Growth and Fiscal Consequences of Terrorism in Nigeria*

Chuku Chuku†1,2,3, Dominic Abang‡2, and Ima-Abasi Isip§3

1Macroeconomics Policy, Forecasting and Research Department, African Development Bank, Abidjan, Ivory Coast.
2Centre for Growth and Business Cycle Research, University of Manchester, U.K.
3Department of Economics, University of Uyo, Nigeria.

September 2017

Abstract

In spite of government counter-terrorism expenditure and efforts, the incidence of terrorism in Nigeria appears to be rising. This paper examines the growth and fiscal consequences of terrorism in Nigeria by estimating the terrorism–macroeconomy relation using different measures of terror incidence. The results show that terrorism has an economically and statistically significant negative impact on growth; although this impact is considerably small and short-lived, manifesting only after a lag of about three years. Specifically, the cost of terrorism to Nigeria, in terms of lost GDP per annum, is estimated at 0.82 percent. Moreover, there is evidence that terrorism leads to the reallocation of economic activity away from private investment spending to government spending; that is, terrorism crowds out investment at a higher rate than its potential to crowd in government spending. Lastly, terrorism alters the composition of government expenditure—with the defence component of government expenditure rising vis-a-vis other expenditure items. The results are robust to allowing for dynamic interactions between terrorism and macroeconomic aggregates.

Keywords: Terrorism, economic growth, transfer functions, counter-terrorism expenditure, structural VAR

JEL Classification: H56, D74, F43

*We thankfully acknowledge the financial support for this project provided by African Economic Research Consortium (AERC). We have benefited from review comments by Ibi Ajayi, Leonce Ndikumana, Akpan Ekpo, Dick Durevall, Rodney Smith, and researchers in AERC Thematic Group B—Macroeconomic Policy and Growth

†chukuchuku.econs.lect@uniuyo.edu.ng, chukuchuku@gmail.com.; Phone +234 806 724 7177
‡dominic.abang@yahoo.com
§imabasiisip@gmail.com
1 Introduction

Although the characteristics of terrorism has been changing in recent times, the primary objective of terrorism is still to impose sufficient political and economic pressure on a government so that it concedes to the demands of the terrorist (Enders and Sandler, 1996). The more challenging problem, however, is that the motivation for terrorism in a resource-rich, socially heterogeneous developing country like Nigeria could be confounded by additional dimensions, such as resource competition, ethnic fractionalization, and economic deprivation; all of which interact to make the situation more intricate to understand or deal with, especially because of the relatively lower capacity of a typical developing economy to confront the increasing sophistication of terrorist activities. Hence, the consequences of terrorism in such an environments is likely to extend beyond the destruction of lives and property to longer term macroeconomic impacts.

One could classify the consequences of terrorism by their economic and non-economic effects (see Frey, Luechinger and Stutzer, 2007). The economic effects could arise from several channels, but four of them seem to be particularly pervasive. First, terrorism has a direct effect on the economy through the destruction of human and physical capital (Collier, 1999). Second, terrorism is likely to induce counter-terrorism expenditure, thereby diverting expenditure from production-related activities to defence-related activities, which are generally considered to be less productive (Blomberg, Hess and Orphanides, 2004; Gaibulloev and Sandler, 2011). Third, terrorist activities create economy-wide risks and uncertainties that distort the equilibrium resource allocation within a country by changing individuals’ savings, investment, and consumption behaviour. Moreover, this risk and uncertainty effect also leads to the redirection of foreign direct investments (FDI) away from the country with a higher risk to those with lower risks (Blomberg, Hess and Weerapana, 2004; Eckstein and Tsiddon, 2004). Indeed, a recent World Bank study shows that FDI has been redirected from Nigeria to other West African countries, particularly Benin (see IEP, 2014). Fourth, terrorism is known to negatively affect several sectors of the economy, especially tourism and financial markets (Eldor and Melnick, 2004; Enders and Sandler, 1996).

In this paper, we focus on the growth and fiscal consequences of terrorism in Nigeria over the last three decades. In particular, using several measures of terrorism from the Global Terrorism Database (GTD), we attempt to obtain an estimate of the cumulative cost of terrorism, in terms of lost GDP per capita; examine the extent to which terrorism alters the composition of government expenditure; and the extent to which it leads to the reallocation of economic activity between investments and defence expenditure. We build intuition using a small theoretical model of terrorism, government expenditure, and

---

1 In Nigeria, typical examples of recent activities that trigger this channel are the torching of residential and business facilities in the North-Eastern parts of Nigeria, and the blowing up of gas pipelines in the Niger-Delta region.
economic activity, inspired by Yang, Lin and Chen (2012), which guides our empirical analysis of the terrorism–macroeconomy relationship in Nigeria, based on the estimation of transfer functions in autoregressive distributed lag (ARDL) models and structural vector autoregressive models (VAR), used to control for potential dynamic interactions.

A study of terrorism and its growth and fiscal consequences in Nigeria is unique for several reasons. First, unlike many other countries that have experienced significant numbers of terrorist activities—for examples, Pakistan, Israel, the United States, and some countries in Europe—there are hardly any studies on the economic impact of terrorism in Nigeria. Moreover, the literature has not considered the possibility that the economic consequences of terrorism may be dependent on the extent of resource dependence, and the nature of the political regime in place. Our study goes a step further by accounting for these two considerations in the analysis. Also, our focus on a developing country, like Nigeria, helps to understand whether growth is sustainable under the kind of circumstances that developing countries face, especially with respect to the weak institutional and military capacity to protect their citizens and assets from terrorist activities, which could have severe consequences for the development process (see Blomberg, Broussard and Hess, 2011). Secondly, because Nigeria has a long and dynamic history of terrorism that dates back to independence (although we do not go that far into the past), it allows us to study the effects of terrorism on the economy over the long-run and short-run horizons. Furthermore, from a methodological point of view, by conceptualizing the problem in a structural VAR framework, we are able to conduct our analysis in such a way that it accounts for the political and economic theoretic priors in a structurally unifying manner, which provides some advantages over the traditional use of ad-hoc, unrestricted VAR methods in the literature. Typical examples are Eckstein and Tsiddon (2004) and Ismail and Amjad (2014), the only relevant exception we are aware of, however, is the study by Blomberg, Hess and Orphanides (2004).

Our results are quite revealing. First, we find that terrorism has a negative economic and a statistically significant impact on growth—albeit, small and short-lived, with manifestations occurring only after a lag of about three years. Specifically, the quantitative cost is about 0.82 percent of GDP lost per annum. The results also show evidence that terrorism leads to the reallocation of economic activity away from private investment spending to government spending on defence infrastructure, with an overall net effect of crowding out private investments. Furthermore, terrorism alters the composition of government expenditure by causing an increase in the defence component of government expenditure vis-a-vis other expenditure items. The advantage, however, is that it has the potential to crowd in investments in the later years. The results are generally robust to alternative specifications, especially the introduction of dynamic interactions between terrorism and macroeconomic variables within a structural VAR framework. One policy implication of the result is related to the budgeting and expenditure strategies of government. In particular,
the process of budgeting should factor in the effects of counter-terrorism activities in a way that optimizes its potential to crowd in growth-enhancing investments.

The balance of the paper is organized as follows. In Section 2, we present a brief overviews of the state of the literature on terrorism, conflict, and the macroeconomy. In Section 3, we explore the political economy of terrorism in Nigeria, presenting some statistics and underlying interpretations. In Section 4, we present a simple theoretical model of terrorism, counter-terrorism expenditure, and economic activity that helps to inform our empirical investigation. In Section 5, we present the empirical strategy, describing the process of data construction for terrorism. Section 6 presents the results, and finally, Section 7 presents the conclusion along with some policy implications.

2 Overview of terrorism and conflict related studies

Any meaningful discussion of the impacts of terrorism requires a clear perspective on the definition of the concept, especially in the light of the controversy about what should, and should not be classified as terrorism. In this study, we carefully avoid this controversies by adopting the official and policy relevant definitions of terrorism used by relevant international organizations. In particular, we follow the definitions used by the United Nations (UN) and the US Department of Defence, which defines terrorism as “the unlawful use or threatened use of force or violence against individuals or property to coerce or intimidate governments or societies, often to achieve political, religious or ideological objectives” (Enders and Sandler, 2011, p.5).

This official definition highlights at least five major components that should be present for any activity to be classified as terrorism: (i) violence; (ii) political, ideological, or religious motivation; (iii) presence of perpetrator(s); (iv) effect on victim(s); and (v) target audience(s). These five components seem to be present in almost all the violent activities witnessed in Nigeria since independence.

Because the economic impact of conflict, civil wars, rebel movements, and terrorism are closely related (see Collier et al., 2003), a lot of insight could be taken gleaned from conflict related studies. An interesting study by De Groot (2010) examine the spillover effects of conflict on neighbouring countries in Africa and find both negative and positive spillover effects of conflict, depending on whether a neighbouring country has direct contagion with the conflict country, or is non-contagious with the conflict country. With a wider sample of countries, Dunne (2012) show that the economic effect of military expenditure is negative in the short run and depends on the income level of a country, with countries experiences conflict having a more persistent impact on economic outcomes. These conflict related

---

2 Other competing official definitions of terrorism include the one by the Federal Bureau of Investigations (FBI), and the Defence Intelligence Agency (DIA), which have been collected in White, p.12
3 The civil war that lasted between 6 July 1967 – 15 January 1970 is an exception of what may be classified as terrorism in Nigeria, although it was ethnically and ideologically motivated, it was more of a civil war than a terrorist event.
results are somewhat corroborated in a case study of the economic cost of conflict in Darfur by Ali (2013), which shows that the conflict in Darfur cost Sudan about 171% of GDP in 2003.

The literature on the terrorism–macroeconomy relation has mostly been inspired by the seminal paper by Blomberg, Hess and Orphanides (2004), who conduct an empirical investigation of the macroeconomic consequences of international terrorism and its interactions with alternative forms of collective violence. Their results show that, on average, the incidence of terrorism may have an economically significant negative effect on growth. They also find that terrorism is associated with a redirection of economic activity away from investment spending and towards government spending with different levels of incidence among different sets of countries. Similarly, Gassebner and Luechinger (2011) assess more than seventy previous terrorism studies using extreme bounds testing and found that economic activity had a robust and negative relationship with terrorism. In the specific case of Pakistan, Mehmood (2014) estimate the aggregate cost of terrorism to the Pakistani economy between 1973 and 2008 to be 33.02 percent in cumulative terms.

From a theoretical point of view Collier (1999); Eckstein and Tsiddon (2004); Frey et al. (2007); Sandler and Enders (2008); Yang et al. (2012) and Mirza and Verdier (2008) present theoretical models explaining the channels through which terrorism impedes economic growth. Generally, these channels can be classified into direct and indirect costs. Specifically, Collier (1999) identifies the most obvious and direct peril of civil war (of which terrorism can be considered a related phenomenon), as the destruction of physical capital, including the destruction of public infrastructure, and the loss of human capital. This destruction leads to a simultaneous amplification of transaction costs resulting from reduced security, as the effectiveness of government institutions are compromised. Another important factor is the share of GDP directed toward investment spending. Gaibulloev and Sandler (2008) shows that terrorism causes economic activity to diverge from investment spending to government spending on terrorism, mainly for installing non-productive defence mechanisms against terrorist activities.

Also, Eckstein and Tsiddon (2004) and Naor (2006) argue that terrorism increases the perceived probability of an untimely death and, therefore, prompts people to substitute future savings for current consumption in order to enhance utility in the present at the expense of the future, which is another cause for decline in economic activity (see, also Shahbaz, Shabbir, Malik and Wolters, 2013). Although the reviewed studies cover the extensive literature, there remain, however, some gaps. For example, by conducting panel data analysis, most of the existing studies are unable to uncover the country-specific idiosyncrasies in the economy-terrorism relation, especially for a resource-rich, developing country. This paper attempts to fill an aspect of this gap by endeavouring to uncover the country-specific characteristics of the economy-terrorism relationship for Nigeria—a resource-rich country.
3 The political economy of terrorism in Nigeria

In recent times, Nigeria has ascended the ranks as one of the most active terror destinations in the world—in terms of frequency of attacks and sophistication of attacks. As depicted in Figure 1, which displays the total number and sophistication of terrorist attacks by major terror organizations in the world between 2000 and 2013, Nigeria ranks second globally, in terms of frequency of incidence, with over 750 attacks during that period. And, although the level of sophistication of terrorist events in Nigeria, which is measured by the number of suicide attacks, is comparatively low (see Panel B of Figure 1), the trend appears to be increasing in recent times in spite of increased government counter-terrorism expenditure and efforts.\(^4\) Terrorism related activities are not altogether new in Nigeria. Since the post-independence era, the chequered history of the country can be characterized by several episodes of internally motivated crisis. Specifically, these terrorism-related crimes have been escalated by the multi-faceted political and religious demands of different competing groups, and for reasons of ethnic fractionalization. Some of the most contentious issues include: the demands for appropriation of oil rents, reforms in fiscal federalism and political restructuring, which has primarily contributed to the emergence of militia and terrorist groups in the southern and northern regions respectively.

Although in recent times, what is generally recognized as terrorism in Nigeria are the activities of the Boko Haram sect—whose activities have been localized in the North-Eastern region and neighbouring countries, targeting innocent civilians, religious and public places, government officials, and security forces—it is only one of many formal and informal groups engaged in what qualifies as terrorist activities (see Tonwe and Eke, 2013, for an anatomy of their operations). The relevance and strength of the group has risen quickly from being a regional phenomenon to attaining global status. This is confirmed by the recent trends that show links between Boko Haram and ISIL, an organization to which they had earlier pledged their allegiance. This increasing relevance and spread also imply stronger and more significant influence on the political and economic fundamentals of the Nigerian economy, begging for answers to questions concerning the underlying factors behind the origin and growth of terrorism in Nigeria, the consequences of government counter-terrorism activities, and the strategies for economic insulation.

It is generally believed that the nature of terrorism in Nigeria is mostly elite-motivated, originating from the fallout of political competition for resources. Advocates of this theory argue that it is very difficult for perpetrators of terrorism, who are often poor and uneducated rural dwellers, to mobilize resources to launch large-scale and sustained campaigns against civilians and the military forces for several years. This argument appears reasonable, especially if one considers the demographic distribution and concentration of...
insurgency in the history of Nigeria. For example, in the early 2000’s, when the president and ruling party were mostly from the South-West region, the insurgency was more concentrated in the South-South region, with manifestations in the form of militancy, vandalism, and kidnappings. However, between 2007 and 2015, when the president emerged from the South-South region, militancy dramatically reduced in the South-South region and became concentrated in the Northern regions, in the form of bombings on civilians and military formations, kidnapping of pupils, and killing of so-called “infidels.”

The mechanisms underlying the activities of these terrorist groups suggest a strategic tactic. They often try to exploit the government’s counter-terrorism dilemma by using violence to provoke governments into harsh and indiscriminate counter-terrorism responses that often affect the entire society, including the innocent population. Two examples are common: (i) when mobile telecommunication services are disabled in the affected regions and different degrees of curfews are imposed; and (ii) when an emergency rule is imposed, which suspends democratic institutions and allows the armed forces to perform so-called cleansing and restoration operations unhindered. The problem, however, is that these measures are often abused, as there are many cases of human rights abuses and extra-judicial killing by the armed forces in the affected areas (see Amnesty International, 2016). These counter-terrorism actions are often considered to be provocative to residents.
and turns them against the government, which eventually leads to the radicalization of some of the citizens, making it easier for terrorist groups to recruit new members by claiming to represent and protect the interest of these vulnerable groups who, according to the recruiting terrorist groups, are being repressed by the state.

In a bid to use a combination of sanctions and incentives (commonly referred to as the carrot-and-stick approach), the government has been implementing several incentive-based programmes. For example, the Amnesty programme, which was designed to pardon repentant militants and rehabilitate them through vocational and professional training programmes and also offer them monthly stipends during the process of integration back into the society. Moreover, additional budget outlays have been granted the armed forces to better equip them to fight terrorism in the country. Because recent investigative evidence has revealed large-scale financial corruption in government efforts toward counter-terrorism in Nigeria, and they have had repercussions to the fight against terrorism—as the credibility of government effort toward the fight against terrorism is often perceived to be insincere.

4 A model of terrorism, counter-terrorism expenditure and economic activity

To motivate the empirical strategy used in the study, we briefly describe a model that can be used to characterize the relationship between terrorism, counter-terrorism expenditure, and economic activity. The general ideas of the model are based on the formulation in Yang et al. (2012), which draws from the public finance and growth literature in for examples: Barro (1990); Barro and Sala-i Martin (1992); Futagami, Morita and Shibata (1993). For simplicity, consider a closed economy consisting of a representative household and a government. The household supplies labour inelastically which is used to produce a single composite commodity that could be consumed, accumulated as capital, and used to pay for income tax to the government. Assume that the government operates a balanced budget, and it can spend its tax revenue on two items: core infrastructure and anti-terrorism expenditure. The effect of public expenditure is to increase the welfare of the society by improving the safety of lives and property and decreasing the probability of terrorist attacks. The government’s anti-terrorism expenditure enters the utility function of the household due to the fact that it improves welfare by decreasing the risk and uncertainty of terrorist attacks and hence, increases safety. Assuming a constant population, the consumer’s objective is thus to maximize the discounted sum of lifetime utility

\[
\text{Max } \int_0^\infty U(C, E)e^{-\rho t}dt,
\]
where $C$ is consumption per capita, $E$ is anti-terrorism expenditure, and $\rho > 0$ is the rate of time preference. We assume a log utility function that is additively separable in anti-terrorism expenditure, such that the instantaneous utility function is:

$$U(C, E) = \ln C + \delta \ln E, \quad \delta > 0,$$

(2)

where $\delta$ is an approximate measure of the impact of anti-terrorism spending on the welfare of the household. The budget constraint of the consumer is a flow equation linking capital accumulation to the difference between its net output and consumption expenditure, given as:

$$\dot{K} = (1 - \tau)Y - C,$$

(3)

where $K$ represents the capital stock and the over-dot indicates continuous change with respect to time. $\tau$ is the fixed income tax rate, $Y$ is the level of output. Let production be characterized by constant returns to scale, so that private capital stock, $K$, and public services, $S$, are feed as inputs into a Cobb-Douglas type production function. Further, terrorism destroys a certain fraction, $\theta$, of capital stock, thus the production function is given as

$$Y(K, S) = A(K(1 - \theta))^{1-\alpha}S^{\alpha}, \quad \alpha \in (0, 1); \quad \theta \in (0, 1),$$

(4)

where $\alpha$ is the input share of public services. Putting the model together, the consumer’s problem is to maximize discounted utility, Eq. (2), subject to the resource constraint Eq. (3) and the production capacity Eq. (4).

The government receives income tax $\tau Y$, which it spends on core infrastructure $G$ and anti-terrorism expenditure $E$. Let $\phi$ and $1 - \phi$ denote the proportion of government spending in core infrastructure and anti-terrorism expenditure, respectively. Then, by balanced budget assumption, $G + E = \tau Y$, and the relationship between the flow of public infrastructure accumulation and the expenditure on core infrastructure can be written as:

$$\dot{S} = G = \phi \tau Y$$

(5)

Therefore, on the balanced growth path (BGP), private consumption, and the stock of private and public capital will all grow at the same rate.\(^5\) To obtain the economy’s transitional dynamics, we define two transformed variables, $X = \frac{S}{K}$ and $Z = \frac{C}{K}$, and we apply them to the private capital accumulation equation, ??, the Euler equation, ?? and the public capital accumulation equation, Eq. (5), to obtain a two-equation dynamic system

\(^5\)See Barro (1990) for a proof.
with respect to the transformed variables $X$ and $Z$, as follows:

$$
\dot{X} = F(X, Z, \phi) = [\phi \tau A X^{\alpha-1} - (1 - \tau) A X^\alpha + Z]X
$$

(6)

$$
\dot{Z} = J(X, Z, \phi) = [-\alpha(1 - \tau) A X^\alpha - \rho + Z]Z
$$

(7)

For a unique perfect-foresight equilibrium to exist in the dynamic system above, the number of unstable roots should be equal to the number of jump variables. Yang et al. (2012) prove that this condition holds for the system in Eq. (6) and Eq. (7), and so we can use the system to analyse how the balanced growth rate and social welfare will respond to an increase in terrorism through the destruction of capital, and a rise in the fraction of total government expenditure spent on anti-terrorism.

At steady state growth, the economy is characterized by $\dot{X} = \dot{Z} = 0$, and $X$ and $Z$ are at their stationary levels denoted by $X^*$ and $Z^*$. From Eqs. (6) to (7), we can obtain the following steady state equilibrium relationships

$$
\frac{dX^*}{d\phi} = \frac{\tau X^*}{(1 - \alpha)[\phi \tau + (1 - \tau) \alpha X^*]} > 0
$$

(8)

$$
\frac{dZ^*}{d\phi} = \frac{\tau A X^{*\alpha}(1 - \tau) \alpha^2}{(1 - \alpha)[\phi \tau + (1 - \tau) \alpha X^*]} > 0
$$

(9)

Let the steady state growth rate be denoted by $\gamma$, so that the following relationship holds

$$
\gamma = \dot{S}/S = \dot{K}/K = \dot{C}/C = \dot{Y}/Y.
$$

(10)

By using the variable transformation $X = S/K$ with some substitution, we can rewrite Eq. (5) as:

$$
\gamma = \frac{\dot{S}}{S} = \phi \tau \frac{A X^{*\alpha-1}}{1 - \theta}.
$$

Comparative static analysis can be used to draw insights from the model; in particular, by differentiating Eq. (10) with respect to $\theta$ and $\phi$, we can understand how terrorism, and government counter-terrorism expenditure affects economic activity and growth. Thus, the relationship between changes in $\theta$, $\phi$, and $\gamma$ is given as:

$$
\frac{d\gamma}{d\phi} = \frac{\tau(1 - \tau) \alpha A X^{*\alpha}}{\phi \tau + (1 - \tau) \alpha X^*} > 0,
$$

(11)

which can be summarized as follows:

**Proposition 1.** An increase in the fraction of government spending on core public infrastructure vis-a-vis counter-terrorism infrastructure will increase economic growth.

**Corollary.** An increase in the share of government expenditure on counter-terrorism infrastructure vis-a-vis core public infrastructure will diminish economic growth.
Thus, economic activity is a function of the extent of terrorist activities, $\theta$, the composition of fiscal policy, $\phi$, capital and investments, $K_t$, and other structural variables $T_t$ not captured by the theory, thus
\[
\gamma = F(\theta, \phi, K_t, \tau, T)
\] (12)

Overall, two major insights emerge from the theoretical formulation. First, increased terrorism suppresses available capital for growth, and induces governments to divert resources to relatively unproductive counter-terrorism spending. Secondly, increased terrorism will result in more aggregate uncertainty which will result in higher interest rates across the economy, reduced domestic investments and lower steady state growth rates.

5 Empirical strategy

5.1 Transfer functions in ARDL models

To empirically examine the growth and fiscal consequences of terrorism in Nigeria, we make use of transfer functions in autoregressive distributed lag (ARDL) models and control for potential dynamic interactions in a structural vector autoregressive model (VAR), drawing from relevant applications in, for example, Blomberg, Hess and Orphanides (2004); Enders and Sandler (1996); Gaibulloev and Sandler (2008); Mehmood (2014). Consider the following generalization of an ARDL model:
\[
y_t = \alpha + A(L)y_{t-1} + C(L)z_t + B(L)\epsilon_t,
\] (13)

where $A(L), B(L),$ and $C(L)$ are polynomials in the lag operator $L$, and $\{y_t\}$ is the sequence of the endogenous variable, here we have assumed a single variable, abstracting from multiple endogenous variables, and $\{z_t\}$ is the exogenous variable—terrorism. The model is called a distributed lag, in that it distributes the effect of $z_t$ on $y_t$, and the polynomial $C(L)$ is the transfer function that shows how changes in the exogenous variable $z_t$ are transferred to the endogenous variable $y_t$, with coefficients on different lags denoting the transfer function weights (see Enders, 2015, p. 268).

The general assumption here is that the $z_t$ sequence is white noise and evolves independently of the $y_t$ sequence. The problem, however, is that this assumption is often not the case in applied situations like ours. Therefore, we require a further generalization that ensures the $z_t$ is a stationary autoregressive (AR) process. So that the system of equations now become
\[
\begin{align*}
y_t &= \alpha + A(L)y_{t-1} + C(L)z_t + B(L)\epsilon_t \\
z_t &= D(L)z_{t-1} + E(L)\epsilon_{zt},
\end{align*}
\] (14)
where $D(L)$ is the polynomial in the lag operator $L$, with roots that ensure that $\{z_t\}$ is stationary, and $\epsilon_{zt}$ is white noise. Given the independence of $\{z_t\}$ with respect to $\{y_t\}$, it implies that shocks to $\{z_t\}$ would affect $\{y_t\}$, but not the other way round. Further, since $\{z_t\}$ evolves independently of $\{y_t\}$, we could use purely statistical devices such as the methodology of Box, Jenkins, Reinsel and Ljung (2015) to estimate $\{z_t\}$. In particular, we estimate $\{z_t\}$ within an autoregressive integrated moving average (ARIMA) framework, selecting from the most plausible alternatives.

In summary, the procedure for fitting the ARDL model described in Eq. (14) involves the following four steps, as outlined in Enders (2015):

Step 1: Estimate the data generating process (DGP) for the terrorism series. This involves fitting an ARIMA model to the terrorism series and retrieving the filtered residuals, $\{\hat{\epsilon}_{zt}\}$, which serve as pure innovations in the $\{z_t\}$ (terrorism) sequence.

Step 2: Identify plausible candidates for the transfer function $C(L)$. This is done by using the results from Step 1 (i.e., $D(L)$) to filter the $\{y_t\}$ sequence, thus $D(L)y_t \equiv y_{ft}$. In this way, one is able to identify the pattern of the most plausible transfer functions by observing the spikes in the cross-correlograms between the $y_{ft}$ and $\hat{\epsilon}_{zt-i}$ sequences. Significant cross-correlations at lag $i$ imply that innovations in the exogenous variable affects the value of the endogenous variable at period $t + i$.

Step 3: Identify plausible candidates for the autoregressive function $A(L)$. This involves the regression of $y_t$, (not $y_{ft}$) on the selected lags of $z_t$. i.e., $y_t = C(L)z_t + \epsilon_t$, where $\epsilon_t$ denotes the error term. At this stage, one can now plot and observe the partial autocorrelation function (PACF), which would suggest the correct form for the $A(L)$ function.

Step 4: Estimate the transfer function $C(L)$ and the autoregressive function $A(L)$ in a combined system. This is the last stage of the procedure, which requires the joint estimation of the $A(L)$ and $C(L)$ functions, based on the results and choices from Steps 2 and 3. The desirable properties of the selected model—i.e., significant coefficients, parsimony, white-noise errors, and small forecast errors—are then compared to other plausible candidate models from Steps 2 and 3, and the most promising is selected.

Once we have estimated the coefficients of the system in Eq. (14), it is possible to back out the impulse response functions. In particular, we can trace out the effects of an $\epsilon_{zt}$ shock on the entire $\{y_t\}$ series from the following:

$$y_t = \alpha_0 + A(L)y_{t-1} + C(L)[1 - D(L)L]\epsilon_{zt} + \epsilon_t,$$

(15)

so that by solving for $y_t$ and taking expectations, it becomes clear that the impulse responses
are the coefficients of the solution at each lag $\Theta_i$ thus:

$$\Theta_i = \frac{C(L)[1-D(L)L]}{[1-A(L)L]} \quad (16)$$

This methodology constitutes the baseline estimation technique used in the study.

### 5.2 Counterfactuals: growth with and without terror

From the results obtained in the transfer functions of the ARDL, it is possible to use the information to hypothesize what per capita GDP could be with no terrorism in Nigeria and what the cumulative cost of terrorism has been in terms of lost GDP during the sample period. This procedure involves comparing the actual level of GDP (with terrorism) to a hypothesized counterfactual level of GDP—that is, the potential value of GDP if there is zero level of terrorism over the entire period. We carry out this experiment following the output gap literature (see D’Auria, Havik, Mc Morrow, Planas, Raciborski, Roger and Rossi, 2010, for example), and the methodology used in Mehmood (2014).

To fix ideas, let the cumulative increase in actual GDP with terrorism be denoted by $CGDP_{pc_t}$, let hypothetical cumulative increase in GDP without terrorism be represented by $CGDP_{pc_{hpo}}$, where the subscript $hpo$ stands for hypothetical. Let the point estimate of the effect of terrorism on GDP$_{pc}$ be given as $\hat{\beta}_{terror}$ and the cumulative increase in terrorism be denoted as $CTerror_t$. By implication, the direct effect of terror is given as ($-\hat{\beta}_{terror} \times Terror_t$). Therefore, to obtain an estimate of the cumulative cost of $Terror$ on $GDP_{pc}$, we apply the following manipulation:

$$CGDP_{pc_t} = CGDP_{pc_{hpo}} + (-\hat{\beta}_{terror} \times Terror_t) \quad (17)$$

$$CGDP_{pc_{hpo}} = CGDP_{pc_t} + (\hat{\beta}_{terror} \times Terror_t)$$

In simple terms, Eq. (17) says that the hypothetical (counterfactual) GDP without terrorism is equal to the actual GDP with terrorism, after discounting for the effect of terror. Finally, we obtain an objective estimate of the cumulative cost of terror (along with the associated 95 percent confidence interval) for Nigeria by finding the output gap thus:8

$$\frac{CGDP_{pc_{hpo}} - CGDP_{pc_t}}{CGDP_{pc_{hpo}}} = \%Cost\ of\ Terror$$

---

8As pointed out by a reviewer, this measure of terror cost based on output gap lost can only capture a fraction of the total cost of terror, as there are other aspects of the cost of terrorism that are not captured by this formulation, including, for example, the spillover effects on neighbouring countries (see De Groot, 2010)
5.3 Reallocation, composition, and dynamic effects

To establish the extent to which terrorism leads to reallocation of economic activity across investments and government expenditure, we re-estimate the specification in Eq. (14) with investments-in-GDP and government expenditure-in-GDP as dependent variables, respectively. Potential changes in the composition of government expenditure as a result of terrorist activities are also investigated using the baseline specification. In the case of decoupling the composition effects, defence expenditure in total government expenditure is used as the dependent variable. The rationale for interpreting the results from these regressions as reallocation and composition effects are discussed further in the results section.

In the baseline specification outlined previously, potential feedback effects and dynamic interactions among the macroeconomic variables are switched off a priori. We relax this restriction by utilizing a structural VAR model that allows us to combine insights from the baseline regression with political and economic theory so as to put a structure on the dynamic relationships expected to hold among the variables. In particular, we consider a four-variable VAR that includes the log of real GDP per capita, investments in GDP, government expenditure in GDP and a measure of terrorism. Because of the symmetry in the variance-covariance matrix, this 4-variable VAR has \(4 \times (4 + 1)/2\) free off-diagonal elements. Consequently, we need at least six restrictions to exactly identify the system, and more restrictions would imply an over-identified system, which could be tested for plausibility using over-identifying restrictions tests. Let the reduced form errors from the VAR be given as \(\epsilon_{\text{GDPpc}}, \epsilon_{\text{Inv}}, \epsilon_{\text{Exp}}, \epsilon_{\text{Ter}}\), which correspond to the GDPpc, investments, government expenditure, and terrorism equations respectively. Then the short-run structural restrictions we impose on the model can be shown using the mapping from the reduced form errors to the structural innovations as follows

\[
A \epsilon_t = B \nu_t
\]

where the \(A\) matrix contains the structural restrictions and parameters to be estimated, and the \(B\) matrix is normalized so that the errors are orthogonal and \(\nu_t\) are the structural innovations from each equation.

From the specification in Eq. (18), the first row of \(A\) implies that the current level of terrorism is not affected by contemporaneous shocks to any other variable in the system, the second row implies that government expenditure is only affected by contemporaneous shocks to terrorism, and the same logic follows up to the fourth row where we experiment
with two different restrictions: first, we assume that contemporaneous shocks to every other variable in the system affect GDPpc, so that the cell with (?) in row four is replaced by $\alpha_{42}$; secondly, we endeavour to account for the hypothesis that government expenditure on counter-terrorism efforts are less productive (and sometimes counter productive)—thus, we replace (?) with zero implying that shocks to government expenditure induced by terrorism have no contemporaneous effects on GDP per capita. An alternative rationalization of a structural VAR in a similar context can be found in Blomberg, Hess and Orphanides (2004).

5.4 Data description and sources

Terrorism data is collected from the Global Terrorism Database (GTD), which is one of the most comprehensive and reliable source for terrorism data around the world. This is particularly so because the GTD contains information about the date of every terrorist attack, country of attack, city of attack, perpetrators, number of fatalities, number of injured, and the target audience. To harmonize the different dimensions of terrorist activities into one single variable, we construct a baseline terror index, following the methodology and recommendations of the expert panel of the Institute for Economics and Peace (see IEP, 2014). We also use other methods described in the literature to conduct robustness analysis. In particular, the terror index for each year is constructed based on a scoring of the impacts of terrorism on four different dimensions. Table 1 depicts the weights used for the construction of the terror index, based on the four dimensions of terror impact. Notice that the weight on the approximate cost of total property damage from terrorist attacks is zero. There are two main reasons for this: first, information on the cost of property damage from terrorist events in Nigeria is scarce, and second, even when information does exist, it is often suspect, depending on the credibility of the source of the estimate. This informs our decision to switch it off with a zero weight. In Table 2, we illustrate the construction of the composite terror index for two years—2012 and 2013—using raw data for the different dimensions of terrorism in Nigeria drawn from the Global Terrorism Database (GTD). For robustness checks, we also experiment with alternative measures of terrorism that are common in the literature: the number of incidents, the number of fatalities, and the number of injured victims. Similar measures have been used in panel and VAR regressions such as: Cevik and Ricco (2015); Crain and Crain (2006); Eckstein and Tsiddon (2004); Enders and Sandler (1996); Meierrieks and Gries (2012), and Gaibulloev and Sandler (2011).

As for the macroeconomic time series data used in the study, most were obtained from the International Financial Statistics database of the International Monetary Fund (IMF). Some series, however, require additional explanation. Data on counter-terrorism

---

9 Available online at [http://www.start.umd.edu/gtd/](http://www.start.umd.edu/gtd/).
Table 1: Indicator weights for terrorism index

<table>
<thead>
<tr>
<th>No.</th>
<th>Dimension</th>
<th>Scoring weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Total number of incidents in a year</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Total number of fatalities caused by terrorism in a given year</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Total number of injuries caused by terrorism in a given year</td>
<td>0.5</td>
</tr>
<tr>
<td>4</td>
<td>Approximate cost of total property damage from terrorist attacks</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 2: Demonstrating the construction of terror index: 2012 and 2013

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Weight</th>
<th>Number</th>
<th>Score</th>
<th>Terror index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of incidents</td>
<td>1</td>
<td>342</td>
<td>342</td>
<td></td>
</tr>
<tr>
<td>Total number of fatalities</td>
<td>3</td>
<td>2003</td>
<td>6009</td>
<td></td>
</tr>
<tr>
<td>Total number of injuries</td>
<td>0.5</td>
<td>513</td>
<td>256.5</td>
<td></td>
</tr>
<tr>
<td>Terror index 2013</td>
<td></td>
<td></td>
<td></td>
<td>6607.5</td>
</tr>
<tr>
<td>Total number of incidents</td>
<td>1</td>
<td>613</td>
<td>613</td>
<td></td>
</tr>
<tr>
<td>Total number of fatalities</td>
<td>3</td>
<td>1497</td>
<td>4491</td>
<td></td>
</tr>
<tr>
<td>Total number of injuries</td>
<td>0.5</td>
<td>1026</td>
<td>513</td>
<td></td>
</tr>
<tr>
<td>Terror index 2012</td>
<td></td>
<td></td>
<td></td>
<td>5617</td>
</tr>
</tbody>
</table>

expenditure, which is proxied by military and defence expenditure, is retrieved from the Stockholm International Peace Research Institute (SIPRI) database. SIPRI data contains information on government capital and recurrent expenditure on the armed forces, peace forces, paramilitary forces, and government agencies engaged in defence activities. The other variables used are as follows: log of real gross domestic product per capita ($GDP_{pc}$); total government expenditure in GDP ($EXP$); investment in GDP ($INV$); natural resource rents in GDP ($Nat.Res$); openness ($OPN$), which is measured as trade to GDP ratio; inflation ($INF$), which is measured as the year on year percentage change in consumer price index; political regime ($Pol.$), which is constructed as an indicator variable taking the value of 0 for years under military rule, and 1 for periods under democratically elected governments.

6 Results

6.1 Terrorism and economic activity

We start by discussing how we model and estimate the terror series in the paper. As noted earlier, the empirical and theoretical literature have shown that terrorism is determined by a host of factors. Prominent factors include economic and political variables, but the list is almost endless as there is also evidence of the effect of other factors such as governance, religion, repression, ethnic fractionalization, colonial history, geographic location, and

10The database can be accessed online at [http://www.sipri.org/research/armaments/milex/milex_database](http://www.sipri.org/research/armaments/milex/milex_database)
the bad-neighbours’ effect among other. Hence, as much as we would like to have a structurally grounded model of the terrorism equation, we are not very fortunate to have access to sufficient data on the multi-faceted dimensions and determinants of terrorism at the moment. We, however, work around this problem by using the purely statistical devices of Box-Jenkins, which rationalize the use of single-equation models that relate current values of a variable to its past values as useful summary devices to generate reliable inference and short-term forecasts.\footnote{See Box et al. (2015) for a recent book-length description of this approach}

We estimate the terrorism series according to an autoregressive integrated moving average (ARIMA) in which we choose from plausible alternative models on the basis of the one that returns the lowest information criterion.\footnote{To be concrete, we use the Schwartz Bayesian information criterion (SBIC) to select from alternative specifications. This choice is informed by its strengths over alternative criteria in the context of the specific data characteristics. In particular, it imposes a stricter penalty for loss of degrees of freedom, which is desirable when dealing with small samples.} Using this approach, the most promising ARIMA model for the terrorism series in Nigeria is presented below with t-statistics in parenthesis:

\[
\text{Terror}_t = 0.222 - 0.229\text{Terror}_{t-1} - 0.298\text{Terror}_{t-4} + \epsilon_{2t} - 0.597\epsilon_{2t-1}
\]

\((3.73)\) \((-0.90)\) \((-1.66)\) \((-2.91)\). \((19)\)

This result suggests at least two things: first, because the AR(1) and AR(4) terms are hardly significant at conventional levels (i.e., 5%), we cannot conclude that terrorist activities in Nigeria have a memory. This conclusion is also supported by the correlogram for the terrorist series, which shows that most of the autocorrelation coefficients are within two standard deviations from unity or the 95 percent confidence bands; secondly, the significant coefficient on the moving average term, MA(1), indicates that terrorist activities appear to be a white-noise process. Therefore, we conclude that acts of terrorism in Nigeria are randomized—so that the number of incidents in a particular year is not significantly correlated with those of the past years. This independence property of terrorist activities, suggests that feedback to terrorism from other macroeconomic fundamentals are likely to be weak if they even exist. Thereby justifying the use of the transfer function approach, which is a parsimonious variant of the VAR approach when feedback effects do not exist (see Box et al., 2015; Enders, 2015, pp. 267-289). The residuals from Eq. \((19)\) are regarded as the filtered values of the terrorism series, which are interpreted as pure innovations in the terror sequence used for calculating dynamic multiplier responses.\footnote{Dynamic multiplier responses are otherwise known as impulse responses in the case of a VAR where all variables are endogenous in the system.}

The results from the transfer function and two-stage least squares estimates of the impact of terrorism on the log of GDP per capita are presented in Table \(3\). The pattern of the right-hand side coefficients, which appear in the ARDL, are informed by two
Table 3: Transfer function weights and 2SLS estimates of terrorism and growth

<table>
<thead>
<tr>
<th></th>
<th>Agg. Terror Index</th>
<th>Terror Incidence</th>
<th>Terror Fatalities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Impact Effect</td>
<td>Long-run Effect</td>
<td>Impact Effect</td>
</tr>
<tr>
<td>( \Delta \ln GDP_{pc,t-1} )</td>
<td>0.305* (0.159)</td>
<td>0.331** (0.159)</td>
<td>0.297* (0.161)</td>
</tr>
<tr>
<td>( \Delta e_{\text{Terrorism},t-3} )</td>
<td>-0.913** (0.448)</td>
<td>-1.385** (0.668)</td>
<td>-0.774* (0.422)</td>
</tr>
<tr>
<td>( \Delta \ln \text{Inv./GDP}_{t-1} )</td>
<td>0.0869 (0.260)</td>
<td>0.118 (0.262)</td>
<td>0.0710 (0.264)</td>
</tr>
<tr>
<td>( \Delta \ln \text{Nat.Res./GDP}_{t} )</td>
<td>0.0790 (0.080)</td>
<td>0.0482 (0.079)</td>
<td>0.0726 (0.080)</td>
</tr>
<tr>
<td>( \Delta \ln \text{Inflation}_{t-3} )</td>
<td>-0.139*** (0.046)</td>
<td>-0.143*** (0.046)</td>
<td>-0.137*** (0.046)</td>
</tr>
<tr>
<td>( \Delta \ln \text{Opn/GDP}_{t} )</td>
<td>0.0870 (0.059)</td>
<td>0.100 (0.058)</td>
<td>0.0858 (0.060)</td>
</tr>
<tr>
<td>( \Delta \ln \text{Pol.regime}_{t-2} )</td>
<td>3.765** (1.540)</td>
<td>3.794** (1.536)</td>
<td>3.765** (1.564)</td>
</tr>
<tr>
<td>( \text{Constant} )</td>
<td>2.074 (1.213)</td>
<td>1.935 (1.209)</td>
<td>2.087 (1.233)</td>
</tr>
</tbody>
</table>

Robust standard errors are reported in parentheses when available: *, **, and *** are symbols for the 10, 5 and 1 percent significant levels respectively.

Our results are generally consistent with the theoretical prediction that terrorist activities negatively affect economic growth. Moreover, the impact of terrorism on economic activity is similar when we use different measures of terrorism; there are only slight differences in the magnitude of the coefficients and the strength of significance. In particular, when terrorist activity is measured using the composite terror index, the coefficient is \(-0.91\), indicating that terrorist incidence decreases GDP per capita growth by approximately 0.9 percentage point on impact, and by approximately 1.3 percentage points in the long run. Although the estimated impact may seem small, it is slightly higher than the global average impact of 0.56 percentage points estimated by Blomberg, Hess and Orphanides (2004).

\(^{14}\text{The } Q\text{-statistic is given as } Q = T(T + 2) \sum_{i=0}^{k} \rho_{yz}(i)/(T - k), \text{ where } \rho_{yz}(i) \text{ denotes the sample cross-correlation coefficient between any two variables at period } t \text{ and } t - i.\)
and the Western European average of 0.2 percentage points in Gaibulloev and Sandler (2008), but directly comparable to the estimates by Mehmood (2014) for Pakistan. When compared to the global average, the higher impact of terrorism on growth in Nigerian helps to buttress the idea that weak institutions and technical capacity may undermine the ability of developing countries to adequately mitigate the macroeconomic consequences of terrorism.

Figure 2: Dynamic multiplier responses and 95% Bootstrap Error Bands.

Next, we investigate whether this comparatively stronger impact of terrorism in Nigeria is a result of potential endogeneity problems by estimating the relationship using 2SLS internal-instrumentation based technique—the most likely answer from our results is, no. Apart from minuscule differences, the results from the time series model generally hold true in the 2SLS specification too (compare the second and last columns in Table 3). This provides robustness for the conclusion that terrorist events have modest negative effects on economic activity in Nigeria, and this effect is comparatively larger than the global and the European average, but comparable to the Pakistani average, as previously noted.

An important feature of the effect of terrorism on growth in Nigeria is the delay factor. 

15We use an internal instrumentation strategy for the 2SLS approach—that is, the instrumental variable for terrorism, the potentially endogenous explanatory variable, is obtained as the fitted value from the regression of terrorism on all the exogenous explanatory variables.
The results show that the effects of terrorism on growth only begin to manifest after a lag of about three years. Moreover, insofar as the autoregressive part of the distributed lag model—i.e., the coefficient on GPP\textsubscript{pc}—is 0.3 and is significant at conventional levels, it indicates that the memory (or persistence) of the response of GDP\textsubscript{pc} to any terrorist event is important, and the rate of decay given by the AR(1) coefficient is somewhat fast.

The impulse responses, or more appropriately, the dynamic multiplier functions, measure the impact of a unit change in the terrorism on GDP\textsubscript{pc} growth. In Panels 1 and 2 of Figure 2, we display the dynamic multiplier functions (impulse responses) of a one-unit shock to the innovations of terrorism on the time path of GDP\textsubscript{pc} and terrorism, and in Panels 3 and 4 of Figure 2, we display the dynamic multipliers for a one standard deviation shock to GDP\textsubscript{pc} along with the 95 percent bootstrap error bands. In Panel 1 of Figure 2, we see that the response of GDP\textsubscript{pc} growth to a terrorism shock corroborates the regression results. In particular, notice that the negative response of GDP\textsubscript{pc} to a terror shock only begins to manifest around the third period, and quickly dies out to zero somewhere around the sixth period, implying that terrorism only has a temporary effect on economic activity in Nigeria after a short lag. Similarly, in Panel 2 of Figure 2, we see that, apart from the small spike around the fifth year, the response of terrorism to a terrorist shock declined rapidly and monotonically, revalidating the low memory and stationarity properties of the terrorism series.

Next, we examine the signs and significance of the standard growth determinants and control variables included in the regressions of Table 3, following the growth regression traditions (Barro, 1996; Sachs and Warner, 1997). Generally, all the signs of the control variables included agree with the conclusions from standard growth theory and literature. In particular, investments, natural resource rents, and openness are conducive to per capita growth, whereas, inflation is inimical to growth, although some of the variables are not statistically significant at conventional levels. Interestingly, unlike the results in typical cross-country literature, where institutional variables tend to be fragile in their ability to statistically influence economic growth, our findings show that the effect of the political regime—0 for military regimes and 1 for democracies—on economic growth in Nigeria, is not only positive but economically and statistically significant in all specifications. In short, democratic regimes have a positive and non-trivial impact on GDP\textsubscript{pc} growth.

### 6.2 Counterfactuals: Growth with and without terrorism

In endeavouring to examine possible counterfactual scenarios, we ask two questions: (i) if there was no terrorism in Nigeria, what would have been the path and level of GDP per capita between 1980 and 2014? (ii) what is the cumulative cost of terrorism in the last three decades, in terms of lost GDP? Using the methodology described in Section 4, we compute the path for GDP\textsubscript{pc}\textsubscript{hpo,t} = GDP\textsubscript{pc}\textsubscript{t} + (\beta\textsubscript{terror} \times C\textsubscript{Terror}\textsubscript{t}), where GDP\textsubscript{pc}\textsubscript{hpo,t}
is hypothetical GDP at time $t$ and $\beta_{\text{terror}}$ is the estimated terror coefficient from Table 3. The results for this computation are plotted in Figure 3 along with the actual GDP per capita over the same period. We see that, apart from the short-lived spikes observed in the 1990s, the hypothetical trajectory of GDPpc without terrorism, closely follows the actual trajectory, except for the last decade—2005 to 2014—where the difference starts to become noticeable. This pattern corroborates the earlier conclusion about the small and temporary effect of terrorism on economic activity in Nigeria.

To obtain the aggregate cost of terrorism to the Nigerian economy in terms of lost GDP over the last three decades, we first obtain the cumulative percentage points increase in terrorism and the cumulative percentage points increase in GDP per capita between 1980 and 2014—that is, 37.2 and 86.3, respectively. Next, using the coefficient on the aggregate terror index in Table 3, we apply the data to Eq. (17), so that the computed cumulative percentage increase in hypothetical GDPpc is 119.78, computed as $86.3 + (0.9 \times 37.2)$, which is used to compute the combined output gap from terrorism for the same period, thus:

$$\frac{119.78 - 86.3}{119.78} = 27.95\%$$

Hence, we conclude that the cumulative cost of terrorism to Nigeria, in the last three decades, has been somewhere around 28 percent of GDPpc, which is bounded by the 95 percent confidence band of 19.15 percent and 36.75 percent. This roughly implies that the average annual cost of terrorism to Nigeria, in terms of lost GDP, is somewhere around

\[\text{Mehmood (2014) uses a similar methodology to estimate the cumulative cost of terrorism in Pakistan and found that between 1973 and 2008, terrorism cost Pakistan somewhere around 33.02\% in terms of lost GDP.}\]
0.82 percent (a little less than one percent) per annum.\textsuperscript{17}

### 6.3 Reallocation and fiscal composition effects

Does terrorism lead to a reallocation of economic activity? The literature has identified several possible channels by which terrorism could have first-round effects on aggregate economic activity before the second-round effects on aggregate economic growth eventually materialize. For example, it could work through the destruction of human and physical productive capital; it could also work through the distortion of households’ and firms’ optimal savings and spending plans, or through the reallocation of spending from presumably more productive investment spending to presumably less productive spending on national security. Though an attempt to uncouple all the possible channels in operation would be a tedious exercise, it is, however, possible to examine the extent to which domestic investments and government spending are affected by terrorism.

<table>
<thead>
<tr>
<th></th>
<th>Terror Index</th>
<th>Terror Incidence</th>
<th>Terror Fatalities</th>
<th>2SLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta \text{Inv.}/\text{GDP}_{t-1}$</td>
<td>-0.0874</td>
<td>-0.110</td>
<td>-0.0831</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.172)</td>
<td>(0.175)</td>
<td>(0.172)</td>
<td></td>
</tr>
<tr>
<td>$\Delta e_{\text{Terrorism}}_{t-3}$</td>
<td>-0.621**</td>
<td>-0.821*</td>
<td>-0.583**</td>
<td>-0.634**</td>
</tr>
<tr>
<td></td>
<td>(0.282)</td>
<td>(0.416)</td>
<td>(0.263)</td>
<td>(0.276)</td>
</tr>
<tr>
<td>$\Delta \text{lnGDP}_{pct-1}$</td>
<td>0.128</td>
<td>0.149</td>
<td>0.131</td>
<td>0.125</td>
</tr>
<tr>
<td></td>
<td>(0.104)</td>
<td>(0.105)</td>
<td>(0.104)</td>
<td>(0.102)</td>
</tr>
<tr>
<td>$\Delta \text{Nat. Res.}/\text{GDP}_{t-1}$</td>
<td>0.104**</td>
<td>0.0823</td>
<td>0.102**</td>
<td>0.104**</td>
</tr>
<tr>
<td></td>
<td>(0.051)</td>
<td>(0.052)</td>
<td>(0.051)</td>
<td>(0.050)</td>
</tr>
<tr>
<td>$\Delta \text{Inflation}_{t-2}$</td>
<td>-0.0297</td>
<td>-0.0305</td>
<td>-0.0299</td>
<td>-0.0262</td>
</tr>
<tr>
<td></td>
<td>(0.031)</td>
<td>(0.032)</td>
<td>(0.031)</td>
<td>(0.030)</td>
</tr>
<tr>
<td>$\Delta \text{Opn}/\text{GDP}_t$</td>
<td>0.108***</td>
<td>0.0997**</td>
<td>0.113***</td>
<td>0.114***</td>
</tr>
<tr>
<td></td>
<td>(0.040)</td>
<td>(0.041)</td>
<td>(0.041)</td>
<td>(0.038)</td>
</tr>
<tr>
<td>$\text{Lending rate}_{t-1}$</td>
<td>-0.0505</td>
<td>-0.0666</td>
<td>-0.0467</td>
<td>-0.0589</td>
</tr>
<tr>
<td></td>
<td>(0.119)</td>
<td>(0.121)</td>
<td>(0.119)</td>
<td>(0.116)</td>
</tr>
<tr>
<td>$\text{Constant}$</td>
<td>-0.0749</td>
<td>0.103</td>
<td>-0.169</td>
<td>0.118</td>
</tr>
<tr>
<td></td>
<td>(2.286)</td>
<td>(2.334)</td>
<td>(2.282)</td>
<td>(2.214)</td>
</tr>
</tbody>
</table>

Robust standard errors are reported in parentheses when available: *, **, and *** are symbols for the 10, 5, and 1 percent significant levels respectively.

\textsuperscript{17}This is obtained by the following division $28/34$
An increase in government expenditure to GDP ratio combined with a decline in the investment to GDP ratio would be consistent with the hypothesis that terrorism leads to a reallocation of resources away from the accumulation of productive capital, through reduced investments, towards increased spending on national security, which is potentially less productive (see Koh, 2007). The results for this investigation are presented in Table 4 and Table 5. The estimated equations are similar to the baseline equation presented in Table 3, the only difference being that we now use investment in GDP and expenditure in GDP as the respective dependent variables. Moreover, we also include the lending rate as one of the explanatory variables in the investment equation.

The results from the investment equation in Table 4 are quite revealing. First, we note that terrorism has a moderate negative and a statistically significant impact on the investment ratio, somewhere around two-thirds of a percentage point (when using the aggregate terror index). Other significant determinants of investments are natural resource rents in GDP and the level of openness, both of which are conducive to higher levels of investments. Focusing on the results from the government expenditure equation presented in Table 5, there is evidence that terrorism positively induces greater government spending, although this evidence is not statistically significant. The positive impact being around one-fifth of a percentage point. Further, the results show that natural resource rents and our measure of political regime are significant determinants of government expenditure in Nigeria.

Being cautious about imposing any structural interpretation on the results, especially because the terrorism variable is not statistically significant, we are able to say something about the net effect of the impacts of terrorism on overall spending in the domestic economy. Notice that the induced fall in the investment ratio as a result of terrorism is about 0.6 percentage point, while the increase in government spending is only about 0.2 percentage point. Therefore, when these opposite effects are taken together, the negative effect of terrorism on economic activity may be operating by crowding-out investments at a rate faster than its potential to crowd in government spending.

One possible reason why the observed crowding-in effect of terrorism on aggregate government expenditure in GDP is not statistically significant could be because of the multifaceted and dynamic nature of the composition of government expenditure in Nigeria, which is masked when considered as a share of GDP at the aggregate level. For this reason, we also use an alternative measure—the share of defence expenditure in total government expenditure. Table 6 contains the results from the estimation of the effect of terrorism on the share of defence expenditure in total expenditure. We see that terrorism alters the composition of government expenditure by inducing more spending on defence and military components vis-a-vis other components of government spending. This composition effect is somewhere around half of a percentage point, and it is statistically significant. Further, the positive and statistically significant effect of natural resource rents on the share of defence
Table 5: Transfer function weights and 2SLS estimates of terrorism and government expenditure

<table>
<thead>
<tr>
<th></th>
<th>Terror Index</th>
<th>Terror Incidence</th>
<th>Terror Fatalities</th>
<th>2SLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\Delta \text{Exp./GDP}_{t-1})</td>
<td>-0.148</td>
<td>-0.168</td>
<td>-0.145</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.158)</td>
<td>(0.155)</td>
<td>(0.158)</td>
<td></td>
</tr>
<tr>
<td>(\Delta e\text{Terrorism}_{t-3})</td>
<td>0.198</td>
<td>0.231</td>
<td>0.195</td>
<td>0.249</td>
</tr>
<tr>
<td></td>
<td>(0.312)</td>
<td>(0.437)</td>
<td>(0.294)</td>
<td>(0.287)</td>
</tr>
<tr>
<td>(\Delta \ln\text{GDPpc}_{t-1})</td>
<td>0.0926</td>
<td>0.103</td>
<td>0.0908</td>
<td>0.0592</td>
</tr>
<tr>
<td></td>
<td>(0.100)</td>
<td>(0.098)</td>
<td>(0.100)</td>
<td>(0.094)</td>
</tr>
<tr>
<td>(\Delta \text{Nat. Res./GDP}_t)</td>
<td>0.175***</td>
<td>0.179***</td>
<td>0.174***</td>
<td>0.171***</td>
</tr>
<tr>
<td></td>
<td>(0.056)</td>
<td>(0.055)</td>
<td>(0.056)</td>
<td>(0.056)</td>
</tr>
<tr>
<td>(\Delta \text{Inflation}_{t-2})</td>
<td>0.0189</td>
<td>0.0160</td>
<td>0.0194</td>
<td>0.0270</td>
</tr>
<tr>
<td></td>
<td>(0.033)</td>
<td>(0.032)</td>
<td>(0.033)</td>
<td>(0.032)</td>
</tr>
<tr>
<td>(\Delta \text{Opn/GDP}_t)</td>
<td>0.0160</td>
<td>0.0164</td>
<td>0.0152</td>
<td>0.0230</td>
</tr>
<tr>
<td></td>
<td>(0.040)</td>
<td>(0.040)</td>
<td>(0.040)</td>
<td>(0.039)</td>
</tr>
<tr>
<td>(\text{Pol.regime}_{t-1})</td>
<td>1.095***</td>
<td>1.040***</td>
<td>1.098***</td>
<td>1.219***</td>
</tr>
<tr>
<td></td>
<td>(0.095)</td>
<td>(0.097)</td>
<td>(0.095)</td>
<td>(0.083)</td>
</tr>
<tr>
<td>Constant</td>
<td>-1.165</td>
<td>-1.191</td>
<td>-1.155</td>
<td>-1.063</td>
</tr>
<tr>
<td></td>
<td>(0.735)</td>
<td>(0.737)</td>
<td>(0.735)</td>
<td>(0.726)</td>
</tr>
</tbody>
</table>

Robust standard errors are reported in parentheses when available: *, **, and *** are symbols for the 10, 5, and 1 percent significant levels respectively.

expenditure also holds here as in the aggregate expenditure equation, although the effect using the share of defence expenditure in total government expenditure is minuscule.

### 6.4 Dynamic interactions

In the analysis presented so far, dynamic interactions between terrorism and the macroeconomic variables were switched off a priori. We now consider the possibility that this relationship may have been either confounded or misattributed by exploring potential dynamic interactions among macroeconomic variables. The results from the structural VAR estimation, using the identification strategy specified in Eq. (18), is presented in Figure 4. Our identification approach is based on the use of economic intuition and the statistical information from the already estimated models to examine possible sets of eligible restrictions on the model, and then use over-identifying restrictions test to arrive at a plausible choice for the relationship. In particular, we estimate a 4-variable structural
Table 6: Transfer function weights and 2SLS estimates of terrorism and defence expenditure

<table>
<thead>
<tr>
<th></th>
<th>Terror Index</th>
<th>Terror Incidence</th>
<th>Terror Fatalities</th>
<th>2SLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>∆Defence/GDP&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>-0.160</td>
<td>-0.144</td>
<td>-0.165</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.215)</td>
<td>(0.223)</td>
<td>(0.218)</td>
<td></td>
</tr>
<tr>
<td>∆eTerrorism&lt;sub&gt;t-3&lt;/sub&gt;</td>
<td>0.455***</td>
<td>0.473***</td>
<td>0.399***</td>
<td>0.230***</td>
</tr>
<tr>
<td></td>
<td>(0.009)</td>
<td>(0.004)</td>
<td>(0.008)</td>
<td>(0.064)</td>
</tr>
<tr>
<td>∆lnGDP&lt;sub&gt;pc&lt;/sub&gt;&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>0.0184</td>
<td>0.0203</td>
<td>0.0187</td>
<td>0.328</td>
</tr>
<tr>
<td></td>
<td>(0.022)</td>
<td>(0.022)</td>
<td>(0.022)</td>
<td>(0.307)</td>
</tr>
<tr>
<td>∆Nat. Res./GDP&lt;sub&gt;t-2&lt;/sub&gt;</td>
<td>0.0605***</td>
<td>0.0620***</td>
<td>0.0617***</td>
<td>0.0126***</td>
</tr>
<tr>
<td></td>
<td>(0.006)</td>
<td>(0.006)</td>
<td>(0.006)</td>
<td>(0.008)</td>
</tr>
<tr>
<td>∆Opn/GDP&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>0.00621</td>
<td>0.00712</td>
<td>0.00607</td>
<td>0.0810</td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
<td>(0.005)</td>
<td>(0.005)</td>
<td>(0.073)</td>
</tr>
<tr>
<td>Pol.regime&lt;sub&gt;t-2&lt;/sub&gt;</td>
<td>-0.180</td>
<td>-0.160</td>
<td>-0.179</td>
<td>-1.029</td>
</tr>
<tr>
<td></td>
<td>(0.125)</td>
<td>(0.129)</td>
<td>(0.127)</td>
<td>(0.883)</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.000735</td>
<td>-0.0279</td>
<td>-0.00356</td>
<td>-1.788</td>
</tr>
<tr>
<td></td>
<td>(0.148)</td>
<td>(0.151)</td>
<td>(0.149)</td>
<td>(1.732)</td>
</tr>
</tbody>
</table>

Robust standard errors are reported in parentheses when available: *, **, and *** are symbols for the 10, 5, and 1 percent significant levels respectively.

The impulse responses and the corresponding 95 percent bootstrap error bands are presented in Figure 4. In Panel 1 of Figure 4, we see that the response of GDP per capita to a terror shock becomes negative after about three periods, and is less pronounced when compared to the previous static model. Further, we observe in Panels 2 and 3 that there is a short-lived contemporaneous increase in defence expenditure and a decrease in investments in response to a terror shock. In Panel 4, we plot the dynamic responses of investments to a shock in government expenditure, which shows that the contemporaneous positive response of investments provides evidence for the existence of complementarities between government spending and private sector investments in the economy, although this is not large. In other words, government spending seems to crowd in investments spending.

Overall, because the findings from the structural VAR model, which also accounts for dynamic interactions, corroborate the earlier results, it provides an extra layer of validation.
by confirming that the negative effects of terrorism on growth and its reallocation and composition effects are robust to allowing for dynamic interactions between terrorism and the macroeconomic variables.

7 Policy implications and conclusion

This study examines the political economy of terrorism in Nigeria and follows up by investigating the macroeconomic consequences of terrorism, especially as it affects growth and government fiscal behaviour. Different measures of terrorism are used, including a composite terror index, the number of incidents, the number of fatalities, and the number of injured—all of which are reported in the Global Terrorism Database. The empirical strategy involves the use of transfer function weights estimated within an ARDL framework, two stage least squares regressions and structural VAR models to uncouple the terrorism macroeconomy relationship for Nigeria.

The results from the study can be summarized in three main findings. First, we find that terrorism has an economically and statistically significant negative impact on growth; although this impact is considerably small and short-lived, it only manifests after a lag of about three years. Secondly, there is evidence, albeit not statistically robust, of terrorism leading to the reallocation of economic activity away from investments spending to government spending. Specifically, terrorism crowds out investments at a rate
greater than its potential to crowd in government spending. Thirdly, there is evidence that terrorism alters the composition of government expenditure—that is, the defence component of government expenditure rises vis-a-vis other expenditure items with higher levels of terrorism. The results are robust to allowing for dynamic interactions between terrorism and macroeconomic aggregates.

Finally, to the extent that the nature of terrorism in Nigeria is evolving in ways that are difficult to capture with numbers, it is important to draw policy implications from the results with some degree of caution. For one thing, the results suggest that the impact of terrorist activities should be systematically taken into account when preparing government budgeting and expenditure plans. Further, there is evidence that regime stability, greater economic diversification, and openness help to mitigate the negative consequences of terrorism; hence, policies that encourage trade openness in items that are not considered risky for national security should be encouraged.
References


