

# Terrorism and Fiscal Policy Volatility in Developing Countries: Evidence from cross-country and Panel Data

Urbain Thierry Yogo

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# **Terrorism and Fiscal Policy Volatility in Developing Countries: Evidence from cross-country and Panel Data**

Thierry Urbain YOGO

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TEL. + 33 4 73 17 74 00  
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## **The authors**

Thierry Urbain Yogo

Post-doctoral research fellow and Associate researcher

Clermont Université, Université d'Auvergne, CNRS, UMR 6587, CERDI, F-63009 Clermont Fd

CEREG, University of Yaoundé II/Cameroon

Email: [yogout@gmail.com](mailto:yogout@gmail.com); [urbain\\_thierry.yogo@udamail.fr](mailto:urbain_thierry.yogo@udamail.fr)

**Corresponding author:** Thierry Urbain Yogo



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## **Abstract**

This paper investigates the effect of terrorism on fiscal policy volatility in developing countries. Using both cross-country and panel data analysis for 66 countries from 1970 to 2012, we find that an increase in the number of terrorist incidents raise the volatility of the discretionary component of fiscal policy. In addition, the analysis shows that fiscal volatility is positively influenced by the volatility of output growth, the consumer price inflation volatility, the degree of fractionalization of both the government and the opposition. The results also show that the volatility is higher in countries of small size and lower in more democratic countries. Our results are robust to reverse causality, endogeneity bias and the presence of various controls. This paper complements and extends the previous literature by providing the evidence that terrorism substantially increases the uncertainty surrounding the conduct of fiscal policy in developing countries.

**Key words:** Fiscal policy, Terrorism, fiscal policy volatility

**JEL codes:** E60, H30, D74, O11

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## 1. Introduction

In 2013, a total of 9,707 terrorist attacks occurred worldwide, resulting in more than 17,800 deaths and more than 32,500 injuries (START<sup>1</sup>, 2013). In addition terrorist attacks lead to a wide range of economic and social consequences, including the destruction of human and physical capital. The consequences of terrorism are particularly severe in developing countries which are more vulnerable to external shocks and domestic shocks. While there is a long tradition in the economic profession to assess the economic consequences of conflicts, terrorism has received little attention. However, the 2001 terrorist attacks triggered a new wave of studies aiming to assess the economic cost of terrorism. In this line the early paper of Gupta et al (2004) highlights the fiscal consequences of terrorism in low and middle income countries. Their findings show that terrorism is associated with lower tax revenues, higher government spending on defense and changes in the composition of government spending. Recently, Drakos and Konstantinou (2014) have shown that a shock in terrorism risk significantly increases the subsequent trajectory of public order and safety spending in European countries. However these studies fail to address the effect of terrorist incidents on the uncertainty surrounding the conduct of fiscal policy.

In this study, we explore the potential effects of terrorism on the volatility of the discretionary component of fiscal policy in developing countries. In fact terrorism attacks raise the uncertainty on both local and foreign investments, deteriorate business climate and drive out tourists and potential revenues. Since tax revenues are likely to be affected by the level of both domestic and foreign investment, terrorism may result in greater fiscal instability. Likewise, in response to terrorist attacks, governments increase public spending on homeland security. This comes at the expense of fiscal stability because terrorism negatively affects the tax base and lowers the efficiency of tax administration. In addition terrorist incidents can undermine consumer and investor confidence. This may reduce incentives to spend or invest. The uncertainty associated to consumption and investment behavior will result in higher fiscal volatility because public spending is positively correlated with growth expectation.

The contribution of this paper is threefold. (i) We provide empirical evidence of the relationship between terrorism and fiscal policy volatility on a panel of developing countries. (ii) This article contrasts cross-country and panel data evidence while controlling for a wide range of macroeconomic and institutional factors. (iii) We propose an identification strategy to deal with the issue of endogeneity and measurement error in addressing the effect of terrorism on fiscal policy. We build upon the existing literature on the determinants of conflicts in order to provide a source of exogenous variation for terrorist incidents (see Miguel et al, 2004; Hsiang, Burke and Miguel, 2014). We argue that terrorism is more likely to occur in countries characterized by scarcity of economic resources due to long lasting economic shocks and higher initial level of conflict. Specifically, we build our instrument of terrorist incidents by multiplying the initial level of terrorism in a specific country by the variation in rainfall. Furthermore, we check the robustness of our finding by using three different methods. In the first robustness check we use the generated instrument approach coined by Lewbel (2012). The method is applied to supplement external instrument and improves the efficiency of the IV estimator. In this framework, the identification is achieved using heteroskedastic covariance restriction. For the second robustness check, we resort to the system-GMM estimator which allows for the use of lagged differences and lagged level of the explanatory variables as instruments (Blundell and Bond, 1998). Finally, we take advantage

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<sup>1</sup> National Consortium for the Study of Terrorism and Responses to Terrorism.

of difference in difference estimator to check for the robustness of our findings. Other robustness tests include the use of the number of victims as an alternative interest variable and the disaggregation of spending between consumption and investment.

This paper is policy relevant for several reasons. The study sheds a new light on the understanding of the key drivers of fiscal uncertainty. In fact, modelling fiscal volatility is important to understand the sources of aggregate fluctuation (Fernando-Villaverde et al, 2013). In addition, fiscal volatility is reported to have a negative effect on economic activity (Woo, 2011). Therefore, understanding the sources of fiscal volatility may help design appropriate policies to reduce the vulnerability of countries to shocks.

Using a sample of 66 developing countries over the period 1970 to 2012, the paper shows that terrorism increases fiscal policy volatility in developing countries. Specifically, a one percent increase in the number of terrorist incidents induces a rise in fiscal volatility ranging between 0.21% (cross country analysis) and 0.37% (panel data analysis).

The structure of the article is as follows: Section 2 gives a brief overview of the literature. Section 3 sets out the methodology used to identify the effect of terrorism on fiscal volatility. Section 4 discusses the results and Section 5 offers conclusions.

## **2. Literature review**

Several studies have assessed the impact of conflict and terrorism on economic activities. Addison et al (2002) find that armed conflicts and violence adversely affect financial development by undermining the confidence in domestic currency due to the fear of inflation and money depreciation. In the same line, armed conflict and violence directs financial resources away from productive assets and affect the regulation of the financial system. Using a sample of 79 countries, they find that conflicts and violence reduce financial development. This can obviously lead to lower growth since financial development is proven to be positively correlated with the former.

Addressing the effect of terrorism on the state of world economy, Abadie and Gardeazabal (2008) show both theoretically and empirically that terrorism increases uncertainty and reduces the expected return to investment. Therefore, higher intensity of terrorist attacks is associated with lower net foreign direct investment position. Estimates based on a sample of 90 countries suggest that a one standard deviation increase in the terrorist risk induces a fall in the net foreign investment position of about 5% of GDP.

Another channel through which terrorism may affect economic activities is via its impact on regional and domestic tourism. Drakos and Kutan (2003), in a study covering Greece, Israel, Turkey and Italy find that the intensity of terrorist incidents has significant domestic and cross country effects on tourism.

Terrorism also affects international trade by raising the transaction costs and the cost of doing business. As shown by Nitsch and Schumacher (2004), doubling the number of terrorist incidents may lead to a decrease of bilateral trade by 6%.

Terrorist threats may also have negative effects on fiscal stance as suggested by Gupta et al (2004), Bloomberg et al (2004). Accordingly, terrorism increase government spending at the expense of investment and macroeconomic stability. These papers contrast with the traditional literature which focuses on the macroeconomic and institutional determinants of the fiscal volatility.

The literature highlights a variety of factors as potential causes of volatility. This includes excessive government spending, high inflation, overvalued exchange rates, political and institutional factors. Acemoglu et al (2003) shows that countries with large public sector experience higher volatility. In fact as suggested by Gavin and Perotti (1997), the fiscal policy response to the business cycle occurs through the supply of credit which translates into higher public spending during booms and spending cuts in recession. External shocks can generate domestic inflation and act as an important source of fiscal risk. In this line, Bertin-Levecq (2002) argues that shocks in the terms of trade can negatively affect fiscal revenues, especially in countries suffering from underdeveloped tax system. In addition, the volatility of growth can be detrimental for fiscal revenues as it makes the latter less predictable. Such an effect can also occurs when the country lacks deep financial system and is unable to smooth shocks by issuing debt on domestic or international financial markets (Gavin and Perotti, 1997; Bertin-Levecq, 2002).

Woo (2005, 2011) emphasizes the role of political variables as the potential drivers of fiscal policy instability. Using a large sample of countries over the period 1960-2000, Woo (2011) finds that political instability is positively and significantly associated with fiscal policy volatility. In fact political instability can result in swings among different fiscal policies, especially if the polarization of social preferences is high (Woo, 2011). Likewise, the paper shows that there is a positive relationship between politically motivated assassinations and fiscal volatility. Woo (2011) argues that political unrest shorten the horizons of politicians and increase the likelihood of short term policies which come at the expense of macroeconomic stability.

According to Acemoglu et al (2003), economic instability is expected to be greater in institutionally weak societies. They argued that in institutionally weak societies, there are weak constraints on rulers. Therefore, rulers use their political power to redistribute assets and income to themselves in the process creating economic turbulence. In addition, when institutions are weak, political and economic instability is higher because various groups permanently fight to come to power. In the same time, politicians are forced to conduct unsustainable policies in order to satisfy various groups and remain in power.

While several papers have studied the effect of political variables on fiscal policy volatility, few papers have addressed the effect of terrorism as a shock and potential source of both political and economic instability. The early paper of Gupta et al (2004) shows that terrorism negatively and significantly impacts economic activities through changes in the level and composition of public spending. These changes come from the increase in defense and security spending in response to terrorist attacks.

In order to combat terrorism, governments increase public spending on homeland security, military operation and counter terrorism activities. This can rise fiscal imbalance and threaten fiscal consolidation. A direct consequence could be fiscal policy instability since the capacity of the government to absorb external shock by increasing expenditure or issuing debt is weakened. Likewise, Gupta et al (2004) argue that terrorism affects the fiscal account by eroding the tax base, lowering the efficiency of tax administration and changing the composition of public spending. In addition, the increase of military expenditure in response to terrorist attacks may divert the investments from the accumulation of productive capacities and crowd-out spending on social sectors including education and health. However, the empirical investigation carried out by Gupta et al (2004) shows that terrorism indeed increases defense spending, but this is at the expense of macroeconomic stability rather than at the cost

of lower spending in education and health. Therefore increased terrorist incidents can translate into fiscal volatility through macroeconomic instability.

This contrasts with the findings of Bloomberg et al (2004) which suggest that terrorist risk leads to an increase of consumption spending and fall in investment. Since tax revenues are likely to be affected by the level of both domestic and foreign investment, terrorism may result in greater fiscal instability. In the same line, using a panel of European countries over the period 1994-2006, Drakos and Konstantiniou (2014) find that terrorist attacks significantly increase the subsequent trajectory of public spending on public order and safety. However, the magnitude of the effect is small and lasts only one year.

### 3. Empirical analysis

This section revolves around three main parts. First, we describe how terrorism and fiscal policy volatility are measured. Second, the econometric model is described. Finally, we discuss the identification strategy used in order to uncover the causal effect of terrorism on fiscal volatility.

#### 3.1. Data on Terrorism and fiscal policy volatility

##### 3.1.1. Terrorism incident dataset

Terrorism data used in this paper are drawn from the Global Terrorism Database-GTD hereafter- which is maintained by the National Consortium for the Study of Terrorism and Responses to Terrorism (START) based at the University of Maryland.<sup>2</sup> The START uses various sources for data collection including media articles, unclassified documents, electronic news archives, existing data sets, books and legal documents. The GTD records incidents of terrorism from 1970 to 2012 for over 160 countries. The terrorism is defined as *the threatened or actual use of illegal force and violence by a non-state actor to attain a political, economic, religious or social goal through fear, coercion or intimidation*.

In order to be considered as a terrorist incident, the following conditions should be satisfied: (1) the incident must be intentional: the result of a conscious calculation on the part of a perpetrator. (2) the incident must entail some violence or threat of violence, including violence against property or/and against people. (3) The perpetrator of the incident should be sub-national actors. Therefore, GTD does not include acts of state terrorism. In addition, the action undertaken should be outside the context of legitimate warfare activities. It is worth mentioning that GTD records both national and transnational terrorism incidents.<sup>3</sup> The GDT reports, among other, information about the day, month and year of the terrorist incident, the duration of the incident, the incident location, the type of attack, the type of weapon used, the target and perpetrators (if known), total number of fatalities.

In this paper, we are only interested in the frequency of terrorist attacks. Therefore, we computed the number of terrorist incidents by country and by year. Since our main focus is on developing countries, we use a final sample of 66 developing countries covering the period

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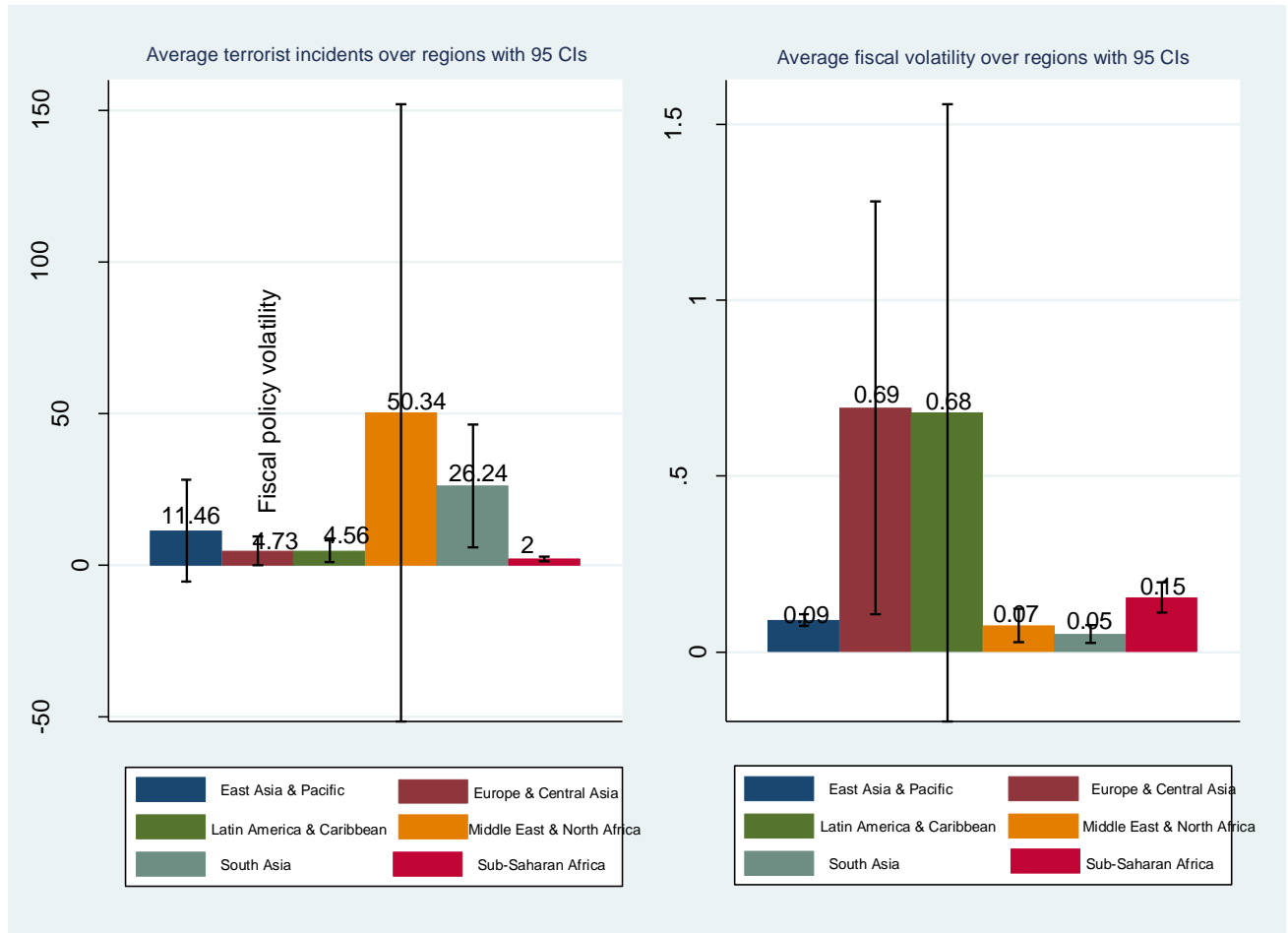
<sup>2</sup> Data are available free of charge at <http://www.start.umd.edu/gtd/>

<sup>3</sup> Note that this is a plus compared to ITERATE (International Terrorism: Attributes of Terrorism Events) which record only transnational terrorism. ITERATE is an alternative source for terrorist attacks. The list of countries is provided in appendix.



1970-2012. A brief look at the data suggests that the average number of attacks per country over the entire period stands at 6. The minimum number of terrorist incidents is 1 while the maximum recorded is 50 (see Table 1). A disaggregation of these statistics by region shows that the most affected region is the Middle East and North Africa with 50 terrorist incidents on average over the period of study. The less impacted region is Sub-Saharan Africa where 2 incidents were reported on average (see Figure 1).

**Figure 1:** Terrorism and fiscal policy volatility across regions



**Source:** Author's calculations

### 3.1.2. Measuring fiscal policy volatility

In order to build the measure of fiscal policy volatility, we focus on government spending. As suggested by Woo (2011), government spending is a policy variable that is influenced by policy decisions and widely used in the implementation of government policy. Another justification often put forward is that unlike government spending, tax revenue and budget deficit are outcome of government policies<sup>4</sup>. Moreover cross-country data on government spending are more available and less subject to measurement error than tax revenues data. There are two ways to measure the volatility of fiscal policy (Woo, 2011; Cevik and Teksoz, 2014). The naïve approach consist on using the standard deviation of the annual growth rate of fiscal spending/tax revenue/primary budget balance, over the period of study. Then, it is

<sup>4</sup> As robustness check, we alternatively use government consumption and government spending on investment. We also take into account countries which do not report any incident of terrorism by using  $\log(1+\text{terrorism})$

worth noting that this method does not isolate the exogenous component of policy changes. However as shown by Woo (2011) and Agnello and Souza (2014), it is important to distinguish fiscal volatility from adaptability to sudden changes of economic conditions because the latter is more likely to stabilize the economy while the former may discourage growth. In this paper, we are interested in the discretionary component of fiscal policy that doesn't represent reaction to changes in economic conditions or reflect exogenous changes in political preferences. Therefore, following Fatas and Mihov (2003), Woo (2011) and Agnello and Souza (2014), we estimate the subsequent model for each of the countries over the entire time span:

$$\Delta \log(G_{it}) = \alpha_i + \beta_i \Delta \log(G_{it-1}) + \gamma_i \text{Growth}_{it-1} + \delta_i X_{it} + \tau_i \text{trend} + \varepsilon_{it} \quad (1)$$

where  $G_{it}$  is the real general government expenditure,  $\text{Growth}_{it-1}$  is the one lag of GDP growth,  $X_{it}$  is a vector of control variables including inflation and inflation squared;  $\text{trend}$  is the time trend. The measure of the discretionary fiscal policy volatility is the logarithm of the standard deviation of the residuals recovered from equation (1). Descriptive statistics presented in Table 1 show that the fiscal policy volatility ranges between a minimum of 0.02 and a maximum of 8.79 with an average value of 0.30 over the sample period. Likewise, consumption expenditures are less volatile than investment expenditures. A more detailed picture suggests that the more volatile region is East Europe and Central Asia while the less volatile is South Asia.

### 3.2. Econometric Model

This section discusses the empirical strategy which is adopted in order to identify the effect of terrorism on the fiscal policy volatility. The economic relationship we are interested in is the following:

$$\log(\text{volatility})_{it} = \text{constant} + \alpha \log(\text{terrorism})_{it} + X'_{it}\beta + \mu_{it} \quad (2)$$

In equation (2),  $X'_{it}$  is a set of control variable and  $\mu_{it}$  is an unobserved error term. In line with the existing literature (see Woo, 2011; Agnello and Souza, 2014; Cevik and Teksoz, 2014), we use two set of control variables: macroeconomic controls and institutional controls.

**Table 1:** Descriptive statistics (cross country)

Variable	Obs	Mean	Std. Dev.	Min	Max
Fiscal Volatility	65	0.3069808	1.111271	0.0241606	8.797791
Volatility of consumption expenditure	65	0.4425122	1.858663	0.024232	14.79205
Volatility of investment expenditure	65	0.4773917	1.996533	0.0252467	15.97412
Number of terrorist attacks	65	6.421705	11.52089	1	50.66667
Number of victims	65	0.1782433	0.3951999	0	2.330331
Log(GDP growth instability)	65	3.694725	2.365018	0.8934791	18.11915
Log(inflation instability)	65	1.637238	0.9616074	-.2520737	5.333652
Trade openness	65	65.65811	31.48994	16.80632	160.1294
Financial openness	65	0.3386756	0.2170911	0.0626581	1
Log(population)	65	9.231863	1.40668	6.532918	13.6172
Democracy	65	1.824248	4.298072	-7.324324	10
Major government crisis	65	0.1831016	0.2304842	0	0.9583333
Checks and balances	65	2.869416	1.051101	1	7.514286
Size of the cabinet	65	21.60354	4.8552	12.08108	31.2973
Opposition fractionalization	65	0.4541938	0.2144558	0	0.8714285
Government fractionalization	65	0.1701471	0.1687731	0	0.7326807
Income inequality	65	44.20599	7.952554	25.6129	65.27795

The first group of controls includes growth volatility, logarithm of inflation volatility, trade openness, financial openness, logarithm of population and income inequality. The growth volatility is measured as the five years rolling standard deviation of the GDP growth. It is included to control for potential effects of macroeconomic shocks on fiscal policy. In fact, the government could be forced to adjust the budget in response to sudden change in growth prospects. We therefore expect a positive effect of growth volatility on the volatility of fiscal policy. Likewise the consumer price inflation volatility is the five years rolling standard deviation of the inflation and is included to control for the destabilizing effect of external shocks such as terms of trade shocks or a depreciation of the real exchange rate<sup>5</sup>. Because the high volatility of inflation increases the uncertainty in the conduct of fiscal policy, we expect a positive relationship between these two variables. Trade openness is measured as the sum of import and export in percentage of GDP. Following Rodrik (1998) and Woo (2011), we expect a positive relationship because greater openness exposes the country to more external shocks and greater exposure to external shocks induces important fluctuations in public spending. In the same line, financial openness measures the degree of capital account's openness and the extent to which the restrictions on international financial transactions are low. The total population enters regression to control for country size effects. As shown by Afonso et al (2010), larger country size helps to insure against idiosyncratic shocks, but spreads the cost of financing government expenditure over more taxpayers. We therefore expect a negative effect of population on fiscal policy volatility. Finally, income inequality is included in regression to take into account the potential effect of polarization on fiscal policy. As shown by Woo (2011), a high degree of polarization may lead to more volatility. Data related to growth, inflation, trade openness and population are drawn from the World

<sup>5</sup> Note that the results qualitatively remain unchanged when we control for the volatility of oil rent which might be a potential source of fiscal volatility in resource rich countries. The main drawback is that the inclusion of this variable may reduce the explanatory power of inflation which intended to capture price shocks of various sources.

Development Indicator of the World Bank. Data on financial openness are from Ito and Chinn (2013). The income inequality is measured by the Gini coefficient of gross income obtained from the Standardized World Income Inequality Database (SWIID).

Concerning the institutional controls, we use a measure of democracy, major government crises, check and balances, size of the cabinet, opposition fractionalization and Government fractionalization. As a measure of democracy, we use the variable Polity2 from the Polity IV project. This variable ranges between -10 (strongly autocratic) and +10 (strongly democratic) and measures the extent to which a country is democratic. Democracy supposes more control on the executive and prevents the ruler to use excessive public spending in order to remain in power. The level of democracy should therefore be negatively correlated with fiscal policy volatility. Data on major government crises captures any rapidly developing situation (excluding revolts) that threatens to bring the downfall of the current regime. Likewise the size of the cabinet refers to the number of “cabinet rank” at the end of the year. These data are provided by the Cross National Time-Series Data Archives (CNTS). Government crisis is more likely to generate political instability. We then expect a positive relationship with fiscal policy volatility. In the same time increased size of the cabinet leads to excessive expenditure and more volatility. The check and balances captures the extent to which the action of the executive can be controlled. This measure is provided by the Database of Political Institutions (DPI) of the World Bank. The effect of check and balances on fiscal policy volatility is controversial. According to Fatas and Mihov (2003) political constraints have a negative and significant impact on the volatility. However, using a full set of controls, Agnello et al (2014) find a positive but not significant effect. The fractionalization measures the probability that two deputies picked at random from the legislature/opposition will be of different parties. We expect a positive relationship with fiscal volatility because more fractionalization induces greater infighting between various political groups (Acemoglu et al, 2003).

In equation (2), we are interested in identifying the coefficient  $\alpha$ , the effect of terrorism on fiscal policy volatility. We test the hypothesis that terrorism positively affects fiscal volatility in developing countries. In fact, an intensification of terrorist attacks induces a rise in public spending allocated to domestic security. This also drives the spending away from investment and reduces the tax base. Likewise terrorist incidents lead to higher uncertainty which affect the business climate and push the entrepreneurs to invest in activities from which they can easily and quickly withdraw their capital (Acemoglu et al, 2003). The descriptive statistics related to the control variables are presented in Table 1.

### 3.3. Identification strategy

The simplest strategy to estimate the effect of terrorism on fiscal volatility is to use ordinary least square regression. However, this approach may raise three distinctive issues. Although terrorist incidents are less predictable, they are deeply rooted in economic and social deprivation. Therefore, terrorism can be considered as endogenous. Thus, by using ordinary least squared, we may be capturing reverse causality or the effect of some omitted characteristics that are correlated with terrorism. In addition terrorist incidents may be measured with error. In this context, OLS estimates will be biased and the effect of terrorism on fiscal volatility will not be interpreted as causal.

In this research, our strategy is to instrument terrorism building on the existing literature on the determinants of conflicts. We argue that terrorism is more likely to occur in countries characterized by scarcity of economic resources due to long lasting economic shocks and higher initial level of conflict. Specifically, we build our instrument of terrorist incidents by

multiplying the initial level of terrorism in a specific country by the variation in rainfall. The formula used is the following:

$$Inst_{it} = iter_i * rain_{it} \quad (3)$$

In this equation,  $Inst_{it}$  is the exogenous determinant of terrorism,  $iter_i$  is the initial level of terrorism, the number of terrorist incidents at the beginning of the sample period,  $rain_{it}$  measures rainfall shock and is calculated as the five years rolling standard deviation of rainfall.

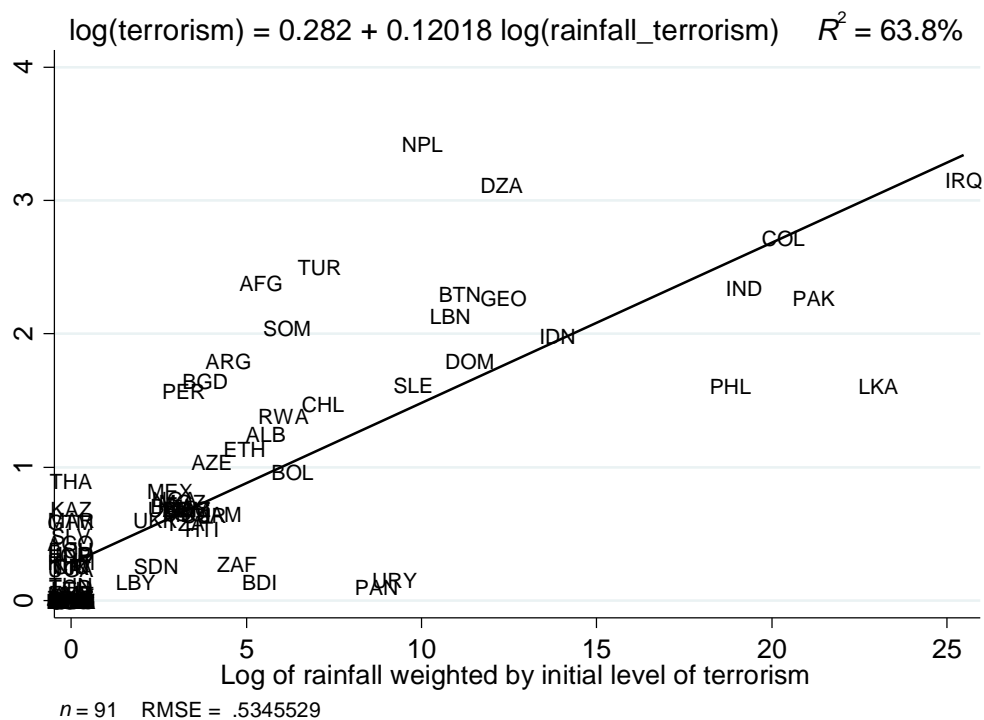
There is an increasing body of the literature highlighting the effect of economic condition on the likelihood of conflict. In a well know paper, Miguel and al (2004) shows that negative growth shocks increase the likelihood of conflict and that this effect remains unchanged whether we consider a more democratic, richer or more ethnically diverse country. They also show that variation in rainfall can be considered as a source of exogenous variation of income growth. Recently Hsiang, Burke and Miguel (2014), drawing from various disciplines including economics, political science, geography and archeology, find a strong causal evidence of climate events on human conflicts. This effect holds for all major regions in the world and across time. We build upon these evidences to argue that variation in rainfall is a potential exogenous source of variation in the incidents of terrorism. However, this effect is more likely to be amplified by the initial level of terrorism. In fact, higher initial level of terrorism may reveal the inability of society to solve issues such as conflict of ideas, land conflict or address political complaints peacefully (OECD, 2013). In addition, prolonged unresolved conflicts provide a fertile ground to the spread of terrorism (Fink and Barakat, 2013; Kis-Katos et al, 2011). Using a sample of 159 countries over the period 1970-2007, Kis-Katos et al ( 2011) clearly show that terrorism increases with experiences of domestic conflict. Likewise, Drakos and Konstantinou (2013) provides evidence that terrorism risk is positively influenced by past terrorism risk. Moreover they find that public spending is ineffective in reducing observed level of terrorism. This reasoning suggests that rainfall shock weighted by the initial level of conflict is an instrument for the current incidence of terrorism. The use of initial values of variables as instrument also follows the suggestion of De la Croix and Doepke (2003), Bloomberg et al (2004). The reasoning underlying this instrumentation approach is that economic shocks as measured by the variation in rainfall increase the likelihood of terrorist attacks in the context where the culture of violence is deeply rooted<sup>6</sup>. Specifically, extreme variability in rainfall may exacerbate conflict over economic resources. In the context where the culture of violence is widespread, these conflicts are not solved through peaceful means and translate into terrorism. Figure 2 displays the first stage relationship between our instrument and the number of terrorist incidents on the whole sample period.

The figure shows a strong positive relationship between our instrument and the number of terrorist incidents. This suggests that rainfall is clearly a useful source of variation for identifying the causal effect of terrorism on fiscal volatility.

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<sup>6</sup> Note that here we use the initial level of terrorism as a proxy of the culture of violence.

**Figure 2:** Average number of terrorist incidents versus the rainfall weighted by initial terrorism



A major concern in this type of exercise relates to the validity of exclusion restriction. A potential violation of the exclusion restriction may arise if rainfall instrument affects fiscal volatility through channels other than terrorism. We do not think that this is the case. In fact, the exogeneity of the instrument is intuitively plausible because there is no reason to believe that fiscal volatility drives the variability in rainfall. In addition, the current state of fiscal volatility is less likely to affect the initial level of terrorism. In this sense, our instrumental approach helps to rule out the issue of reverse causality. Nevertheless, the variability in rainfall can affect fiscal policy volatility through its effect on other determinants of conflict including GDP growth and inequality. To substantiate the validity of our identification strategy, we control for the volatility of growth and for inequality in the econometric model. We also show that the results are robust to the introduction of regional dummies that permit to take into account spillover effects and common regional effect. Besides, to address the issue of measurement bias which is also a potential source of endogeneity, we use 40-years average data in cross-country analysis and five-year non overlapping mean in the panel data analysis

We follow in this line Woo (2011) and Agnello and Souza (2014). In addition to the use of an instrument, we control for a full set of macroeconomic and institutional variables in order to avoid the omitted variable bias. In addition, we use the Fuller's modified Limited Information Maximum Likelihood (LIML) which is more robust to weak instrument (Stock and Yogo, 2004; Davidson and Mackinnon, 2006a).

## Empirical findings

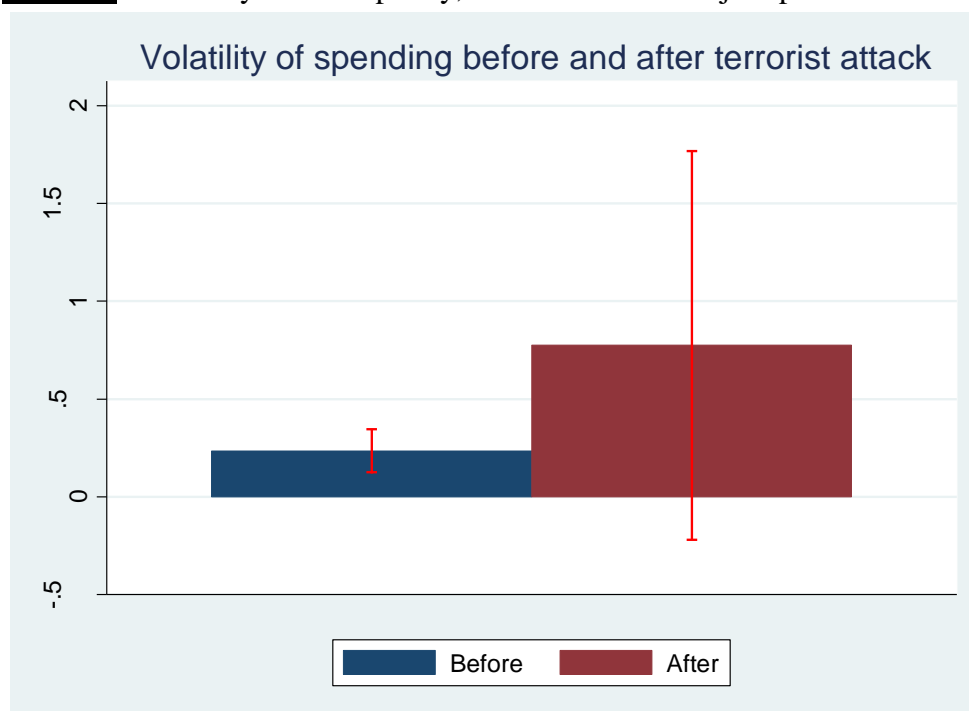
This section presents the results from the empirical investigation of the effect of terrorism on fiscal policy volatility. Section 4.1 takes a first look at the data to understand the behavior of fiscal volatility before and after a major episode of terrorism on the one hand. On the other hand, we compare the volatility between countries with higher terrorist incidents and countries with lower terrorist incidents. Section 4.2 discusses the results of the cross-country analysis while the results of the panel data are described in section 4.3. In section 4.4, we check the robustness of the results.

### 4.1. Terrorism and fiscal volatility: naïve evidence

The first step of our investigation consists of comparing the magnitude of the volatility before and after a major episode of terrorist attack. We define a major episode of terrorist attack as the maximum number of terrorist incidents faced by a country over the sample period. We drop from the sample<sup>7</sup> countries whose highest number of terrorist incidents occurs at the beginning of the sample period. The reasoning underlying this test is that fiscal policy responds to the change in the frequency of terrorist attacks. Therefore, we expect that on average the volatility of fiscal policy will be greater after a major terrorist incident.

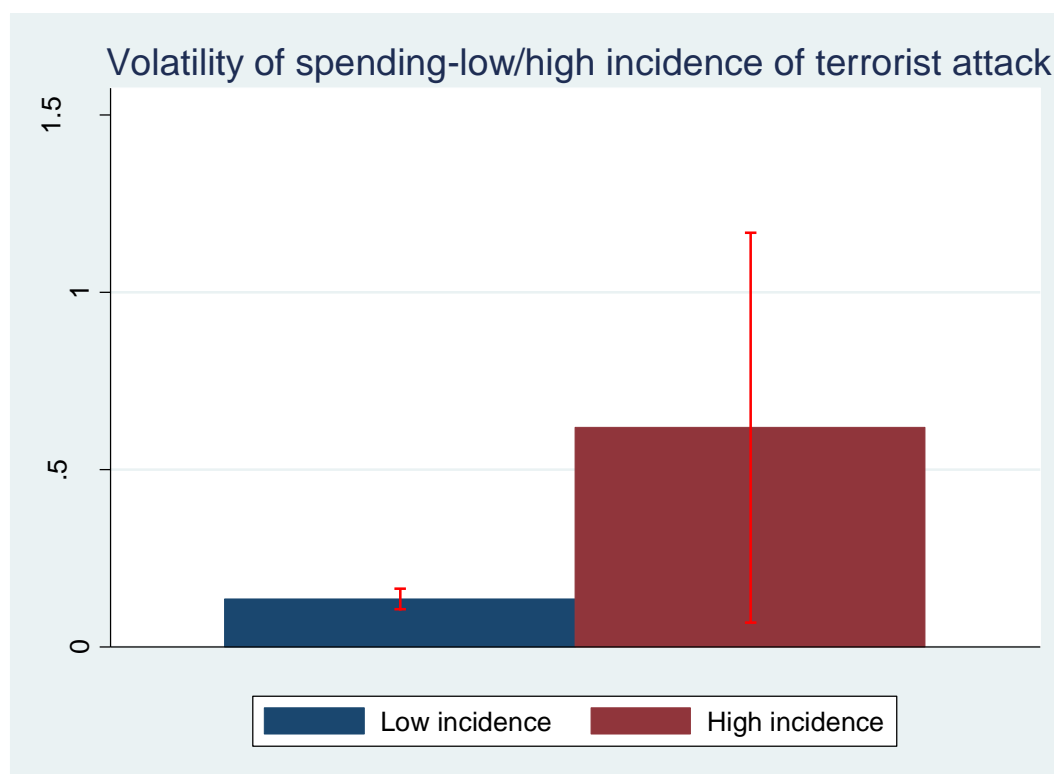
Figure 3 present the level of volatility before and after a peak year of terrorist attacks.

**Figure 3:** Volatility of fiscal policy, before and after major episode of terrorist incident



Source: Author's calculations

<sup>7</sup> Only in this specific test.

**Figure 4:** Volatility of fiscal policy, most affected versus less affected

**Source:** Author's calculations

The figure shows that after a peak year of terrorist attacks, the volatility of fiscal policy is more than twice as the corresponding level observed prior the attack. In the same manner, split the sample around the median of the distribution and compare the volatility above and below the median. On average countries above the median experiences 14 terrorist incidents. This is almost fourteen times the number of terrorist attacks faces by countries that are below the median. Figure 4 presents the result.

Figure 4 shows that on average, the volatility of public spending is higher for countries above the median of the distribution.

Overall this first look at the data suggests that fiscal policy volatility is positively correlated with terrorism in developing countries.

## 4.2. Cross-country analysis

We start by quantifying the relationship between fiscal volatility and terrorism in a cross-country setting which will serve as a benchmark. Since, we are primarily interested in the long run effect of terrorism on fiscal volatility, the cross country regression will be appropriate as a starting point. In order to carry out this analysis, data are averaged over the sample period.

Table 2 reports the OLS estimates as well as instrumental variable estimates. Columns (1) to (3) present the results based on the OLS estimator. We check various specifications to ensure the robustness of the results. All the specifications are controlled for regional effects and the standard errors of the coefficients are corrected using the standard Huber-White procedure. In addition, in order to ensure that the results are not driven by outliers, we implement the high breakdown MM-estimator of Yohai (1987). The estimates reported in columns (2) to (3)



show that the coefficients associated with terrorism are all positive and significant at the 10% level. The results also provide a support to the importance of macroeconomic factors in explaining fiscal volatility. Specifically, GDP growth instability, Inflation instability and trade openness enter regression in both positive and significant coefficients. Among the institutional variables, only the variable which measures the major government crisis has the expected positive sign. The instrumental variable estimates are presented in column (4) to (6). In all the three specifications, the effect of terrorism is positive and significant at the 5% level. Specifically a one percent increase in the number of terrorist incidents leads to a rise of volatility ranging between 0.19% and 0.21%. Taking the highest estimate, a one standard deviation increase in terrorist attacks induces a rise of 0.18 standard deviation in fiscal volatility. As it can be seen, the magnitude of the IV estimate is slightly higher than the one observed in the OLS. This reflects the fact that taking the average of data reduces the attenuation bias induced by the measurement error. Considering the validity of our instrumentation strategy, the first stage regression suggests that our instrument is not weak. The coefficient of the instrument is significant at 1% level and the Fisher test of the weak identification is higher than the critical values of the size of bias as computed by Stock and Yogo (2005).

As previously discussed, it is possible that our instrument doesn't perfectly satisfy the exclusion restriction. Even in this case, our instrumentation strategy remains valid. In fact as shown by Anderson and Rubin (1949), Moreira and Poi (2003), Berkowitz, Caner and Fang (2012), we can still draw a valid inference when the exclusion restriction is not fully satisfied. In this vein, we first provide the Anderson and Rubin (1949) confidence interval which is robust to weak instrument. This permits to draw a valid inference independently of the strength of instrument and define a set of values of parameter for which the null hypothesis of "no effect" of the endogenous variable can be rejected. The Anderson and Rubin (AR) confidence intervals are presented at the bottom of Table 2 and show that the coefficients of terrorism lie within the AR interval. However as pointed out by Berkowitz, Caner and Fang (2012), the AR test rely on a strong assumption that the instrument is perfectly exogenous and therefore may have bad small sample property. Therefore to substantiate our identification strategy, we also report the fractionally resampled AR test. The fractionally resampled AR test proposed by Berkowitz, Caner and Fang (2012), permit to draw a valid inference while allowing the instrument to be weakly correlated with the residuals of the structural equation. The results show that the hypothesis of a significant positive effect of terrorism on fiscal policy cannot be rejected at the 10% level.

Turning to the other controls included in the regression, both growth and inflation exhibit the expected positive sign. This confirms the findings of the recent paper of Cevik and Teksoz (2014). However, the results do not support the hypothesis of a significant effect of institutional variables.

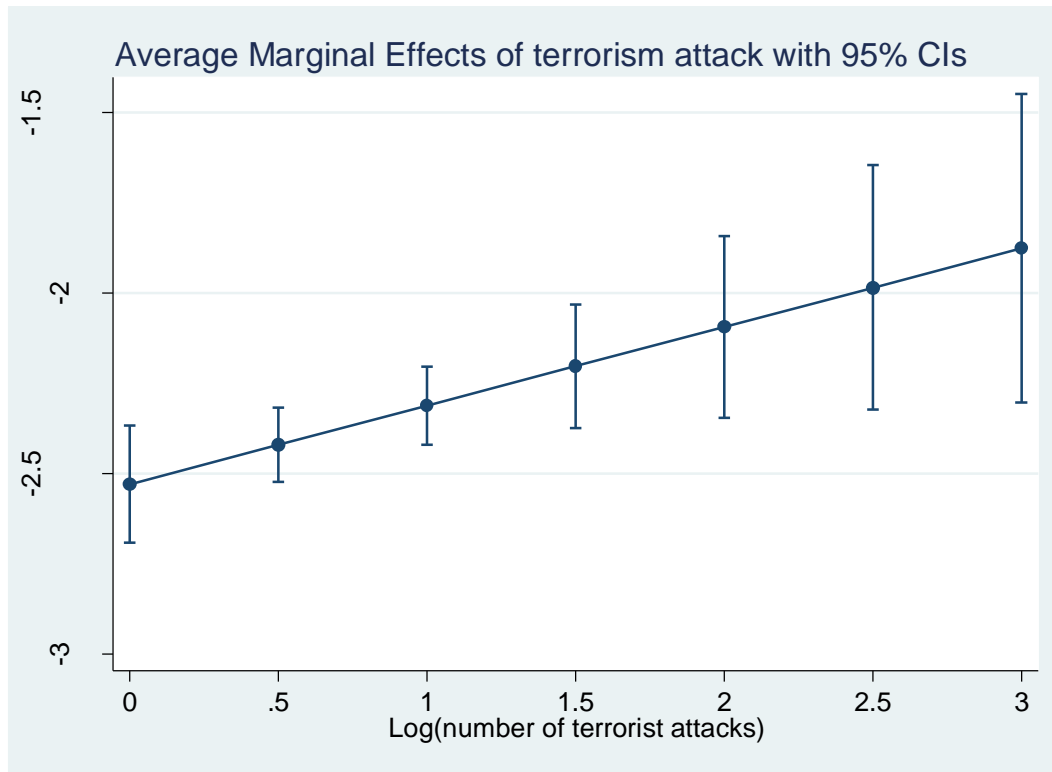
**Table 2:** Terrorism and fiscal policy volatility, cross-country evidence

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS			2SLS		
Dependent Variable:	Log(fiscal instability)			Log(fiscal instability)		
<b>Log(number of terrorist attacks)</b>	<b>0.112</b>	<b>0.132*</b>	<b>0.129*</b>	<b>0.192**</b>	<b>0.213**</b>	<b>0.218**</b>
	<b>(0.0683)</b>	<b>(0.0745)</b>	<b>(0.0706)</b>	<b>(0.094)</b>	<b>(0.093)</b>	<b>(0.093)</b>
Log(GDP growth instability)	0.0583**	0.0556**	0.0530**	0.041*	0.038	0.040*
	(0.0264)	(0.0254)	(0.0247)	(0.025)	(0.024)	(0.024)
Log(inflation instability)	0.291***	0.308***	0.302***	0.308***	0.327***	0.330***
	(0.0592)	(0.0529)	(0.0566)	(0.055)	(0.053)	(0.054)
Trade openness	0.00462*	0.00518*	0.00540*	0.002	0.003	0.002
	(0.00269)	(0.00295)	(0.00297)	(0.002)	(0.002)	(0.003)
Financial openness	-0.239	-0.255	-0.296	0.217	0.210	0.221
	(0.327)	(0.318)	(0.317)	(0.416)	(0.405)	(0.411)
Log(population)	-0.0722	-0.0876	-0.0859	-0.132**	-0.144***	-0.146***
	(0.0582)	(0.0588)	(0.0593)	(0.053)	(0.053)	(0.055)
Democracy	-0.0245	-0.0234	-0.0209	-0.029*	-0.026	-0.028
	(0.0223)	(0.0220)	(0.0210)	(0.017)	(0.017)	(0.018)
Major government crisis	0.545**	0.521**	0.555***	0.394**	0.362*	0.339
	(0.232)	(0.202)	(0.209)	(0.192)	(0.185)	(0.212)
Checks and balances	0.0680	0.0445	0.0408	0.104**	0.073	0.079
	(0.0666)	(0.0671)	(0.0585)	(0.052)	(0.058)	(0.061)
Size of the cabinet	0.00711	0.00744	0.00840	0.013	0.015	0.014
	(0.0114)	(0.0105)	(0.0105)	(0.010)	(0.010)	(0.011)
Opposition fractionalization		0.236	0.232		0.285	0.273
		(0.423)	(0.357)		(0.281)	(0.283)
Government fractionalization		0.194	0.221		0.109	0.120
		(0.322)	(0.374)		(0.294)	(0.320)
Income inequality			-0.00662			0.004
			(0.0100)			(0.010)
Intercept	-3.221***	-3.218***	-2.977***	-2.881***	-2.918***	-3.028***
	(0.665)	(0.658)	(0.712)	(0.559)	(0.552)	(0.610)
Continent fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
<b>First stage</b>						
<b>Log(rainfall weighted by initial terrorism)</b>				<b>0.079***</b>	<b>0.077***</b>	<b>0.078***</b>
				<b>(0.017)</b>	<b>(0.017)</b>	<b>(0.017)</b>
Observations	66	66	65	66	66	65
R squared	0.454	0.455	0.456	0.55	0.55	0.55
F-stat for weak identification				21.354	20.947	22.213
AR-Confidence interval				[-.01, .48]	[.01, .51]	[.02, .50]
Fractionally resampled AR-test-Pvalues				0.10	0.10	0.10

**Note:** Robust standard errors in parentheses. Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

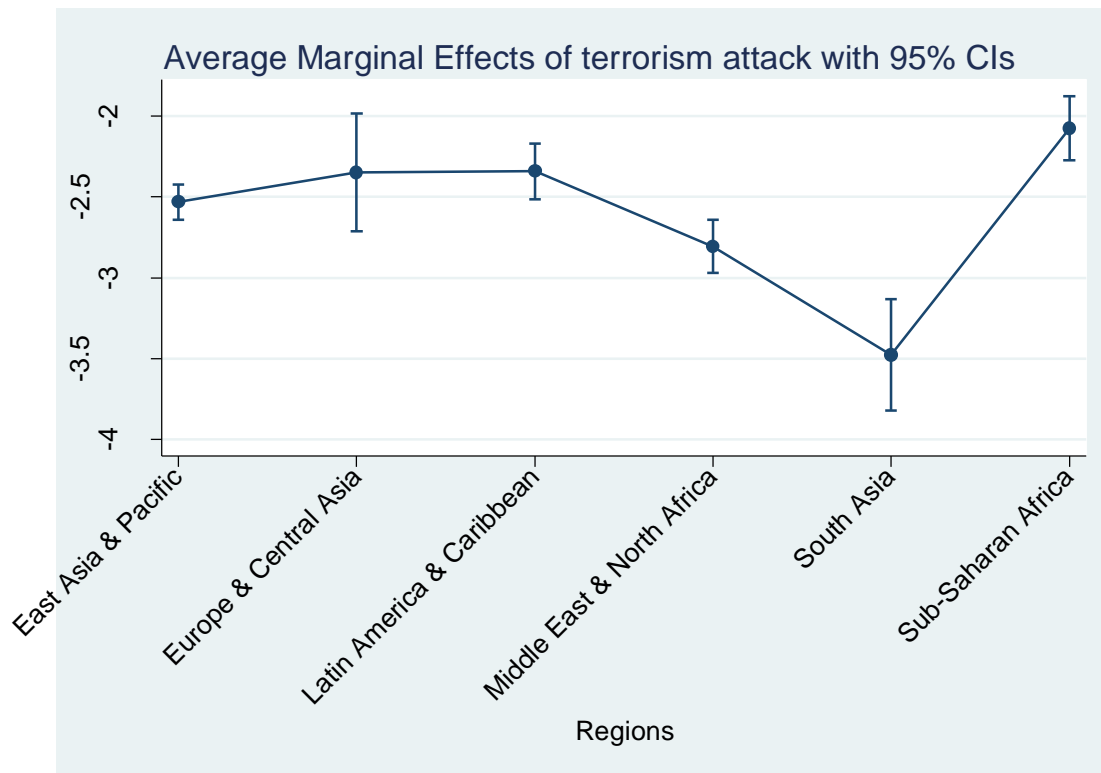
In order to refine the interpretation of the main findings, Figure 5 displays the marginal effect of terrorist attacks with 95% confidence interval. We allow the number of terrorist incidents to vary from 0 (no attack) to the maximum while the other variables in the model are set at the mean. The figure shows that everything held constant, going from no attack to the maximum increases the marginal effect of terrorism by 92%.

**Figure 5:** Marginal effect of terrorist attacks, cross-country analysis



**Source:** Author's calculation

Likewise, we set the value of the number of terrorist incidents at the mean of the distribution and assess how the marginal effect changes across regions. Figure 6 shows that South Asia is the region whose volatility of fiscal policy responds less to the rise in terrorist incidents. Conversely, Sub-Saharan Africa is the region where the volatility of fiscal policy is very responsive to terrorism. The difference in the responsiveness is huge as it stands at 300%.

**Figure 6:** Marginal effect of terrorist attacks over regions, cross-country analysis

**Source:** Author's calculation

#### 4.3. Panel data analysis

Although the main purpose of this research is to carry-out a cross-country comparison of the response of fiscal policy to terrorist attacks, the cross-section regressions may capturing only the long run effect of terrorism. We therefore reexamine the evidence presented in Table 2 using panel regression.

Table 3 presents the OLS estimates of the effect of terrorism on fiscal policy volatility. Data are averaged over five non-overlapping years to reduce annual fluctuation and measurement error. This reduces the time dimension to seven non overlapping periods. In the first three columns, in addition to the traditional controls, we add region fixed effects and time effects. The results are similar to the ones obtained using cross-country regressions. The terrorism increases the volatility of fiscal policy by a magnitude ranging between 0.11% and 0.15%. The main macroeconomic controls are also significant with the expected sign. In contrast with the cross country analysis, the main institutional variables are significant at the 5% level. When fixed effects are introduced in the model, the effect of terrorism drops by more than half, implying that a one percent increase in terrorist attacks raises the volatility of 6%. While the use of panel data helps reduce the omitted variable bias, it can increase the measurement error bias, especially in the fixed effect setting (Bound et al., 2001; Griliches and Hausman, 1986).

**Table 3:** Terrorism and the volatility of fiscal policy, OLS-Fixed Effect

	(1)	(2)	(3)	(1)	(2)	(3)
	OLS			OLS		
Dependent variable	Log(fiscal instability)			Log(fiscal instability)		
<b>Log(number of terrorist attacks)</b>	<b>0.113***</b>	<b>0.150***</b>	<b>0.136***</b>	<b>0.0452</b>	<b>0.0709**</b>	<b>0.0661*</b>
	<b>(0.0439)</b>	<b>(0.0432)</b>	<b>(0.0438)</b>	<b>(0.0355)</b>	<b>(0.0335)</b>	<b>(0.0346)</b>
Log(GDP growth instability)	0.0361**	0.0307**	0.0480**	0.0398***	0.0353***	0.0516***
	(0.0149)	(0.0156)	(0.0194)	(0.0121)	(0.0126)	(0.0162)
Log(inflation instability)	0.407***	0.419***	0.442***	0.408***	0.422***	0.441***
	(0.0817)	(0.0754)	(0.0850)	(0.0770)	(0.0719)	(0.0774)
Trade openness	0.00379**	0.00419**	0.00400**	0.00366***	0.00377***	0.00354***
	(0.00182)	(0.00166)	(0.00187)	(0.00138)	(0.00125)	(0.00130)
Financial openness	-0.137	-0.127	-0.0320	-0.127	-0.135	-0.0201
	(0.202)	(0.195)	(0.217)	(0.168)	(0.163)	(0.168)
Log(population)	-0.0582*	-0.0936***	-0.0752**	-0.0696*	-0.100***	-0.0804**
	(0.0347)	(0.0316)	(0.0298)	(0.0368)	(0.0349)	(0.0348)
Democracy	-0.0222**	-0.0245***	-0.0224**	-0.0278***	-0.0270***	-0.0274***
	(0.00960)	(0.00875)	(0.0101)	(0.00806)	(0.00744)	(0.00912)
Major government crisis	0.0193	0.00332	-0.000409	-0.0807**	-0.0804**	-0.0893*
	(0.0906)	(0.0858)	(0.100)	(0.0378)	(0.0383)	(0.0481)
Checks and balances	0.0662**	0.0302	0.0316*	0.0630***	0.0388**	0.0421***
	(0.0262)	(0.0205)	(0.0189)	(0.0216)	(0.0184)	(0.0159)
Size of the cabinet	-0.00279	-0.00292	-0.00155	-0.00538	-0.00582	-0.000650
	(0.00542)	(0.00516)	(0.00497)	(0.00648)	(0.00632)	(0.00662)
Opposition fractionalization		0.358**	0.309		0.322***	0.287**
		(0.151)	(0.197)		(0.0947)	(0.134)
Government fractionalization		0.499**	0.424**		0.457***	0.375**
		(0.196)	(0.212)		(0.147)	(0.147)
Income inequality			0.00173			0.00929
			(0.0105)			(0.00802)
Intercept	-2.984***	-2.862***	-3.229***	-2.750***	-2.642***	-3.446***
	(0.538)	(0.476)	(0.777)	(0.380)	(0.338)	(0.725)
Continent fixed effect	Yes	Yes	Yes			
Country fixed effect				Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	296	296	261	296	296	261
R-squared	0.526	0.554	0.559	0.505	0.532	0.541
Number of groups	66	66	65	66	66	65
Number of years	7	7	7	7	7	7

**Note:** Robust standard errors in parentheses. Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 4 reports the estimates of the instrumental variable regression. Columns (1) to (3) present the results with region and time effects. According to these estimates, a one percent increase in the number of terrorist attacks leads to 0.33% rise of fiscal volatility. In other words, doubling the number of terrorist attacks will increase the volatility of fiscal policy by 33%. In the next three columns we add country fixed effects in the model. As observed in the OLS case, the magnitude of the coefficients of terrorism drops by more than 50%. This may be an insight that specific country characteristics explain an important part of the observed variability of fiscal policy. Concerning the validity of our identification strategy, the first stage regression suggests that our instrument is not weak. Moreover the estimated coefficients lie within the AR confidence interval, suggesting that we can draw valid inference from the model. In addition, we report the fractionally resampled AR test of Berkowitz, Caner and Fang (2012). The test rejects the null hypothesis at the 10% level. In other word with 90% confidence we cannot reject the hypothesis that terrorism significantly affects fiscal volatility. This inference remains valid even if the exclusion restriction is not perfectly satisfied.

Table 4 also shows that the main macroeconomic controls enter in regression with the positive expected sign and most of them are significant at the 1% level. Specifically, the fiscal volatility is positively correlated with growth instability, inflation and trade openness while it is negatively affected by the size of the population. The observed negative effect of population confirms the findings of Agnello and Souza (2014) and suggests that smaller countries face more volatility due to their wider exposure to idiosyncratic shocks. Likewise, our results are in line with the ones of Cevik and Teksoz (2014) showing that the GDP growth volatility has a positive and significant effect on fiscal volatility. However, contrary to ours results, they did not find a significant effect of the volatility of consumer price inflation. Two main reasons may explain this difference in the results. First, their paper focuses on emerging and developed countries while our focus is on developing countries. Second they control for the volatility of natural resource rent which can sometimes translate into inflation. A regard with the institutional variables, an increase in the level of democracy reduce the volatility of fiscal policy by 3%. This result is consistent with the previous empirical literature (See Acemoglu et al, 2003; Agnello et Souza, 2014). In the same time, the higher the fractionalization within the government and within the opposition, the higher the volatility of fiscal policy. Our results don't support the hypothesis of a positive effect of income inequality on fiscal policy volatility. This contrasts with the finding of Woo (2011).

**Table 4:** Terrorism and the volatility of fiscal policy, Instrumental variables estimates

	(1)	(2)	(3)	(1)	(2)	(3)
	Log(fiscal instability)			Log(fiscal instability)		
<b>Log(number of terrorist attacks)</b>	<b>0.283**</b>	<b>0.341***</b>	<b>0.331***</b>	<b>0.126**</b>	<b>0.205***</b>	<b>0.259**</b>
	<b>(0.111)</b>	<b>(0.117)</b>	<b>(0.120)</b>	<b>(0.0538)</b>	<b>(0.0770)</b>	<b>(0.109)</b>
Log(GDP growth instability)	0.037*	0.029	0.050*	0.0452***	0.0407***	0.0630***
	(0.022)	(0.021)	(0.026)	(0.0143)	(0.0138)	(0.0193)
Log(inflation instability)	0.464***	0.482***	0.501***	0.449***	0.470***	0.488***
	(0.087)	(0.080)	(0.089)	(0.101)	(0.0922)	(0.0959)
Trade openness	0.005***	0.006***	0.006***	0.00488**	0.00521**	0.00535**
	(0.002)	(0.002)	(0.002)	(0.00227)	(0.00223)	(0.00235)
Financial openness	-0.096	-0.044	0.082	-0.178	-0.156	-0.0117
	(0.172)	(0.167)	(0.180)	(0.154)	(0.156)	(0.166)
Log(population)	-0.070*	-0.115**	-0.091*	-0.0653	-0.113***	-0.108**
	(0.041)	(0.046)	(0.050)	(0.0482)	(0.0416)	(0.0441)
Democracy	-0.025***	-0.029***	-0.025**	-0.0335***	-0.0337***	-0.0336***
	(0.009)	(0.009)	(0.010)	(0.00801)	(0.00844)	(0.0106)
Major government crisis	-0.087	-0.102	-0.097	-0.177**	-0.199**	-0.230*
	(0.125)	(0.130)	(0.135)	(0.0691)	(0.0843)	(0.120)
Checks and balances	0.061**	0.022	0.017	0.0595***	0.0307*	0.0256*
	(0.026)	(0.025)	(0.027)	(0.0186)	(0.0164)	(0.0142)
Size of the cabinet	-0.010	-0.011	-0.009	-0.0118	-0.0122	-0.00569
	(0.008)	(0.007)	(0.008)	(0.00791)	(0.00825)	(0.00908)
Opposition fractionalization		0.473***	0.442**		0.421**	0.433*
		(0.175)	(0.188)		(0.169)	(0.258)
Government fractionalization		0.581***	0.473**		0.490***	0.356***
		(0.206)	(0.229)		(0.141)	(0.137)
Income inequality			0.001			0.0112
			(0.008)			(0.00823)

Intercept	-2.950*** (0.490)	-2.839*** (0.453)	-3.362*** (0.581)	-3.001*** (0.571)	-2.785*** (0.485)	-3.501*** (0.801)
Continent fixed effect	Yes	Yes	Yes			
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects				Yes	Yes	Yes
<b>First stage</b>						
<b>Log(rainfall weighted by initial terrorism), t-1</b>	<b>0.064*** (0.010)</b>	<b>0.062*** (0.010)</b>	<b>0.060*** (0.010)</b>	<b>0.064*** (0.003)</b>	<b>0.062*** (0.004)</b>	<b>0.060*** (0.006)</b>
Observations	257	257	230	257	257	230
No of countries	66	66	65	66	66	65
R squared	0.53	0.55	0.57	0.53	0.55	0.56
F-stat for weak identification.	41.877	39.607	36.304	288.21	168.93	90.90
AR-Confidence interval	[ 0.08, .57]	[ 0.13, .65]	[ 0.11, .65]	[-0.17, .42]	[-0.17, .38]	[-0.17, .34]
Fractionally resampled AR-test-Pvalues	0.06	0.06	0.08	0.07	0.08	0.07

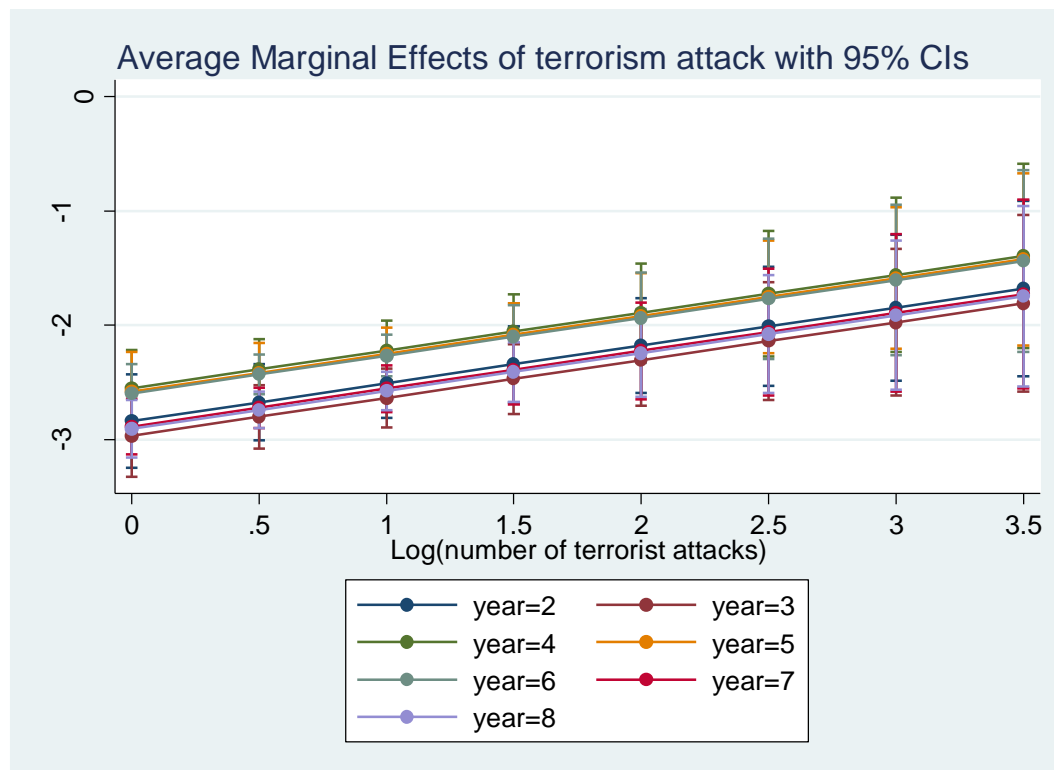
**Note:** Robust standard errors in parentheses. Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.



Two surprising results emerge from Table 4. First, the coefficient of the check and balances does not have the expected sign. The reported effect is positive and significant, especially in the fixed effect model. This contrasts with previous evidences suggesting that more control on the ruler is associated with lower fiscal policy volatility. A potential explanation of this result is that in the context where both the government and the opposition are made up of political parties coming from different background, the higher their power on the executive the higher the difficulty to reach an agreement on the conduct of the fiscal policy. This obviously leads to more fiscal policy volatility. Our findings also suggest that once the model is controlled for fixed effect, the number of major economic crises reduce fiscal volatility. A possible interpretation of this result is that when both the government and the opposition are divided on the way of conducting fiscal policy, major crises allow returning to a more orthodox fiscal policy.

In order to have a better understanding of the main findings of the panel data regression, figure 7 shows the marginal effect of terrorist attacks over the entire sample period.

**Figure 7:** Marginal effect of terrorist attacks, panel data analysis

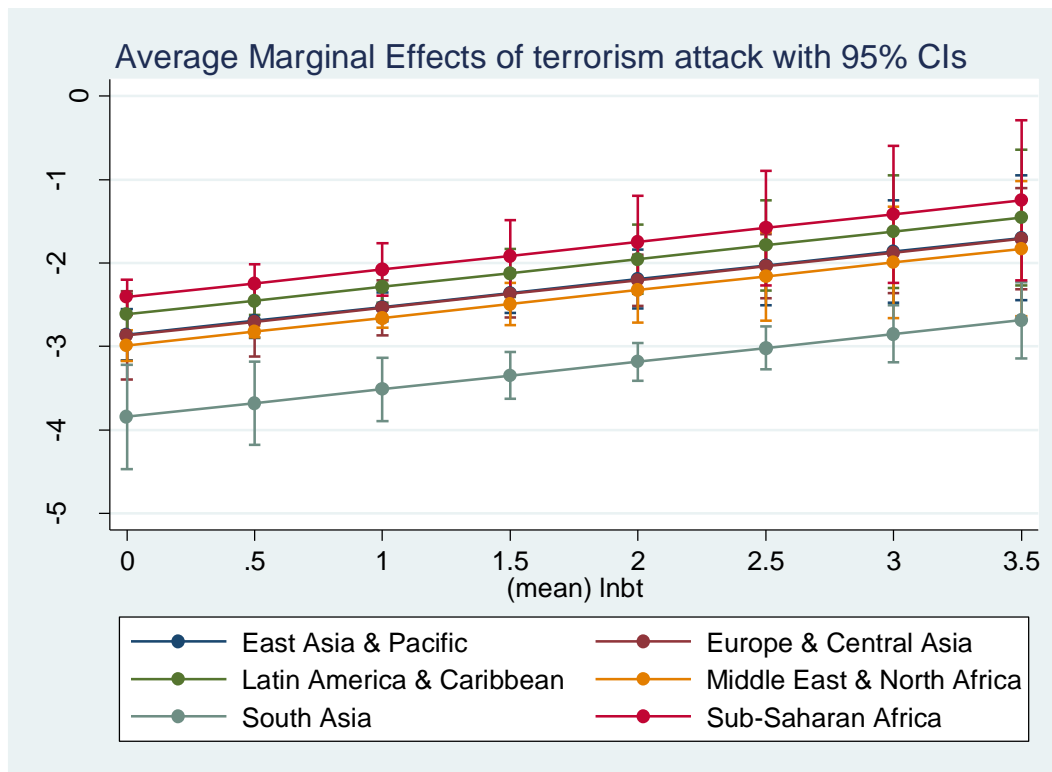


Source: Author's calculations

As in cross-country analysis, we allow the number of terrorist incidents to vary from the minimum value to the maximum while keeping the other controls at the mean. The figure shows that fiscal volatility indeed increases with the number of incident attacks. However, the magnitude is higher than what is observed in cross country regressions. Over the entire period, the increase amounts to 218% of the initial level of volatility. In the same time, the effect of terrorism seems to decrease over the time. The speed of the decrease is lower at the upper level of the distribution of terrorist attacks. For countries at the lower level of the distribution, the effect of terrorism drops by 6.51% while the corresponding fall is 4.63% at the upper level of the distribution, implying that the most affected countries take much time to recover.

We run a similar exercise while analyzing the variation of the responses across regions. Figure 8 presents the results. The figure shows that South Asia is the less responsive region while Sub-Saharan Africa is the most responsive one. This result is consistent with the findings of the cross-country analysis and confirms the findings of previous studies on the high vulnerability of Sub-Saharan Africa.

**Figure 8:** Marginal effect of terrorist attacks over regions, panel data analysis



**Source:** Author's calculations

#### 4.4. Robustness check

We propose three tests in order to check the robustness of our findings. First, we use the generated instrument approach proposed by Lewbel (2012) to improve the identification of the effect of terrorism on fiscal policy volatility. The method of Lewbel (2012) serves to identify structural parameters in models with endogenous regressors in the absence of external instrument. The method may also be applied to supplement external instrument to improve the efficiency of the IV estimator. This is particularly of interest because it allows performing the Hansen test of orthogonality restriction which cannot be performed in the case of exact identification. In the Lewbel's framework, the identification is achieved using heteroskedastic covariance restriction. In a single equation, generated instruments are constructed from the first stage regression equation, by multiplying the residuals by each of the included exogenous

variables in mean-centered form. The results of this regression are presented in Table 5. In the first two columns of this table, we replicate the standard results of the IV estimates while controlling for the number of casualties per terrorist attack. The main reasoning underlying this specification is that a country may undergo a single terrorist attack, but a huge number of casualties. Therefore failing to control for this variable may lead to biased estimates. In fact one may expect that the government is more responsive when the number of casualties is higher. In this case, our finding may capture not the genuine effect of increased incidents of terrorism, but the emotional effect generated by casualties. This is not the case as the estimates reported in Table 5 remains qualitatively stable and very close to that of the baseline model. The two remaining columns of Table 5 provide the results obtained using the method of Lewbel (2012). The estimates are qualitatively unchanged although the magnitude of the effect is smaller than what is obtained from the baseline model. A lower estimate suggests an increase of 0.15% of fiscal volatility for a one percent increase in the number of terrorist incidents. In addition, the P-value of the Hansen J test is 0.27 and suggests that the resulting model is over identified.

**Table 5:** Terrorism and fiscal volatility, Robustness check1

Dependent variable : Log(fiscal instability)	(1)	(2)	(3)	(4)
	Instrumental Variable		Generated instrument approach	
<b>Log(number of terrorist attacks)</b>	<b>0.33157***</b> <b>(0.12003)</b>	<b>0.213**</b> <b>(0.102)</b>	<b>0.167*</b> <b>(0.0967)</b>	<b>0.151**</b> <b>(0.0769)</b>
Log(GDP growth instability)	0.05005* (0.02655)	0.0620*** (0.0189)	0.0381 (0.0260)	0.0500* (0.0284)
Log(inflation instability)	0.50149*** (0.08863)	0.476*** (0.0949)	0.323*** (0.0645)	0.489*** (0.0917)
Trade openness	0.00620*** (0.00210)	0.00536** (0.00228)	0.00221 (0.00229)	0.00505* (0.00260)
Financial openness	0.08977 (0.18214)	0.00896 (0.169)	0.253 (0.317)	0.0231 (0.187)
Log(population)	-0.09052* (0.04974)	-0.100** (0.0438)	-0.132** (0.0590)	-0.0589 (0.0487)
Democracy	-0.02448** (0.01025)	-0.0279*** (0.0101)	-0.0302* (0.0177)	-0.0244** (0.0113)
Major government crisis	-0.09873 (0.13579)	-0.193* (0.103)	0.388 (0.285)	-0.0505 (0.139)
Checks and balances	0.01744 (0.02749)	0.0223* (0.0133)	0.0909 (0.0709)	0.0342 (0.0239)
Size of the cabinet	-0.00861 (0.00803)	-0.00265 (0.00872)	0.0156 (0.0157)	-0.00831 (0.00796)
Opposition fractionalization	0.44513** (0.18810)	0.415* (0.244)	0.261 (0.273)	0.358* (0.202)
Government fractionalization	0.46840** (0.22997)	0.382*** (0.141)	0.0674 (0.349)	0.420 (0.260)
Income inequality	0.00065 (0.00828)	0.00938 (0.00808)	0.00578 (0.00851)	0.00280 (0.00915)
Number of casualties	-0.00018	4.12e-05	-0.00218	-0.000213

Intercept	(0.00016) -3.37860*** (0.58455)	(9.19e-05) -3.531*** (0.840)	(0.00156) -3.260*** (0.713)	(0.000142) -3.441*** (0.729)
Continent fixed effect	Yes		Yes	Yes
Year fixed effects	Yes			Yes
Country fixed effects		Yes		
<b>First stage</b>				
<b>Log(rainfall weighted by initial terrorism), t-1</b>	<b>0.05988*** (0.00996)</b>	<b>0.060160*** (0.00531)</b>		
<i>Observations</i>	230	238	65	230
No of countries	65	65	65	65
R squared	0.57	0.61	0.570	0.598
F-stat for weak ident.	36.15577	128	7.613	22.19
Hansen test-Pvalue			0.406	0.276
Fractionally resampled AR-test-Pvalues	0.07	0.08		

**Note:** Robust standard errors in parentheses. Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

The second approach used to test the robustness of our findings is the general method of moment (GMM) in a dynamic panel data setting. This approach allows addressing the issue of the endogeneity of the main explanatory variable (terrorism) as well as the potential endogeneity of some covariates. We use the two-step system GMM with Windmeijer's (2005) correction of standard errors. In this setting equations in level and equations in differences are combined in a system where lagged variables in difference are used as instruments of the current variable in level. In the same time, lagged variables in level are used to instrument current variables in difference. The Hansen J test is performed to check the validity of the instruments alongside with the first and second order autocorrelation test.

The results are reported in Table 6. Looking at the more complete specification, a one percent increase in the number of terrorist attacks leads to 0.37% increase in fiscal policy volatility. The magnitude of this effect is higher than the upper bound estimate in the baseline IV model. A potential explanation of this result is the fact in the dynamic GMM model we control for the potential endogeneity of some control variables. In fact, Acemoglu et al (2001) show that failing to account for the endogeneity of some controls may lead to downward bias in the coefficient of  $\alpha$  (coefficient of terrorism).

Third, we perform difference in difference treatment effect estimation. Specifically, we built our treatment variable by splitting the sample between most affected and less affected countries according to the mean of the distribution. Thus we generate a variable taking the value 1 for countries that record a number of terrorist incidents above the mean, and 0 otherwise. In order to construct the variable of policy change, for each country we record the year corresponding to the maximum number of terrorist attacks undergo over the sample period. Therefore, our policy variable takes the value 1 for the years following the major episode of terrorist attacks. The results of the difference in difference estimates are presented in Table 7 and confirm the positive effect of terrorism on fiscal policy volatility. A one percent increase in the number of terrorist attacks induces a rise of volatility of 0.24 to 0.31 percent.

**Table 6:** Terrorism and fiscal volatility, Robustness check-two-step GMM estimates

	(1)	(2)	(3)
	Log(Fiscal volatility)		
Log(Fiscal volatility),t-1	0.05430 (0.10293)	-0.05217 (0.08356)	0.07100 (0.07113)
<b>Log(number of terrorist attacks)</b>	<b>0.37933*</b> <b>(0.22210)</b>	<b>0.64000*</b> <b>(0.35100)</b>	<b>0.43767**</b> <b>(0.17820)</b>
Log(GDP growth instability)	0.07178 (0.05071)	0.07053 (0.04573)	0.07952* (0.04733)
Log(inflation instability)	0.45222*** (0.11427)	0.38047*** (0.12330)	0.41742*** (0.08034)
Trade openness	0.00912* (0.00532)	0.01161*** (0.00408)	0.00610* (0.00357)
Financial openness	0.25157 (0.28141)	-0.02394 (0.38730)	0.00344 (0.33167)
Log(population)	0.01239 (0.13200)	0.09156 (0.13116)	-0.01958 (0.12362)
Democracy	-0.02702 (0.02113)	-0.02018 (0.02095)	-0.03732 (0.02361)
Major government crisis	-0.22446 (0.15283)	-0.37789* (0.21596)	-0.24401 (0.17224)
Checks and balances	-0.06835 (0.07358)	-0.08992 (0.08603)	-0.05512 (0.06101)
Size of the cabinet	-0.01147 (0.01652)	-0.02930 (0.01939)	-0.02169 (0.01682)
Opposition fractionalization	0.56261** (0.26288)		0.72137* (0.38708)
Government fractionalization	0.59368* (0.30921)		0.51024 (0.46770)
Income inequality	0.00271 (0.03418)		
Number of victims	0.00008 (0.00019)	-0.00006 (0.00037)	
Intercept	-4.28842* (2.32763)	-4.51149*** (1.21748)	-3.29265*** (1.23901)
<i>Number of observations</i>	218	243	243
Number of countries	60	61	61
Number of instruments	43	37	41
AR test first	0.052	0.046	0.037
AR test second	0.643	0.885	0.664
Hansen test-Pvalue	0.864	0.797	0.697

**Note:** Standard errors in brackets. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

**Table 7:** Terrorism and fiscal volatility, Robustness check-difference in difference estimates

Dependent variable: employment	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>After terrorist attack=1</b>	-0.0465 (0.0605)	0.0686 (0.0449)	-0.0633 (0.0669)	0.00718 (0.0751)	0.0140 (0.0750)	0.0622 (0.0900)	0.0615 (0.0901)
<b>Most affected country=1</b>	-0.600*** (0.110)	-0.247*** (0.0846)	0.162 (0.292)	-0.450 (0.327)	0.429 (0.361)	0.313 (1.227)	0.304 (1.228)
<b>Difference in Difference</b>	<b>0.245*</b> <b>(0.138)</b>	<b>0.201**</b> <b>(0.101)</b>	<b>0.281***</b> <b>(0.107)</b>	<b>0.278**</b> <b>(0.120)</b>	<b>0.261**</b> <b>(0.119)</b>	<b>0.313**</b> <b>(0.132)</b>	<b>0.314**</b> <b>(0.132)</b>
Log(GDP growth instability)		Yes	Yes	Yes	Yes	Yes	Yes
Log(inflation instability)		Yes	Yes	Yes	Yes	Yes	Yes
Trade openness		Yes	Yes	Yes	Yes	Yes	Yes
Financial openness		Yes	Yes	Yes	Yes	Yes	Yes
Log(population)		Yes	Yes	Yes	Yes	Yes	Yes
Democracy			Yes	Yes	Yes	Yes	Yes
Major government crisis			Yes	Yes	Yes	Yes	Yes
Checks and balances				Yes	Yes	Yes	Yes
Size of the cabinet				Yes	Yes	Yes	Yes
Opposition fractionalization					Yes	Yes	Yes
Government fractionalization					Yes	Yes	Yes
Income inequality						Yes	Yes
Number of casualties							Yes
Intercept	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies			Yes	Yes	Yes	Yes	Yes
Observations	1,199	1,179	1,143	982	975	806	806
Adjusted R squared	0.039	0.474	0.587	0.604	0.612	0.619	0.619

**Note:** Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$



**Table 8:** Terrorism and fiscal volatility, Robustness check-victims of terrorist attacks

	(1)	(2)	(3)
	2SLS		
Dependent Variable:	Log(fiscal instability)		
<b>Log(number of victimes in% population),t-1</b>	<b>0.0921***</b> <b>(0.0305)</b>	<b>0.137***</b> <b>(0.0327)</b>	<b>0.139***</b> <b>(0.0324)</b>
Log(GDP growth instability)	0.112*** (0.0234)	0.116*** (0.0310)	0.124*** (0.0326)
Log(inflation instability)	0.389*** (0.0896)	0.416*** (0.0863)	0.415*** (0.0881)
Trade openness	0.00373** (0.00182)	0.00371** (0.00170)	0.00370** (0.00185)
Financial openness	-0.107 (0.120)	0.0534 (0.127)	0.0689 (0.129)
Log(population)	0.0191 (0.0476)	0.0659 (0.0477)	0.0661 (0.0505)
Oil rent volatility			-0.0138 (0.0265)
Democracy	-0.0326*** (0.00731)	-0.0372*** (0.00826)	-0.0375*** (0.00908)
Major government crisis	-0.298*** (0.0770)	-0.355*** (0.0672)	-0.358*** (0.0677)
Checks and balances	0.0513*** (0.0117)	0.0597*** (0.00675)	0.0597*** (0.00706)
Size of the cabinet	-0.0233*** (0.00806)	-0.0206* (0.0111)	-0.0200* (0.0110)
Opposition fractionalization	0.318 (0.206)	0.242 (0.229)	0.264 (0.236)
Government fractionalization	0.175 (0.134)	0.116 (0.0991)	0.105 (0.102)
Income inequality		0.0149* (0.00846)	0.0150* (0.00869)
Intercept	-3.277*** (0.561)	-4.521*** (0.774)	-4.555*** (0.856)
Time & country fixed effect	Yes	Yes	Yes
<b>First stage</b>			
Log(rainfall weighted by initial terrorism),t-1	0.12*** (0.023)	0.11*** (0.026)	0.12*** (0.026)
Observations	184	169	169
R squared	0.580	0.572	0.571
F-stat for weak ident.	29.44	20.05	20.07

**Note:** Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

As an additional robustness test, we use the number of victims as an alternative measure of terrorist threat. Table 8 presents the results and shows that a 1% increase in the number of victims<sup>8</sup> in percentage of total population raises the fiscal volatility by 0.13%. In the regressions presented above, we mainly make use of total government spending.

However, it could be interesting to see whether consumption and investment are affected by terrorism in the same way. Therefore, one report disaggregated estimates by type of spending in Table 9. According to this table, the magnitude of the effect of terrorism on fiscal volatility remains unchanged no matter the type of public spending.

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<sup>8</sup> The number of victims is computed as the sum of deaths and injured people in percentage of the total population.

**Table 9:** Terrorism and fiscal volatility, Robustness check-disaggregated spending

	(1)	(2)	(3)	(4)	(5)	(6)
	2SLS					
Dependent Variable:Log(fiscal instability)	Full model		Consumption		Investment	
<b>Log(1+number of terrorist attacks),t-1</b>	<b>0.254***</b> <b>(0.0943)</b>	<b>0.253***</b> <b>(0.0918)</b>	<b>0.260**</b> <b>(0.117)</b>	<b>0.263**</b> <b>(0.122)</b>	<b>0.251**</b> <b>(0.124)</b>	<b>0.250**</b> <b>(0.124)</b>
Log(GDP growth instability)	0.0620*** (0.0222)	0.0573** (0.0233)	0.0626*** (0.0155)	0.0589*** (0.0135)	0.0596* (0.0352)	0.0586 (0.0371)
Log(inflation instability)	0.499*** (0.0863)	0.495*** (0.0893)	0.545*** (0.0872)	0.519*** (0.0937)	0.478*** (0.0880)	0.477*** (0.0902)
Trade openness	0.00438** (0.00222)	0.00391 (0.00242)	0.000635 (0.00168)	0.000145 (0.00167)	0.00437** (0.00199)	0.00421* (0.00244)
Financial openness	0.0554 (0.183)	0.0276 (0.199)	0.350 (0.229)	0.327 (0.240)	0.0834 (0.188)	0.0758 (0.199)
Log(population)	-0.123*** (0.0413)	-0.122*** (0.0414)	-0.130** (0.0602)	-0.138** (0.0611)	-0.174*** (0.0402)	-0.174*** (0.0403)
Oil rent volatility	-0.0225 (0.0300)	-0.0222 (0.0362)	-0.0217 (0.0211)	-0.0153 (0.0223)	-0.0532 (0.0518)	-0.0540 (0.0530)
Democracy	-0.0379*** (0.0118)	-0.0372*** (0.0117)	-0.0289*** (0.00775)	-0.0254*** (0.00762)	-0.0398** (0.0163)	-0.0394** (0.0168)
Major government crisis	-0.252** (0.127)	-0.232* (0.129)	-0.423** (0.182)	-0.409** (0.170)	-0.205 (0.158)	-0.198 (0.166)
Checks and balances	0.0427*** (0.0109)	0.0400*** (0.00888)	0.0563*** (0.0158)	0.0474*** (0.0146)	0.0678*** (0.0252)	0.0671** (0.0263)
Size of the cabinet	-0.00287 (0.00762)	-0.00181 (0.00771)	0.00383 (0.0106)	0.00688 (0.0112)	-0.00185 (0.00868)	-0.00147 (0.00906)
Opposition fractionalization	0.372 (0.241)	0.365 (0.246)	0.317** (0.157)	0.293* (0.166)	0.290 (0.264)	0.291 (0.269)
Government fractionalization	0.299** (0.142)	0.304** (0.142)	-0.0122 (0.184)	0.0107 (0.200)	0.454*** (0.136)	0.455*** (0.135)

Income inequality	0.0120 (0.00862)	0.0128 (0.00783)	0.00860 (0.00564)	0.00704 (0.00520)	0.0152	0.0154* (0.00891)
Foreign direct investment <sup>0</sup> %GDP		0.0160 (0.0131)		0.0331 (0.0360)		0.00457 (0.0179)
Intercept	-3.801*** (0.854)	-3.824*** (0.831)	-3.312*** (0.724)	-3.206*** (0.604)	-3.111*** (0.935)	-3.113*** (0.931)
Time & country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
<b>First stage</b>						
Log(rainfall weighted by initial terrorism),t-1	0.06*** (0.008)	0.061*** (0.008)	0.065*** (0.008)	0.064*** (0.008)	0.065*** (0.008)	0.066*** (0.008)
Observations	230	230	236	225	232	232
R squared	0.577	0.579	0.563	0.513	0.526	0.526
F-stat for weak ident.	57.20	55.30	65.15	58.82	65.15	64.24

**Note:** Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

## **Conclusion**

Over the recent years, especially in the post September 11<sup>th</sup> period, scholars have devoted much attention to the understanding of the economic cost and consequences of terrorism. Although there is a wide consensus on its negative effect on growth, there is little evidence about the key channels through which this effect occur. This paper argues that by increasing the uncertainty surrounding the conduct of fiscal policy, terrorism negatively affect growth. Therefore, we empirically document the effect of terrorism on the fiscal policy volatility in developing countries. Terrorism is measured by the number of terrorist incidents by year faced by a specific country including domestic and transnational terrorism. The fiscal policy volatility is captured by the standard deviation of a measure of discretionary fiscal policy following the seminal paper of Fatas and Mihov (2003).

Using both cross-country and panel data analysis for a sample of 66 developing countries, over the period spanning from 1970 to 2012, we show that terrorism increases fiscal policy volatility in developing countries. Specifically, a one percent increase in the number of terrorist incidents induces a rise in fiscal volatility ranging between 0.21% (cross country analysis) and 0.37% (panel data analysis). In addition, the analysis shows that fiscal volatility is positively influenced by the volatility of output growth, the consumer price inflation volatility, the degree of fractionalization of both the government and the opposition. The results also show that the volatility is higher in countries of small size and lower in more democratic countries.

Our results are robust to reverse causality, endogeneity bias and the presence of various controls. Moreover, the results stand for the use of alternative identification strategy including system-GMM, the generated instrument approach and the difference in difference estimator. In addition, the findings are qualitatively unchanged when we use disaggregated spending and an alternative measure of terrorism.

This paper complements and extends the previous literature by shedding a light on a new source of fiscal policy volatility and by providing a new economic channel to substantiate the negative relation between terrorism and growth. This paper shows that after controlling for the traditional determinants of fiscal volatility, the terrorism substantially increase the uncertainty surrounding the conduct of fiscal policy in developing countries.

This paper points to more policy efforts to circumvent terrorist threat and put in place tight fiscal rule to ensure a sustainable and stable fiscal policy. In this line, an interesting question to answer is whether countries with explicit fiscal rules face less volatility of public spending.

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## APPENDIX

**Table A:** List of countries

Country				
Argentina	Angola	Panama	Gabon	Mongolia
Ghana	Albania	Peru	Guatemala	Mozambique
Guinea	Burundi	Philippines	Guyana	Mauritania
Namibia	Bangladesh	Paraguay	Honduras	Malaysia
Nicaragua	Bulgaria	Rwanda	Indonesia	Niger
Tanzania	Bolivia	Senegal	India	Nepal
Zambia	Brazil	Sierra Leone	Jamaica	Pakistan
	Botswana	El Salvador	Jordan	
	Central African Republic	Chad	Kenya	
	Cote d'Ivoire	Togo	Cambodia	
	Colombia	Thailand	Liberia	
	Costa Rica	Tunisia	Sri Lanka	
	Dominican Republic	Turkey	Lesotho	
	Algeria	Uganda	Morocco	
	Ecuador	Uruguay	Madagascar	
	Ethiopia	South Africa	Mexico	
	Fiji	Zimbabwe	Mali	