The Economics of Terrorism: An Empirical Investigation into the long-run Effects of Terrorism on Economic Growth

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Terrorism has become an increasingly important topic following the attacks on the World Trade Centre in 2001. Following this incident, an array of literature has evaluated the effect of terrorism on various economic indicators; the most widely covered of these indicators being economic growth. We seek to build upon this existing literature to modernise the research on terrorism and long-run economic growth. We seek to estimate this relationship using regression analysis to investigate the question: Does terrorism have an adverse effect on long-run economic growth? Our results present some evidence of a long-run impact of terrorism on economic growth when excluding for time-effects, although these effects are not sustained into the next period.

1. Introduction

Does terrorism have an adverse effect on economic growth? The answer may seem obvious seeing as the effects of an incidence can often be devastating. Terrorism may damage an economy through channels such as loss of human and physical capital, diversion of foreign direct investment (FDI), a resultant lack of tourism (see Enders *et al*, 1992; Drakon and Kutan, 2003) and lower government spending (e.g. Blomberg *et al*, 2004 henceforth BHO). In addition, there are often forgotten about negative impacts such as those on the stock market, which account for the economic losses sustained by an incident (see Chaudhuri and Sensarma, 2001). For instance, the 9/11 attacks had significant direct and indirect costs, estimated to be around $80-90 billion (Gaibulloev and Sandler, 2012). A less widely covered incident, which occurred in Madrid on 11th March 2004, had effects estimated to be around 0.03% of Spain's Gross Domestic Product (GDP) in 2004 (Busea *et al*, 2007).

Following 9/11, not only has the number of terrorist incidents itself risen[1], but also their role in economic, political and social literature. There has been an array of studies focusing on the relationship between terrorism and economic growth (see BHO, 2004; Gaibulloev and Sandler, 2008; 2009; 2011), each with a different sample of countries, regions and time-frames yet there has been no clear conclusion regarding the long-run effects of terrorism on economic growth. We therefore seek to investigate this relationship using regression analysis to investigate the statement: 'Does terrorism have an adverse effect on long-run economic growth'.

This study expands on the previous work of Gaibulloev and Sandler (2008; 2009; 2011) by expanding the sample size beyond specific regions to look at a cross-country panel regression. Although world samples have been studied before, the use of data beyond the year 2000, as well as a distinction between domestic and transnational terrorism, is yet to be drawn upon. Domestic terrorism is defined as an attack involving perpetrators, victims and targets solely from the host country whereas transnational terrorism involves perpetrators crossing a border before committing an attack (Gaibulloev and Sandler, 2011).

We seek to investigate their specification further using additional control variables of Human Capital (HC) and Physical Capital (PK) to reduce omitted variable bias. This paper also draws upon different econometric techniques to capture the terrorism-growth relationship, namely: (1) dynamic panel estimators, (2) averaging data over five-year periods to abstract from cycles and seek a long-run

[1] See LaFree (2010) for trends in terrorism from 1970-2005.

relationship between our variables and (3) instrumental variable estimators to control for the possible endogeneity between terrorism and economic growth. While panel studies have become more prominent in capturing the effects of terrorism on economic growth, research by Meirekkes and Gries (2013) on the Granger causality of these variables require the need to test for endogeneity.

Our panel estimates confirm the suggested negative relationship between terrorism and economic growth in the long-run, albeit one that is considerably smaller than the previous literature has suggested (BHO, 2004; Tavares, 2004). For instance, an increase in one terrorist incident seems to have a marginal impact on growth of -0.0048% within a five-year period. Furthermore, our investigation also suggests important differences between the significance of different types of incidents and the inclusion of different control variables. For domestic terrorist incidents, the effect is small and significant. In contrast, the effect of a transnational terrorist incident is found to be insignificant although the magnitude of that is seen to be nearly six times as detrimental to growth as a similar rise in domestic incidents. When we do not control for time-specific effects however, this result becomes significant and smaller in magnitude. These results then appear robust when controlling for population, whereas our estimates in our two-way model are not. Additionally, we find the effects of terrorism to have varying impact among different sets of countries; the negative impact was seen only to be significant among a few developing regions, while more advanced regions were largely unaffected.

The remainder of this paper is structured as follows: Firstly, we will discuss the existing literature on the terrorism-economic growth nexus, introducing the key concepts relevant to this dissertation and highlighting previous empirical results using growth regressions. Then, we introduce the theoretical framework behind our study, the empirical model and describe our data. Afterwards, we present and discuss the results of our regressions in relation to existing literature before discussing our conclusion in the final chapter.

2. Literature Review

There is a proliferation of studies on the impacts of terrorism, be it on economic growth or other macroeconomic variables. The growth of such studies has been noticeable since the paper of Blomberg *et al* (2002) which presents dissatisfaction with current economic *status quo* as the cause of terrorism. This is not to say that this is a new phenomenon; studies of terrorism have long been an active field of research, not only in economics but many related disciplines such as sociology and political science. Earlier works date back to the 1960s but only after the September 11th attacks have an array of literature emerged linking terrorism with various economic indicators. This can be owed to the fact that the two main datasets used in the literature, viz: The *International Terrorism: Attributes of Terrorist* Events (ITERATE) Mickolus *et al* (2010); and the *Global Terrorism Database* (GTD) (National Consortium for the Study of Terrorism and Responses to Terrorism), henceforth START (2016), only date back to 1968 and 1970 respectively. The recent empirical literature following the September 11th attacks has reported largely negative effects of terrorism on macroeconomic variables. Nevertheless, the literature has varied between a mixture of cross-country (BHO, 2004; Tavares, 2004) and country-specific examples (Mehmood, 2014; Eckstein, 2013). The distinction between, and use of, domestic and transnational terrorism also adds another dimension to the studies as they are found to have differing effects on key indicators.

2.1. How Terrorism Affects Economic Growth?

The detrimental effects of terrorism are well documented; hence, it is important before discussing the empirical evidence to first discuss the literature on the terrorism-growth nexus. It would be expected that an attack would not only have the capacity to harm economic activity through the loss of physical and human capital (i.e. the loss of infrastructure and the loss of lives etc.) but also through various indirect costs in the immediate aftermath (Meierrieks and Gries, 2013). For instance, studies (BHO, 2004; Gaibulloev and Sandler, 2008) have shown that such incidents often lead to a diversion of government spending from investment to military, often crowding out growth-promoting investment. Moreover, in the wake of a significant attack, or even threat, there is often a period of instability in not only the economic but also the political and social spheres which could have negative effects on growth rates (Malik, 2013).

In addition, literature has shown that foreign direct investment (FDI) can be diverted (see Abadie and Gardeazabal, 2003) away from a country following an attack, which is a particularly important source of investment for developing countries (Gaibulloev and Sandler, 2008). For instance, Enders and Sandler (1996) estimated that terrorism caused a reduction of 13.5% on FDI inflows during the period 1975-1991. This is because expensive counter-measures (i.e. security) are often deployed following these incidents which may increase cost of doing business within that country. Accordingly, an investor would seek to take his investments elsewhere, often to safer countries (Enders *et al*, 2011). This could further detriment growth through the reduction of international trade. Nitsch and Schumacher (2004) address such theory as they look to document the effects of terrorism on international trade using an augmented gravity model. Although they draw on data only from the ITERATE dataset, and therefore do not account for domestic terrorism, their results show compelling evidence of terrorism having a detrimental effect on the volume of trade. In fact, a doubling in number of terrorist incidents in a year has an associated decrease in bilateral trade of 4% - a sizable reduction which supports the general theory. However, it is important to note their dataset does address a broad period of study (1960 to 1993), it could be considered largely outdated and perhaps not relevant to modern-day study.

2.2. Country Specific Studies

Studies that have focused on specific countries often document areas in which terrorism is high and persistent. An illustration of this can be provided by Eckstein and Tsiddon (2004) and Mehmood (2014) in their case studies of the macroeconomic consequences of terrorism in Israel and Pakistan respectively. Using Vector Autoregressive (VAR) models, they both recorded that terrorism affected real GDP growth in the respective countries. In the Israeli case study an increase in terrorism resulted in a decrease in investment, consumption and income in the long-run; in Pakistan, however, terrorism was found to negatively affect worker remittances and government spending, reducing growth by 16.13% in the ten years before their study.

Abadie and Gadeazabal (2003) found similar results in a study of Spain's Basque region. Owing to Spain's economic downturn of the late 1970's and early 1980's (see Lieberman, 2005), they opted for a synthetic control method. This was deemed more appropriate than a time-series analysis, which would distort the results. This allowed them to construct a weighted average of other more peaceful regions, ensuring that their various growth determining factors were similar to those of the Basque region, in order to make a valid comparison. Their results showed

a difference of about 10 percentage points in per capita GDP relative to the control group. They believed this to be because of terrorist conflict, having observed an increasing gap during times of high-terrorism and reducing gap during low-terrorism phases. A weakness of this study, as postulated by Robbins *et al* (2015), suggested that an exact match between the treatment and control group was infeasible. Accordingly, many other factors could have affected the differences in growth between the two regions.

2.3. Regional Analysis

The most active field of terrorism-growth research lies within cross-country studies; while some focus on world studies, others focus on specific regions. For instance, Gaibulloev and Sandler (2011) looked to investigate the adverse effects of domestic and transnational terrorism on growth within Africa. They argued that factors such as low openness, high public spending as a share of GDP and low investment as a share of GDP make determinants of growth in Africa differ greatly to those of the rest of the world. However, using the ITERATE database, they did not report any impact of domestic terrorism.

In a similar specification, Gaibulloev and Sandler (2008) again undertook a regional investigation, this time with a focus specifically on Western Europe. Using a panel of estimates over a 33-year period (1971-2004) their work focused on the important distinction between transnational and domestic terrorism. Results were supporting of previous studies showing the growth limiting ability of transnational terrorism to be both significant and negative. Their results for the effect of domestic terrorism on per capita income growth however were insignificant, making them an unreliable source of interpretation. Similar results were found for their 2009 study on a sample of Asian countries.

2.4. World Studies

In addition to the cross-country studies assessing the regional effects of terrorism, there is a strand of literature that focuses on world studies. BHO (2004) provided a highly-regarded investigation into the macroeconomic consequences of international terrorism. Using a pooled cross-section, their investigation looked at 177 countries over the period 1968-2000. In their initial baseline regression, they found per capita growth to fall by 1.587% in the event of a terrorist incident occurring in each year of the sample period. The results were in fact statistically significant; over the 33-year sample this amounted to a 0.048% reduction in growth per year.

This specification was only useful for capturing the long-run effect of terrorism on growth, and so they re-investigated using a panel estimate with dummies to account for time and fixed effects. The magnitude of the terrorism coefficient was then reported to be much larger – i.e. in a single year an attack was estimated to reduce growth by 0.567% - compared to 0.048% in the cross-sectional estimate. While this difference is not directly addressed in the paper, further inferences can be made when demographics are included. They found the impact of terrorist incidents to be higher in developing countries as opposed to a lower impact in countries with more advanced economies such as those in the OECD. Nevertheless, cause for concern arose with these results as all geographical panels, bar Africa, proved insignificant. Again, this is not addressed and could imply that the 'big picture' represented by the full-sample may not be representative of the smaller sub-samples.

Unlike other studies (i.e. Gaibulloev and Sandler, 2008), BHO (2004) did not differentiate between domestic and transnational terrorism, focusing only on the latter and not controlling for domestic terrorism, which is believed to be more prominent in the sample countries (Ender and Sandler, 2005). Moreover, as Sanchez-Cuenca and Calle (2009) suggested, studies that focus solely on transnational terrorism often lead to incorrect assumptions about domestic terrorism and consequently are a misrepresentation of overall terrorism. Additionally, their sample did not look at data beyond the year 2000. This provides opportunity to modernise their research to incorporate more recent years, where terrorist incidents have been much more prominent (see LaFree, 2010).

Tavares (2004) also investigated the impact of a terrorist attack on GDP growth. He sampled a large group of (unspecified) countries from the years 1987-2001 subject to data provided by the International Policy Institute for Counterterrorism (2003). His findings proved to be consistent with similar world studies, such as BHO (2004), in terms of terrorism having a negative impact on per capita GDP growth. In fact, having found a small but significant negative impact on GDP growth of 0.045% is very much consistent with the reduction in growth of 0.048% found by BHO (2004). However, once additional controls were added the influence of terrorism was neither negative nor significant, which calls his model into question. With these additional controls being basic growth variables such as openness and education expenditure, this leads to a concern regarding omitted variable bias in his model. This paper did leave scope for some aspects to be further explored; mainly, these are that he did not consider potential differences

between types of terrorism and within sub-sample (i.e. regional effects); hence, we will aim to explore these avenues.

2.5. Opportunities

Taken together, the findings from these papers emphasise the need to investigate a world study to account for the rise in terrorism following the September 11th 2001 attacks. Thus, the inclusion of post 9/11 years is particularly attractive for our study. Moreover, looking at the works of Tavares (2004) and a more recent study by Gaibulloev and Sandler (2012) makes the relationship between economic growth and terrorism inconclusive. Having considered these results, there is a further need to revaluate such models with the addition of additional growth variables in the hope of achieving statistically significant results and to clear up the ambiguity in the effects of terrorism on economic growth.

3. Methodology

3.1. Theoretical Framework

The derivation of the theoretical framework begins with Solow's (1956) neoclassical growth model with decreasing returns to capital. While Mankiw, Romer and Weil (MRW) (1992) found this to be consistent with the evidence, they argue that Solow had ignored the role of human and physical capital in its ability to affect growth. They therefore proceeded to incorporate both physical and human capital into the model as a means of explaining why savings and population growth appeared to be too large. As such, the augmented Solow model can be taken as a baseline empirical growth model (see MRW 1992).

Next, we lay out the basic model of our study: a panel model. These differ from cross-sectional studies, which generally focus on average growth rates over a certain period. A panel study, however, often focusses on repeat observations over generally shorter periods of time (Stock and Watson, 2007). A typical panel specification can be found in Appendix 1. This improves the efficiency of econometric estimates by allowing for a further degree of variability, more degrees of freedom and by reducing collinearity among variables (Hsiao, 1986). Moreover, it is argued by Levine and Renelt (1992) that cross-sectional growth regressions are lacking in their ability to capture the casual relationship between economic growth and explanatory variables; thus, more recent studies have used dynamic panel regression to obtain a better estimation.

While panel models are becoming more prominent in literature, their implementation does mean that standard ordinary least squares (OLS) cannot be applied where unobserved individual effects are present; rather, a fixed effect (FE) or random effect (RE) model must be applied. These can, nevertheless, be an improvement on OLS which creates a composite error term with idiosyncratic error and fixed effects (Stock and Watson, 2007). On the other hand, the FE and RE account for these effects separately and so can control for heterogeneity bias if the fixed effects terms are correlated with the explanatory variables. Therefore, we look to apply these models under the presence of unobserved effects. To distinguish between these two models, we will apply the Hausman test with the null hypothesis that the random effects estimator is more appropriate. To further account for econometric issues, we will run the Wald test for the presence of heteroscedasticity, which if present, would mean OLS estimators would become inconsistent.

3.2. Empirical Specification

This study will analyse the impacts of terrorism on the dependent variable growth using the definition of growth in accordance to much of the economic literature (see Gaibulloev and Sandler 2008). This is computed as the log of Gross Domestic Product per Capita (GDPPC) between subsequent years. Following our panel specification and the aim of this paper, we follow a similar model to much of the previous literature (see BHO, 2004; Gaibulloev and Sandler 2008, 2009) to account for the effects of terrorism on economic growth:

$$growth_{it} = \beta_0 + \beta_1 lny_{i,t-1} + \beta_2 \ln(Open)_{it} + \beta_3 \left(\frac{I}{GDP}\right)_{it} + \beta_4 Terror_{it} + \beta_5 OIL_t + \beta_6 AFRICA_t + \alpha_i + \gamma_t + u_{it} \quad (1)$$

The dependent variable growth is as previously defined. The main independent variable being examined in our study is the *Terror* variable, for which data has been drawn upon by the Global Terrorism database (GTD) (START, 2016). Since we are interested in investigating the effects of different types of terrorism, terrorism can be assessed by different variables as discussed in our introduction, namely: domestic terrorism (*dter)*, transnational terrorism *(tter)*, or total terrorism *(totalter).* The remainder of the specification models growth as a function of other explanatory variables. The first of these is lagged income per capita ($lny_{i,t-1}$), which we define as the logarithm of GDPPC averaged for the previous five-year period. This was added to control for convergence. We also include the logarithm of openness consistent with much of the literature (see BHO, 2004). Investment as a share of GDP is also included along with an error term. The variable subscripts i and t in this equation represent an observation in country *i* (=1,…,113) at time *t,* an index for non-overlapping, five year time periods (1970-1974; 1975-1979; etc.). The inclusion of α_i, a collection of country-fixed effects and γ_t, a collection of time-fixed effects, allow control for country-specific and time-specific unobserved heterogeneity respectively, which often cause bias (Gaibulloev and Sandler, 2008).

These variables have been drawn upon as they have been consistently linked throughout literature and economic theory to have an influence on economic growth (Levine and Renelt 1992). In fact, of the 41 growth studies surveyed by Levine and Renelt (1991), these variables were frequently looked at: 33 included investment share, 29 used a measure of population growth, 13 used a human-capital measure and 18 included a measure of initial income (Levine and Renelt, 1992). Thus, the inclusion of these additional explanatory variables is to help

improve the accuracy of the coefficients in the model through reducing omitted variable bias. We also include two dummies, namely AFRICA and OIL dummies, representing countries in Africa and OPEC respectively. An *OIL* dummy was deemed suitable because of the larger growth rates they may exhibit due to oil production (Landau, 1986). An *AFRICA* dummy has been included as African countries have consistently been identified to exhibit lower growth rates than the rest of the world (BHO, 2004).

We will test the robustness of these results with additional determinants of growth as further control variables. Our resultant specification is:

$$growth_{it} = \beta_0 + \beta_1 lny_{i,t-1} + \beta_2 \ln(Open)_{it} + \beta_3 \left(\frac{I}{GDP}\right)_{it} + \beta_4 Educ_{it} + \beta_5 K_{it} + \beta_6 Terror_{it} + \beta_7 OIL_t + \alpha_i + \gamma_t + u_{it} \quad (2)$$

The variable $K$and $Educ$ are representative of elements of physical and human capital respectively and will be discussed in Section 3.4. For robustness, a similar measure will be deployed where we divide the number of incidents by the population to give terrorist incidents per capita.

3.3. Instrumental Variable

Much of the relevant literature points towards one main concern of growth regressions in a panel setting; dealing with potential endogeneity bias between the dependant and independent variables (Younas, 2014), in this case, terrorism and economic growth. This would lead to the OLS estimators becoming biased and inefficient using multiple regression (Stock and Watson, 2007). Although not presented here, we will model terrorism incidents with its lagged values as an instrumental variable in our dynamic panel setting using the two-stage least squared approach[2]. This is because if the independent variable is assumed to be endogenous then it is treated symmetrically with the dependant variable; hence, the lagged values of the independent variables become valid instruments. Although this method does not allow us to control for full endogeneity, it does allow for a weak form of it and we will therefore test its validity statistically.

[2] This test operates in two stages: firstly, it isolates the variation in the endogenous regressor that is uncorrelated with the error term to obtain a residual. This residual in these regressed on the dependant variable (Stock and Watson, 2007). See Appendix 8 for the IV2SLS results.

Notwithstanding this, in line with many previous studies (e.g., BHO, 2004; Gupta *et al*, 2004), terrorism is taken to be exogenous for the remainder of this paper.

3.4. The Dataset

Appendix 3 presents a full specification of the main variables used in our estimates. As do Gaibulloev and Sandler (2008), we favour the use of a terrorism measure where the number of events are measured in contrast to a terrorism dummy, which would take the value of one in the event of one or more terrorism attacks in the given year. This allows us to quantify the effects based on the number of incidents in each period. This data for terrorism is drawn upon using the Global Terrorism Database (GTD). The GTD is an open source-database compiled by START (2016) at the University of Maryland. It includes information on terrorist events around the world from 1970 through to 2015 (START, 2016). The GTD provides a thorough picture of terrorist incidents around the world, providing details on the date, location, weapon and nature of the target for each incident. Furthermore, unlike many other event databases[3], the GTD provides data on both domestic as well as transnational terrorist incidents, making it an appropriate basis for our study. While data is available for both natures of terrorism, they are not directly distinguished within GTD; accordingly, we draw on data from Enders, Sandler and Gaibulloev (2011) who have constructed a method to split the GTD data into domestic and transnational events[4]. To further add robustness to our results, we have included an additional measure where terrorist incidents are scaled by population, which should offer an extra dimension to our analysis.

This is not to say that there are no problems that need to be addressed with this database such as the differing coding conventions between the period 1970-1997 and 1998 onwards (Enders *et al*, 2011). This may distort the illustration of data over the two contrasting periods, with earlier data complying with a broader definition. The details are however not specified on the database and therefore cannot be avoided. Moreover, as with nearly all terrorism databases, we would expect some inaccurate incidents (e.g. Hoaxes, threats etc.) to be reported (Enders *et al*, 2011).

As measures of our independent variables – Real gross Domestic Product per Capita (GDPPC), Investment share of Real GDPPC (I/GDP) and Openness in constant prices (Open) – we have

[3] The most widely used of which is the International Terrorism: Attributes of Terrorist Events (ITERATE) database (Mickolus *et al* 2006).

[4] For a full specification, see: Enders, Sandler and Gaibulloev (2011).

drawn upon the *Penn World Tables 6.3*, compiled by Heston, Summers and Aten (2010). These variables have been averaged over the five-year period to give one observation per period. This allows us to focus on the long-run relationships between terrorism and growth. One advantage of this dataset is their adjustment of the former 3 variables in accordance to purchasing-power parities (PPPs) allowing cross-country comparisons to be made over time. From this data, we can account for our dependant variable, growth, as the difference in logs of GDPPC between years. Subsequently, we again proceed to take a five-year average.

As for Gross capital formation (% of GDP), we again produce a 5-year average and rely on data from the World Bank, which covers most countries and territories. Barro and Lee (2013) provide data on the percentage of people over the age of 15 who have completed secondary schooling, which we employ as our measure of human capital. Data is reported at a five-year frequency; therefore, data is drawn for the beginning of the period for each country.

3.5. Summary

Our empirical investigation will involve analysis of a panel data sample consisting of observations for each country across the sample period 1970 to 2005 inclusive[5]. There will be 113 countries studied in our empirical investigation, many of which we will group together to measure regional effects using GTD definitions. Data is averaged over non-overlapping, five year periods, giving us seven different panel time periods for each country (1970-1974; 1975-1979; etc.). By doing this, not only can we consider the long-run relationship between terrorism and growth, but we can also abstract from crises and eliminate cycles. The sample period 1970 to 2005 was selected for two main reasons, namely: to include many observations for each variable; to further build upon world studies (such as BHO, 2004; Tavares, 2004) which have not included the post-2001 period in their study; and, because the Enders, Sandler and Gaibulloev (2011) dataset only provides incidents up to 2007. This post-2001 period is especially important as, since then, the number of terrorist incidents have seen a substantial rise as terrorism becomes more commonplace in society (see LaFree, 2010). In total, the resulting panel dataset covers 113 countries for 7 periods for 791 observations. Summary statistics are presented in the Appendix 4.

[5] Note that the data for 1993 is unavailable. Additionally, data beyond 2007 is currently available but was unavailable at the time of study for Enders, Sandler and Gaibulloev (2011).

4. Empirical Results

Table 4.1. The Effect of Terrorism on GDP Growth (OLS vs. Two-way FE)

	Standard OLS model		2-way FE model	
	Dependent Variable: *Growth*		Dependent Variable: *Growth*	
Independent Variable	(1)	(2)	(3)	(4)
Totalter	-0.003	-0.006**	-0.004*	-0.0048***
	(0.003)	(0.003)	(0.002)	(0.002)
loglagGDP	-1.591***	-1.506***	-7.505***	-6.661***
	(0.159)	(0.205)	(0.851)	(0.843)
I/GDP	0.124***	0.046	0.051*	-0.023
	(0.022)	(0.032)	(0.030)	(0.045)
Logopeness	1.096***	0.344	2.433***	2.112***
	(0.267)	(0.270)	(0.402)	(0.661)
gcfofGDP		0.207***		0.133***
		(0.041)		(0.043)
Lsc		0.015		0.046*
		(0.015)		(0.025)
AFRICA	-2.031***	-2.037***	0.000	0.000
	(0.407)	(0.426)	(.)	(.)
OIL	-0.321	-0.491	1.288***	1.132**
	(0.680)	(0.753)	(0.370)	(0.455)
N	563	624	563	677
$\bar{R}^2$	0.201	0.288	0.509	0.545
Time effects	Yes	Yes	No	No

Note: robust t statistics in parentheses: "*"=p<0.1, "**"=p<0.05, "***"=p<0.01.

Source: Author's own computation

4.1. OLS vs. Fixed Effects

We begin our results using the baseline growth regression represented by equation (1), as previously presented. First, we report our results using a simple OLS regression represented by a Pooled model. The results for this estimation are reported in Table 4.1 and are in line with much of the previous literature (see BHO, 2004; Gaibulloev and Sandler, 2008) in that (i) terrorism is shown to have a negative impact on economic growth and, (ii) that these results are measured to be statistically significant. The coefficient on the terrorism index is estimated to be less than previously reported, with a value of -0.006. While this could be accounted for by differences in sample and long-run variables, this is most likely due to the presence of unobserved heterogeneity which is often prevalent among OLS estimators.

To account for these effects, we use F-tests to test for the presence of both time-specific and country-specific effects in our model. These tests strongly indicate the presence of country-specific[6] as well as time-specific effects, which signals us to use a two-way FE/RE model. The Hausman test between two-way FE and two-way RE indicates a preference towards the fixed effects estimator. Moreover, having run the Wald test heteroskedasticity, there is statistically significant evidence at the 1% level of the presence of heteroskedasticity; hence, the 'robust'[7] command was used on all regressions to control for this[8]. As such, the results are presented in Table 4.1.

Columns (1) and (4) shows the estimation for our aggregate terrorism measure (*totalter)* while separate analysis is undertaken for domestic and transnational terrorism, reported in Columns (2), (5) and (3), (6) respectively. The tables show the measured coefficient for each variable in our model along with the adjusted R^2 figures ($\bar{R}^2$)[9] for each model.

As can be seen, the introduction of controls from equations (1) to (2) led to an improved specification in both cases, accountable by the removal of some omitted variable bias as shown by the increased $\bar{R}^2$ from 0.201 to 0.288 and 0.509 to 0.543, in OLS and FE respectively. The latter value implies that the independent variables effectively explain 54.3% of overall growth in equation (3). That being the case, I will use the estimates from equation (2) with the inclusion of our additional controls.

[6] We perform two separate F-tests with the null hypothesis that all the (i) individual country-effects and (ii) individual time-effects are the same versus the alternative hypothesis that they differ. The probability for the F joint-statistic equalled 0.0000 for both, thus we reject the null hypothesis in favour of the alternative hypothesis in both cases.

[7] A robust estimator should be efficient even if the errors do not follow a normal distribution.

[8] Prob>chi2 = 0.0000, so we reject the null hypothesis and conclude heteroscedasticity in our model.

[9] $\bar{R}^2$ is a measure used in multifactorial regressions to describe the fraction of variance the regression explains. (Stock and Watson, 2007)

Table 4.2. The Effect of Terrorism on GDP Growth

Dependent Variable: *Growth*						
	2-way FE			1-way FE		
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)
Totalter	-			-0.010***		
	(0.018)			(0.002)		
Tter		-0.0189			-0.057***	
		(0.015)			(0.017)	
Dter			-0.0058***			-0.010***
			(0.002)			(0.002)
loglagGDP	-6.661***	-6.680***	-6.651***	-5.462***	-5.541***	-5.457***
	(0.842)	(0.839)	(0.842)	(0.385)	(0.383)	(0.386)
I/GDP	-0.023	-0.019	-0.023	-0.026	-0.020	-0.024
	(0.024)	(0.046)	(0.045)	(0.050)	(0.050)	(0.050)
Logopeness	2.111***	2.111***	2.107***	2.953***	2.963***	2.956***
	(0.660)	(0.660)	(0.659)	(0.642)	(0.651)	(0.640)
gcfofGDP	0.132***	0.131***	0.133***	0.117***	0.114**	0.116**
	(0.043)	(0.043)	(0.043)	(0.044)	(0.045)	(0.044)
Lsc	0.046*	0.048*	0.045*	0.072***	0.078***	0.072***
	(0.025)	(0.025)	(0.025)	(0.026)	(0.026)	(0.026)
AFRICA	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)
OIL	1.132**	1.109**	1.132**	0.211	0.137	0.201
	(0. 454)	(0.452)	(0.454)	(0.255)	(0.250)	(0.254)
1975.period	1.351*	1.301*	1.356*			
	(0.729)	(0.729)	(0.727)			
1980.period	0.601	0.500	0.616			
	(0.986)	(0.972)	(0.983)			
1985.period	0.006	-0.135	0.031			
	(1.153)	(1.119)	(1.151)			
1990.period	-0.377	-0.528	-0.356			
	(1.311)	(1.281)	(1.307)			
1995.period	-0.150	-0.273	-0.136			
	(1.321)	(1.294)	(1.316)			
2000.period	1.828	1.733	1.851			
	(1.443)	(1.418)	(1.443)			
N	562	562	562	563	563	563
$\bar{R}^2$	0.545	0.544	0.545	0.506	0.505	0.506
Time effects:	Yes	Yes	Yes	No	No	No

Note: robust t statistics in parentheses: "*"=p<0.1, "**"=p<0.05, "***"=p<0.01.

4.2. Fixed Effects Models

Next, we present our results using both a one-way and a two-way error-component model to compare these specifications. The interpretation of the coefficients of *Log(Openness)* and lny_{it-1} show the $\beta\%$ on growth due to a 1% change in the respective size of such variables. Accordingly, and consistent with much of the growth literature (see Barro, 1991), the sign and significance of the coefficient on initial value of GDP per capita is negative and significant at the 1% level. This is a particularly important result, as it is consistent with the convergence hypothesis (Rassekh, 1998) implying that, for the sample of countries included in this study, convergence toward a common growth rate is dependent negatively on the lagged value of GDP per capita. *Log(Openness)* is both significant at the 1% level and positively related to economic growth, a result which was consistent with expectations (see Hyder *et al*, 2004; BHO, 2004; Gaibulloev and Sandler, 2008).

I/GDP yielded a surprising result in that its effect appears both negative and insignificant. This could be accounted for by its high correlation with our measure of physical capital of 0.682. As such, the estimate on at least one of these coefficients will be imprecisely estimated by imperfect collinearity (Stock and Watson, 2007)[10]. As for our additional growth determinants, both human and physical capital elements are found to be positive and significant in relation to economic growth. This subsequently justifies the inclusion of these variables within the specification and was expected given the work of Mankiw *et al*. (1992). Our *OIL* dummy showed a positive and significant effect, increasing economic growth by 1.132 percentage points in countries part of OPEC while our *AFRICA* dummy was omitted due to multicollinearity with our country-specific effects.

In both specifications, our aggregate terrorism measure yields unsurprising results; the negative coefficient on terrorism confirms the predicted negative impact of terrorism on growth and appears significant at the 1% level in the regression. This is in line with past findings that terrorism causes damaging effects on the economy (e.g., BHO, 2004; Gaibulloev and Sandler, 2008; Tavares, 2004). The size of this coefficient indicates that within a five-year period, one incident of total terrorism is associated with a 0.0048% decline in growth rate. Since the average country in the sample experienced 12.25 terrorist incidents a year, this finding shows that terrorism has a negligible effect on long-growth of 12*0.0048%. Figure 1 shows the comparison of our terrorism coefficient with the literature, namely the world studies of Tavares (2004) and BHO, (2004). We take an increase in one terrorist incident as a basis of comparison, in accordance with the comparable literature.

[10] Because the two variables are highly correlated, it would be difficult to estimate the partial correlation of one of these variables keeping the other constant (Stock and Watson, 2007).

The results show that the coefficient on our aggregate terrorism measure is much smaller than previous literature has indicated. An explanation for this could be owed to our use of a dynamic panel specification, which improves the efficiency of the econometric estimate by its addition of the variability of a time-series dimension (Hsaio, 1986). Moreover, since our additional variables are statistically significant, these could posit another explanation by reducing omitted variable bias to give a more accurate coefficient (Hsaio, 1986).

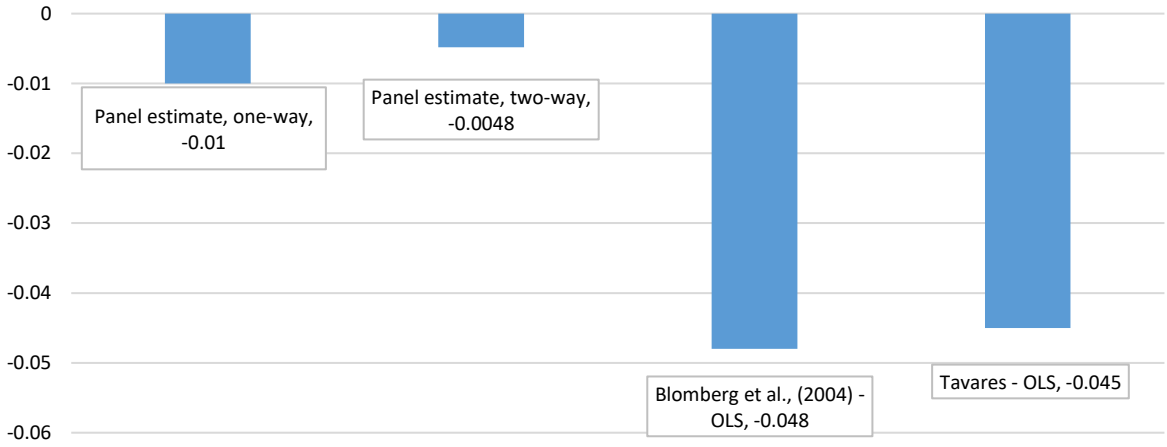

Figure 1. Comparison of Terrorism Coefficient with World Studies (Expressed as % Effect on Economic Growth)

Column (3) finds similar results in terms of size and magnitude for *dter* (domestic terrorism) in that the effect is similarly negative (-0.0058) and again significant at the 1% level. This result is robust to the exclusion of time-effects. The results are much more surprising when we turn to column (2). The coefficient on *tter* (transnational terrorism) is -0.0189, more than three times as large as the corresponding *dter* result. This result is, however, not significant with time-effects. The larger coefficient on transnational incidents was expected, as they are generally larger and more disruptive to routines and growth (Gaibulloev and Sandler, 2011), but the insignificance of the result is surprising. This is because most of the literature finds a significant relationship between transnational terrorism and economic growth (see Enders and Olson, 2012; Gaibulloev and Sandler, 2008). However, this is mostly done using ITERATE data. This brings into question the differences between the specifications. Nevertheless, there has been previous evidence to support our findings. When both the ITERATE and GTD are compared by Gaibulloev and Sandler (2011), they too found a similar result, in that their transnational terrorism coefficient associated with the GTD data typically appeared insignificant[11].

[11] While we would re-evaluate our transnational terrorism measure with the ITERATE dataset, we are unable to do so because of limitations of access to this data.

When we look to exclude time-effects, however, our transnational terrorism indicator turns significant at the 1% level. As such, the insignificance of the results could be accountable to our time-dummies which are jointly explaining the variance in our dependent variable. Consequently, they are taking away the contribution of other explanatory variables and thus their exclusion results in a significant coefficient. Furthermore, whilst removing these effects has a negative impact on the between $\bar{R}^2$, the overall $\bar{R}^2$ increase when using our one-way model[12]. While a larger sample size may be able to account for this issue, we proceed to remove this extra parameter to improve the significance of our explanatory variables.

4.3 Regional Effects

The need for regional analysis is emphasised by Enders and Sandler (2008) following their investigation into the differing economic consequences for developing and developed countries following a terrorist incident. They argue that providing an average picture for all the countries often misrepresents the effect on growth and thus there is a need for smaller-scale panels (Enders and Sandler, 2008). We therefore construct 12 regions using GTD definitions to look at the long-run effects on terrorism on different regions. We present results only for regions where terrorism has a negative impact. Moreover, results are presented using a one-way estimator only in Table 4.3 (in Appendix 5)[13]. The results are mostly insignificant, which is consistent with the results of BHO (2004). More recently, Gaibulloev and Sandler (2012) argue that the modest number of incidents within countries insulates regional samples from the harmful effects of terrorism. Furthermore, as anticipated, none of our terrorism variables are significant for the more developed regions (Gaibulloev and Sandler, 2009)[14]. This is because larger and more advanced economies are better able to withstand any form of terrorism and are therefore less likely to display adverse macroeconomic consequences (Enders and Sandler, 2008).

Results from regions (3) (5) and (6) tell a different story however. These regions, which are considered less developed, are found to have a larger and statistically significant effect on economic growth compared to the more developed regions, as shown by Gaibulloev and Sandler (2008)[15]. For instance, the coefficient for these regions suggest that an additional terrorist incident causes growth to fall by -0.035 and -0.012 percentage points respectively. Again, our domestic and transnational indicators have differing impacts. While two of our developing regions appear to be negatively affected by

[12] Overall $\bar{R}^2$ increases from 0.0398 to 0.0642.
[13] Results were largely the same for our two-way estimator in terms of statistical significance.
[14] Here, I take a developing region to be where over half the sample consists of 'developing countries', as per UNDP definitions (UNDP, 2016).
[15] Regions were defined as per GTD definitions. Full descriptions are given in Appendix 3.

transnational terrorism, domestic terrorism appears insignificant in its impact on growth within any region. Enders *et al*, (2011) find a similar result in their study of Africa. This could be explained by the differing intensities of the incidents. Whereas domestic incidents are more commonplace, they are more routinely dealt with and therefore less likely to cause growth-limiting damage to specific regions than transnational incidents (Gaibulloev and Sandler, 2011).

4.4 Robustness Analysis

As a robustness measure, we implement a new indicator of terrorist activities with an alternative measure, that being incidents per capita. Here, we divide the number of terrorist incidents by the average population for that five-year period. This is important due to the variation in country sizes that we have included in our study, with population varying 90,920 to 1,300,000 (in thousands). It is expected that a larger and more populous country would experience more activity in absolute terms (Meirekkes and Gries, 2012); thus, by scaling for population the terrorism variable would provide a more accurate representation of overall terrorism within a country (Younas, 2014). Results are presented in Table 4.4 (included as Appendix 6).

The resulting estimates yield similar results in terms of size and intensity; transnational incidents again seem to have a larger effect than both domestic and total terrorist per capita incidents at -0.149 compared to -0.029 respectively. Discrepancies, however, arise in terms of statistical significance; domestic and transnational terrorism remain statistically significant and insignificant respectively, while total terrorist incidents per capita become insignificant when accounting for time-effects. Again, however, the exclusion of these time-effects helps to explain these insignificant values, as presented by the results of our one-way estimator. In this estimation, all three of our terrorism measures are suggested to be statistically significant at the 5% level at least. Here, we estimate an additional terrorist incident relative to the population in that country to effect growth by -0.012% in that period. This is line with much of the previous literature, which has used a similar indicator (Gaibulloev and Sandler, 2009; Younas, 2014) to find robust results for estimators. This suggests that the aggregate number of terrorist incidents are robust to scaling for population when time-effects are not considered.

Finally, we look to further establish the long-run relationship between terrorism and growth by regressing the lagged values of terrorism on growth. By doing this, we can test whether past terrorist incidents have a lasting effect on economic growth in their subsequent periods. Since our data is formed within 5 year intervals, our measure of lagged terrorism ($totalter_{i,t-1}$) is defined as the

average number of terrorist incidents for the previous five years. The results are presented in Table 4.5 (in Appendix 7). They show that lagged terrorism is estimated to have an insignificant impact on growth, implying that the negative consequences of terrorism last no longer than five years. In fact, the negative coefficients would suggest that the negative effects of terrorism and growth would not hold regardless of the type of terrorism that occurs. This could be largely explained through the work of Mehmood (2014), who finds that the negative effects of terrorism for most macroeconomic variables last for around two years after the incident.

5. Conclusion

5.1. Summary of Findings

By adding terrorism to a standard growth model, we were able to ascertain the influence that terrorism has on economic growth. Using data averaged over five-year periods, we extended previous studies based on one-year-panel analyses, to confirm the detrimental effects terrorism has on long-run economic growth. These effects are, however, estimated to last no longer than five-years as shown by the specification of our model using lagged terrorist incidents. Furthermore, by distinguishing between different forms of terrorism and accounting for years beyond 2000, we provide a novel analysis of the terrorism-growth relationship which is both more up to date and econometrically efficient.

Our empirical insights implies that the effects vary between different forms of terrorism; specifically, transnational incidents seem to cause more economic harm than domestic incidents. Despite this, the negative coefficient seems to hold regardless of the specification used. The insignificance of our terrorism variables was accountable by the inclusion of time-specific effects. We suspect that the time-effects are taking away the contribution of other explanatory variables. As such, our one-way estimators presented a reduction in economic growth for all domestic, transnational and aggregate terrorist indicators which were robust to controlling for a country's population. Although our aggregate terrorism coefficient may seem small at -0.01%, when we consider that the average country suffers 12 incidents per year, the cumulative effects would be a -0.12% effect on growth. When we turn to regional analysis, the effects are much more selective. For developing countries especially, the effects are more devastating compared to the more advanced economies as they are better able to withstand the effects of an attack.

This paper provides a platform for further study using more recent data. The use of panel data may have improved the efficiency of econometric estimates, but there is still opportunity to include additional variables to further address omitted variable bias. Furthermore, our attempts at instrumental regression were ended due to the invalidity of the instrument; thus, there is scope to expand our research with the use of a more suitable instrumental variable to address any potential endogeneity concerns.

5.2. Limitations

With our focus primarily on whether terrorism exhibits an adverse effect of economic growth, our findings do not identify the channels through which this may operate. Others have in fact done this through looking at diversion of spending from Investment to Government spending (see BHO, 2004). Although this is not deemed necessary for our study, this could be a point to consider in future research for further developing this topic.

Our attempts to include additional determinants of growth beyond that of previous literature were supported on both a theoretical and statistical basis. However, because of the wide array of variables which can be considered as determinants of economic growth, it would be infeasible to identify and control for each one of these variables. It would, therefore, be expected that this study would be affected by a degree of omitted variable bias which may lead to inefficient estimates.

Additionally, due to our interest primarily on the effects on long-run growth, our data has been averaged over non-overlapping five year periods. In addition to potentially losing important information that annual data would provide, the results may also become less precise in their estimate of the given relationship. This is because dynamic changes within periods may be overlooked through this method, as they may cancel each other out once averaged. Moreover, while this is a commonly called upon approach among growth literature (see Beck *et al*, 2000), the ability of a five-year period to proxy for a long-run relationship has been called into question. Instead, averaging over ten-year, or greater, periods may be deemed more suitable for long-run analysis, although this would restrict our sample to only 3 observations for each country.

The use of further, more complex econometric methods could be used to deal with further issues which may affect our study. These are inconsistency and invalid statistical inference, which are often associated with Nickell bias (Nickell, 1981). This becomes a concern when the cross-sectional units (N) surpass the time variables (T). While the use of regional effects has given a value of N which is less than T for some regions, this is not the case for the clear majority of the sample. To deal with this, we could apply a Generalised-Method-of-Moments (GMM) estimator developed by Arellano and Bond (1991). This, as does the 2SLS method, uses instrumental variables to obtain consistent, asymptotically normal and efficient estimators. The consistency of these estimates is however reliant upon the validity of the instrument, of which a suitable instrument is yet to be found within the terrorism growth nexus.

Moreover, we have issues that need to be addressed for the database. As previously mentioned, there are differing coding conventions of the GTD between the period 1970-1997 and 1998 onwards, which may lead to reporting inaccuracies of incidents between the years. Because our sample period covers 1970-2005, this becomes an apparent issue affecting any analysis. Moreover, the GTD uses data from authorities and the media to compile its data. Thus many attacks go unnoticed and have potential to be understated. As such, the database is inherently biased towards those incidents that can capture media attention (LaFree and Dugan, 2007).

6. Appendices

Appendix 1: Panel Specification

These typically take the form (Baltagi, 2005):

$$y_{it} = X'_{it}\beta + \alpha_i + \gamma_t + u_{it}, \qquad i = 1, \dots, N; \quad t = 1, \dots, T. \tag{1}$$

Where y_{it} is representative of the dependent variable, X_{it} and β are the vectors and parameters of explanatory variables r=respectively and u_{it} is the idiosyncratic error term, which we assume to be normally distributed and stationary (Stock and Watson, 2007). The variable subscripts i and t in this equation represent an observation in country *i* (=1,…,155) at time *t,* an index for non-overlapping, five year time periods (1970-1974; 1975-1979; etc.). The inclusion of α_i, a collection of country fixed effects and γ_t, a collection of time fixed effects, allow control for country-specific and time-specific unobserved heterogeneity respectively, which often cause bias (Gaibulloev and Sandler, 2008). Following this, equation (1) represents a two-way error-component model regression model, in which both time-specific and country-specific effects are accounted for by γ_t and α_i respectively (Baltagi, 1981). Country-specific effects are seen to be especially important in growth analysis as the variability of many factors (e.g. political, governmental, social, cultural etc.) are often correlated with the regressors. Accordingly, the addition of α_i to help with variation across countries in initial conditions would help with consistency in the estimation of the parameters (Knight *et al*, 1996).

Appendix 2: Country description

Afghanistan, Albania, Algeria, Angola, Argentina, Australia, Austria, Azerbaijan, Bahrain, Bangladesh, Belgium, Belize, Benin, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Cambodia, Cameroon, Canada, Central African Republic, Chad, Chile, China, Colombia, Republic of the Congo, Costa Rica, Croatia, Cuba, Cyprus, Czech Republic, Denmark, Djibouti, Dominican Republic, Ecuador, Egypt, Ethiopia, Fiji, Finland, France, Gambia, Georgia, Germany, Ghana, Greece, Guatemala, Guinea, Haiti, Honduras, Hong Kong, Hungary, Iceland, India, Indonesia, Iran, Iraq, Ireland, Israel, Italy, Ivory Coast, Jamaica, Japan, Jordan, Kenya, Kuwait, Kyrgyzstan, Laos, Latvia, Lebanon, Lesotho, Liberia, Libya, Luxembourg, Macedonia, Madagascar, Malaysia, Mali, Malta, Mauritania, Mexico, Moldova, Morocco, Mozambique, Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Norway, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Russia, Rwanda, Saudi Arabia, Senegal, Sierra Leone, Singapore, Slovak Republic, Somalia, South Africa, Spain, Sri Lanka, Sudan, Suriname, Swaziland, Sweden, Switzerland, Syria, Taiwan, Tajikistan, Tanzania, Togo, Thailand, Trinidad and Tobago, Tunisia, Turkey, Uganda, Ukraine, United Arab Emirates, United States, Uruguay, Uzbekistan, Venezuela, Vietnam, Yemen, Democratic Republic of the Congo, Zambia, Zimbabwe.

Region 1: North America.

Canada, Mexico, United States.

Region 2: Central America & Caribbean.

Belize, Costa Rica, Cuba, Dominican Republic, Guatemala, Honduras, Jamaica, Nicaragua, Panama, Trinidad and Tobago.

Region 3: South America.

Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Peru, Suriname, Uruguay, Venezuela.

Region 4: East Asia.

China, Hong Kong, Japan, Taiwan.

Region 5: Southeast Asia.

Cambodia, Indonesia, Laos, Malaysia, Philippines, Singapore, Thailand, Vietnam.

Region 6: South Asia.

Afghanistan, Bangladesh, India, Nepal, Pakistan, Sri Lanka.

Region 7: Central Asia.

N/A.

Region 8: Western Europe.

Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland.

Region 9: Eastern Europe.

Albania, Bulgaria, Romania.

Region 10: Middle East & North Africa.

Algeria, Bahrain, Egypt, Iran, Israel, Jordan, Kuwait, Lebanon, Morocco, Saudi Arabia, Syria, Tunisia, Turkey, United Arab Emirates.

Region 11: Sub-Saharan Africa.

Angola, Benin, Botswana, Cameroon, Central African Republic, Chad, Democratic Republic of the Congo, Gambia, Ghana, Guinea, Guinea-Bissau, Ivory Coast, Kenya, Madagascar, Mali, Mauritania, Mozambique, Namibia, Niger, Nigeria, Republic of the Congo, Rwanda, Senegal, Sierra Leone, Somalia, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda, Zimbabwe.

Region 12: Australia & Oceania

Australia, Fiji, New Zealand, Papua New Guinea.

Appendix 3: Data sources and notes

Table 3.1 Summary Statistics on the Growth Determining Variables

Variable	Authors	Data Notes	Sources
Total terrorism - Totalter	National Consortium for the Study of Terrorism and Responses to Terrorism (START) (2016).	There are 82,536 'terrorist' incidents in GTD for 1970–2007. Enders, Sandler and Gaibulloev (2011) begin by excluding observations that do not meet the following three GTD inclusion criteria: (i) the attack is perpetrated for a political, socio-economic, or religious motive; (ii) the attack is intended to coerce, intimidate, or send a message to a wider audience than the immediate victim(s); and (iii) the attack is beyond the boundaries set by international humanitarian law. This leaves them with 66,383 incidents.	Enders, Sandler and Gaibulloev (2011).
Domestic Terrorism - Dter	National Consortium for the Study of Terrorism and Responses to Terrorism (START) (2016).	Domestic terrorism is homegrown in which the venue, target, and perpetrators are all from the same country.	Enders, Sandler and Gaibulloev (2011).
Transnational terrorism Tter	National Consortium for the Study of Terrorism and Responses to Terrorism (START) (2016).	A terrorist attack is transnational when the nationality of a victim differs from the venue country.	Enders, Sandler and Gaibulloev (2011).
Total terrorism per capita - Totaltpc	National Consortium for the Study of Terrorism and Responses to Terrorism (START) (2016).	The number of total terrorist incidents divided by the population.	Enders, Sandler and Gaibulloev (2011).

Transnational terrorism per capita - Ttpc	National Consortium for the Study of Terrorism and Responses to Terrorism (START) (2016).	The number of transnational terrorist incidents divided by the population.	Enders, Sandler and Gaibulloev (2011).
Domestic Terrorism per capita - dtpc	National Consortium for the Study of Terrorism and Responses to Terrorism (START) (2016).	The number of domestic terrorist incidents divided by the population.	Enders, Sandler and Gaibulloev (2011).
Growth	Heston, Summers and Aten (2010).	Annualised growth was calculated as the difference between the logarithms of annual GDPPC figures between years. From this, we computed an arithmetic mean to give us an average for the growth rate over the five-year period. The data string was then multiplied by 100 to find standard deviation in percentage terms. Note that results from a geometric means give similar results.	GDPPC data was sourced at constant PPP in real terms using 2010 US dollars from the PENN World Tables 6.2.
Log(lagGDPPC)	Heston, Summers and Aten (2010).	The natural logarithm of the average of GDPPC for the previous five-year period. This was taken to test the convergence relationship between this variable and the growth variable.	PENN World Tables 6.2.
I/GDP	Heston, Summers and Aten (2010).	I/GDP represents investment as a share of GDP expressed as a percentage of GDP.	PENN World Tables 6.2.
Log(openness)	Heston, Summers and Aten (2010)	Trade openness is measured by the trade ratio (exports and imports to real GDP) extracted from the *PENN World Tables 6.2*. The natural log of this ratio was taken to make results comparable to previous literature and across the sample and establish a β% relationship between the control and independent variable.	PENN World Tables 6.2.

Gross Capital Formation	World Bank.	Gross capital formation consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories (Worldbank). The natural log of this ratio was taken to make results comparable to previous literature and across the sample and establish a β% relationship between the control and independent variable.	Worldbank (2016a).
LSC	Barro and Lee (2013).	% of population (over the age of 15) to have completed secondary schooling measured at 5-year intervals. We use the value for the initial year of our period (i.e. for 1970-1974 we use data for 1970).	Barro and Lee Dataset (2013).
AFRICA	WorldBank (2016b).	The dummy variable AFRICA was given the value of 1 for a country on the continent of Africa, and 0 otherwise.	Countries of Africa are following World Bank definitions.
OIL	OPEC (2017).	The dummy variable OIL was given the value of 1 for a member country of Organisation of Petrolium Exporting Countries (OPEC), and 0 otherwise.	Oil producing countries were drawn from OPEC (2017).

Table 3.1 provides summary statistics on the growth determining variables. A full list of country and variable descriptions can be found in Appendix 2. For our period of study (1970-2005), growth grew by 6.09% on average. Within a 5-year period, a sample country was subject to 12.248 terrorist incidents, with a maximum value of 409.4, whereas the average number of domestic and transnational incidents was less at 9.0132 and 2.177 respectively. The standard deviation for domestic incidents of 30.267 is much higher than that of transnational incidents (5.648). This suggests that the frequency of domestic incidents largely outweighed those of transnational incidents. Investment and GCF averaged at 19.884 and 22.271 respectively as a share of GDP. The mean of the logarithm of openness and lagged GDDPC was 4.055 and 7.896 respectively, while LSC, our *Educ* variable, was around 14.695 for a sample country.

Appendix 4: Summary Statistics

Variable	Mean	Standard Deviation	Min	Max
Growth (Per cent (of GDP)	0.0609	0.0519	-0.131	0.595
Log(lagGDPPC)[16]	7.896	1.214	5.089	10.694
Total terrorism	12.248	38.853	0	409.4
Domestic terrorism	9.0132	30.267	0	378.8
Transnational terrorism	2.177	5.648	0	46
I/GDP (Per cent of GDP)	19.910	10.892	1.263	73.457
Log(openness)	4.055	0.659	0.697	6.989
Gross Capital Formation (Per cent of GDP)	22.271	7.137	3.575	49.0959
LSC (Educ)	14.695	12.47	0.18	65.92
N	791			

[16] Log(lagGDDPC) refers to the logarithm of the average of the previous five-year period.

Appendix 5:

Table 4.3. Regional Effects of Terrorism on GDP Growth (One-way Fixed Effects)

	Dependent Variable: *Growth*						
Independent Variable	(Region 3)	(Region 3)	(Region 5)	(Region 6)	(Region 9)	(Region 11)	(Region 12)
Totalter		-0.005*	-0.035*	-0.012*			
		(0.003)	(0.016)	(0.006)			
Tter	-0.035*				2.309**	-1.517***	-1.403*
	(0.016)				(0.481)	(0.519)	(0.495)
Dter							
loglagGDP	-7.308***	-6.992***	-8.791**	-6.046***	-15.391*	-6.344***	-6.226*
	(1.503)	(1.885)	(2.632)	(0.897)	(3.706)	(0.848)	(2.220)
I/GDP	0.028	0.029	-0.342*	-0.392	-0.197*	-0.041	0.067
	(0.275)	(0.271)	(0.154)	(0.231)	(0.065)	(0.146)	(0.311)
Logopeness	1.857	2.015	0.305	6.471*	16.135	1.575	-2.661
	(2.155)	(2.049)	(1.499)	(2.773)	(8.267)	(0.950)	(8.764)
gcfofGDP	0.054	0.044	0.341*	0.138	0.420***	0.134*	-0.528
	(0.246)	(0.233)	(0.147)	(0.158)	(0.022)	(0.069)	(0.485)
Lsc	0.359*	0.314	-0.092	0.013	0.715	0.145***	-0.028
	(0.160)	(0.186)	(0.053)	(0.100)	(0.923)	(0.033)	(0.117)
AFRICA	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)	(.)
OIL	0.068	0.093	0.000	0.000	0.000	0.000	0.000
	(1.536)	(1.505)	(.)	(.)	(.)	(.)	(.)
N	48	48	40	32	14	136	24
$\bar{R}^2$	0.465	0.469	0.820	0.790	0.656	0.495	0.457

Note: robust t statistics in parentheses: "*"=p<0.1, "**"=p<0.05, "***"=p<0.01.

Source: Author's own computation

Appendix 6:

Table 4.4. The Effect of Terrorism per capita on GDP Growth

Dependent Variable: *Growth*						
	2-way fixed effects			1-way fixed effects		
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)
totaltpc	-0.006			-0.012**		
	(0.004)			(0.006)		
Ttpc		-0.149			-0.342***	
		(0.101)			(0.071)	
Dtpc			-0.029***			-0.050***
			(0.008)			(0.011)
loglagGDP	-6.626***	-6.677***	-6.639***	-5.511***	-5.501***	-5.488***
	(0.843)	(0.838)	(0.843)	(0.387)	(0.385)	(0.386)
I/GDP	-0.014	-0.019	-0.021	-0.016	-0.007	-0.020
	(0.046)	(0.045)	(0.045)	(0.050)	(0.050)	(0.049)
Logopeness	2.133***	2.146***	2.121***	3.070***	3.004***	2.999***
	(0.659)	(0.663)	(0.658)	(0.639)	(0.641)	(0.635)
gcfofGDP	0.127***	0.127***	0.131***	0.106**	0.106**	0.112**
	(0.043)	(0.043)	(0.043)	(0.045)	(0.046)	(0.044)
Lsc	0.046*	0.046*	0.046*	0.074***	0.073***	0.073***
	(0.025)	(0.025)	(0.025)	(0.027)	(0.026)	(0.026)
AFRICA	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)
OIL	1.060**	1.113**	1.110**	0.132	0.078	0.162
	(0.464)	(0.453)	(0.454)	(0.251)	(0.256)	(0.250)
N	563	563	563	563	563	563
$\bar{R}^2$	0.542	0.542	0.543	0.503	0.507	0.505
Time effects:	Yes	Yes	Yes	No	No	No

Note: robust t statistics in parentheses: "*"=p<0.1, "**"=p<0.05, "***"=p<0.01.

Source: Author's own computation

Appendix 7:

Table 4.5. The Effect of Lagged Terrorism on GDP Growth (one-way)[17]

	Dependent Variable: Growth		
Independent variables	(1)	(2)	(3)
totalter_1	-0.001		
	(0.003)		
tter_1		-0.022	
		(0.017)	
dter_1			-0.001
			(0.003)
loglaggdppc	-5.505***	-5.505***	-5.509***
	(0.396)	(0.387)	(0.396)
logopeness	3.023***	3.027***	3.024***
	(0.639)	(0.638)	(0.639)
igdp	-0.014	-0.014	-0.014
	(0.050)	(0.050)	(0.050)
gcfofgdp	0.109**	0.109**	0.109**
	(0.046)	(0.046)	(0.046)
Lsc	0.077***	0.079***	0.077***
	(0.026)	(0.026)	(0.027)
AFRICA	0.000	0.000	0.000
	(.)	(.)	(.)
OIL	0.115	0.084	0.112
	(0.252)	(0.247)	(0.252)
N	563	563	563
$\bar{R}^2$	0.495	0.495	0.495

Note: robust t statistics in parentheses: "*"=p<0.1, "**"=p<0.05, "***"=p<0.01.

[17] Results are similarly for our two-way estimator in that none of the coefficients are significant

Appendix 8: Instrumental Regression:

IV2SLS estimation	
Dependent Variable: Growth	
Instrument: totalter_1	
Independent variables	IV2SLS
totalter	-0.006**
	(0.003)
loglaggdppc	-1.506***
	(0.203)
logopeness	0.343
	(0.268)
igdp	0.046
	(0.032)
oildummy	-0.491
	(0.747)
africadummy	-2.038***
	(0.422)
gcfofgdp	0.207***
	(0.040)
lsc	0.015
	(0.015)
N	563
$\bar{R}^2$	0.288

Note: robust t statistics in parentheses: "*"=p<0.1, "**"=p<0.05, "***"=p<0.01.

The above panel shows results generated using IV2SLS with one lag. In this regression, $totalter_{i,t-1}$ was an excluded instrument. Given that weak tests can cause instrumental-variables estimators to become biased, our IV estimations were subject to a number of tests. The first, the Cragg-Donald weak identification test, is as described: it tests for weak instruments. Our F-value of 41.602 was significant at the 1% level, which showed that the instrument appeared strong. A further test is the Hansen J-statistic which tests the over-identification of all instruments. This again appeared significant at the 1%, meaning we could reject the null hypothesis. This, however, suggests that our instrument may not be valid (Hansen, 1982). For this reason, interpretation of our results become difficult as an invalid instrument may bias the results and we choose to assess these results no further.

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