the case of the US, for example, Becker and Murphy (2001) estimate that the terrorist attacks of September 11, 2001 resulted in a loss of 0.06 percent of productive assets, with a long-run effect of 0.3 percent of GDP. Similarly, Blomberg, Hess, and Orphanides (2004) find an average reduction of 0.05 percent in real GDP per capita growth in an analysis of transnational terrorist attacks across 177 countries during 1968–2000. These calculations, however, do not fully capture the indirect effects of terrorism. Becker and Rubinstein (2004), for example, acknowledge that terrorism may have a large economic impact if the fear of terrorism alters individual behavior. Focusing on Israel's experience, Eckstein and Tsiddon (2004) demonstrate that terrorism has a significant negative effect on income per capita in the short term as well as over a longer time horizon. Similarly, Araz-Takay, Rain, and Okay (2009) examine the economic impact of terrorism in Turkey and show that terrorism has a greater negative effect on the economy during expansions. Abadie and Gardeazabal (2003) examine the effects of terrorism in Spain's Basque region and identify a 10 percentage point decline in per capita income due to terrorism relative to a synthetic control region without terrorism. In a cross-country setting, while Tavares (2004) finds no evidence for terrorism having a discernible impact on economic growth, Crain and Crain (2006) and Meierrieks and Gries (2012) identify a significant negative effect of terrorism on economic activity.

While there is a burgeoning literature on the macro-financial impact of terrorism, there is sparse empirical research on the fiscal consequences of terrorism. Gupta and others (2004) provide the most relevant example in this context and present evidence that terrorism and other types of armed conflict distort the composition of public expenditures and impede revenue collection in low- and middle-income countries. This analysis, however, coalesces terrorism and episodes of civil conflict by using a composite index and thereby does not exclusively measure the impact of terrorism. Other studies tangentially touch upon the relationship between terrorism and public finances. For example, while focusing on the growth impact of terrorism, Blomberg, Hess, and Orphanides (2004) show that terrorism is associated with lower investment and higher government spending. Gaibulloev and Sandler (2008) conduct a similar analysis and find that acts of terrorism lead to an increase in government spending in European countries.

III. Data and Descriptive Statistics

Terrorism can be generalized as the premeditated use of violence against civilians by a non-state actor outside the context of legitimate warfare activities to obtain economic, political, religious,

or social objective through fear, coercion and intimidation of larger audiences other than the immediate victims. In this context, two indicators of terrorism—the number of attacks and fatalities—are drawn from the GTD introduced by LaFree and Dugan (2007) and maintained by the University of Maryland. The GTD is considered to be most comprehensive database on terrorism across the world, covering both domestic and transnational terrorist events. Thereby, it provides a broader perspective on terrorist incidents excluding episodes of civil conflict and those cases in which state actors are reportedly involved. As a robustness check, we conduct the econometric analysis after filtering out attacks and fatalities about which there is not sufficient information to make an unambiguous determination of whether or not it is exclusively terrorism. The GTD provides series for this restrictive (narrow) definition of terrorism since 1997.

The dataset used in this paper encompasses an unbalanced panel of annual observations on 153 countries, excluding Afghanistan and Iraq, over the period from 1970 to 2013.[4] Economic and financial statistics are assembled from the IMF's Government Finance Statistics, International Financial Statistics and World Economic Outlook databases, the World Bank's World Development Indicators database, and the OECD database on tax revenues. Military spending figures are sourced from the Stockholm International Peace Research Institute (SIPRI) database and the World Military Expenditure and Arms Transfers (WMEAT) report published by the US Department of State. The democracy index comes from the Polity IV database, compiled by the Center for Systemic Peace.

The summary statistics for all variables used in this study appear in Appendix Table A1. There is a great degree of dispersion across countries in terms of tax revenue and the level and share of military spending. The mean value of tax revenue as a share of GDP is 18.3 percent over the sample period 1970–2013, but it varies from a minimum of 16.5 percent to a maximum of 22.2 percent. Military spending as a share of GDP has a mean value of 2.4 percent and ranges from a minimum of 1.8 percent to a maximum of 3.8 percent. Our main explanatory variable of interest is terrorism, measured by the number of terrorist attacks or fatalities scaled by population in a given year. The broad measures of terrorism exhibit significant variation across countries over the period 1970–2013. While the mean value of terrorist attacks is 15.5 with a minimum of 3.4 and a maximum of 43.6, there is an upward trend in frequency. Likewise, the number of terrorism-related fatalities per million inhabitants ranged from a minimum of 0.03 to a maximum of 13, with a mean value of 2.5 over the sample period. Other explanatory variables show analogous patterns of significant variation across countries.

IV. Econometric Model and Estimation Results

Drawing from the existing literature on the determinants of tax revenue and military spending and using a dynamic panel data approach, the following equation is estimated to investigate the impact of terrorism on public finances:

$$(1) \quad FIS_{i,t} = \alpha + \beta FIS_{i,t-1} + \gamma TER_{i,t} + \delta X_{i,t} + \eta_i + \nu_t + \varepsilon_{i,t}$$

[4] The list of countries is presented in Appendix Table A2.

in which $FIS_{i,t}$ is the fiscal variable (tax revenue as a share of GDP or military spending as a share of GDP) in country i at time t; and $FIS_{i,t-1}$ is the lagged dependent variable to capture persistence in tax revenue or military spending over time. $TER_{i,t}$ is the number of terrorist attacks or fatalities scaled by population. The term $X_{i,t}$ is a vector of control variables, including (log) real GDP per capita, (log) consumer price inflation, share of agriculture in GDP, natural resource dependence, trade openness, and a composite measure of democracy to capture institutional characteristics. In estimating military spending, we introduce (log) population and a binary variable for the Cold War period as additional control variables (instead of inflation, agricultural output, and natural resource dependence) and enter the lagged indicator of terrorism to account for the budget cycle as well as to deal with the potential endogeneity of the regressors. The η_i and ν_t coefficients denote the time-invariant country effects and the time effects controlling for common shocks, respectively. $\varepsilon_{i,t}$ is an idiosyncratic error term that satisfies the standard assumptions of zero mean and constant variance. To account for possible heteroskedasticity, robust standard errors are clustered at the country level.

The fixed-effects and random-effects models do not explicitly deal with temporally and spatially correlated errors in panel data. They both may yield inefficient coefficient estimates with biased standard errors. Moreover, fiscal policy variables tend to be persistent over time, raising the possibility of first-order serial correlation, which is detected by the Wooldridge-Drukker test in the panel dataset used in this analysis. Accordingly, we first estimate a static version of the model excluding the lagged dependent variable, using a Prais-Winsten regression with panel-corrected standard errors (PCSE). An important advantage of the PCSE procedure is to correct for interdependence of the error terms across countries and over time and thereby yield more accurate estimates with insignificant loss in efficiency (Beck and Katz, 1995).

Dynamics of the dependent variables are likely to be an important factor in the estimation, as changes in tax revenue and military spending occur over a long period of time. Moreover, dynamic modeling also partially controls for possible reverse causality between the dependent variables and explanatory factors. We estimate the dynamic model using the system Generalized Method of Moments (GMM) method proposed by Arellano and Bover (1995) and Blundell and Bond (1998). This involves constructing two sets of equations, one with first differences of the endogenous and pre-determined variables instrumented by suitable lags of their own levels, and one with the levels of the endogenous and pre-determined variables instrumented with suitable lags of their own first differences.[5] The system GMM estimator takes into account unobserved country effects and possible endogeneity of the explanatory variables, providing more robust and consistent parameter estimates.[6] We apply the one-step version of the system GMM

[5] The difference GMM approach of Arellano and Bond (1991), which uses only the first difference equation, yields similar results but with reduced statistical significance for some variables.

[6] While we address the possibility of reverse causality by using the system GMM approach with lagged variables of terrorism, we also implement a panel vector autoregression (VAR) framework to assess the relationship between acts of terrorism and military spending.

estimator to ensure the robustness of the results, as the standard errors from the two-step variant of the system GMM method are known to be downward biased in small samples.[7]

In tax revenue estimations, we treat the dependent variable, real GDP per capita and consumer price inflation as endogenous and the terrorism indicator and other control variables as exogenous. In military spending estimations, we treat the dependent variable, real GDP per capita and trade openness as endogenous and the terrorism indicator and other control variables as exogenous. To avoid a proliferation of instruments, we collapse the instrument set as suggested by Roodman (2009). We validate the system GMM identification assumptions by applying a second-order serial correlation test for the residuals and the Hansen *J*-test for overidentifying restrictions. In all the regressions, the *p*-values of the Arellano-Bond (AR) autocorrelation test and the Hansen *J*-test results confirm the absence of second-order serial correlation in the residuals and the validity of internal instruments.

Table 1 presents our estimation results for the determinants of tax revenue as a share of GDP for the period 1970–2013, with the terrorism term defined as the number of terrorist attacks or fatalities scaled by population. Our results are broadly in line with the existing literature focusing on various classical determinants of tax revenue. With regards to terrorism, both indicators—the number of attacks or fatalities scaled by population—are found to be statistically significant at the 5 percent level with a negative effect on the tax-to-GDP ratio. The point coefficient estimate for the number of terrorism-related fatalities per million inhabitants, however, is -0.0004, which is about four times greater than the point coefficient estimate for the number of terrorist attacks. Furthermore, although the marginal economic impact appears to be inconsequential at face value, the cumulative effect in a given year could still be significant in countries where terrorism is endemic with frequent attacks and a large number of fatalities.

The results obtained with the system GMM estimator show that the estimated coefficient of the lagged dependent variable is positive and significant at the 1 percent level, confirming a high degree of persistence in tax revenue as a share of GDP over time. Thus, we conclude that dynamic estimation is the appropriate choice for statistical inference. The results show a strong association between macroeconomic conditions and tax revenue performance. The positive coefficient on real GDP per capita is consistent with the view that the tax-to-GDP ratio increases with the level of income, while consumer price inflation has a significant adverse effect. We also confirm that structural features of the economy, measured by the share of agriculture in economy, natural resource dependence, and trade openness, influence the level of tax revenue, as expected. On the other hand, political and institutional characteristics, measured by a composite index of democracy, have the expected positive sign, but the point coefficient estimate is not significant at conventional levels, when the lagged dependent variable is included in regressions.

[7] The econometric results are broadly similar when we use the two-step GMM estimator with a small sample correction procedure recommended by Windmeijer (2005).

Table 1. Determinants of Tax Revenue (Percent of GDP)

	PCSE		GMM	
Variables	Attacks	Fatalities	Attacks	Fatalities
Tax revenue (t-1)	…	…	**0.7306*** **	**0.7305*** **
			(0.093)	**(0.092)**
Terrorism	**-0.0001** **	**-0.0004** **	**-0.0001***	-0.0008
	(0.000)	**(0.000)**	**(0.000)**	(0.001)
Real GDP per capita	**0.1100*** **	**0.1057*** **	0.0405	0.0371
	(0.025)	**(0.025)**	(0.030)	(0.030)
Inflation	-0.0016	-0.0018	**-0.0154** **	**-0.0146** **
	(0.004)	(0.004)	**(0.007)**	**(0.007)**
Agricultural output	**-0.0081*** **	**-0.0084*** **	-0.0010	-0.0012
	(0.001)	**(0.001)**	(0.003)	(0.003)
Natural resource rents	**-0.0045*** **	**-0.0046*** **	**-0.0033** **	**-0.0033** **
	(0.001)	**(0.001)**	**(0.002)**	**(0.002)**
Trade openness	0.0003	0.0004	0.0003	0.0003
	(0.000)	(0.000)	(0.000)	(0.000)
Democracy index	**0.0173*** **	**0.0160*** **	0.0027	0.0027
	(0.003)	**(0.003)**	(0.002)	(0.002)
Number of observations	4,162	4,162	4,039	4,039
Number of countries	151	151	151	151
R^2	0.900	0.899	…	…
Specification tests (p-values)				
AR(2)	…	…	0.467	0.515
Hansen J-test	…	…	0.981	0.982

Note: Robust standard errors are reported in parentheses. All regressions include a constant term and year fixed effects, which are not displayed in the table. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.
Source: Authors' calculations.

Turning to our main variable of interest, we find that terrorism has a marginal negative effect on tax revenue performance, after controlling for economic and institutional factors. The point coefficient estimate for the number of terrorism-related fatalities scaled by population is -0.0008, which is about eight times greater than that on the number of terrorist attacks. This effect, however, is not robust to alternative specifications and empirical strategies employed in this paper. In our view, these findings reflect the temporary impact on economic activity of most acts of terrorism, even if they may cause physical damage and greater uncertainty. Unlike civil wars, terrorist events do not necessarily have a long-lasting effect on macroeconomic developments and undermine a country's institutional infrastructure for tax collection.

We explore the link between terrorism and the composition of government spending by estimating the impact on military spending as a share of GDP (Table 2). We also estimate the model using military spending as a share of total government expenditures and reach broadly

similar results, which are presented in a series of robustness checks. With the contemporaneous PCSE model, we find that the coefficients on both indicators of terrorism are positive and significant, even after controlling for domestic and international factors such as the Cold War. The coefficient on terrorism as measured by the number of fatalities scaled by population is over three times greater than as measured by the number of attacks. However, military spending appears to be persistent over time, with a positive coefficient that is statistically significant at the 1 percent level. Accordingly, our preferred method of estimation for military expenditure is also dynamic with the system GMM approach, which yields similar results.

Higher level of income and larger population are associated with lower military spending as a share of GDP, although the coefficients on real GDP per capita and population are not significant at conventional levels. We also find a negative association between democracy and military spending. Though statistically insignificant at conventional levels, this may reflect public's expenditure preferences away from military spending in more democratic countries. The Cold War dummy, on the other hand, is highly significant, with a positive effect on military spending, as expected.

The results obtained with the system GMM estimator indicate that the coefficients on both indicators of terrorism are significant and positively associated with military spending.[8] The coefficient on the number of fatalities scaled by population is almost double the coefficient on the number of attacks. Once again, although the marginal economic impact is small, the cumulative effect could reach a significant level in countries where terrorism is prevalent with recurrent attacks and large number of fatalities. The total impact of terrorism as measured by the number of fatalities per million inhabitants could increase military spending by 0.1 percent of GDP on average and as much as 0.8 percent of GDP in the case of Pakistan.

[8] The results of the panel VAR approach, available upon request, confirm that terrorism has a positive effect on military spending, while military spending has a mildly negative effect on terrorism.

Table 2. Determinants of Military Spending (Percent of GDP)

	PCSE		GMM	
Variables	Attacks	Fatalities	Attacks	Fatalities
Military spending (t-1)	...	...	**0.8243*** **	**0.8264*** **
			(0.040)	**(0.040)**
Terrorism	**0.0002****	**0.0007*****	**0.0003*****	**0.0005*****
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**
Real GDP per capita	**0.0541*****	**0.0516*****	-0.0818	-0.0796
	(0.020)	**(0.020)**	(0.055)	(0.054)
Population	0.0043	0.0021	-0.0103	-0.0070
	(0.025)	(0.026)	(0.012)	(0.011)
Trade openness	-0.0006	-0.0006	0.0001	0.0001
	(0.000)	(0.000)	(0.001)	(0.001)
Cold War dummy	**0.1122*****	**0.1146*****	**0.0649*****	**0.0644*****
	(0.040)	**(0.040)**	**(0.017)**	**(0.017)**
Democracy index	-0.0063	-0.0063	-0.0022	-0.0019
	(0.005)	(0.005)	(0.003)	(0.003)
Number of observations	5,252	5,252	5,121	5,121
Number of countries	150	150	150	150
R^2	0.132	0.135	...	...
Specification tests (p-values)				
AR(2)	...	...	0.105	0.103
Hansen J-test	...	...	0.194	0.161

Note: Robust standard errors are reported in parentheses. All regressions include a constant term which is not displayed in the table. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

Source: Authors' calculations.

Considering the possibility of cross-country heterogeneity in the coefficient estimates, we drop countries with no incidence of terrorism and divide the sample in two groups of countries that experience below or above the median of the sample statistical distribution with respect to terrorist incidents. This approach identifies hidden variability not captured by the full sample estimates, and also provides an implicit assessment of nonlinearities. The results obtained with the system GMM estimator, summarized in Table 3, show some changes in the magnitude and statistical significance of estimated coefficients across subsamples. First, the impact of terrorism—as measured by the number of fatalities per million inhabitants—on tax revenue is greater in countries with above-median number of terrorist incidents than those with below-median number of terrorist incidents. This finding, however, is not statistically significant. Second, with regards to the impact on military spending, the point coefficient estimates both for the

number of attacks and fatalities are significantly larger in the high terrorism sample than those for the low terrorism sample.[9]

Table 3. Heterogeneity in Terrorism Incidence

Dependent variable:	**Tax revenue** (percent of GDP)	**Military spending** (percent of GDP)	**Military spending** (percent of total expenditure)
Attacks			
Low Terrorism	-0.0001 (0.0017)	-0.0002 (0.0001)	0.0000 (0.0012)
High Terrorism	0.0000 (0.0001)	**0.0003**** **(0.0001)**	**0.0005***** **(0.0002)**
Fatalities			
Low Terrorism	0.0053 (0.0043)	-0.0005 (0.0177)	0.0131 (0.0175)
High Terrorism	-0.0008 (0.0007)	**0.0007***** **(0.0002)**	**0.0009***** **(0.0003)**

Note: The reported coefficients are for the respective terrorism variable in each model and estimated with the system GMM approach using the same specifications presented in Section IV. The "High Terrorism" group is restricted to observations with above-median terrorism values (5 for attacks, 0.193 for fatalities per million residents); the "Low Terrorism" group includes everything less than or equal to these values. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

Source: Authors' calculations.

V. FURTHER ROBUSTNESS CHECKS

In this section, we use numerous approaches to check the robustness of the empirical results and to attain a more nuanced picture of their economic and statistical significance. Firstly, we turn to a quasi-experimental approach using the difference-in-differences methodology to analyze the average effect of terrorism on tax revenue and military spending. This approach requires splitting the sample into two groups: a "treatment" group (*TERT*) and a control group (*TERC*). Countries that at any point during the sample period experience above-average terrorism (measured by both the number of attacks and fatalities per scaled by population) are assigned to the treatment group. We define the "exogenous shock" criteria ($\mathrm{FIS}_{\mathrm{TERT}}$) as the largest change in measures of terrorism. All other observations are assigned to the control group ($\mathrm{FIS}_{\mathrm{TERT}}$). Following Angrist and Krueger's (1999) specification, the conditional means take the following form:

$$(2)\quad E\left(FIS_{i,t}\middle|TERC\right) = \beta_i + \beta_t$$

[9] The result of *t*-test further suggests that the estimated coefficients for subsamples are significantly different.

(3) $E(FIS_{i,t}|TERT) = E(FIS_{i,t}|TERC) + \emptyset$

The parameter ∅ measures the impact of terrorism shocks when the two equations are differenced:

(4) $E(FIS_{i,t}|TERT) - E(FIS_{i,t}|TERC) = \emptyset = \emptyset_i + \emptyset_t$

This difference (∅) effectively becomes the time and event averaged terrorism shock resulting from the set of terrorism shocks. As such, it is composed of two parts: $\emptyset_i$ is the county-specific effect of terrorism and $\emptyset_i$ is the time-varying effect of terrorism. The empirical findings based on the difference-in-differences approach, summarized in Table 4, are broadly consistent with the system GMM results. We find some evidence indicating that terrorism has a negative effect on tax revenue performance, and strong evidence that terrorism is associated with an increase in military spending as a share of GDP.

Table 4. Impact of Terrorism—Difference-in-Differences Estimation

Dependent variable:	**Tax revenue** (percent of GDP)	**Military spending** (percent of GDP)	**Military spending** (percent of total expenditure)
Attacks	**0.120*** (0.032)**	0.034 (0.044)	**0.088** (0.044)**
Fatalities	**-0.114*** (0.030)**	**0.108*** (0.039)**	**0.289*** (0.040)**

Note: The reported coefficients are for the respective interaction term in each model -- the "difference in differences". All regressions are estimated using the same covariates used in the PCSE models in Section IV. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

Source: Authors' calculations.

Secondly, although unobserved heterogeneity in our broad panel is expected to be picked up to a large extent by country and time effects, we divide our sample into two groups: advanced economies, and developing and low-income countries. The results obtained with the system GMM approach, estimated over the years 2000-2013, are summarized in Table 5.[10] The point coefficient estimates for the subsample of developing and low-income countries are consistent with those of our main results. However, for advances economies, we find little evidence for a statistically significant impact of terrorism on fiscal variables. All in all, the results provide cautious support for the view that public finances in developing and low-income countries are more vulnerable to terrorism than those in countries that are richer and diversified.

[10] Since the system GMM approach is designed to work well with large number of countries relative to the time dimension, we estimate subsamples for the period 2000-2013.

Table 5. Impact of Terrorism in Developing and Low-Income Countries

Dependent variable:	**Tax revenue** (percent of GDP)	**Military spending** (percent of GDP)	**Military spending** (percent of total expenditure)
Attacks			
Advanced Economies	-0.0001 (0.0001)	0.0009 (0.0009)	-0.0001 (0.0005)
Developing and Low-Income Countries	-0.0001 (0.0001)	**0.0001**** **(0.0000)**	**0.0002**** **(0.0001)**
Fatalities			
Advanced Economies	0.0004 (0.0003)	**0.0048**** **(0.0021)**	0.0008 (0.0009)
Developing and Low-Income Countries	-0.0003 (0.0005)	**0.0006***** **(0.0002)**	**0.0008***** **(0.0003)**

Note: The reported coefficients are for the respective terrorism variable in each model and estimated with the system GMM approach using the same specifications presented in Section IV. Each sample includes the years 2000-2013. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

Source: Authors' calculations.

Thirdly, we use a restrictive (narrow) definition of terrorism, filtering out cases about which there is not sufficient information to determine whether or not an incident is exclusively terrorism. These restrictive figures on the number of terrorist attacks and fatalities are available since 1997 for most countries in the GTD database. The results obtained with the system GMM estimator, summarized in Table 6, show that alternative definitions of terrorism yield similar results for all dependent variables, including military spending as a share of total expenditure.

Table 6. Alternative Definitions of Terrorism

Dependent variable:	**Tax revenue** (percent of GDP)	**Military spending** (percent of GDP)	**Military spending** (percent of total expenditure)
Attacks			
Broad Definition	**-0.0002*** **(0.0001)**	**0.0002*** **(0.0001)**	**0.0002*** **(0.0001)**
Narrow Definition	**-0.0002*** **(0.0001)**	**0.0002*** **(0.0001)**	**0.0002*** **(0.0001)**
Fatalities			
Broad Definition	-0.0011 (0.0010)	**0.0019**** **(0.0001)**	0.0009 (0.0006)
Narrow Definition	-0.0021 (0.0015)	0.0045 (0.0029)	0.0010 (0.0025)

Note: The reported coefficients are for the respective terrorism variable in each model and estimated with the system GMM approach using the same specifications presented in Section IV. The sample is restricted to the period 1997-2013, during which data for the narrow definition of terrorism is available. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

Source: Authors' calculations.

Finally, although the GTD dataset excludes episodes of civil conflict, we address such a definitional concern by including a measure of internal armed conflict as an additional control variable in our regressions. Using a comprehensive set of conflict data collected by the Uppsala Conflict Data Program (UCDP) at the Department of Peace and Conflict Research of Uppsala University and the Center for the Study of Civil War at the International Peace Research Institute in Oslo (PRIO), we construct a binary variable that takes a value of 1 if a country experiences 1,000 or more battle-related deaths resulting from internal armed conflict in any given year, or 0 otherwise.[11] The results obtained with the system GMM estimator, summarized in Table 7, indicate that the coefficients on internal armed conflict have the expected signs (i.e. negative in estimating tax revenue and positive in estimating military spending). Our findings on the impact of terrorism on public finances remain robust to the inclusion of the internal armed conflict variable, although there is limited overlap between incidents of terrorism and episodes of high-intensity internal conflict.

[11] This variable is coded as binary since the UCDP/PRIO Armed Conflict Dataset does not provide accurate point-estimates of battle-related deaths.

Table 7. Internal Armed Conflict and Impact of Terrorism

Dependent variable:	**Tax revenue** (percent of GDP)	**Military spending** (percent of GDP)	**Military spending** (percent of total expenditure)
	(1)	(2)	(3)
Terrorism (attacks)	**-0.0001***	**0.0003****	**0.0005****
	(0.0000)	**(0.0001)**	**(0.0002)**
Internal armed conflict	-0.0049	0.0237	0.0588
	(0.0294)	(0.0430)	(0.0675)
	(4)	(5)	(6)
Terrorism (fatalities)	-0.0008	**0.0005*****	**0.0006*****
	(0.0006)	**(0.0001)**	**(0.0002)**
Internal armed conflict	-0.0007	0.0261	0.0660
	(0.0266)	(0.0406)	(0.0605)

Note: The reported coefficients are for the respective terrorism and internal armed conflict variables in each model, estimated with the system GMM approach using the same specifications presented in Section IV. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

Source: Authors' calculations.

VI. CONCLUSION

This paper is an empirical study of the impact of terrorism on government finances, an underdeveloped strand of the literature. We consider a broad panel of 153 countries over a long time span running from 1970 to 2013, using two indicators of terrorism and various econometric techniques to ensure robustness of the empirical results. We find that terrorism has only a marginal negative effect on tax revenue performance, after controlling for economic and institutional factors. This effect is also not robust to alternative specifications and modeling techniques. In our view, these findings reflect the temporary impact on economic activity of most acts of terrorism, even if they may cause physical damage and greater uncertainty. Unlike civil wars, terrorist events do not necessarily have a long-lasting effect on macroeconomic developments and undermine a country's institutional infrastructure for tax collection.

On the other hand, we find strong evidence that terrorism is associated with an increase in military spending as a percent of GDP (and a share of total government expenditure). This effect appears to be greater when terrorist attacks are frequent and result in large number of fatalities. We should note that, although higher military spending may divert government resources away from education, healthcare, and infrastructure, it can also have positive spillover effects by enhancing law and order. Finally, the econometric analysis supports the view that public finances in developing and low-income countries are more vulnerable to terrorism than those in countries that are richer and diversified.

What conclusions can we draw from these results? The sources of terrorism are beyond the scope of this paper, and may well be linked in part to exogenous factors outside the direct control of policymakers. The empirical evidence presented in this paper, however, indicates that

greater economic diversification and openness, and institutional development over the longer term, can mitigate the impact of terrorism on public finances in terms of tax revenue performance and the composition of government expenditures. The paper's econometric results also suggest that the impact of terrorist activity should be taken into account for budget planning and expenditure allocation purposes.

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APPENDIX

Table A1. Summary Statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Median	Max.
Tax revenue (percent of GDP)	5378	20.4	10.7	0.7	18.2	58.1
Military spending (percent of GDP)	5646	2.9	3.3	0.0	2.0	35.8
Military spending (percent of total expenditure)	5328	10.1	8.8	0.0	7.6	118.0
Number of terrorist attacks						
Broad definition	6750	15.6	67.3	0.0	0.0	2212.0
Narrow definition	2704	11.8	67.5	0.0	0.0	1933.0
Number of terrorism fatalities per million residents						
Broad definition	6695	2.5	23.4	0.0	0.0	998.9
Narrow definition	2672	0.7	3.3	0.0	0.0	65.1
Real GDP per capita (log)	6923	7.9	1.6	4.2	7.8	11.4
Population (log)	7328	15.6	1.9	10.6	15.7	21.0
Inflation	6607	41.3	475.0	-72.7	6.6	23773.1
Agricultural output (percent of GDP)	6966	17.6	15.1	0.0	13.2	78.3
Natural resource rents (percent of GDP)	6098	9.7	13.9	0.0	4.2	100.4
Trade openness (percent of GDP)	6945	77.7	46.5	0.2	68.3	444.1
Democracy index	6776	-1.0	6.5	-10.0	-3.0	10.0

Source: ICRG, GTD, Polity, SIPRI, WDI, and WEO.

Table A2. List of Countries

Advanced Economies	Emerging Markets		Low-Income Countries
Australia	Albania	Russia	Bangladesh
Austria	Algeria	Saudi Arabia	Benin
Belgium	Angola	Serbia	Bhutan
Canada	Argentina	Slovak Republic	Bolivia
Cyprus	Armenia	Slovenia	Burkina Faso
Denmark	Azerbaijan	South Africa	Burundi
Finland	Bahrain	Sri Lanka	Cambodia
France	Belarus	Suriname	Cameroon
Germany	Bosnia-Herzegovina	Swaziland	Central African Republic
Greece	Botswana	Syria	Chad
Ireland	Brazil	Thailand	Comoros
Israel	Bulgaria	Trinidad and Tobago	Congo (Brazzaville)
Italy	Chile	Tunisia	Congo (Kinshasa)
Japan	China	Turkey	Djibouti
Luxembourg	Colombia	Turkmenistan	Eritrea
Netherlands	Costa Rica	Ukraine	Ethiopia
New Zealand	Croatia	United Arab Emirates	Gambia
Norway	Czech Republic	Uruguay	Ghana
Portugal	Dominican Republic	Venezuela	Guinea
Singapore	Ecuador	...	Guinea-Bissau
South Korea	Egypt	...	Haiti
Spain	El Salvador	...	Honduras
Sweden	Equatorial Guinea	...	Ivory Coast
Switzerland	Estonia	...	Kenya
United Kingdom	Fiji	...	Kyrgyzstan
United States	Gabon	...	Laos
...	Georgia	...	Lesotho
...	Guatemala	...	Liberia
...	Guyana	...	Madagascar
...	Hungary	...	Malawi
...	India	...	Mali
...	Indonesia	...	Mauritania
...	Iran	...	Moldova
...	Jamaica	...	Mozambique
...	Jordan	...	Myanmar
...	Kazakhstan	...	Nepal
...	Latvia	...	Nicaragua
...	Lebanon	...	Niger
...	Libya	...	Nigeria
...	Lithuania	...	Papua New Guinea
...	Macedonia	...	Rwanda
...	Malaysia	...	Senegal
...	Mauritius	...	Sierra Leone
...	Mexico	...	Solomon Islands
...	Morocco	...	Sudan
...	Namibia	...	Tajikistan
...	Pakistan	...	Tanzania
...	Panama	...	Togo
...	Paraguay	...	Uganda
...	Peru	...	Uzbekistan
...	Philippines	...	Vietnam
...	Poland	...	Yemen
...	Qatar	...	Zambia
...	Romania	...	Zimbabwe