Empirical Economics (2020) 58:723–748
https://doi.org/10.1007/s00181-018-1543-3

Shock and awe? Fiscal consequences of terrorism

Serhan Cevik[1] · **John Ricco**[2]

Received: 17 December 2015 / Accepted: 6 July 2018 / Published online: 25 August 2018

Abstract
This article investigates how the frequency and severity of terrorism affect government finances in a large sample of 156 developed and developing countries over the period 1970–2016. The empirical results indicate that terrorism has a negative effect on tax revenue performance, especially in countries where terrorism has become endemic with frequent attacks and large numbers of fatalities relative to population, and that this effect becomes more pronounced in dynamic models accounting for potential endogeneity. Similarly, controlling for a plethora of economic, demographic and institutional factors, we find compelling evidence that terrorism is associated with a significant increase in military spending as a share of national income. These effects of terrorism on government operations and finance appear to be greater in countries where attacks are frequent and result in large numbers of fatalities. Our empirical findings also confirm that the state of public finances in developing countries is more vulnerable to acts of terrorism than those in countries that are richer and more diversified.

Keywords Terrorism · Public finances · Tax revenue · Military spending

JEL Classification D74 · H20 · H56

1 Introduction

There has been a dramatic increase in the number of terrorist attacks across the world from 651 in 1970 to the peak of 10,073 in 2014, raising the number of casualties from 171 to over 17,500, according to the Global Terrorism Database (GTD). Ter-

✉ Serhan Cevik
scevik@imf.org

John Ricco
johnricco226@gmail.com

[1] International Monetary Fund, Washington, DC, USA

[2] Penn Wharton Budget Model, Philadelphia, PA, USA

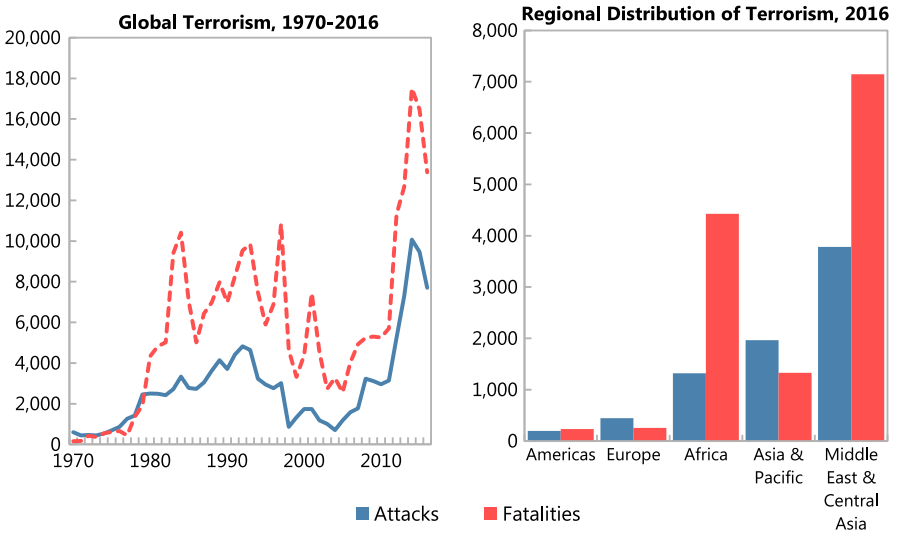

Fig. 1 Terrorism across the world. *Source*: GTD; authors' calculations.

rorism does not only victimize tens of thousands of people, but have a multitude of economic consequences through direct and indirect channels. While the direct costs associated with 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 resource allocations—is more challenging to pinpoint with a reasonable degree of precision. There is a growing literature on the connections between terrorism and economic growth, but little knowledge on the impact of terrorism on government operations and finance has yet been available. The objective of this paper is therefore to develop a better understanding of the fiscal dimension of terrorism by empirically exploring the consequences for tax revenue performance and the composition of government spending (Fig. 1).

This paper contributes to the literature in several important ways. First, we concentrate on an underdeveloped strand of research and examine the impact of terrorism on fiscal variables. Specifically, we ask how and the extent to which terrorism, measured by the number of terrorist attacks and fatalities scaled by population, affects tax revenue mobilization and alters the composition of government spending by diverting resources away from more productive areas to military.[1] Second, to the best of our knowledge, with regards to these questions, this paper is the first to focus exclusively on terrorism, excluding episodes of civil conflict, in a cross-country setting. Third, we use an expansive dataset of annual observations on a sample of 156 developed and

[1] Due to data constraints, we use military spending as a proxy for a broader definition of security-related expenditures (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.

developing countries[2] over a lengthy period spanning from 1970 to 2016, and utilize dynamic panel data models that explicitly account for unobservable heterogeneity, potential endogeneity and persistence of the regressors, and cross-sectional dependence. Furthermore, 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, which identifies hidden variability not captured by the full sample estimates, and thereby provides an implicit assessment of nonlinearities.

Our empirical analysis yields five main findings. First, we find that acts of terrorism have a negative effect on tax revenue performance, especially in countries where terrorism is an endemic phenomenon with frequent attacks and large numbers of fatalities relative to population, and that this effect becomes more pronounced in dynamic models accounting for potential endogeneity and controlling for a plethora of economic, demographic and institutional factor. Second, with regards to the composition of government expenditures, we obtain compelling evidence that terrorism is associated with a significant increase in military spending, especially when terrorist attacks are prevalent and cause large numbers of casualties. Third, the number of fatalities scaled by population has a greater effect on government operations and finance than the number of terrorist attacks. Fourth, although the marginal impact of terrorism appears to be small, the cumulative effect in a given year can still be highly significant in countries where frequent attacks result in large numbers of fatalities. Fifth, the state of public finances in developing countries is far more vulnerable to terrorism than that in countries with higher level of income and more diversified economies. All in all, our results can be interpreted as evidence for the imperative of economic diversification and openness and institutional development over the longer term to mitigate the potential fiscal impact of terrorism.

The remainder of this paper adopts the following structure. Section 2 provides a brief overview of the literature on terrorism and the economy. Section 3 describes data description and sources. Section 4 describes the salient features of our empirical strategy and econometric results, followed by concluding remarks are in Sect. 5.

2 A concise overview of the related literature

There is a flourishing body of literature on the economic and financial consequences of terrorism, ranging from formal theoretical models to quantitative empirics to understand the channels of transmission and associated costs.[3] From a theoretical point of view, the relationship between violence and economic activity operates through direct and indirect channels with potential feedback mechanisms (Collier 1999; Frey et al. 2007; Mirza and Verdier 2008). The direct economic costs of terrorism are associated with loss of life and destruction of physical capital. According to Becker and Murphy

[2] We exclude Afghanistan and Iraq because of the wars waged by foreign powers outside of these countries' effective control and due to large gaps in economic and fiscal data over time.

[3] Enders and Sandler (2012) provide a comprehensive survey of the literature on terrorism.

(2001), terrorism should not have a large effect on the economy 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 et al. 2002; Eckstein and Tsiddon 2004; Gupta et al. 2004; Johnston and Nedelescu 2005; Enders and Sandler 2012; Gaibulloev and Sandler 2008; Abadie and Gardeazabal 2008; Filer and Stanisic 2016).

On the empirical side, Becker and Murphy (2001) estimate that the terrorist attacks of September 11, 2001, resulted in a marginal loss of 0.06% of productive assets for the US economy, with a long-run effect of 0.3% of GDP. Similarly, looking at a broader sample of 177 countries during 1968–2000, Blomberg et al. (2004) estimate a relatively small average reduction of 0.05% in real GDP per capita growth in an analysis of transnational terrorist attacks, but identify a larger effect in developing countries. Using a cross-country dataset for the period 1987–2001, Tavares (2004) confirms that terrorism does not have a significant impact on growth, when additional controls are taken into account. Conducting an empirical analysis of seven Western European countries, Gries et al. (2011) and find that terrorism does not have a causal effect on growth, while economic developments appear to contribute to the incidence of terrorism in some countries. On the other hand, Blomberg et al. (2011) find a significant impact of terrorism on economic growth, especially among hydrocarbon-dependent economies, in sub-Saharan Africa; Gaibulloev and Sandler (2009) present similar evidence for growth-limiting effect of transnational terrorism in Asian countries.

These estimations, however, may not fully capture the indirect effects of terrorism, especially in countries where the incidence of terrorism is high. 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) develop a more nuanced analysis and 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 et al. (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 attributable to acts of terrorism relative to a synthetic control region without terrorism, due mainly to the adverse effects of greater uncertainty on financial markets and investment flows.

While there is a prolific literature on the economic and financial impact of terrorism, little has been written about its fiscal consequences. Providing the most relevant example in this context, Gupta et al. (2004) present evidence that terrorism and other types of armed conflict distort the composition of government 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 on public finances. Using panel data for 29 European countries, Drakos and Konstantinou (2014) find that terrorism leads to a persistent increase in spending on public order and safety. On the other hand, focusing on member countries of the North Atlantic Treaty Organization (NATO) over the period 1968–2015, George and Sandler (2017) find that terrorist attacks have no significant effect on military expenditures. Utilizing cross-country data for the period 2002–2011, Procasky and Ujah (2016) show that terrorist activity lowers sovereign credit ratings and thereby increases the cost of borrowing, especially for developing countries. There are also other studies tangentially touching upon the relationship between terrorism and public finances. For example, while focusing on the growth impact of terrorism, Blomberg et al. (2004) show that terrorism is associated with shifting resources from investment to higher government spending. More recently, Gaibulloev and Sandler (2008) conduct a similar analysis and find that acts of terrorism lead to an increase in government spending in European countries.

3 Data description

Terrorism can be generalized as the premeditated use of violence by a nonstate 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 (Enders and Sandler 2012). The quantification of terrorist incidents, however, remains a challenging task, as most existing datasets (such as the International Terrorism: Attributes of Terrorist Events (ITERATE) project and the Country Reports on Terrorism by the United States Department of State) cover only international terrorism with limited information on domestic terrorism. Moreover, as noted by Enders and Sandler (2012), the ITERATE dataset has shortcomings because of its reliance on print and electronic media for information on terrorist incidents. Accordingly, we follow many other empirical studies and draw our indicators of terrorism—the number of attacks and fatalities—from the GTD introduced by LaFree and Dugan (2007) and maintained by the National Consortium for the Study of Terrorism and Responses to Terrorism (START) of the University of Maryland. The GTD is considered to be the most comprehensive database on terrorism across the world, covering both domestic and transnational terrorist events since 1970, and it has been used in a growing number of empirical studies (e.g., Freytag et al. 2011; Gries and Meierrieks 2013; Younas 2015; Filer and Stanisic 2016; Procasky and Ujah 2016).[4]

The GTD defines an incident of terrorism according to the following criteria: (i) the incident must be intentional; (ii) the incident must entail some level of violence or threat of violence and (iii) the perpetrators of the incidents must be sub-national actors. In addition, at least two of the following three criteria must be present for an incident to be included in the GTD: (i) the act must be aimed at attaining a political, economic, religious or social goal; (ii) there must be evidence of an intention to coerce, intimidate

[4] Enders et al. (2011) provide a detailed analysis of the ITERATE and GTD datasets.

or convey some other message to a larger audience (or audiences) than the immediate victims and (iii) the action must be outside the context of legitimate warfare activities. As most countries experience domestic as well as transnational terrorism, we use the total number of terrorist incidents as reported by the GTD. This is the appropriate measure to have a complete coverage in our empirical analysis, taking into consideration the location of terrorist incidents, not the national origin of victims or terrorists.[5]

We compile a comprehensive dataset that comprises an unbalanced panel with annual observations on 156 countries over the period from 1970 to 2016.[6] Demographic, 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, the Penn World Tables (PWT), 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 composite indices of corruption and external security threats are obtained from the International Country Risk Guide (ICRG) database, while a binary variable of domestic conflicts is based on the armed conflict dataset produced by Uppsala Conflict Data Program (UCDP) at the Department of Peace and Conflict Research, Uppsala University and the Centre for the Study of Civil War at the Peace Research Institute Oslo (PRIO).

Summary statistics for the variables used in the empirical analysis are provided in Appendix Table 5. There is a great degree of dispersion across countries in terms of tax revenue performance and the composition of government spending as measured by the level and share of military expenditures. The mean value of tax revenue as a share of GDP is 20.1% over the sample period 1970–2016, but it varies from a minimum of 0.6% to a maximum of 50%. Military spending as a share of GDP has a mean value of 2.9% and ranges from a minimum of nil to a maximum of 35.8%. Our main explanatory variable of interest is terrorism, measured by the number of terrorist attacks or fatalities scaled by population. These measures of terrorism exhibit significant variation across countries during the period from 1970 to 2016. With an upward trend in frequency, the mean value of terrorist attacks is 16.8 with a minimum of nil and a maximum of 2214. Likewise, the number of terrorism-related fatalities per million inhabitants ranges from a minimum of nil to a maximum of 7781, with a mean value of 33.5 over the sample period. As reported in Appendix Table 5, other explanatory variables included in the empirical analysis show analogous patterns of significant variation across countries.

In a macro-panel setting, it is important to consider the presence of cross-sectional dependence emerging from greater economic, financial and institutional integration of countries over the past several decades. Furthermore, in the context of terrorism, as indicated by Gaibulloev et al. (2013), there is significant cross-country dependence, due probably to the prevalence of terrorist networks, common grievances, and ideo-

[5] It should be noted that the GTD is missing terrorism data in 1993, due to the loss of original documents. However, subsequent efforts obtained preliminary reports providing country-level statistics for incidents of terrorism in 1993. Detailed information on the treatment and presentation of these figures is available in the "Appendix" of the GTD Codebook and at http://www.start.umd.edu/gtd/faq/.

[6] The list of countries is presented in Appendix Table 7.

logical spillovers. Therefore, to check the existence of such interdependencies across countries in our dataset, we use the Pesaran (2004) cross-sectional dependence (CD) test, which is based on the average of pair-wise correlation coefficients obtained from standard augmented Dickey-Fuller regressions. The results of the CD test, presented in Appendix Table 6, indicate that residuals across countries are correlated and hence there is strong cross-sectional dependence within our sample.

4 Econometric model and estimation results

4.1 Empirical strategy

Conceptually, the fiscal implications of terrorism are influenced by direct impacts on economic activities as well as behavioral responses by government institutions and private agents through a multitude of transmission channels. Concerning government revenues, the compounding of losses in human and physical capital caused by acts of terrorism can impede tax performance by undermining the administrative capacity for tax collection and enforcement and placing the economy on a slower growth path, perhaps through increasing risk and uncertainty in financial markets and worsening consumer and business confidence. On the expenditure side, a government may react to terrorist attacks by upgrading the lost infrastructure and increasing security-related expenditures perhaps through shifting public resources away from more productive areas such as infrastructure, education, healthcare, and other social services. Furthermore, this redirection in government fiscal activity in response to the incidence of terrorism is likely to have discernible—direct and indirect—effects on financial markets and the pace and composition of economic growth in the short run as well over the longer term.

To empirically investigate the impact of terrorism on government finances, we follow the existing literature on the potential determinants of tax revenue and military spending and estimate the following equation, using static and dynamic panel data approaches, to investigate the impact of terrorism on public finances:

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

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 period 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. In analyzing the impact on tax revenue in a large panel of developed and developing countries, we follow the conventional literature led by Tanzi (1992), Stotsky and WoldeMariam (1997), Ghura (1998), Teera and Hudson (2004), Gupta (2007) and Castro and Camarillo (2014), among others, and include the level of development represented by (log) real GDP per capita, macroeconomic stability proxied by (log) consumer price inflation, the sectoral composition of a country's economy measured by the share of agriculture value-added

in GDP, natural resource rents as a share of GDP[7] and trade openness,[8] demographic characteristics measured by (log) population, the share of urban population, and an index of human capital,[9] institutional features proxied by a corruption index and a democracy score, and measures of external security threat and domestic conflict as control variables in the term $X_{i,t}$. In analyzing the impact on military spending, we draw on previous studies including Davoodi et al. (2001), Goldsmith (2003), Dunne et al. (2008), Albalate et al. (2012) and George and Sandler (2017), and replace inflation, agricultural output and natural resource rents with a binary variable for the Cold War period as an additional control variable along with the lagged indicator of terrorism, instead of the contemporaneous observation, to account for the budget cycle and 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.

In the panel data context, the standard fixed effects model may not effectively deal with temporally and spatially correlated errors and thereby yield inconsistent coefficient estimates with biased standard errors (Kapetanios et al. 2011).[10] 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. We attempt to mitigate the problem of cross-sectional dependence through different strategies, such as including country and time fixed effects in the regressions to take into account time-invariant country characteristics and common shocks, and by correcting standard errors for contemporaneous correlated and heteroscedastic errors. Accordingly, we estimate the static version of our model using two approaches: (i) a Prais–Winsten regression with panel-corrected standard errors (PCSE) and (ii) the Driscoll–Kraay standard errors method, which correct for interdependence of the error terms across countries and over time and produce heteroscedasticity in consistent standard errors that are robust to very general forms of spatial and temporal dependence (Beck and Katz 1995; Driscoll and Kraay 1998).

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 lengthy period. Moreover, dynamic modeling also partially controls for possible reverse causality between the dependent variables and explanatory factors. Therefore, 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

[7] Natural resources rents are calculated as the difference between the price of a commodity and the average cost of producing it by estimating the world price of units of specific commodities and subtracting estimates of average unit costs of extraction or harvesting costs. These unit rents are then multiplied by the physical quantities countries extract or harvest to determine the rents for each commodity as a share of GDP.

[8] Trade openness is measured by the sum of exports and imports of goods and services as a share of GDP.

[9] Human capital is measured per person according to the average years of schooling and the return to education.

[10] The fixed effects estimation results are presented in Appendix Table 8 for tax revenues and Appendix Table 9 for military spending.

predetermined variables instrumented by suitable lags of their own levels, and one with the levels of the endogenous and predetermined variables instrumented with suitable lags of their own first differences. The system GMM estimator takes into account unobserved country effects and possible endogeneity of the explanatory variables, providing more robust and consistent parameter estimates.[11]

While terrorism could be an endogenous factor in some countries, identifying a credible time-varying instrument for all countries on terrorism that satisfy the instrument exogeneity and exclusion restriction is challenging to say the least. Therefore, following the empirical literature, we rely on the system GMM estimation technique to deal with potential endogeneity. In tax revenue and military spending estimations, we treat the lagged dependent variable and most control variables (including terrorism) as endogenous or predetermined, and keep demographic and institutional variables as exogenous. To avoid a proliferation of in the number 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.

4.2 Impact on tax revenue

We begin the analysis by first presenting the results of our static estimations for the impact of terrorism on tax revenue as a share of GDP in Table 1. These regression models are based on the entire sample covering the period 1970–2016 and estimated using alternative methodologies and specifications with different measures of terrorism (the number of terrorist attacks and fatalities scaled by population) and additional control variables on the incidence of external security threats and domestic conflicts. Turning first to the control variables, the pattern of coefficients is as expected and broadly comparable to the findings in previous studies on the determinants of tax revenue mobilization. The estimated coefficient on real GDP per capita has the predicted positive sign, and with a greater magnitude in the results based on the Driscoll–Kraay standard errors method. Controlling for other factors, the level of income still plays a significant role in shaping cross-country differences in tax revenue performance. Consumer price inflation, which tends to capture macroeconomic stability, also has the expected negative effect on revenue mobilization, with a larger and statistically more significant coefficient when estimated using the Driscoll–Kraay approach. In line with the previous research, we find that the share of agriculture and natural resource rents appear to constitute a drag on tax performance, while trade openness has a highly significant positive effect across all specifications. Regarding demographic factors, the results obtained from the static estimations indicate that population, urbanization and human capital endowments have the expected positive impact, especially with the Driscoll–Kraay standard errors method. Finally, measures of institutional charac-

[11] We apply the two-step version of the system GMM estimator with a small sample correction procedure recommended by Windmeijer (2005).

Table 1 Determinants of tax revenue: static estimations. *Source*: Authors' calculations

Variables	Panel-corrected SE				Driscoll–Kraay SE			
	Attacks		Fatalities		Attacks		Fatalities	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Terrorism	−0.000	−0.000	−0.297	−0.169	−0.000***	−0.000***	−0.268	−0.462
	(0.000)	(0.000)	(0.473)	(0.475)	(0.000)	(0.000)	(0.549)	(0.713)
Real GDP per capita	0.069***	0.064***	0.063***	0.064***	0.185***	0.185***	0.185***	0.183***
	(0.026)	(0.024)	(0.024)	(0.023)	(0.048)	(0.050)	(0.052)	(0.052)
Inflation	−0.002	−0.002	−0.001	−0.001	−0.012**	−0.012**	−0.013**	−0.013**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.007)	(0.007)	(0.007)	(0.007)
Agricultural output	−0.010***	−0.010***	−0.010***	−0.010***	−0.007***	−0.007***	−0.007***	−0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Natural resource rents	−0.006***	−0.006***	−0.006***	−0.006***	−0.001	−0.001	−0.001	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Trade openness	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.002***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Population	0.008	0.005	0.011	0.007	0.482***	0.485***	0.469***	0.471***
	(0.008)	(0.007)	(0.009)	(0.009)	(0.097)	(0.096)	(0.098)	(0.094)
Urbanization	0.006***	0.006***	0.006***	0.006***	0.005**	0.005**	0.005**	0.005**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)	(0.003)

Table 1 continued

Variables	Panel-corrected SE				Driscoll–Kraay SE			
	Attacks		Fatalities		Attacks		Fatalities	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Human capital	0.290*** (0.037)	0.294*** (0.036)	0.291*** (0.036)	0.296*** (0.036)	0.178*** (0.053)	0.178*** (0.051)	0.177*** (0.055)	0.174*** (0.052)
Corruption	−0.030*** (0.008)	−0.028*** (0.007)	−0.029*** (0.007)	−0.028*** (0.007)	−0.018*** (0.005)	−0.018*** (0.005)	−0.018*** (0.005)	−0.019*** (0.005)
Democracy	0.006*** (0.002)	0.007*** (0.002)	0.007*** (0.002)	0.007*** (0.002)	0.001* (0.000)	0.001* (0.000)	0.003* (0.001)	0.003* (0.001)
External threat	–	−0.004 (0.004)	–	−0.004 (0.004)	–	0.001 (0.004)		0.002 (0.005)
Domestic conflict	–	−0.015 (0.013)	–	−0.016 (0.013)	–	−0.009 (0.019)		−0.028 (0.020)
Number of observations	2683	2683	2683	2683	2683	2683	2683	2683
Number of countries	114	114	114	114	114	114	114	114
R^2	0.94	0.94	0.94	0.94	0.20	0.20	0.19	0.20

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

teristics are found to be highly significant factors influencing tax mobilization in our sample of countries over the period 1970–2016. In particular, we find that corruption has an adverse effect, while democracy contributes to the strength of tax revenue performance.

With regards to our main explanatory variable of interest, the coefficients on both indicators of terrorism—the number of attacks and fatalities scaled by population—are found to be negative but statistically insignificant across all specifications and estimation methods, except for the number of terrorist attacks when estimated using the Driscoll–Kraay approach. However, the static estimations indicate that the negative impact of terrorism as measured by the number of fatalities scaled by population is two to four times greater than when it is measured by the number of attacks. These results remain broadly intact when we include external security threats and domestic conflict as additional control variables. On the whole, even though the marginal impact of terrorism appears to be negligible at face value, the cumulative effect on tax revenue performance in any given year can still be substantial, especially in countries where terrorism is endemic with frequent attacks and large numbers of fatalities.

The results obtained with the system GMM estimator, reported in Table 3, indicate that the coefficient of the lagged value of tax revenue is positive and significant at the 1% level across all specifications, confirming a high degree of persistence in the tax-to-GDP ratio over time. Dynamic modeling conveys a similar story in terms of directional relationships, but the inclusion of the lagged dependent variable leads to the loss of statistical significance for some control variables. For example, while the level of income and structural features of the economy (the share of agriculture, natural resource rents and trade openness) remain relevant for tax revenue mobilization, demographic and institutional factors except corruption are no longer statistically significant.

Turning to our main explanatory variable of interest, we find that the impact of terrorism on tax revenue performance remains negative but becomes statistically significant across all specifications even when external security threats and domestic conflicts are included as additional control variables. Akin to the static estimations, dynamic modeling shows that the impact of terrorism as measured by the number of fatalities scaled by population is more pronounced than when it is measured by the number of attacks. In our view, the system GMM estimations perform better with the potential endogeneity of terrorism with respect to tax revenue performance directly or indirectly through spillovers from economic and financial developments.

4.3 Impact on military spending

We explore the link between terrorism and government expenditures by estimating the impact on military spending as a share of GDP.[12] Again, we begin the analysis with the static estimations, based on alternative methodologies and specifications with different measures of terrorism (the number of terrorist attacks and fatalities scaled by population) and additional control variables on the incidence of external security

[12] We also estimate the model using military spending as a share of total government expenditures and reach broadly comparable results, which are available upon request.

threats and domestic conflicts. The results, reported in Table 2, show that the estimated coefficients on control variables are generally as expected and in line with the previous literature on the determinants of military spending. A higher level of income is associated with larger military expenditures as a share of GDP, albeit the magnitude and statistical significance of the coefficients on real GDP per capita diminish in the results based on the Driscoll–Kraay standard errors method. On the other hand, trade openness appears to have a dampening effect on military spending, which becomes highly significant with the Driscoll–Kraay approach. While large countries appear to spend more on defense, urbanization and human capital are found to have the opposite effect on military spending in our sample of countries over the period 1970–2016. Institutional characteristics are highly significant across all specifications and regardless of the estimation methodology: corruption leads to higher defense expenditures, whereas democracy brings about a lower level of spending on military. Finally, the Cold War dummy is shown to be a highly significant factor, with a positive effect on military spending, as expected.

Turning to our main variable of interest, we find that the coefficients on both indicators of terrorism are positive and highly significant in most specifications. This is especially the case with the number of fatalities, which has a greater effect on military spending than the number of attacks. The estimated pattern of coefficients on terrorism remains broadly unchanged when we include external security threats and domestic conflict as additional control variables, which also appear to have a highly significant positive effect on defense expenditures.

Dynamic modeling reveals that military spending is very persistent over time, with the coefficient on the lagged value of military spending remaining positive and highly significant at across all specifications. The estimation results obtained with the system GMM approach, reported in Table 3, are generally in line with the findings based on static models, but there are some notable changes in the direction and significance of control variables. The level of per capita income turns out to have a negative effect on military spending, but this is not statistically significant at conventional levels. Similarly, demographic factors (population, urbanization and human capital endowments) do not appear to be relevant for budgetary allocations to defense. Trade openness, on the other hand, remains an influential factor, albeit at a reduced significance in dynamic estimations covering the period 1970–2016, indicating that more open countries tend to spend less on military. We also find that institutional characteristics behave as expected, with corruption contributing to an increase in military expenditures, while democracy having a dampening effect. Finally, the Cold War dummy remains significant, with a positive effect on military spending, across all dynamic specifications.

With regards to the impact of terrorism on military spending, the results obtained with the system GMM estimator indicate that the coefficients on both indicators are statistically significant at the 5% level and positively associated with an increase in defense expenditures. In dynamic models, the coefficient on the number of fatalities scaled by population is substantially greater than the coefficient on the number of attacks, as well as compared to those coefficients estimated using the static models. These results remain robust to the inclusion of measures of external security threats and domestic conflicts as additional control variables. Once again, although the marginal impact of terrorism on military spending appears to be small, the cumulative effect

Table 2 Determinants of military spending: static estimations. *Source*: Authors' calculations

Variables	Panel-corrected SE				Driscoll–Kraay SE			
	Attacks		Fatalities		Attacks		Fatalities	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Terrorism	0.000**	0.000*	1.966***	1.821***	0.000	0.000	2.753***	2.389***
	(0.000)	(0.000)	(0.458)	(0.456)	(0.000)	(0.000)	(0.226)	(0.295)
Real GDP per capita	0.338***	0.322***	0.346***	0.322***	0.070*	0.093*	0.055*	0.075*
	(0.071)	(0.066)	(0.072)	(0.066)	(0.071)	(0.064)	(0.050)	(0.054)
Trade openness	−0.001	−0.001	−0.001	−0.001	−0.003***	−0.003***	−0.003***	−0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Population	0.021	0.039	0.042	0.048	0.265*	0.171	0.251*	0.189
	(0.027)	(0.024)	(0.030)	(0.025)	(0.119)	(0.126)	(0.125)	(0.125)
Urbanization	−0.008***	−0.008***	−0.009***	−0.008***	−0.001*	−0.001*	−0.001*	−0.001*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)
Human capital	−0.397***	−0.327***	−0.412***	−0.310***	−0.391***	−0.465***	−0.389***	−0.438***
	(0.091)	(0.079)	(0.095)	(0.079)	(0.068)	(0.057)	(0.061)	(0.053)
Corruption	0.021**	0.027**	0.021**	0.023*	0.033**	0.041**	0.035**	0.040**
	(0.012)	(0.012)	(0.012)	(0.012)	(0.015)	(0.016)	(0.015)	(0.015)
Democracy	−0.018***	−0.017***	−0.017***	−0.017***	−0.010***	−0.007***	−0.009***	−0.007***
	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)

Table 2 continued

Variables	Panel-corrected SE				Driscoll–Kraay SE			
	Attacks		Fatalities		Attacks		Fatalities	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Cold War	0.062*** (0.037)	0.065*** (0.038)	0.050*** (0.036)	0.062*** (0.038)	0.179*** (0.061)	0.146*** (0.053)	0.166*** (0.059)	0.145*** (0.055)
External threats	–	0.026*** (0.006)	–	0.023*** (0.006)	–	0.022*** (0.009)	–	0.014*** (0.007)
Domestic conflict	–	0.078*** (0.025)	–	0.075*** (0.025)	–	0.172*** (0.057)	–	0.146*** (0.055)
Number of observations	2898	2898	2898	2898	2898	2898	2898	2898
Number of countries	114	114	114	114	114	114	114	114
R^2	0.23	0.27	0.24	0.27	0.33	0.34	0.36	0.37

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

Table 3 Determinants of tax revenue and military spending: dynamic estimations. *Source*: Authors' calculations

Variables	Tax revenue				Military spending			
	Attacks		Fatalities		Attacks		Fatalities	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Lagged dependent variable	0.820*** (0.130)	0.829*** (0.127)	0.754*** (0.130)	0.765*** (0.128)	0.757*** (0.079)	0.724*** (0.096)	0.790*** (0.076)	0.765*** (0.085)
Terrorism	−0.000*** (0.000)	−0.000*** (0.000)	−0.876** (0.795)	−0.795** (0.871)	0.000** (0.000)	0.000** (0.000)	0.669** (0.397)	0.474** (0.000)
Real GDP per capita	0.157*** (0.114)	0.152*** (0.112)	0.194*** (0.108)	0.189*** (0.108)	−0.109 (0.144)	−0.098 (0.151)	−0.161 (0.157)	−0.148 (0.153)
Inflation	−0.001 (0.006)	−0.000 (0.006)	−0.002 (0.005)	−0.002 (0.005)	–	–	–	–
Agricultural output	−0.012*** (0.004)	−0.013*** (0.004)	−0.011*** (0.005)	−0.011*** (0.005)	–	–	–	–
Natural resource rents	−0.003* (0.005)	−0.002* (0.005)	−0.004* (0.006)	−0.003* (0.006)	–	–	–	–
Trade openness	0.001** (0.000)	0.001** (0.000)	0.001*** (0.000)	0.001*** (0.000)	−0.001* (0.001)	−0.001* (0.001)	−0.001* (0.001)	−0.001* (0.000)
Population	0.008 (0.010)	0.007 (0.010)	0.004 (0.010)	0.004 (0.010)	−0.011 (0.019)	−0.014 (0.020)	−0.011 (0.021)	−0.016 (0.020)
Urbanization	0.001 (0.003)	0.001 (0.003)	0.002 (0.003)	0.002 (0.003)	0.005 (0.005)	0.005 (0.005)	0.007 (0.005)	0.007 (0.005)
Human capital	0.117 (0.137)	0.106 (0.133)	0.189 (0.132)	0.177 (0.131)	−0.141 (0.141)	−0.139 (0.144)	−0.179 (0.153)	−0.174 (0.148)

Table 3 continued

Variables	Tax revenue				Military spending			
	Attacks		Fatalities		Attacks		Fatalities	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Corruption	−0.043* (0.030)	−0.043* (0.028)	−0.058* (0.028)	−0.057* (0.027)	0.018* (0.030)	0.023* (0.031)	0.028* (0.032)	0.031* (0.032)
Democracy	0.005 (0.005)	0.006 (0.005)	0.007 (0.005)	0.007 (0.005)	−0.010** (0.005)	−0.011** (0.005)	−0.008** (0.004)	−0.009** (0.004)
Cold War	–	–	–	–	0.086* (0.061)	0.092* (0.062)	0.076* (0.063)	0.079* (0.064)
External threat	–	0.008 (0.007)	–	0.004 (0.007)	–	0.017 (0.012)	–	0.012 (0.011)
Domestic conflict	–	−0.016 (0.027)	–	−0.002 (0.029)	–	0.091*** (0.038)	–	0.084*** (0.039)
Number of observations	2670	2670	2670	2670	2850	2850	2850	2850
Number of countries	114	114	114	114	114	114	114	114
Number of instruments	51	53	51	53	45	47	45	47
Specification tests (p values)								
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.712	0.686	0.836	0.807	0.411	0.524	0.859	0.897
Hansen J-test	0.622	0.690	0.645	0.671	0.386	0.423	0.437	0.453

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

could reach a significant level in countries where terrorism is prevalent with recurrent attacks and substantial number of fatalities.

4.4 Robustness checks

We conduct a number of sensitivity checks to verify our econometric findings, and to attain a more nuanced picture of how terrorism affects government finances. First, although unobserved heterogeneity in our broad panel is expected to be picked up to a considerable extent by country and time fixed 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 from 2000 to 2016, are summarized in Table 4. The point coefficient estimates for the subsamples are broadly consistent with those of our baseline results and indicate that the impact of terrorism on government operations and finances is significantly greater in developing and low-income countries than that in countries that are richer and more diversified in economic activity. Nevertheless, it should be noted that even advanced economies are vulnerable to acts of terrorism when the number of fatalities scaled by population is taken into account.

Second, considering the possibility of cross-country heterogeneity in the coefficient estimates, we drop countries with no incidence of terrorism and divide the sample into 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 provides an implicit assessment of nonlinearities. The results obtained with the system GMM estimator, available upon request, show some changes in the magnitude and statistical significance of estimated coefficients across subsamples. 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 num-

Table 4 Income heterogeneity and impact of terrorism. *Source*: Authors' calculations

Dependent variable	Tax revenue (percent of GDP)	Military spending (percent of GDP)
Attacks		
Advanced economies	−0.000 (0.000)	0.000 (0.000)
Developing and low-income countries	−0.001*** (0.001)	0.002** (0.001)
Fatalities		
Advanced economies	−0.256* (0.005)	0.185* (0.0004)
Developing and low-income countries	−0.895** (0.814)	0.747*** (0.427)

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 Table 3
***, **, and * denote significance at the 1, 5, and 10% levels, respectively

ber of terrorist incidents. This finding, however, is not statistically significant. 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.[13]

5 Conclusion

This paper contributes to the literature by focusing on the impact of terrorism on government finances—an underdeveloped strand of empirical research. Using a broad panel of 156 countries over a long time span running from 1970 to 2016, we find that acts of terrorism has a negative effect on tax revenue performance, especially in countries where terrorism is endemic with frequent attacks and large numbers of fatalities relative to population, and that this effect becomes more pronounced in dynamic models accounting for potential endogeneity. Similarly, controlling for a plethora of economic, demographic and institutional factor, we find compelling evidence that terrorism is associated with a significant increase in military spending. Thus, even though the marginal impact appears to be inconsequential at face value, the cumulative effect of terrorism on government operations and finance can still be very significant in countries where attacks are frequent and result in large numbers of casualties. Our empirical findings also confirm that the state of public finances in developing countries is more vulnerable to acts of terrorism than that in countries that are richer and more diversified.

In our view, the empirical results presented in this article 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, acts of terrorist do not necessarily have a long-lasting effect on macroeconomic developments or undermine a country's institutional infrastructure for tax revenue mobilization. Nevertheless, government finances in developing countries are far more vulnerable to terrorism than those in countries that are richer and more diversified in economic activity. From a policy point of view, while tacking terrorism is a complex challenge, our findings can be interpreted as evidence for greater economic diversification and openness and institutional development over the longer term to mitigate the potential impact of terrorism on public finances. We should also note that, even though higher military spending may divert government resources away from more productive areas (such as education, healthcare, and infrastructure), it can also have positive spillover effects by enhancing law and order.

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. Nevertheless, the empirical evidence presented in this article indicates that greater economic diversification and openness, and institutional improvements over the longer term, can mitigate the impact of terrorism on government operations and finance. In particular, with respect to effective revenue mobilization and efficiency in government spending,

[13] These result of *t* test further suggests that the estimated coefficients for subsamples are significantly different.

the paper's econometric results suggest that the potential impact of terrorism should be considered for budget planning and expenditure allocation purposes.

Acknowledgements The authors thank the editor, Robert Kunst, and two anonymous referees for their constructive comments that led to marked improvements in the paper. This article also benefited from helpful suggestions on a previous draft provided by Mark De Broeck, Annalisa Fedelino, Vitor Gaspar, Sanjeev Gupta, Daniel Leigh, Edouard Martin, Marco Pani, Christopher Towe, and the participants of a seminar at the Fiscal Affairs Department of the International Monetary Fund (IMF). The views expressed herein are those of the authors and should not be attributed to the IMF, its Executive Board, or its management.

Appendix

See Tables 5, 6, 7, 8 and 9.

Table 5 Summary statistics. *Source*: ICRG, GTD, PRIO, PWT, SIPRI, IMF, World Bank, Authors' calculations

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Tax revenue (percent of GDP)	5888	20.1	10.6	0.6	50.0
Military spending (percent of GDP)	5646	2.9	3.3	0.0	35.8
Military spending (percent of total expenditure)	5328	10.1	8.8	0.0	118.0
Terrorism					
Attacks	7943	16.8	78.0	0.0	2214.0
Fatalities	7943	33.5	209.8	0.0	7781.0
Real GDP per capita (log)	6746	8.2	1.5	4.8	11.6
Inflation	6897	0.4	4.6	−0.7	237.7
Agricultural output (percent of GDP)	5669	17.5	15.2	0.0	94.0
Natural resource rents (percent of GDP)	6680	7.2	10.7	0.0	89.2
Trade openness (percent of GDP)	6554	78.9	50.2	0.2	531.7
Population (log)	7824	15.6	1.9	10.6	21.0
Urbanization	7824	49.5	23.9	2.8	100.0
Human capital	6167	2.2	0.7	1.0	4.5
Corruption	4094	−3.0	1.4	−6.0	0.0
Democracy	6565	1.4	7.4	−10.0	10.0
External security threats	4094	−9.7	2.0	−12.0	0.0
Domestic conflict	7943	0.2	0.4	0.0	1.0

Table 6 Cross-sectional dependence test results (1970–2016). *Source*: Authors' calculations

Variable	CD test	*p* value
Tax revenue	37.00	0.00
Military spending	118.94	0.00
Terrorism		
Attacks	86.79	0.00
Fatalities	31.07	0.00
Real GDP per capita	313.49	0.00
Inflation	193.27	0.00
Agricultural output	253.75	0.00
Natural resource rents	97.02	0.00
Trade openness	129.27	0.00
Population	592.35	0.00
Urbanization	481.49	0.00
Human capital	584.15	0.00
Corruption	119.39	0.00
Democracy	123.04	0.00
External security threats	89.67	0.00
Domestic conflict	0.95	0.34

The null hypothesis is no cross-sectional dependence in residuals

Table 7 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

Table 7 continued

Advanced Economies	Emerging markets		Low-income countries
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
UK	Fiji	–	Kyrgyzstan
USA	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

Table 8 Determinants of tax revenue: fixed effects model. *Source*: Authors' calculations

Variables	Attacks		Fatalities	
	(1)	(2)	(1)	(2)
Terrorism	−0.000***	−0.000**	0.268	0.525
	(0.000)	(0.000)	(0.555)	(0.595)
Real GDP per capita	0.185***	0.185***	0.185***	0.183***
	(0.024)	(0.025)	(0.025)	(0.025)
Inflation	−0.012***	−0.012***	−0.013***	−0.013***
	(0.003)	(0.003)	(0.003)	(0.003)
Agricultural output	−0.007***	−0.007***	−0.007***	−0.007***
	(0.001)	(0.001)	(0.001)	(0.001)
Natural resource rents	−0.001	−0.001	−0.001	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Trade openness	0.001***	0.001***	0.001***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
Population	0.482***	0.484***	0.469***	0.471***
	(0.044)	(0.045)	(0.044)	(0.045)
Urbanization	0.005***	0.005***	0.005***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)
Human capital	0.178***	0.178***	0.177***	0.174***
	(0.044)	(0.044)	(0.044)	(0.044)
Corruption	−0.018***	−0.018***	−0.018***	−0.019***
	(0.006)	(0.006)	(0.006)	(0.006)
Democracy	0.003*	0.003*	0.003*	0.003*
	(0.001)	(0.001)	(0.001)	(0.001)
External threats	–	0.001	–	0.001
		(0.003)		(0.003)
Domestic conflict	–	−0.008	–	−0.028
		(0.016)		(0.016)
Number of observations	2683	2683	2683	2683
Number of countries	114	114	114	114
R^2	0.20	0.20	0.19	0.20

Robust standard errors are reported in parentheses. All regressions include a constant term and fixed effects, which are not displayed in the table

***, **, and * denote significance at the 1, 5, and 10% levels, respectively

Table 9 Determinants of military spending: fixed effects model. *Source*: Authors' calculations

Variables	Attacks		Fatalities	
	(1)	(2)	(1)	(2)
Terrorism	0.000***	0.000**	2.753***	2.389***
	(0.000)	(0.000)	(0.214)	(0.219)
Real GDP per capita	0.070*	0.093*	0.055	0.075*
	(0.036)	(0.036)	(0.036)	(0.035)
Trade openness	−0.003***	−0.003***	−0.003***	−0.003***
	(0.000)	(0.000)	(0.000)	(0.000)
Population	−0.265***	−0.171***	−0.252***	−0.189***
	(0.062)	(0.062)	(0.060)	(0.061)
Urbanization	−0.001	−0.001	−0.001	−0.001
	(0.003)	(0.002)	(0.002)	(0.002)
Human capital	−0.391***	−0.465***	−0.389***	−0.438***
	(0.067)	(0.067)	(0.065)	(0.065)
Corruption	0.033***	0.041***	0.035***	0.040***
	(0.009)	(0.009)	(0.009)	(0.009)
Democracy	−0.010***	−0.007***	−0.009***	−0.007***
	(0.002)	(0.002)	(0.002)	(0.002)
Cold War	0.179***	0.146***	0.166***	0.146***
	(0.021)	(0.022)	(0.020)	(0.021)
External threats	–	0.022***	–	0.014***
		(0.004)		(0.004)
Domestic conflict	–	0.172***	–	0.146***
		(0.026)		(0.025)
Number of observations	2898	2898	2898	2898
Number of countries	114	114	114	114
R^2	0.32	0.34	0.36	0.35

Robust standard errors are reported in parentheses. All regressions include a constant term and fixed effects, which are not displayed in the table

***, **, and * denote significance at the 1, 5, and 10% levels, respectively

References

Abadie A, Gardeazabal J (2003) The economic costs of conflict: a case study of the Basque Country. Am Econ Rev 93(1):113–132

Abadie A, Gardeazabal J (2008) Terrorism and the world economy. Eur Econ Rev 52(1):1–27

Albalate D, Bel G, Elias F (2012) Institutional determinants of military spending. J Comp Econ 40(2):279–290

Araz-Takay B, Arin K, Omay T (2009) The endogenous and non-linear relationship between terrorism and economic performance: Turkish evidence. Defense Peace Econ 20(1):1–10

Arellano M, Bover O (1995) Another look at the instrumental-variable estimation of error-components models. J Econom 68(1):29–52

Beck N, Katz N (1995) What to do (and not to do) with time-series cross-section data. Am Polit Sci Rev 89(1):634–647

Becker G, Murphy K (2001) Prosperity will rise out of the ashes. Wall Street J 29 Oct 2001

Becker G, Rubinstein Y (2004) Fear and response to terrorism: an economic analysis. Department of Economics Working Paper. University of Chicago, Chicago
Blomberg S, Hess G, Orphanides A (2004) The macroeconomic consequences of terrorism. J Monet Econ 51(1):1007–1032
Blomberg S, Broussard N, Hess G (2011) New wine in old wineskins? Growth, terrorism and the resource curse in sub-Saharan Africa. Eur J Polit Econ 27(2011):S50–S63
Blundell R, Bond S (1998) Initial conditions and moment restrictions in dynamic panel data models. J Econom 87(1):115–143
Castro G, Camarillo D (2014) Determinants of tax revenue in OECD countries over the period 2001–2011. Contaduria y Administracion 59(3):35–59
Collier P (1999) On the economic consequences of civil war. Oxf Econ Pap 51(1):168–183
Davoodi H, Clements B, Schiff J, Debaere P (2001) Military spending, peace dividend, and fiscal adjustment. IMF Staff Pap 48(2):290–316
Drakos K, Konstantinou P (2014) Terrorism, crime and public spending: panel VAR evidence from Europe. Defence Peace Econ 25(4):349–361
Driscoll J, Kraay A (1998) Consistent covariance matrix estimation with spatially dependent panel data. Rev Econ Stat 80(4):549–560
Dunne J, Perlo-Freeman S, Smith R (2008) The demand for military expenditure in developing countries: hostility versus capability. Defence Peace Econ 19(4):293–302
Eckstein T, Tsiddon D (2004) Macroeconomic consequences of terror: theory and the case of Israel. J Monet Econ 51(1):971–1002
Enders W, Sandler T (2012) The political economy of terrorism. Cambridge University Press, New York
Enders W, Sandler T, Gaibulloev K (2011) Domestic versus transnational terrorism: data, decomposition, and dynamics. J Peace Res 48(3):319–337
Filer R, Stanisic D (2016) The effect of terrorist incidents on capital flows. Rev Dev Econ 20(2):502–513
Frey B, Luechinger S, Stutzer A (2007) Calculating tragedy: assessing the costs of terrorism. J Econ Surv 21(1):1–24
Freytag A, Kruger J, Meierrieks D, Schneider F (2011) The origins of terrorism: cross-country estimates of socio-economic determinants of terrorism. Eur J Polit Econ 27:S5–S15
Gaibulloev K, Sandler T (2008) Growth consequences of terrorism in Western Europe. Kyklos 61(1):411–424
Gaibulloev K, Sandler T (2009) The impact of terrorism and conflicts on growth in Asia. Econ Polit 21(3):359–383
Gaibulloev K, Sandler T, Sul D (2013) Common drivers of transnational terrorism: principal component analysis. Econ Inq 51:707–721
George J, Sandler T (2017) Demand for military spending in NATO, 1968–2015: a spatial panel approach. Eur J Political Econ 53:222–236
Ghura D (1998) Tax revenue in Sub-Saharan Africa: effects of economic policies and corruption. IMF Working Paper, No. 98/135. International Monetary Fund, Washington
Goldsmith B (2003) Bearing the defense burden, 1886–1989: why spend more? J Conflict Resolut 47(5):551–573
Gries T, Meierrieks D (2013) Do banking crises cause terrorism? Econ Lett 119:321–357
Gries T, Krieger T, Meierrieks D (2011) Causal linkages between domestic terrorism and economic growth. Defense Peace Econ 22(5):493–508
Gupta A (2007) Determinants of tax revenue efforts in developing countries. IMF Working Paper, No. 07/184. International Monetary Fund, Washington
Gupta S, Clements B, Bhattacharya R, Chakravarti S (2004) Fiscal consequences of armed conflict and terrorism in low- and middle-income countries. Eur J Polit Econ 20(1):403–421
Johnston B, Nedelescu O (2005) The impact of terrorism on financial markets. IMF Working Paper, No. 05/60. International Monetary Fund, Washington
Kapetanios G, Pesaran M, Yamagata T (2011) Panels with nonstationary multifactor error structures. J Econom 160:326–348
LaFree G, Dugan L (2007) Introducing the global terrorism database. Terror Political Violence 19(1):181–204
Lenain P, Bonturi M, Koen V (2002) The economic consequences of terrorism. OECD Economics Department Working Paper, No. 334. Organization for Economic Co-operation and Development, Paris

Mirza D, Verdier T (2008) International trade, security and transnational terrorism: theory and a survey of empirics. J Comp Econ 36(2):179–194
Pesaran M (2004) General diagnostic tests for cross section dependence in panels, Cambridge Working Papers in Economics No. 0435. University of Cambridge, Cambridge
Procasky W, Ujah N (2016) Terrorism and its impact on the cost of debt. J Int Money Finance 60(2):253–266
Roodman D (2009) How to do xtabond2: an introduction to difference and system GMM in Stata. Stata J 9(1):86–136
Stotsky J, WoldeMariam A (1997) Tax effort in Sub-Saharan Africa. IMF Working Paper, No. 97/107. International Monetary Fund, Washington
Tanzi V (1992) Structural factors and tax revenue in developing countries: a decade of evidence in open economies. In: Goldin I, Winters L (eds) Structural adjustment and agriculture. University of Cambridge Press, Cambridge
Tavares J (2004) The open society assesses its enemies: shocks, disasters, and terrorist attacks. J Monet Econ 51(1):1039–1070
Teera J, Hudson J (2004) Tax performance: a comparative study. J Int Dev 16:785–802
Windmeijer F (2005) A finite sample correction for the variance of linear efficient two-step GMM estimators. J Econom 126(1):25–51
Younas J (2015) Terrorism, openness and the Feldstein–Horioka paradox. Eur J Polit Econ 38:1–11