Terrorism and the macroeconomy: Evidence from Pakistan

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ABSTRACT

Pakistan with highest number of terrorism related deaths of any country over the past decade, the number exceeding the total terrorism related deaths for both the European and North American continents, provides an ideal laboratory to study impact of terrorism on the macroeconomy (GTD, 2012). Quasi-Structural VAR, VECM, Impulse Response Functions and Granger-Causality tests on a sample that covers over 4500 terrorist incidents and consequent 10, 200 deaths [from 1973 to 2010] are employed to study the relationship between terrorism and the macroeconomy. One of the major advantages of the current methodology is that it not only enables one to circumvent the heterogeneity biases inherent in cross-country studies but it also allows distinguishing between short and long-run effects. It is documented that cumulatively terrorism has cost Pakistan around 33.02 % of its real national income i.e. terrorism costs Pakistan around 1 % of real GDP per capita growth every year.

Keywords: Terrorism, macroeconomy, developing country, Pakistan

JEL Code: E0; H56; O5

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INTRODUCTION

Studies on the impact of terrorism on the economy have exclusively focused on developed countries (see e.g. Eckstein and Tsiddon, 2004; Enders and Sander, 1996). This is surprising because developing countries are not only hardest hit by terrorism, but are more responsive to external shocks. Terrorism in Pakistan, with magnitude greater than Israel, Greece, Turkey, Spain and US combined[1] in terms of incident and death count, has consistently hit news headlines across the world. Yet, terrorism in Pakistan has received relatively little academic attention[2]. Only recently (post 9/11), due to the strategic importance of 'war on terror' for the economic powers of the world and much higher death rates, terrorism in Pakistan has attracted more local and global attention. The nations in the NATO alliance (North Atlantic Treaty Organization) have secured their borders against terrorism through a proactive counterterrorism strategy, which has resulted in increased terrorist activities in logistically easier targets such as Pakistan. Various game theoretic analyses and empirical studies make the point that terrorists move to softer or easier targets when the probability of success of traditional targets decreases. For example, the installation of metal detectors at airports deflected terrorism targets from skyjacking, towards logistically easier activities of hostage taking and assassinations (Enders and Sandler, 1993).

The persistence of the problem of terrorism did not stimulate the government or academics of the country to undertake a thorough examination of the costs of terrorism. No systematic study focuses on estimating the loss to aggregate economic variables. Some data are presented on cost of terrorism in Pakistan (For example, see IMF PRSPP, 2010, p.3 and Pakistan Economic Survey, 2011), but they are crude estimates without much scientific basis (for example, both are subjective estimates by government officials). This dearth of comprehensive analysis of terrorism in Pakistan limits policy makers and academics' ability to formulate and test hypotheses, to conduct operational planning and to take effective counterterrorism measures for Pakistan, a point also noted by Hussain (2010). Furthermore, the conclusions from most of the studies on economic impact of terrorism cannot be readily applied to Pakistan as they are cross-country analyses where various country-specific factors are naturally ignored. These studies are especially prone to heterogeneity bias. In their seminal article, Blomberg, Hees and Orphanides (2004) note that controlling for various country specific effects by including dummy variables in their cross-country growth regressions to study the impact of terrorism on an economy are "crude" estimations at best. Enders and Sandler (2006) also note that different "institutional structures and levels of terrorism" make cross-country analysis of terrorism suspect (Enders and Sandler, 2006 p.214). It is posited here that the study of terrorism and its impact on economy should be made on a case-by-case basis. This paper estimates the economic costs of terrorism for Pakistan with particular focus on post 9/11 costs.

[1] The mentioned countries are thought to be biggest victims of terrorism and have received the most academic attention.

[2] The notable analysis of Hussain (2010) on the spatial patterns of terrorist attacks stands out.

The case of Pakistan is unique for studying the impact of terrorism on the economy for a number of reasons. Firstly, Pakistan has a long and intense history of terrorism[3] which allows one to capture the effect on the economy in the long run. Secondly, growth retarding effects of terrorism are hypothesized to be more pronounced in developing rather than developed countries (Blomberg et al, 2004; Frey, Luechinger and Stutzer, 2007). Thirdly, the Pakistani economy is exceptionally vulnerable to external shocks with 12 IMF programmes during 1990-2007 (IMF, 2010; 2011). Lastly, the case study of terrorism for a developing or least developing country is yet to be done. Scholars of the Copenhagen Consensus 2008 studying terrorism note the "need for additional case studies, especially of developing countries" (Enders and Sandler, 2008 p.31). This research attempts to fill this void.

Post 9/11, in a short span of around 10 years, many studies on terrorism and its economic consequences have been conducted and terrorism has been theorized to adversely affect the economy through various channels. For example, it is hypothesized to have an adverse effect on GDP through loss in savings through reduction in FDI and tourism revenues (Enders and Sandler, 1996; Enders, Parise and Sandler, 1992), reallocation of resources from consumer and investment spending to relatively unproductive military spending (Blomberg et al., 2004; Eckstein and Tsiddon, 2004). It can have negative repercussions on the financial sector by increasing transaction costs (Eldor and Melnick, 2004; Johnston and Nedelescu, 2006) and can cause a reduction in bilateral trade through tightening of border controls (Nitsch and Schumarcher, 2004). In the current study, these channels are carefully explored by the means of a Quasi-Structural VAR (Enders, 2010). Ocal and Yildrim (2010) distinguish the impact of terrorism on the economy into three separate time periods. The first is the short-run direct effect of destruction of factors of production. Second is the medium-run effect of loss in consumer and investor confidence. And third is the long-run loss in productivity due to increase in transaction costs due to higher risk premiums and counterterrorism related expenditures. Given the long history of terrorism and concentration of terrorism in economic hubs[4] for Pakistan, there it can be expected that the adverse effects of terrorism on growth would not just be profound but would be felt through both the short and long run channels. In the presence of a cointegrating relationship, the short-run effects can be evaluated by Vector Error Correction extension of the Quasi-Structural VAR, where significant lagged differenced estimates capture the short run effects, while the statistical significance of error correction term signify the long-run effects (see e.g. Verbeek, 2008).

The results of the estimations suggest that terrorism has cost Pakistan around 33 .02 percent of its real national income over the sample time period of 1973 to 2008, with the adverse impact mainly stemming from fall in domestic investments and lost workers' remittances from abroad. This averages to a per annum loss of around 1 % of real GDP per capita growth. Moreover, VECM estimates show that terrorism impacts the economy primarily through medium and long run channels. The article also finds that the negative effect of terrorism

[3] The first recorded events date back to the birth of the nation when the first Prime Minister of Pakistan was shot dead in October 1951. Moreover, during the sample period under study more than 4500 terrorist incidents were recorded (CIA declassified documents, 2000; GTD, 2012).

[4] According to Global Terrorism Database (2011) from 1973-2008 around 65% of terrorist violence was in the four provincial capitals.

lasts for at least 2 years for most of the macroeconomic variables studied, with the adverse effect on worker remittances, a hitherto ignored factor, lasting for 5 years. The results are robust to different lag length structures, policy variables, structural breaks and stability tests. Furthermore, it is shown that they are unlikely to be driven by omitted variables, or [Granger type] reverse causality. Hence, the article finds evidence that terrorism, particularly in emerging economies, might pose significant macroeconomic costs to the economy.

The rest of the article is organized as follows. Section 2, provides a historical background of terrorism in Pakistan. This is followed by a section on theoretical framework outlining the most important theoretical contributions on terrorism and the macroeconomy. Section 4 describes the data, while section 5 discusses the empirical methodology and provides the VAR estimations. This follows a section on the sensitivity of results where various econometric and economic robustness checks are performed. Next two sections are devoted to an analysis of counter-factual scenarios and persistence of terrorism. The penultimate section discusses the main results in light of theory and recent evidence. A final section provides some concluding remarks.

HISTORICAL BACKGROUND AND OVERVIEW

Terrorism[5] in Pakistan, influenced by various global and local events, went through various evolutionary stages. In 1977, General Zia-ul-Haque came to power through a military coup and arrested and later executed the then Prime Minister Zulfiqar Ali Bhutto. This led to a formation of a terrorist out-fit named Al-Zulfiqar. In order to quash the terrorist outfit and Mr Bhutto's popularity in his home province, General Zia created an ethnic based militant political party in his province, composed of immigrants from India, the Muhajir Qaumi Movement (MQM). Terrorism by and against MQM has accounted for around 40 per cent of all terrorist violence in the country since its formation (Fair, 2004). General Zia, to establish his own constituency and legitimize his rule, also enforced some strict Islamic laws in the country based on a certain Sunni jurisprudence. The Iranian revolution encouraged the minority religious sect (Shias) in Pakistan, to openly protest against the Sunni interpretation of laws and demanded that they should be exempt from the law. General Zia, responded again, by creating an anti-Shia religious militant organization (Sipah-e-Sahaba). The SSP gave rise to many splinter terrorist groups. Around 30% of all terrorism in Pakistan can be traced back to SSP, including the current wave of suicide terror attacks post 9/11 (Hussain, 2010). Another factor greatly influencing the evolution of terrorism in Pakistan is the Soviet Invasion of Afghanistan in 1979. To counter the Soviet threat, the US injected around six

[5] To qualify for an act to be considered terrorism the following GTD criteria had to be fulfilled:

1. The violent act was aimed at attaining a political, economic, religious, or social goal;
2. The violent act included evidence of an intention to coerce, intimidate, or convey some other message to a larger audience (or audiences) other than the immediate victims; and
3. The violent act was outside the precepts of International Humanitarian Law.

billion dollars into the region to fight the Soviets (Weiner, 1998). After the soviet withdrawal in 1989, the US left the region with thousands of battle hardened and armed militants who, ironically, turned against Pakistan and the US after 9/11.

The terrorism in Pakistan went through two major stages (see figure 1). The first stage occurred with coinciding of ethnic and sectarian terrorism as a consequence of formation of MQM and separatist movements in Baluchistan (one of Pakistan's four provinces). The second stage was one of religious terrorism, which was a consequence of incurring the wrath of militants because of Pakistan's support for US in its war against terror. As can be seen in figure 5, recent wave of terror has been much more deadly in terms of fatalities[6]. For example, from 1973-2001, average terrorism induced deaths per year were around 125, whereas from 2001-2008, the death toll had risen more than three-fold with over 480 fatalities per year.

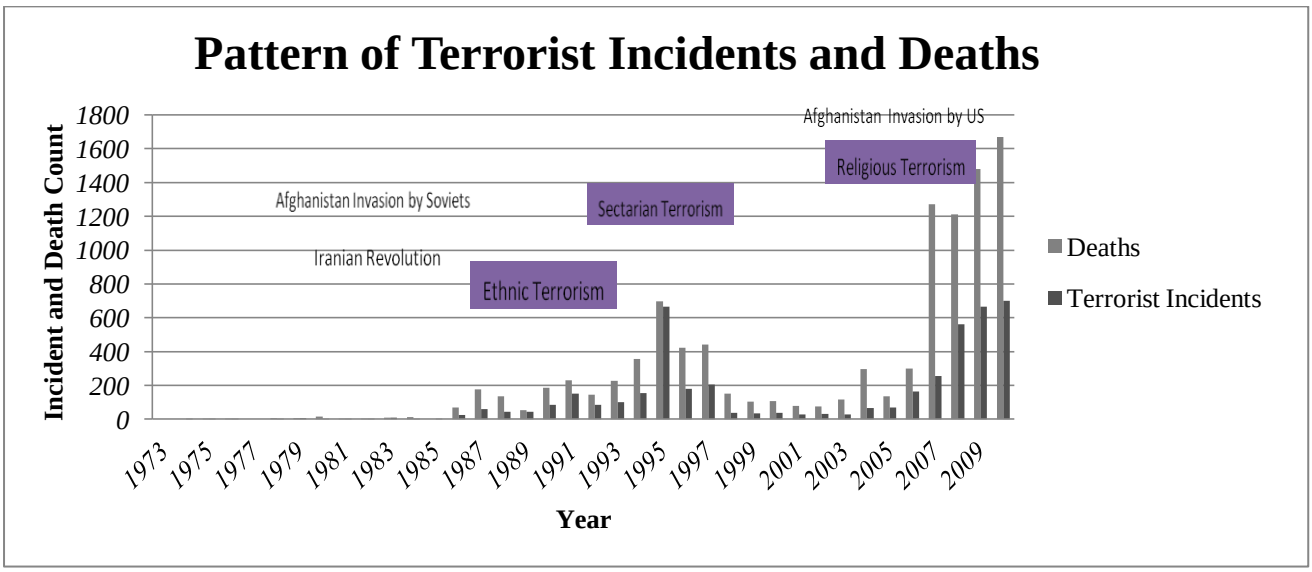

Figure 1 Evolution of Terrorist incidents and terrorism induced deaths in Pakistan from 1973-2010[7].

Abadie and Gardeazabal (2008) note that the losses through the open economy channels due to terrorism might be limited if investors have opportunities to diversify their portfolio domestically. Such an opportunity is apparently not available to investors in Pakistan, especially when we observe the spatial distribution of the terrorist events. Hussain (2010) studies the geographical distribution of terrorist attacks from 1974-2007 and observes that though over time the motivation of terrorism varied, its geography remained exceedingly similar. The Geographical Information System (GIS) map is reproduced in Figure 2 with incident count in the capitals given in parenthesis. Around 65 percent of terrorism in Pakistan occurred in the four provincial capitals and federal capital (Karachi: 1152, Lahore: 909, Quetta 82, Peshawar: 133 and Islamabad: 69), which is also where most of production of the country takes place. The GIS map gives us an overview on spatial distribution of terrorism in

[6] Increased death rate post 2004 was a direct result of a rise in suicide bombing.
[7] Source: Global Terrorism Database (GTD).

Pakistan and makes the point that most of the terrorism occurred at the production centres of Pakistan and contrary to the popular perception in Pakistan, most of the terrorism does not occur in the remote tribal areas in North-East. Hence, this combined with Pakistan's relative openness[8] emphasises that the adverse effects of terrorism, especially through the open economy channels cannot be ignored when studying terrorism in Pakistan.

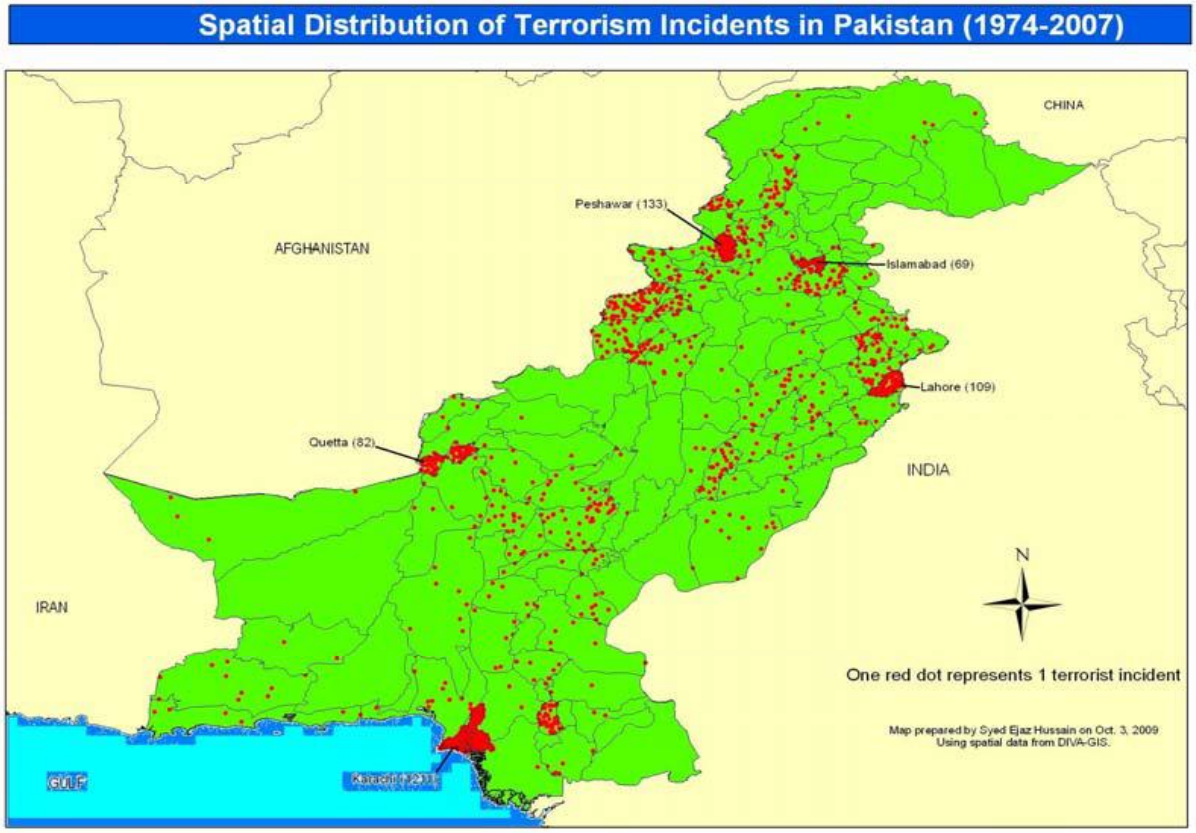

Figure 2. Terrorist Incident distribution of Pakistan for period of 1974-2007 [Hussain: 2010].

The negative association of terrorism and GDP per capita can be observed from the evolution of GDP per capita growth and terrorist risk in Pakistan over the past decades. Instead of relying on the much used measure of incident count, a terrorism risk index along the lines of Eckstein and Tsiddon (2004) is constructed that explicitly considers the magnitude of terrorist attacks by incorporating deaths and injuries in the measure[9] (See A.1 for more details). Use of traditional measures of terrorist activity i.e. incident and death counts do not significantly change the results. Nevertheless, the death count and terrorism index measures gives one more efficient estimates than incident count. During our sample period the terrorism index increases by more than 700%. Moreover, on average, an increase in terrorist index by 500% corresponds to an increase of terrorist activities by 43 events and consequent 68 deaths and 135 fatal injuries.

[8] For example, trade openness ratio for Pakistan averaged around 26 per cent during our period of study.
[9] This becomes important as deaths per incident greatly varied according to the particular wave of terrorism (see Figure 1).

As can be seen in Figure 3, a period of increased terrorist risk often coincided with a period of lower income growth in Pakistan. Moreover, negative correlation coefficient between terror index and GDP per capita growth is observed. However, one should note that a dramatic increase in GDP post 9/11 is seen even with high terrorism levels. This is as a direct result of economic reforms in 2000s with a flurry of privatizations and liberalizations in 2001 by the Musharraf regime (Qayyum et al. 2008)[10]. It is of course not implied that terrorism or security situation is the only determinant of income growth. However, it is posited here that at least a part of the growth retardation is attributed to increase in terrorism. More careful econometric scrutiny will uncover that terrorism indeed exerts a large statistically and economically significant negative impact on the macroeconomy.

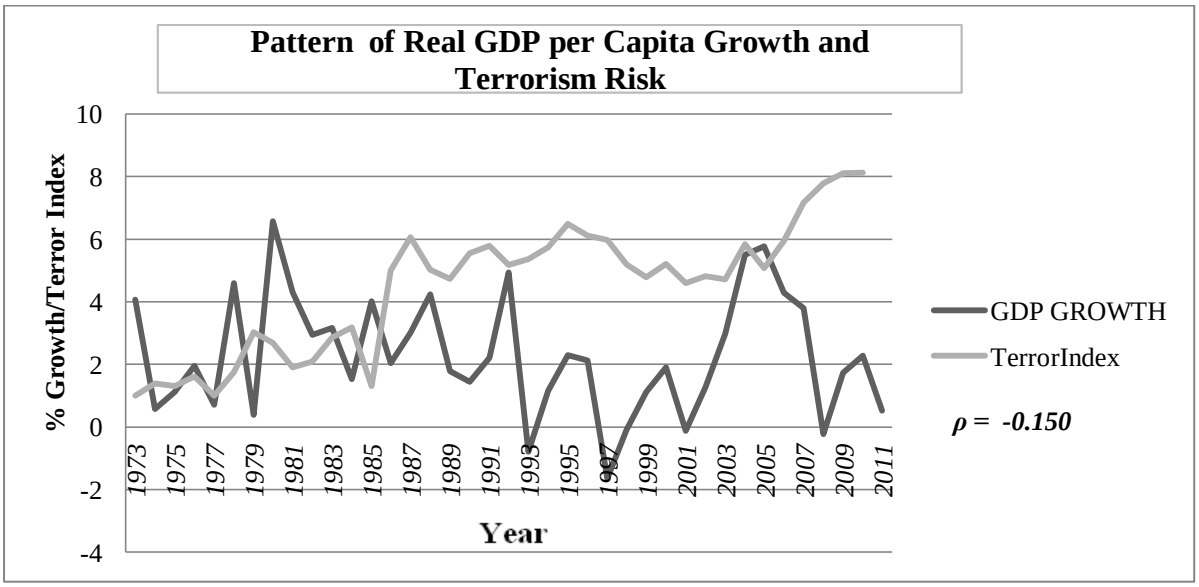

Figure 3. Terrorism Index and real GDP per capita growth in constant 2000 dollars[11] [Source WDI, GTD and own computations].

THEORETICAL FRAMEWORK

Economists have long been interested in understanding the economic consequences of conflict and war (Keynes, 1919; Robbins, 1942). Economic reasoning can be readily applied from conflict to terrorism. However, terrorism differs from conflict in the sense that several criteria need to be simultaneously fulfilled for an act to be classified as terrorism. For example, not only should the extra normal violence be perpetrated by sub-national groups and directed at an audience beyond the immediate effectee, but a political, religious or ideological motive is required (Enders and Sandler, 2006).

[10] For a detailed review on the economy of Pakistan, see Easterly (2003).
[11] Source: World Development Indicators, World Bank (WB) and Global Terrorism Data Base (GTD). Data for GDP series was available till 2011, however terrorist data was only available till 2010.

The purpose of the following two subsections is to describe the most important theoretical contributions to study the impact of terrorism on the macroeconomy. After elucidation of the two main models, its testable implications will be presented which will become the basis for choice of variables and specifications.

In the past, two formal models by Eckstein and Tsiddon (2004) and Abadie and Gardeazabal (2008) were proposed, to study impact of terrorism on the economy, each focusing on particular factors and channels through which terrorism affects the economy. The Eckstein and Tsiddon (2004) closed economy model hypothesizes an increase in total discount rate to translate into a reduction of income and other macroeconomic variables, while Abadie and Gardeazabal (2008), hereafter referred to as AG (2008), open economy model hypothesizes capital out flow to have an adverse effect on the economy. Eckstein and Tsiddon (2004) model is a closed economy framework whereas AG (2008) model assumes perfect capital mobility. Pakistan, like most countries with exports and gross capital formation averaging around 13.9 and 16.7 per cent of GDP respectively, during our period of study makes the analyses of both closed and open economy channels important. Explanations of the models follow.

Eckstein and Tsiddon Model

Eckstein and Tsiddon (2004), hereafter referred to as ET (2004), is one of the few studies that formally model the effect of terrorism on the economy[12]. ET (2004) builds on the Blanchard-Yaari Model (Yaari, 1965; Blanchard, 1985) by introducing an exogenous increase in death rate caused by terrorism. They assert changes in (perceived) life expectancy caused by terrorism adversely affect the economy through a reaction[13] by government and individuals. Governments respond to terrorism by consuming more defence goods, whereas individuals change their consumption and investment patterns. The theory predicts that the increase in probability of death caused by terrorism (which individuals translate into increase of value of present relative to future) reduces steady states level of investment in the short run and consumption and production in the long run. ET (2004) extends the Blanchard-Yaari Model by introducing terrorism and defence spending in the model. They do this by making the death rate endogenous. Now, terrorism increases the death rate which is no longer constant as in the Blanchard-Yaari model, and government can intervene to decrease the death rate by increasing counterterrorism expenditures:

$$(1)\ d = d(G);\ 1 > d(G) > 0; d'(G) < 0; d"(G) > 0; 0 < G < F; d(F(.)) > 0.$$

G and F represent government spending and total production, respectively. The model assumes that all government spending is done on production of defence which serves to produce security and decrease the (perceived) death rate. As can be seen from the structure of the model in (1), the defence production is positive, constant and financed by non-

[12] Many scholars including Walter Enders and BHO (2004) recognize the absence other formal models on terrorism and the macroeconomy.

[13] Krueger (2007) empirically explores the same phenomenon documenting an "over-reaction" by the affected governments in the face of terrorism.

distortionary lump sum tax of G and that the perceived death rate is a decreasing function of government spending.

Furthermore, the government spends only a proportion of production on defence. As productive capital is spent on defence this decreases the capital stock in present but opens up the possibility of lesser discount rate due to increased security and hence relatively higher investment in the future. An increase in terrorism will increase the perceived death rate resulting in reduced consumer confidence and higher consumption today relative to tomorrow which can now be mitigated through government buying security. Hence a rational government forgoes investment in capital stock to produce defence goods and hence buys security, as the alternative scenario would be steady state at even lower consumption and capital stock.

In the absence of government spending and terrorism, the equilibrium is at a point much lower than before as increased discount rate reduces consumption and investment in the long run. The extension by ET (2004) characterises the steady state output at an intermediate level in presence of government spending and terrorism, i.e. lesser than the equilibrium of no terrorism but higher output than that of terrorism and no government spending.

ET (2004) derive this scenario of government rationally manufacturing security and obtain equation (2) and (3)[14]:

(2) $U_i = (F(K(G)) - G) / [d(G + \rho)]$

(3) $F(K(G))' - 1 / F(K(G)) - G = d'(G)/d(G)$

Since $d'(G) < 0$ (equation 5), optimal intervention of government implies $F(K(G))' < 1$ where $F(K(G))$ and $F(K(G))'$ is net production and net marginal product respectively. The positive marginal product justifies government intervention and equilibrium at intermediate production level. The prediction of the framework is one of lower steady state capital, output and consumption in the long run but higher consumption and government spending in the short run.

Abadie and Gardeazabal Model

Before going to the empirical results, Abadie and Gardeazabal (2008) model of terrorism in an open economy setting is also worth mentioning. AG (2008) theorize that capital mobility determines the equilibrium level of output in the face of terrorism, as direct or immediate costs of terrorism in terms destruction of capital are relatively insubstantial. However, their use of cross-sectional data limits the evaluation of this assumption, which is tested by estimating a VECM here. They note that international investors have various options to diversify their portfolio; hence terrorism induces agents to move their investments to safer locations. They extend a stochastic version of the AK endogenous growth model, by introducing shocks of terrorism to the domestic economy. Terrorism reduces the mean and increases the variance (hence risk) of return on capital through two channels. First, being the

[14] See ET (2004) for all the steps involved.

direct destruction of capital and second being decrease in marginal productivity of capital through increase in terrorism intensity or terrorism risk. As the model assumes perfect capital mobility, investors will look to diversify their portfolios by moving their investments to safer venues. The equilibrium will be one of lower investment from abroad and hence lower output growth in the presence of terrorism. Hence in the VAR equations, open economy channels are incorporated i.e. whether foreign direct investments and workers remittances from abroad are impacted by terrorism. The lack of data on return and volatility of assets does not allow us to evaluate the sources of loss in these foreign investments. However, VECM extension allows one evaluate the (hypothesized negligible) short-run or immediate impact of terrorism.

The above models have at least five testable implications which can be tested with the current data:

(i) Increased terrorism will reduce domestic investment through higher death rate adjusted discount rates and hence lower steady state output growth.

(ii) Increased terrorism will induce governments to divert resources to relatively unproductive military spending.

(iii) Increased terrorism will result in larger interest rates across the economy due to increased uncertainty and hence increase consumption in the short run but decrease it in the long run.

(iv) Increased terrorism impacts open economy channels by decreasing returns on foreign investments.

(v) Direct or short-run impact of terrorism on the macroeconomy is insubstantial as the loss to real economy is propagated through low productivity and lower returns.

DATA DESCRIPTION AND RELATED ISSUES[15]

The previous section provides a theoretical base for the specifications to follow. The models provided the testable predictions regarding the various channels through which terrorism might affect the income of a country. AG (2008) emphasised a large 'indirect effect' through the external sector which are evaluated by studying the impact of terrorism on FDI, Exports, Worker Remittances from Abroad, in explaining the loss of income. ET (2004) on the other hand, in their closed economy framework, proposes a contraction of domestic investments, consumption and increased government spending to spearhead the decline in income. The results give tentative support for both models, with terrorism negatively affecting the income through a fall in domestic investments, exports, worker remittances[16]. Moreover, VECM estimates also support the AG (2008) hypothesis with negligible immediate or direct effects of terrorism.

[15] Further explanations, sources and related notes on all variables and labels can be found in Appendix A.1.
[16] See explanations in light of theoretical implications in the discussion of results.

This section describes some data issues and elaborates on some important variables used in the study. As noted earlier, scholars from Copenhagen Consensus called for case-studies of terrorism for developing countries in 2008, yet not many studies could fill in this void. This was probably due to the limited data available in developing countries, as was witnessed during the course of this study. Quarterly figures for GDP, investment, Exports were not available, whatever data that was available was highly fragmented. The data mainly came from Central Bank of Pakistan (SBP), Federal Bureau of Statistics Pakistan (FBS), Finance Ministry of Pakistan, Education Ministry and World Bank. Furthermore, data prior to 1973 was almost never available.

RGDP is the log of annual real gross domestic Product per capita obtained from Central Bank of Pakistan's Handbook of Statistics (various issues). The data for terrorism is obtained from Global Terrorism Database (GTD), maintained by the National Consortium for Study of Terrorism and Responses to Terrorism (START) at the University of Maryland. GTD data is particularly reliable when compared to other databases[17] as it is not only complied under the supervision of academics privy to technicalities of research but is also comprehensive for study of terrorism in Pakistan as the database contains vast amount of information in the form of 120 variables and considers events of all terrorist incidents as opposed to only international or transnational terrorist events. 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" (GTD website, 2012). Nevertheless, one should note two important limitations of GTD as it compiles data from various news agencies which makes it susceptible to media bias of reporting only spectacular events and the fact that GTD incident count grew rapidly from 1970s to 1980s which might also be due to increase in coding staff. One should also note that terrorism here is taken in a broader sense that includes domestic as well as transnational terrorism. This is in contrast with most studies which focus on transnational or international terrorism. Only recently, the importance of domestic terrorism is recognized. Enders, Sandler and Gaibulloev (2011) note (by comparing and cross-checking against various datasets of terrorism) that domestic terrorist incidents vastly outnumber transnational terrorist events. Hence, for any proper estimation on macroeconomic costs of terrorism for Pakistan, both domestic as well as transnational terrorist events should be taken into account. An intuitive index for terrorism in Pakistan similar to Eckstein and Tsiddon (2004) construction of the index for Israel is calculated[18]. The index equals to the logarithm (e + the average of number of terrorist incidents, terrorism induced deaths and injuries)[19]. The need for a terrorism index for Pakistan is recognized by Hussain (2010) dissertation on spatial patterns of terrorism in Pakistan. Furthermore, the index is more appropriate than the much used incident count measure as it directly accounts for the magnitude of terrorism. More importantly for the present study, incident count would

[17] South Asian Terrorism Portal is maintained by former police officer and is only available from 1988 onwards while ITERATE dataset mainly documents international terrorist incidents. See Figure G for plot of SATP and GTD incident counts.

[18] The results from the index are similar to Israeli study; hence data from Pakistan with terrorism of much higher magnitude lends additional statistical validity to the index and encourages its use elsewhere.

[19] The inclusion of exponential eliminates the problem when the average is zero and introduces a base of 1 when there is no terrorism.

fail to sufficiently capture to the atmosphere of fear, uncertainty and insecurity that is fundamental cause for agents to change their economic behaviour. The study combines insights from the closed economy, ET (2004) and Abadie and Gardeazabal (2008) which enables one to capture substantial costs of terrorism that includes domestic as well as external costs.

Based on the ET (2004) model a measure of interest rate in the economy is needed that is responsive to short-term market fluctuations to see if terrorism through increased uncertainly increased the interest rates across the whole economy. The call money rate (which represents interbank lending rate) is used as it is more responsive to market fluctuations in Pakistan given the fixed interest rate policy of Pakistan till the 1990s. Table 1 below, gives summary statistics of major variables used in the specifications to follow:

Table 1: Descriptive Statistics

	Mean	*Standard Error*	*Median*	*Standard Deviation*	*Sample Variance*	*Minimum*	*Maximum*	*Obs*
Year	1991.5	1.755942	1991.5	11.11306	111	1973	2010	38
RGDP	3.06827	0.105371	3.023145	0.632228	0.399712	1.63431	4.04605	38
Rinv	2.273742	0.113081	2.28331	0.678489	0.460347	0.701743	3.48207	36
RExp	2.172307	0.111838	2.221205	0.671026	0.450276	0.816555	3.27354	36
RCon	0.722185	0.003559	0.717014	0.021355	0.000456	0.684242	0.761833	36
Rintrate	11.09903	0.772227	10.63475	4.403768	21.46802	3.12006	22.8851	38
FDI	0 .237302	0.013062	0.245008	0.078372	0.006142	0	0.37338	38
TerrorIndex	4.245391	0.319039	4.914495	1.914233	3.66429	1	7.31081	38
Inflation	9.623951	0.930822	8.094065	5.521262	31.19145	2.91413	26.663	38
Wrem	1.184973	0.05431	1.229775	0 .33464	0.106186	0.311118	1.5885	38
GovExp	0.947676	0.027807	0.970597	0.166843	0.027837	0.576912	1.18989	36
InflationRisk	0.105263	0.050453	0	0.311012	0.096728	0	1	38
ExRateRisk	0.1935484	0.0721312	0	0.4016097	0.1612903	0	1	31

Explanation of mnemonic labels and sources can be found below in Appendix A.1.

EMPIRICAL METHODOLOGY

A variant of VAR (which is an extension of AR models in a multivariate scenario) that describes dynamic evolution of variables from their common history is employed to study the impact of terrorism on the macroeconomy. The use of VAR models allows us to move away from the tightly structured theoretical models and capture the dynamic relationship between variables. Sims (1980) has advocated the use of VAR models to explain the movements in various macroeconomic variables. A simple VAR has the advantage of not making the distinction between exogenous and endogenous variables as it considers all variables to be

endogenous. Furthermore, one does not need to impose arbitrary restrictions to ensure identification. From a statistical point of view, the use of VAR is particularly useful in prediction as factors affecting various macroeconomic variables are many and varied. The dynamic relationships, interdependencies and evolution of GDP, investment, exports are better captured by a VAR, relative to adherence to strict structural models with the added advantage of being "more parsimonious and includes fewer lags (than AR models), and that more accurate forecasting is possible" (Verbeek, 2008, p.336). There is also precedence in (Eckstein and Tsiddon, 2004; Enders and Sandler, 1993) of using VARs to estimate impact of terrorism on macroeconomic variables. The VAR is represented as follows:

$$A(L)\vec{Y} = C + \vec{\varepsilon}$$

Where, $A(L)$ is a lag polynomial equivalent to $A_1L^1 + A_2L^2 + A_3L^3 + ... + A_pL^p$, while $\vec{Y}$, $\vec{\varepsilon}$ and C are n x 1 vectors, with $\vec{Y}$ representing a vector of endogenous variables, $\vec{\varepsilon}$ the vector of disturbance terms and C the vector of intercept terms, respectively.

Particularly, a mix of structural and standard VAR i.e. Quasi-Structural VAR is proposed to study the relationship of terrorism and the marcoeconomy in this relatively small sample. A Quasi-Structural VAR starts with an unrestricted model, then it imposes restrictions based on theory, Granger Causality tests and statistical significance (Enders, 2010). This method is robust in the sense that it gains from advantages of both standard and structural VARs while mitigating the disadvantages of both methods. Unlike simultaneous equation models, this methodology does not impose fixed coefficient expectational rules. It captures dynamics and coevolution of variables (Standard VAR), does not lose sight of theory (Structural VAR), while at the same time can be readjusted based on new evidence (new advantage). Zaman (2012) notes that the causal structures imposed ex ante in a structural VAR leaves no room to modify the specifications in response to evidence provided by data. The current methodology circumvents this problem and provides an opportunity to change the specification as new evidence come to light i.e. although, it bases the choice of variables on structural models, however, it drops the statistically insignificant independent variables and Granger uncaused dependent variables. This has additional advantage in small samples as lesser equations are specified and crucial degrees of freedom are saved. It is also more robust than single equation methods that utilizes quasi-randomization and instrumentation which according to Sims (2010) are often based on a "misunderstanding of exogeneity" (i.e., there is underlying endogeneity through omitted structural relationships). Furthermore, the single equation methods are criticised for their various heterogeneity biases and failure to take into account simultaneous coevolution of different variables (see Deaton, 2010). Quasi-Structural VAR tries to mitigate these concerns by taking a bird's eye view, avoiding strict assumptions on exogeneity, modifying the specifications in response to evidence and studying the simultaneous coevolution of the variables. Additionally, Pesaran and Timmermann (2005) show that this method displays limited finite sample bias and small forecast errors. Hence, the current methodology is not only well suited to evaluate the impact of terrorism on the marcoeconomy but can also answer the much debated question of cost of post 9/11 terrorism, for example by comparing the predicted and actual growth path of the macroeconomy.

Based on the exclusion restrictions of statistical insignificance and Granger causality, the following system of Quasi-Structural VAR is specified, in natural logarithms[20]:

(4) $RGDP_t = \beta_i + \beta_1 GDP_{t-1} + \beta_2 TerrIndex_{t-1} + \beta_3 FDI_{t-1} + \beta_4 Rintrate_{t-1} + \beta_5 RExp_{t-1} + \varepsilon_t$

(5) $RInv_t = \beta_j + \beta_6 RInv_{t-1} + \beta_7 TerrIndex_{t-1} + \beta_8 FDI_{t-1} + \beta_9 Rintrate_{t-1} + \beta_{10} Inflation_{t-1} + \varepsilon_t$

(6) $FDI_t = \beta_k + \beta_{11} FDI_{t-1} + \beta_{12} TerrIndex_{t-1} + \beta_{13} RInv_{t-1} + \beta_{14} Rintrate_{t-1} + \beta_{15} Inflation_{t-1} + \varepsilon_t$

(7) $RExp_t = \beta_l + \beta_{16} RExp_{t-1} + \beta_{17} TerrIndex_{t-1} + \beta_{18} RInv_{t-1} + \beta_{19} FDI_{t-1} + \varepsilon_t$

(8) $RCon_t = \beta_o + \beta_{20} RCon_{t-1} + \beta_{21} TerrIndex_{t-1} + \beta_{22} RInv_{t-1} + \beta_{23} Rintrate_{t-1} + \varepsilon_t$

(9)
$WRem_t = \beta_m + \beta_{24} WRem_{t-1} + \beta_{25} TerrIndex_{t-1} + \beta_{26} FDI_{t-1} + \beta_{27} Rintrate_{t-1} + \varepsilon_t$

(10)
$GovExp_t = \beta_n + \beta_{28} GovExp_{t-1} + \beta_{29} TerrIndex_{t-1} + \beta_{30} FDI_{t-1} + \beta_{31} Rintrate_{t-1} + \beta_{32} Inflation_{t-1} + \varepsilon_t$

The choice of variables and main results

The Quasi-Structural VAR is specified based on three criteria. The first being one of parsimony in light of relatively small sample. Second, are the variables under scrutiny in the face of terrorism with theory and Granger-Causality tests deciding on what to treat as endogenous and third of course are the economic considerations based on ET (2004) and AG (2008) models[21]. The specifications are also different from other studies in that they take into account theoretical considerations, specifically those from ET (2004) and AG (2008). Furthermore, most studies almost omit the theoretical elements almost entirely and estimate bi-variate VAR or ARDL systems (see for example, Jaeger and Paserman, 2008; Shahbaz and Feridun 2010; Enders and Sandler, 1996).

Integration of order 1 for some variables in the series and subsequent co-integration as determined by Johansens test (1991) motivates the estimation of the equations in their natural logarithms of the level variables without a deterministic trend. First differences are not employed due to the cointegrating relationship and so various co-movements among

[20] See explanation of mnemonic labels of variables in Appendix A.1.

[21] For example, the statistically insignificant consumption, real interest rate and FDI are always kept unless it dramatically increases standard errors in the estimated equations.

variables are not lost in the process [Doan (2000)].

Granger causality tests are also particularly useful here as it further reduces the number of estimated equations and hence saves the degrees of freedom, without compromising on complexity. Groenewold and Tang (2007) also recommend Granger-Causality tests, as they are applicable regardless of different orders of integration of variables. The tests reveal that though terrorism predicts changes in the macroeconomic variables in scrutiny, but the same cannot be said the other way round (see Table A in A.2).

The main results are presented in Table 2 where it can be seen that terrorism is negatively impacting GDP, domestic investment, exports, worker remittances and government spending after a one year lag with largest impact stemming from a fall in domestic investments and worker remittances from abroad. For a discussion of terrorism and its negative impact on government expenditures in light of implication (ii) see *discussion of main findings* section below.

A 10 % increase is terrorist risk index is associated around 1 % fall in real GDP per capita with the similar increase in terrorist risk limiting domestic investments and worker remittances by 0.05 % each. It is easy to derive the total cost of terrorism in terms of lost GDP for the entire sample period. This is done by considering the cumulative percentage increase in terrorism, actual GDP per capita from 1973 to 2008 (631 and 119 percentage point increase, respectively) and point estimate of terrorism (0.093). Following output gap literature (see Lipsey and Chrystal, 2007; D'Auria, 2010):

Actual GDP with terrorism = Potential GDP without terrorism (X) + Effect of Terror

$119 = X + (-0.093 \times 631)$

Potential GDP without terrorism (X) = Actual GDP with terrorism + Effect of Terror

$X = (119) + (0.093 \times 631)$

$X = 177.68\ \%$

Comparing the potential and actual real GDP per capita growth, the output gap due to terrorism is

$$\frac{177.68 - 119}{177.68} = 33.02\ \%$$

Similarly, based on the statistical variation in the point estimate, the range of potential increase in real GDP per capita is computed to be between 25.83 % to 39.95 %.

Comments on the selected variables are also in order; RInv is a flow variable which measures value of new stock added which is more responsive to various shocks than gross investments. Moreover, worker remittances is also included that is a valuable source of foreign income for Pakistan which is motivated to stress on losses due to open economy channel of terrorism as laid out by AG (2008); it should be noted Pakistani citizens living abroad not only send money to family and friends for consumption, but is also is an important source of savings and investments from abroad. Giuliano and Ruiz-Arranz (2009) provides evidence for this

phenomenon from a broad panel of about 100 developing countries. The positive effect of remittances by easing liquidity constraints for investments is documented for countries with

Table 2: VAR Estimates

VARIABLES	(1) RGDP	(2) RInv	(3) FDI	(4) RExp	(5) RCon	(6) Wrem	(7) GovExp
L.RGDP	-0.86						
	(0.628)						
L.TerrIndex	**-0.09*** **	**-0.05** **	**0.003**	**-0.01***	**-0.000**	**-0.05*** **	**-0.01***
	(0.027)	(0.022)	(0.0027)	(0.003)	(0.001)	(0.015)	(0.006)
L.RInv		0.86***	0.10***	-0.05	0.00		
		(0.130)	(0.016)	(0.035)	(0.002)		
L. FDI	0.03***	0.03***	0.014	0.02**		0.11**	0.04*
	(0.009)	(0.009)	(0.011)	(0.001)		(0.040)	(0.019)
L.Rintrate	0.19**	0.18**	-0.04***		-0.00	0.36	0.05**
	(0.089)	(0.076)	(0.001)		(0.001)	(0.036)	(0.020)
L.RExp	0.15**			0.01***			
	(0.059)			(0.033)			
L. RCon					0.09***		
					(0.008)		
L.inflation		0.03***	(0.096)				0.01**
		(0.009)	0.03***				(0.002)
L. Wrem						0.08***	
						(0.006)	
L. GovExp							0.09***
							(0.013)
Constant		-0.45*	-0.19	0.03**	0.05	0.15**	-0.01
		(0.223)	(0.280)	(0.011)	(0.052)	(0.068)	(0.911)
Observations	36	36	36	36	36	36	36
Adj R-2	0.94	0.96	0.94	0.94	0.97	0.90	0.96
F-statistic	109.01	160.39	116.70	127.98	319.54	78.98	148.91

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: Model Selection according to IC and restrictions imposed based on F-tests and theory, see text for more details.

less developed financial systems. Moreover, FDI in Pakistan averaged around 1.70% of GDP during our period of study while Pakistanis' abroad sent, around three times that amount.

Furthermore, net FDI inflows in Pakistan can be motivated by political rather than economic reasons. For example, the US, Pakistan's biggest source of FDI inflows, often increased the FDI inflows during heightened period terrorism, due to Pakistan's role as its "front line ally" against the Soviets in 1980s and against the Taliban insurgency in 2000s. This hypothesis is checked out in the VAR estimates in table 2, where terrorism is negatively associated with Worker Remittances' and effect of terrorism on FDI is statistically insignificant. Moreover, coefficient estimates of real consumption are small and statistically insignificant (For further discussion of results in table 2 in light of the theoretical implications i - v outlined earlier see *discussion of main findings* section below).

For lag length selection, Bayesian information criterion (BIC) was considered which is particularly useful in small samples as it imposes a stricter penalty for loss of degrees of freedom relative to for example AIC (Swartz, 1978). Moreover, Inoue and Kilian (2006) compare asymptotic and finite sample properties of various model selecting criteria and conclude that traditional methods tend to over-select over-parameterized models while the BIC provides "the best approximating model among candidate models". Moreover, Diebold (1998) also notes that the disadvantage of larger bias due to model misspecification is often not sufficiently large in practice to justify a departure from consistent model selection procedure as BIC (see also Pesaran, Pick and Timmermann, 2011). Hence, BIC is used for lag length selection which considers lag length of 1 as optimal fit with complexity.

Table 3: VECM ESTIMATES

VARIABLES	(1) D_ RGDP	(2) D_ TerrIndex	(3) D_ FDI	(4) D_ Rintrate	(5) D_ RExp
Error Correction$_{t-1}$	-3.478***	-3.846	32.88***	-29.22	-32.66***
	(0.873)	(6.630)	(10.95)	(23.88)	(95.58)
LD.RGDP	0.858	3.352	-2.107	22.32	84.01
	(0.631)	(4.787)	(7.909)	(17.24)	(69.01)
LD.TerrIndex	0.0266	-0.0469	-0.472	-0.195	2.734
	(0.0346)	(0.263)	(0.434)	(0.946)	(3.788)
LD.FDI	-0.0217*	0.00275	0.285*	-0.252	-2.518*
	(0.0129)	(0.0980)	(0.162)	(0.353)	(1.413)
LD.Rintrate	-0.0131	-0.0466	0.118	-0.0241	-1.321
	(0.0103)	(0.0780)	(0.129)	(0.281)	(1.125)
LD.RExp	-0.0134**	-0.0191	0.0482	-0.341**	-1.342**
	(0.00615)	(0.0467)	(0.0772)	(0.168)	(0.673)
Constant	-0.00981	-0.0170	1.319***	0.318	0.105
	(0.0338)	(0.256)	(0.424)	(0.924)	(3.697)
Observations	34	34	34	34	34

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Moreover, apart from the Granger-Causality tests, the unidirectional impact of terrorism to the macroeconomy can also be evaluated from a Vector Error Correction Model (VECM)[22]. Johansen (1998) has shown that although cointegration necessarily implies a long-run relationship but VECM can also identify the direction of that causality i.e. statistically significant error correction term(s) in VECM series can be taken as evidence for directional causality. The presence of cointegrating relationship enables one to do this (see section on robustness). Table 3 gives the VECM estimations.

One can see that error correction term is significant for real GDP per capita, exports and FDI, however not so for terror index (and interest rate), implying the unidirectional causality from terrorism to the macroeconomy (which is also further evidenced by results Granger-Causality tests, see robustness section). Moreover, the magnitude of error correction term in the GDP per capita series imply that the adjustment is mainly driven by FDI and Exports where within the first year there is an adjustment of around 30 % towards the equilibrium. Additionally, as mentioned earlier, the statistical significance of lagged differences can be interpreted as short-run impact of terrorism on the macroeconomy. It is seen that lagged and differenced terrorism measure is statistically insignificant for the major macroeconomic series. Hence, the immediate or short-run impact of terrorism does not seem large.

ROBUSTNESS[23]

Two sets of robustness checks are performed. First are econometric stability checks which evaluates whether the causal interpretation of the terrorism to macroeconomy is indeed justified. Second, are economic robustness tests where control variables, other risk, crises and policy variables are added to the baseline equations of Table 2 to see if the results are overturned.

Long run properties of a time series process, crucially depends upon the imposition of unit roots, and one runs the risk of interpreting our coefficients in a spurious regression, hence it becomes very important to test for unit roots in the variables. Chow tests to check for structural breaks were performed at optimal break points determined by Clemente-Montañés-Reyes tests (Clemente, Montañés and Reyes, 1998). The presence of structural breaks motivate us to perform Clemente, Montañés and Reyes unit root test, this has additional advantage over Perron and Vogelsang (1992) unit root tests as it can take into account up to two break points when considering the presence of unit root. This is important as when there are structural breaks standard unit root test statistics are biased towards non rejection of a unit root (Enders, 2010). The tests find I (1) or a unit root in all but five variables. Johansens cointegration test (1991) instead of Engle and Granger (1987) was performed which is more robust[24] in a system of equations, the results of the test finds at least one cointegrating vectors in the all the independent series (see Table E1/E2 in A.2 for results). As a result, we can

[22] VECM estimates lagged differenced variables and error correction term(s) representing disequilibrium on the endogenous differenced variable. It is a restricted VAR, where restriction is imposed in the form of long-run relationship (See Enders, 2010 for more details).

[23] See Appendix for the mentioned tables and tests.

[24] For a discussion of Johansens cointegration test and its advantages over Engle and Granger see Verbeek (2008) and Enders (2010).

assert that long run equilibrium relationship exists, and we can interpret the coefficients of our equations as long as they are integrated to the order 1, which is established by testing for unit root at first differences[25].

Wald tests for the null hypothesis of joint insignificance are rejected for the series at 1 per cent significance levels. Furthermore, Lagrange multiplier tests for VARs as mentioned in Johansens (1995) and Verbeek (2008) are performed. The tests fail to reject the nulls of (no) omitted variables, autocorrelation of residuals and homoskedasticity. The existence of long run equilibrium relationship as determined by results of Johansens cointegration test (1991) and subsequent I (1) of series, implies a temporal causality in at least one direction. To establish the direction and whether the terrorism improves forecasts for RGDP, Granger-Causality tests are run. The result of Granger-Causality tests conclude unidirectional effect flowing from terrorism to the macroeconomic variables under study and not vice versa, see Table A in A.2. As can be seen from the table, inclusion of terrorism improves forecasts for all the macroeconomic variables under scrutiny. As an additional robustness check that VAR might be spurious, first differences were taken to observe any change of signs and relative magnitude of variables (following Stock and Watson, 1993 advice). The signs of RGDP, RExp, RInv and RWrem remain negative. Furthermore, FDI and RCon is still statistically insignificant and coefficient of RGDP is greater than RExp, RInv and Wrem as in the original VAR, adding to the consistency of the estimates of the original VAR equation (see Table F).

To analyse the normality of residuals, Shapiro and Wilk (1965) tests are performed on individual time series. The results of the test fail to reject the null of normally distributed residuals, though this is interesting given the small sample and is also a validation for the choice of the Quasi-Structural VAR technique. Stability of residuals are checked by applying cumulative sum of recursive residuals square (CUSUMSQ) test as suggested by Pesaran & Pesaran (1997) and Galpin & Hawkins (1984). The advantage of this is that, unlike the Chow test that requires break point(s) to be specified, it can be used without any prior knowledge of the structural break point and it provides reliable results even if departure from constancy of residuals is sudden and haphazard. As can be seen from figure H in A.2, the residuals remain in the confidence interval and hence fail to reject the null hypothesis of parameter stability.

As far as economic robustness checks are concerned, different approaches are taken here. Figure 8 gives the evolution of terrorist risk and political risk indices from 1995 to 2010. Political risk index developed by Political Risk Services Group (PRSG) quantifies 12 indicators of political risk, based on detailed country reports and expert assessments of various factors that are fundamental to the economy. For example, the index incorporates corruption, property rights, labour costs, barriers to international trade, efficiency of the judicial and taxation system etc (see PRSG website and A.1 for more details). One can see from the figure, that although terrorism has continued to increase post 9/11, these institutional factors remain essentially stable. Contrary to expectations, the correlation coefficient is actually negative, where factors such as corruption and lack of property rights are associated

[25] All ADF and PP tests reject the null of unit root at 1 % significance levels for first differences.

with decreased instead of increased terrorism. Hence, one can be reasonably assume that these economic factors do not to endogenize the current results[26].

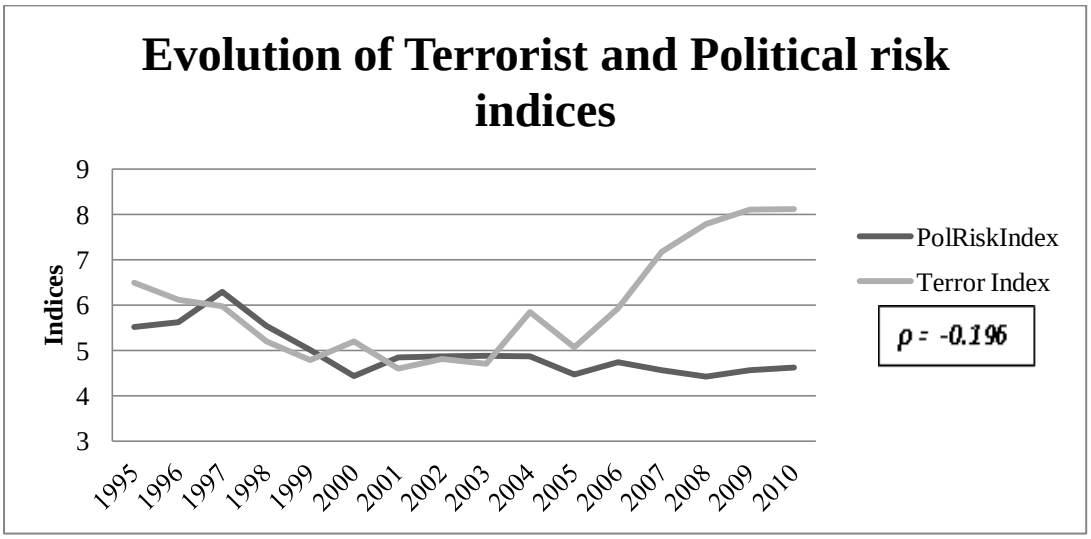

Figure 8: Evolution of Terrorist and Political risk index over time (Source: PRSG and SBP).

Moreover, a bi-variate VAR for RGDP and Terror Index according to information criteria is also run (see Table D in A.2). The coefficient of terrorism index is negative and with similar magnitude to the baseline VAR specification (0.089 relative to benchmark 0.093 in table 2). The similarity of terror index coefficients in bi-variate regressions in Table D and unrestricted VAR in Table 2 also mitigates the concern of omitted variable bias, as terrorist attacks might in fact be interpreted as exogenous shocks to the economy, hence additional control variables only improves precision, not coefficient estimates. This is exactly in line with the consensus in empirical literature relating terrorism and income. Almost all[27] empirical (case studies and cross country analyses), fail to build a case for negative relationship between terrorism and growth (See Abadie, 2006; Krueger and Laitin, 2008; Drakos and Gofas, 2006; Feldman and Ruffle, 2007). Krueger and Maleckova (2003) interestingly relate terrorism to voting behaviour and conclude that terrorism is a "political, not an economic phenomenon" (Krueger and Maleckova, 2003, p.142). Hence, economic variables do not determine the level of terrorism in a given country and the causal interpretation from terrorism to the macroeconomy can be justified.

Moreover, Bodie (1982) and Levine et al (2001) document that inflation is particularly important for the real economy and may have direct impact on macroeconomic variables under study. Busse and Hefeker (2007) extends this line of research and suggest that inflation may actually proxy the quality of macroeconomic policy, as low inflation is particularly associated with sound macroeconomic fundamentals and policy. Colacito and Croce (2011) on the other hand, demonstrate that exchange rate risk and shocks might be

[26] Government spending/Consumption data till 2008 and political risk index data from 1995 prevented the inclusion of the political index in the VAR estimates.
[27] Derin-Gure (2009) is a notable exception.

particularly detrimental for exports and hence long run growth prospects. Moreover, Reinhart and Carlos (1996) combines these two views and show how exchange rate and inflation risk combine to have a reinforcing effect, precipitating large depreciations and crises particularly in developing countries. In line with this, in addition to incorporating structural breaks in form of year dummies as determined by Clemente et al (1998) tests, measures incorporating exchange rate and inflation risk are added to the base line equations to assess the validity of results. Table 6 gives the results (See Appendix A.1 for explanation on construction of these variables).

It can be seen from column 1 of Table 6 that as expected inflation risk enters with a statistically significant negative sign. The results are essentially the same with negative coefficient of terrorism and positive impact of FDI, real interest rate. However, the obvious multicollinearity between exchange rate risk and real exports have greatly decreased the precision of real exports, rendering it statistically insignificant[28].

Following the Augmented Solow model, measures of human capital: primary, secondary, university enrolment rates were added as explanatory variables; together and separately to assess the validity of coefficient estimates (Column 2 through 4). Primary equation levels seem to be particularly positively related to real GDP with statistical significant coefficient estimates. However, with the data at hand secondary and tertiary enrolment is statistically insignificant. This might be due to limited data, particularly only 31 observations for exchange rate. Lastly, as various structural breaks might bias the coefficient estimates. Column 5 of Table 6 estimates the baseline equation with year dummies representing structural breaks. The break points were determined by statistical significance of break points in the series as opposed to arbitrary imposition at various important years (based Clemente et al (1998) tests). This gave structural break points for year 1980, 1996, 2002 (both innovation and additive outlier approaches were used). This also makes economic sense as 1996 was the year when the negative shock of the Asian crisis hit Pakistan, while 2002 was year of economic reforms including large-scale privatizations undertaken by the Musharraf regime. The structural break coefficient is marginally significant and enters with a negative sign. This is probably due to the positive effect of 2002 reformed nullified by the large Asian crisis shock of 1996. Lastly, to evaluate whether the fall in macroeconomic variables is explained by the recent financial crisis, a crisis dummy (CRDUM) that takes the value of 1 for the crisis years of 2007 and 2008 is also included in the baseline regression (column 6). The results are extremely similar with terrorism again entering with a negative sign while the coefficient estimate for the recent crisis dummy insignificant at conventional significance levels (with a p-value of 0.49). This makes sense as the poorly developed financial markets in Pakistan prevented the propagation of the financial crisis to credit markets in Pakistan. Moreover, loss in exports which can and did hurt the Pakistani economy is already included and hence controlled for in the regressions. Additionally, to access whether the negative effects of terrorism diminishes, a quadratic term of terrorism index was added to the baseline regression.

[28] Drop in number of observations from 36 to 31 is due to lesser data for exchange rate risk variable.

Table 6: Robustness Checks

VARIABLES	(1) RGDP	(2) RGDP	(3) RGDP	(4) RGDP	(5) RGDP	(6) RGDP
L.RGDP	-0.0140	0.412	0.468	0.676	-0.131	0.540
	(0.582)	(0.739)	(0.719)	(0.868)	(0.580)	(0.770)
L. TerrIndex	-0.0622**	-0.0763**	-0.0647*	-0.0649*	-0.0598**	-0.0712**
	(0.0267)	(0.0309)	(0.0310)	(0.0317)	(0.0264)	(0.0321)
L.FDI	0.0352***	0.0124	0.0107	0.0181	0.0362***	0.0196
	(0.00937)	(0.0143)	(0.0140)	(0.0217)	(0.00926)	(0.0177)
L. Rint	0.0228***	0.0256***	0.0266***	0.0235**	0.0258***	0.0266***
	(0.00786)	(0.00768)	(0.00750)	(0.0102)	(0.00809)	(0.00791)
L. RExp	0.00619	-0.000542	-0.00195	-0.00300	0.00716	-0.00186
	(0.00549)	(0.00784)	(0.00768)	(0.00818)	(0.00546)	(0.00816)
ExrateRisk	-0.00159	-0.0292	-0.0986	-0.0670	0.0204	-0.00638
	(0.0953)	(0.0932)	(0.102)	(0.126)	(0.0955)	(0.0999)
InflationRisk	-0.441***	-0.384**	-0.419**	-0.421**	-0.455***	-0.340*
	(0.141)	(0.160)	(0.157)	(0.160)	(0.139)	(0.174)
L.Primary Enrolment		0.0542*	0.125**	0.126**		0.0500*
		(0.0260)	(0.0544)	(0.0556)		(0.0270)
L. Secondary Enrolment			-0.0802	-0.0830		
			(0.0548)	(0.0563)		
L. Tertiary Enrolment				-0.0112		
				(0.0249)		
Structural Breaks					-0.0986	
					(0.0763)	
CRDUM						-0.113
						(0.160)
Constant	0.973	-3.306	-3.393	-2.542	1.048*	-3.227
	(0.570)	(2.259)	(2.198)	(2.933)	(0.565)	(2.291)
Observations	31	31	31	31	31	31
R-squared	0.949	0.958	0.962	0.962	0.953	0.959

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

However, the statistically insignificance of the coefficient estimates fail to find any evidence of a diminishing effect. It should also be noted that although at some specifications the magnitude of terrorism coefficient is somewhat reduced relative to the base line specification of equation (4). Nevertheless, the results are still interpreted from the baseline due to the following reasons. Firstly, in the robustness checks the number of observations fall by around 15 % due to inclusion of exchange rate risk variable. Moreover, there are further losses of degrees of freedom with inclusion of more variables in the form of unrestricted equations. Lastly, the cumulative loss of terrorism (with the robustness equation) is within the range of 25.83 % to 39.95 % of the base line equation.

From the results of robustness tests, one can conclude that even in a relatively small sample, the estimates are stable, reliable and the causal interpretation taken here is not far-fetched.

COUNTER FACTUAL EXPERIMENTS

The counter-factual experiments serve to calculate the cost of post 9/11 terrorism. One of the main reasons that assessing the costs of terrorism and conflict in general is difficult is because of the difficulty to ascertain how the economy and its agents would behave in absence of conflict. The use of VAR is particularly helpful in this regard, as information set can be extended to include more variables that can affect the evolution of the economy. A counter-factual experiment where terrorism continues at the same (much lower) intensity of pre 9/11 levels is performed. The counter-factual is obtained by asking VAR to predict when terror index takes the much lower pre 9/11 average. This is in turn compared with VAR estimates of actual (much higher) terrorism and actual GDP growth. This provides a scientific base, amidst the random flurry of estimates by politicians, media personnel and government, of estimating the costs of post 9/11 terrorism in Pakistan. Figure 5 gives the result of VAR predictions. It can be seen from Figure 5 that the VAR when asked to predict GDP for post 9/11 in absence of intense terrorism of 2000s as shown in Figure 1, clearly shows an upward trend. Furthermore, it is seen that the sudden drop in GDP cannot be explained if we use average values of terrorism index in the equations. Interestingly, out of sample prediction for 2009 and 2010 seem to be highly accurate (as GDP data is available till 2010) and sudden fall in GDP cannot be explained unless we add the terrorism measure in the specification.

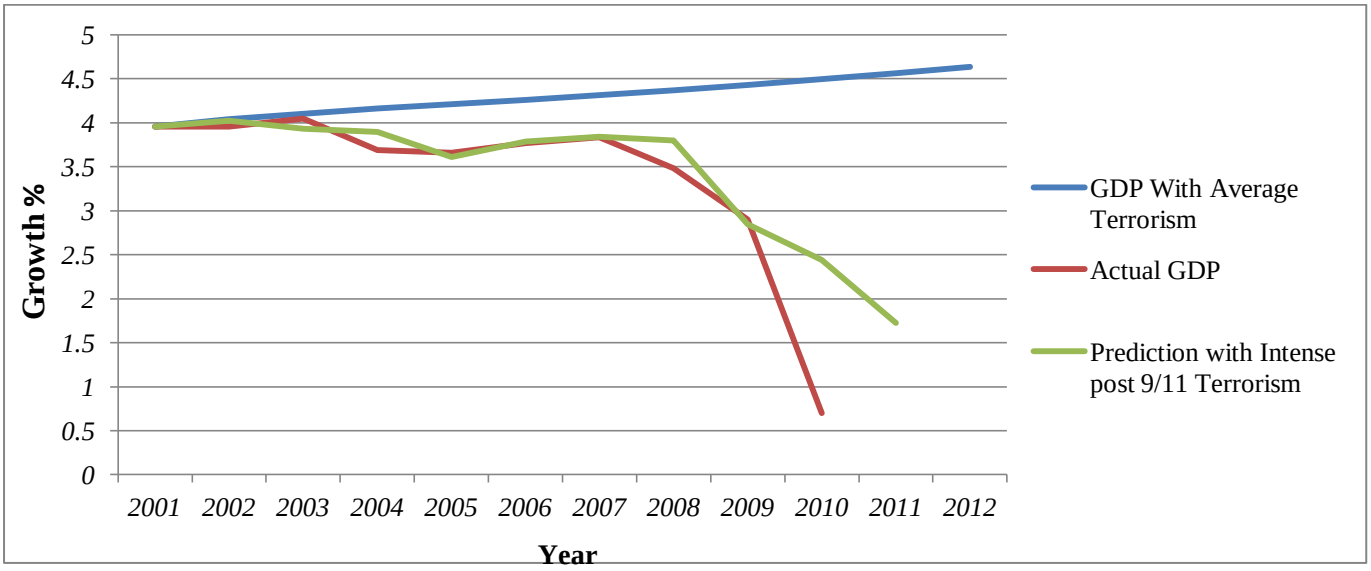

Figure 5. Real Output per capita growth with predicted and actual patterns [Source: SBP, GTD and own computations].

The table below gives yearly and total losses of Real GDP per capita growth from the above exercise at 95% confidence interval bands with lower and upper bounds (LB and UB, respectively).

Table 4: Terrorism Losses Post 9/11

Years	RGDP With Average Terrorism LB	RGDP with Average Terrorism UB	Actual GDP	Prediction with Intense post 9/11 Terrorism	Loss LB %	Loss UB %
2001	-	-	3.95715	-	-	-
2002	4.04476	4.4407239	3.95818	4.02	0.086580	0.482544
2003	4.10070	4.5664644	4.04605	3.93	0.054646	0.520414
2004	4.16172	4.6486713	3.69207	3.9	0.469650	0.956601
2005	4.21337	4.6973023	3.66045	3.61	0.552918	1.036852
2006	4.26179	4.7498902	3.77139	3.79	0.490395	0.9785
2007	4.31265	4.8111745	3.83629	3.84	0.476363	0.974885
2008	4.36877	4.8808987	3.48207	3.8	0.886704	1.398829
2009	4.43047	4.9573893	2.90163	2.85	1.52883 [P]	2.05575 [P]
2010	4.49674	5.038587	0.71034	2.44	3.78639 [P]	4.32823 [P]
2011	4.56625	5.1229354	n/a	1.73	2.84060[P]	3.39728[P]
				Total Loss with available data:	**8.332**	**12.733**
			Predicted loss till 2011:		**11.173**	**16.129**

Note: Predicted losses till 2011 is based on out of sample forecasts [Source: SBP, GTD and own computations].

It is estimated that if Pakistan was not engulfed in the intense wave of suicide terrorism in 2009 and 2010 that killed 2868, the real GDP per capita of Pakistan would have grown by around 5.32 to 6.38 at (95 percent confidence intervals) in these two years (see Table 3). Furthermore, the total for the past 10 years is at most 16.13 per cent of real GDP per capita growth which is tantamount to 6.32 billion US dollars (see Table B1 in A.2). Similar, patterns of reduction of Investment and Exports is also observed and a drop in Investment and Exports is not seen unless we bring the data for high terrorism of 2000s into the picture see pictorial illustration of the VAR predictions with exports as dependent variable below:

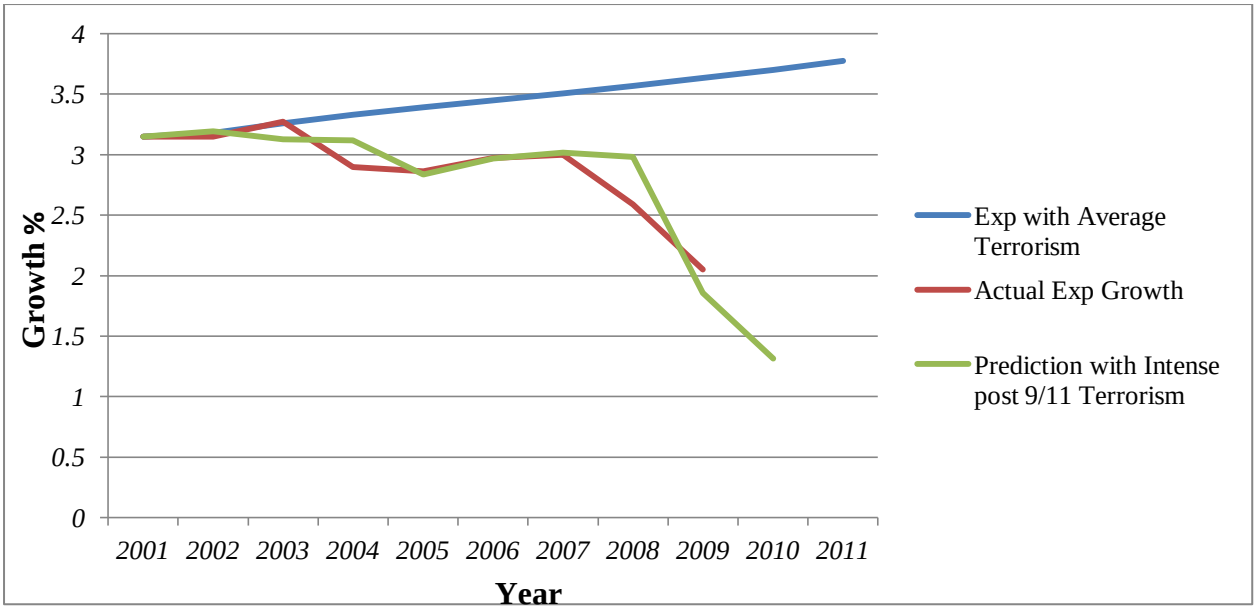

Figure 6. Real Export growth predicted and actual patterns [Source: SBP, GTD and own computations].

As can be seen from the figure above, out of sample predictions (2009/2010) are good. If we exclude the particularly high terrorism years of late 2000s, the actual drop is left unexplained. It is estimated that post 9/11 terrorism reduced the Investment and Exports of Pakistan by 5.71 and 10.5 per cent[29], respectively (see also Table B2/3 in A.2).

PERSISTENT EFFECT OF TERRORISM

The increasing of lags in the VAR system to judge the persistence of terrorism not only violates the information criteria but are very sensitive to alternative specifications (probably due to loss in degrees of freedom given the sample size). It is statistically more appropriate to judge the persistence of the negative effect of terrorism on macroeconomic variables under study by observing the Impulse response functions (IRF). The restrictions (as determined by joint significance) are identical to those in VAR estimates. The IRFs here measures the response of macroeconomic variables for an impulse of terrorism, keeping constant all other variables i.e. IRFs are responses of macroeconomic variables with respect to terrorism shocks. Standard orthogonal impulse responses with one unit shocks (as opposed to generalized impulse responses) are applied due to its simplicity and robustness (Jacobs and Wallis, 2005). Figures 7 gives the plots of impulse response functions for an impulse of terrorism on RGDP. It can be seen that impulse of terrorism lasts a little over 2 years (as it becomes statistically insignificant afterwards). Similar is the case for real investments with the negative effect of terrorism again lasting for around 2 years (Figure K2 in A.2). The most

[29] This is approximately a loss of around 353 and 305 (constant) million dollars, respectively (see Table B2/3 in A.2).

dramatic IRF result is for worker remittances, with subsequently induced shocks remaining negatively statistically significant until year 5.

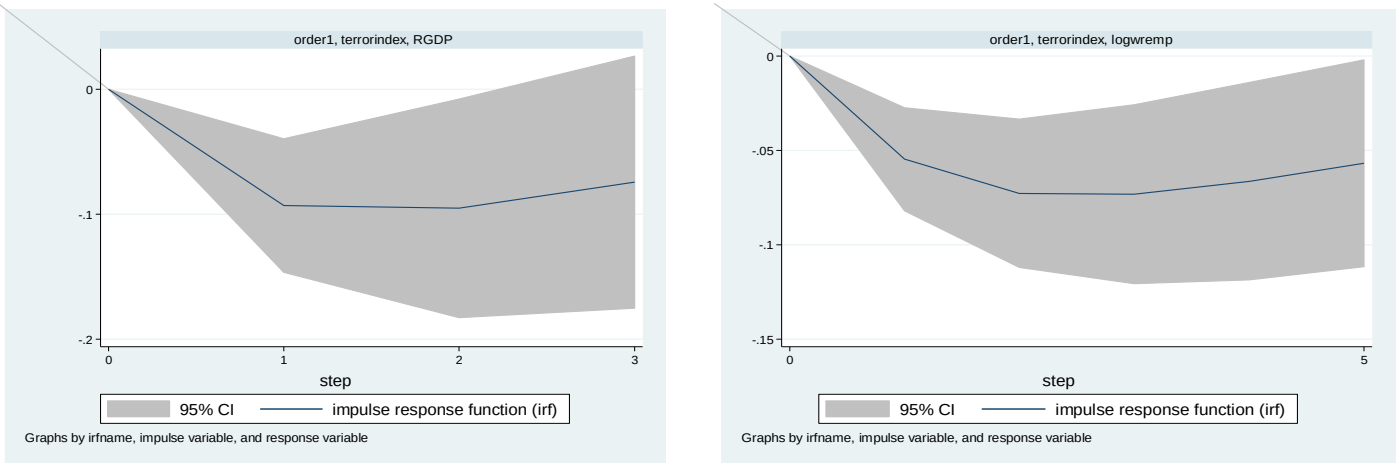

Figure 7: Impulse Response of Real GDP and Worker Remmitances on Terrorism from 2008 onwards[30].

This implies that the effect of terrorism in Pakistan is long-lasting, though more accurate estimation would be possible if monthly or quarterly data was available. This is indeed a staggering finding as estimates by Eckstein and Tsiddon (2004) indicated that the negative effect of terrorism on exports, investment and GDP in Israel lasted as little as a single quarter. This may be a result of several factors, one of them being that Pakistan is a developing country, with GDP per capita is around 1/27 times that of Israel and its institutions and the economy less equipped to deal with external shocks (WDI, 2012). The implication of the finding is that even if terrorism came to sudden halt in Pakistan, the negative effects would take some time to dissipate, especially for Worker Remittances, where workers would not send money to Pakistan for around 5 years after terrorism has seized. The authorities would need to take additional steps and make a credible commitment that the improvement in security situation in the country is here to stay.

Intervention Analysis

Given the recent anti-war on terror sentiment in Pakistan (Gallup survey, 2011) and dismal performance of economy of Pakistan over the recent past, politicians and the media have given considerable attention to economic consequences of 9/11. The impact of 9/11 on the economy of Pakistan has come to light recently with IMF and Finance Ministry of Pakistan (2011) each publishing a report one the cost of post 9/11 terrorism. These estimates range

[30] Each step represent years forward from 2008 onwards, where step one is 2009, step 2 year 2010 and so forth and CI is the confidence interval.

from US $ 60 to 70 billion, each relying on estimates by government officials and at times politicians on various sectors of the economy (IMF PPRP, 2010; PES, 2011). The kind of unidirectional temporal causality observed through Granger Causality tests and VECM, makes the use of intervention analysis an effective statistical tool to gauge whether, the intervention of 9/11 had any significant effect on the evolution of GDP of Pakistan. This methodology is essentially a reproduction of impact of 9/11 on the US economy (see e.g. Becker and Murphy, 2001 and IMF, 2001) for the case of Pakistan. This also serves as a robustness check for the results of counterfactual scenarios above. Three scenarios are introduced in the RGDP VAR equation (4) of Table 2. The first, with Interv1 variable is when the impulse of 9/11 is transitory and only lasts for one time period i.e. in 2002 only[31]. The second case of inclusion of Interv2 is when effect of 9/11 is not assumed transitory and the intervention variable takes the value of 1 from the year 2002 onwards (and zero otherwise). The last scenario is the intervention as a gradual adjustment, which is probably most appropriate as terrorism gradually rose post 9/11 and so does the intervention variable (interv3) here where it achieves the value of unity at the peak year of terrorism.

The results are presented in Table 5 where as before terrorism, FDI and exports take the statistically significant hypothesized signs with the intervention 2 and 3 entering with statistically significant and large negative signs. It can be seen for example when effect of 9/11 is assumed fleeting, no statistical relation emerges as terrorism does not have any impact on real GDP, similar result is found for an intervention of 9/11 on GDP of US (in Enders and Sandler, 2006), yet case 2 and 3 find negative statistical association of terrorism and GDP, with the magnitude of case 3 being around 62 percent greater than case 2. This makes sense as it took till 2004 for Pakistan to fully participate in the "war against terror" and launch a full-fledged military operation which is thought to incur the wrath of all militant splinter groups fighting US along the Afghan border. The effect of 9/11 on the economy of Pakistan, being thousands of miles away from the twin towers, is around -0.35% of GDP, around 10 times the estimates by Becker and Murphy (2001) and IMF (2001) for the effect of 9/11 on US, the direct and immediate victim of the 9/11 terrorist events.

[31] As 9/11 attacks are hypothesized to have an indirect and lagged effect on the economy of Pakistan, the year after 2001 is considered. More details on the intervention variable can be found in A.1.

DISCUSSION OF MAIN FINDINGS

It is derived from coefficient estimates of VAR (0.093), changes in terrorism index (631 %) and increase in Real GDP per capita (119 %) that real GDP per capita in Pakistan would have grown by [(0.093 x 631) + (119)] = 177.7 % from 1973 to 2008 if there been no terrorism for

Table 5: Intervention Analysis

VARIABLES	(1) RGDP	(2) RGDP	(3) RGDP
L.RGDP	-0.95	-0.62	-0.34
	(0.666)	(0.603)	(0.612)
L.TerrIndex	-0.10***	-0.12***	-0.11***
	(0.031)	(0.032)	(0.028)
L.FDI	0.28***	0.30***	0.35***
	(0.088)	(0.082)	(0.083)
L.Rintrate	0.20**	0.08	0.07
	(0.098)	(0.097)	(0.095)
L.RExp	1.61**	1.46**	1.11*
	(0.625)	(0.553)	(0.560)
Interv3			**-0.35****
			(0.138)
Interv1	**-0.08**		
	(0.176)		
Interv2		**-0.22****	
		(0.102)	
Constant	1.99***	1.57**	1.31**
	(0.618)	(0.581)	(0.591)
Observations	36	36	36
R-squared	0.94	0.95	0.95

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

our period of study, this is a direct loss of 33.02 % due to terrorism[32]. Furthermore, from the IRFs we see that impulse of terrorism lasts at least as long as 2-3 years for most macroeconomic variables in Pakistan.

VAR estimates also show that post 9/11 drop in real GDP cannot be explained unless we include a measure of terrorism. Counterfactuals experiments on post 9/11 scenarios indicate

[32] Calculated by comparing actual real GDP per capita growth (119 %) and hypothetical GDP growth without terrorism (177.7 percent) from 1973 to 2008 i.e. $\frac{177-119}{177.68} = 33.02$ % (see main results for more details).

that had terrorism stayed its pre-9/11 levels, RGDP, RExp, RInv[33] would be 11.2, 10.5 and 5.71 percent higher, respectively. The counterfactual experiment on the particularly violent wave of terrorism of 2009 and 2010 that killed more than 2500 people predicts a loss of 5.32% of real per capita GDP in these two years. In hard currency terms the war on terror has cost Pakistan a loss of 6.32 billion US dollars in real income alone.

From the intervention analysis, it was observed that the impulse of 9/11 exerts a statistically significant and large negative impact of -0.35 % on GDP per capita. This is an interesting finding as Enders and Sandler (2006) note that bi-directional causality at some lags and the fact that US was already entering a recession in 2001 made it difficult to isolate the fall in GDP due to the intervention of 9/11. The same cannot be said for Pakistan as the economy was actually beginning to boom in 2000s. Moreover, from Granger causality tests, bi-directional causality could not be determined at different lag lengths in addition to lag length selection according to information criteria. This is further corroborated by VECM estimates, where the absence of short and long-run relationship was documented from the macroeconomy to terrorism.

Prediction of Eckstein and Tsiddon (2004) model are fulfilled in at least two counts with terrorism being negatively associated with real income and investment (implication i), though effect on private consumption (RCon) is insignificant (hence implication iii is not satisfied), which is also documented elsewhere (see for example Persitz, 2005; ET, 2004; Rubinstein and Becker, 2004). This can probably be explained by positive substitution effect of higher consumption and negative income effect of lower consumption cancelling each other out in face of increased terrorism risk. It is also interesting to note that Government spending is negatively associated with terrorism, significant at conventional levels, which is in stark violation of ET (2004) prediction of a positive relation between terrorism and government spending (implication ii). It was reasoned that an increase in terrorism would raise government spending through an increase in military spending. Gaibulloev and Sandler (2008 and 2009) document this phenomenon, where high terrorism incidence is associated with larger government spending. However, these analyses fail to take into account host of factors. Firstly, their cross-county analysis fail to take into account time-variant heterogeneity. This becomes particularly alarming as they base their studies on long time horizons. As was outlined in *Historical Background and Overview* section above, various economic reforms, internal and external shocks, influences the nature of terrorism, institutions of the country and macroeconomic fundamentals. These factors need to be explicitly analysed when analysing terrorism and its long term macroeconomic consequences (This is done in *Robustness* section below, where crises, risk and structural break variables are constructed and added in the baseline equations to evaluate the sensitivity of results in Table 2). Moreover, the aforementioned analyses often impose unrealistic strict exogeneity assumptions on the variables (through using random and fixed effect methods) and fail to take into account the useful information of past terrorism and macroeconomic variables.

[33] See Appendix A.1 for explanation of variables.

This ‘paradoxical’ outcome of negative effect of terrorism on government spending may be due to at least three reasons (there is clearly a need to model these factors formally to get a more holistic picture of terror and government spending). First, ET (2004) do not take into account long run impact of terrorism on the economy when considering this lemma, as terrorism might cripple the income of the country so much making the government unable to respond by spending more on the military (hence, there might be willingness but not the ability to respond). Second, variation in government or military spending very roughly captures the 'counter-terrorism expenditures' which ET (2004) emphasise on. Data for military spending was available though it was limited to 1988 onwards; the strong correlation coefficient of 0.94 between military and government spending (probably because of direct military interventions and large influence of the army in domestic politics) and the data limitation caused us to quote and interpret only the regression with government spending. Lastly, the model implicitly assumes that all governments consciously act to maximise societal welfare which is not the case (see e.g. Acemoglu, Egorov and Sonin), where conflicts between the populace and the governments’ interests arise. This effect is more pronounced for developing countries. Hence, the negative impact of terrorism and government spending is not counter-intuitive as emphasized.

Abadie and Gardeazabal (2008) use FDI as their endogenous variable in their cross country regressions to analyse open economy channel of terrorism and find evidence in support of their hypothesis. Adverse effect of terrorism on FDI could not be ascertained for Pakistan with alternate specifications and lag length selections[34]. This does not mean that losses of terrorism through the open economy channel are insubstantial. The statistical insignificance of FDI may be due to the aforementioned reason of FDI in Pakistan being motivated by political rather than economic considerations. Careful scrutiny of other variables that are influenced by open economy channels find support of Abadie and Gardeazabal (2008) hypothesis (implication iv). Workers’ Remittances (WRem) from abroad and foreign exports are hit hard by terrorism (see table 2). Effect of terrorism on Workers Remittances is not only unique, but also neglected so far, while studying macroeconomic impact of terrorism. This might also be a developing country specific effect. Apart from the fastest growing developing countries, such as China and India, foreign direct investment as a proportion of GDP is often very low for most developing countries (see for example WDI of World Bank), hence WRem might be an important avenue hit by terrorism in developing countries in such cases. The magnitude and persistence of WRem is also noteworthy with 5 times the magnitude of losses in foreign exports and almost equal to the loss of real investment and the negative effect lasting for around 5 years. As outlined earlier, AG (2008) fail to test for short-run impact of terrorism, however, the data at hand allowed the evaluation of AG (2008) hypothesis, by the means of VECM (implication v). Based on the statistically insignificant lagged, differenced

[34] Bi-variate VAR of terrorism and FDI (not shown) with monthly observations at some lags for the period of 2002-2007 does become marginally significant.

terrorism measure in the VECM (see Table 3), one finds evidence for implication v i.e. the immediate or short-run impact of terrorism on the macroeconomy is negligible[35].

It is also important to discuss the limitations of this study. First, there might be omitted variable bias due to the Quasi-Structural VAR specification. However, similarity of terrorist coefficient estimates in unrestricted model and bi-variate VAR, resilience of coefficient estimates to inclusion of various policy and risk variables show that this might not be exceptionally detrimental as terrorism might in fact be exogenous. Moreover, as opposed to the conventional wisdom hypothesis that emphasizes on the economic roots of terrorism, empirics of terrorism often fail to find any robust negative relationship between terrorism and income growth. For example, Krueger (2007) shows by analysing extensive microeconomic data that there is no systematic negative relationship flowing from low incomes to terrorism. Moreover, he shows that as certain level of human capital is needed to perpetrate terrorist acts, terrorist in fact are recruited from relatively wealthy and educated households. In a much broader survey, Gassebner and Luechinger (2011), by running 13.4 million different regressions and using combinations of 65 variables from 43 different studies also document no significant causal effects of income on terrorism. More important in the current context, Fair (2008) documents a similar phenomenon in Pakistan, by utilizing data on killed militants' families, she finds that militants are conversely recruited from middle class and well educated families. This is further corroborated by Blair, Fair, Malhotra and Shapiro (2012) who find evidence of a higher support base of terrorism from the relatively wealthy. In a robust survey of 6000 individuals across Pakistan where item non-response and social desirability biases (inherent in this kind of study) is explicitly corrected, it is found that the poor are actually much more averse (23 times) to extremist violence relative to middle class citizens.

Second, it might also be the case that the effect of terrorism is not effectively segregated from other forms of conflicts. But with no war during the period of study, and the robust coding of terrorist incidents by GTD, one can justify the interpretation of results as impact of terrorism instead of conflict[36]. Furthermore, Crenshaw (1991) in her seminal contribution to political theory of terrorism also suggested internal conflict might in fact determine terrorism, hence the distinction might in fact be unnecessary.

CONCLUDING REMARKS

The chain reaction in the form of war of terrorism, triggered by the tragic events of 9/11 had profound impact on Pakistan. The article has highlighted the economic impact of terrorism on major macroeconomic variables. Ironically, neither the 9/11 attacks were planned in Pakistan, nor were any of the 19 hijackers involved in the incident were from Pakistan or had Pakistani

[35] These results are robust even if we use strictly restricted models based on ET (2004) and AG (2008) i.e. excluding the WRem, Exports, FDI and including only ET (2004) variables and vice versa. However, given the small sample, unrestricted models are used to gain efficiency.

[36] In the robustness checks and Figure 8 below, one can also see political risk index which incorporates internal conflicts do not increase at times of high terrorism.

origins (9/11 Commission Staff Statement, Chapter 2), yet Pakistani economy was most severely hit by the intense and more importantly recurring terrorist attacks in its economic hubs. Though Pakistan is a large country[37], but like most developing countries its production facilities are few and spatially concentrated, where most of the terrorism took place. Its ability to absorb macroeconomic shocks is limited, hence the multitude of IMF rescues. Furthermore, the finding of terrorism affect on the macroeconomy lasting for as long as 2 years is also consistent with Pakistan's sensitivity and vulnerability to shocks hypothesis. Though it is not an exhaustive study on the economic impact of terrorism in Pakistan by any means, for example the article omits loss of estimate of compensation to victims and refugees, effects on financial markets, defence expenditures[38], loss of tax revenues etc (mainly due to data limitations), but it does highlight the effect of terrorism on major macroeconomic variables and it is expected that aforementioned losses should be translated in losses in real GDP. The study estimates the direct cost of post 9/11 terrorism to be around 7 billion in US dollars. Moreover, it is documented that cumulatively terrorism has cost Pakistan around 33.02 % of its real national income which is equivalent to approximately a loss of 1% of real GDP per capita every year. This is alarming for a country ranked 127th at UN Human Development Index with 22.6 % of population living on less than 1.25 dollars a day (UN Statistics, 2011). With around, 40% of population below the age of 15 (World Bank, 2011), hence a huge potential to benefit from the so-called demographic gift. Pakistan needs an early end to this war, if it can not materialise; it definitely needs a major revamping of its exporting sector and to take steps to encourage domestic investments and worker remittances.

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[37] Ranked 6th most populous country in the world (CIA World Fact Book, 2011).

[38] According to Statistics made available by SBP (Central Bank of Pakistan) ratio of defense to GDP has actually fallen post 9/11, probably due to strengthening of the peace process in 2001 with India (see figure J in A.2).

APPENDIX

A.1 Variable Description and Sources

TerrIndex: Terrorism Index = ln[exp(1) + Average of total yearly incidents, deaths and injuries] where the data was obtained from the Global Terrorism Database (GTD).

RGDP: Log of Nominal GDP per capita per year from Central Bank of Pakistan (SBP) deflated by its own chained price index.

RInvestment (RInv): Log of nominal Gross Fixed Capital Formation per capita from Central Bank of Pakistan (SBP) deflated by CPI. GFCF would respond better to change in investment patterns due to various shocks in contrast to gross investment.

RExports (RExp): Real Exports per capita deflated by CPI from SBP.

Wrem: Log of Workers' Remittances from Abroad per capita deflated by CPI from SBP.

FDI: Log of FDI per capita deflated by CPI from SBP.

GovExp: Log of nominal government expenditure in a given year deflated by CPI from SBP.

RCon: Log of real private consumption per capita deflated by CPI from SBP.

School Enrol: Primary, secondary and university enrolment, normalized by age cohort from Pakistan Education Survey (various issues)[39].

Inflation: Year on Year inflation rate as measured by changes in consumer price index from SBP.

RIntrate: Real Call money rate representing real interest rate {Nominal interest is converted to real by conventional formula of Real Interest = (1+nominal interest)/ (1+inflation rate)} from SBP.

Interv1: The intervention variable that the takes value of 1 in 2002 and 0 in all other periods.

Interv2: The intervention variable takes value of 1 from 2002-2008 and 0 otherwise.

Interv3: The intervention variable takes the value of 0.14 in 2002 and linearly increases to take value of 1 in 2008 the peak year for terrorism to date, and 0 for all other years.

InflationRisk: It takes the value of 1 for high inflation years i.e. when inflation is one standard deviation above mean.

ExRateRisk: It takes the value of 1 for sudden changes in exchange rates i.e. when exchange rate is one standard deviation above mean or below mean.

[39] As opposed to World Development Indicators, education data from pre 1980 can also be recovered from PES.

PolRiskIndex: This index taken from Political Risk services group evaluates 12 factors in an economy: Turmoil, Restrictions on equity, Restrictions on local operations, Taxation discrimination, Repatriation restrictions, Exchange controls, Tariff barriers, Nontariff barriers, Payment delays, Expansionary economic policies, Labor costs, Foreign debt based on detailed country reports and expert assessments. Moreover, the index is divided by 10 for all years for ease of graphical comparison with terror index.

A.2 Tables and Figures

Table A1: Engle-Granger Causality

	Exogenous Variables"	
Dependent Variable	**L.TerrIndex**	**L.RGDP/L.RInv/L.RExp/L.Wrem**
RGDP	-0.093*** (9.62)	-
TerrIndex	-	0.110 (0.977)
RInv	-0.054** (6.33)	-
TerrIndex	-	0.197 (0.825)
RExp	-0.010* (4.14)	-
TerrIndex	-	0.003 (0.04)
Wrem	0.05*** (12.75)	-
TerrIndex	-	0.005 (0.05)

"F-Statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A2: Engle-Granger Causality

Exogenous Variables"		
Dependent Variable	L.TerrIndex	L.GovExp/L.RCon/L.FDI
GovExp	-0.012*	-
	(4.09)	
TerrIndex	-	0.03
		(0.81)
RCon	0.00	-
	(0.00)	
TerrIndex	-	0.09
		(0.21)
FDI	0.014	-
	(1.78)	
TerrIndex	-	2.00

"F-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table B1: RGDP Losses

2001	RGDP	Loss in RGDP (%)	RGDP in Loss in Billion Rs	Exchange rate[40]	Billion $ US
2002	28015	0.4825439	13518.46736	61.4349	0.220045
2003	29389	0.5204144	15294.4588	58.5034	0.261428
2004	30363	0.9566013	29045.28527	57.5826	0.504411
2005	32587	1.0368523	33787.9059	59.3576	0.569226
2006	33904	0.9785002	33175.07078	59.87564	0.554066
2007	35154	0.9748845	34271.08971	60.64102	0.565147
2008	35106	1.3988287	49107.28034	62.62875	0.784101
2009	35908	2.055751782	73817.93498	78.61953	0.938926
2010	37309	4.32823946	161482.286	83.87801	1.925204
		Total Loss:	**443.499780**		**6.322555**

[40] Exchange rate is the average of exchange rate in the given year.

Table B2: Investment losses

Year	GFCF with Average Terrorism	Actual GFCF	Prediction with Intense post 9/11 Terrorism	Loss % GFCF	Loss Million $ US
2001	3.16619	3.16619	3.16619		
2002	3.456001	3.15136	3.205855	0.3046419	23.98444165
2003	3.627957	3.22943	3.113857	0.3985279	30.68406409
2004	3.740155	2.87747	3.005027	0.8626856	64.97583395
2005	3.818735	2.91027	2.935731	0.9084655	66.93838636
2006	3.868643	3.1008	3.175746	0.7678438	55.35842977
2007	3.920827	3.16608	3.312657	0.7547477	53.24854845
2008	3.980178	3.48207	3.370569	0.4981081	34.39352964
2009	4.046849	3.70127	3.226439	0.3455795	23.35227715
2010	4.119641	N/A	3.5513572	0.568284[P]	
2011	4.196846	N/A	3.886676	0.310170[P]	
			Total Loss with available data:	**4.8406**	**352.9355111**
			Predicted Loss till 2011	**5.7190551**	

Table B3: Real Exports losses

Year	Exp with Average Terrorism	Actual Exp Growth	Prediction with Intense post 9/11 Terrorism	Loss % Exp	Loss Million $ US
2001					
2002	3.1815539	3.14975	3.193668	0.031804	2.01492329
2003	3.260799	3.27354	3.126776	0	0
2004	3.3308739	2.89699	3.119721	0.433884	35.5649995
2005	3.3925321	2.86381	2.835525	0.528722	49.2085886
2006	3.4481158	2.97098	2.967906	0.477136	48.0007568
2007	3.5053295	2.99744	3.018854	0.50789	53.3415948
2008	3.5665815	2.59106	2.982177	0.975522	116.949564
2009	3.6324969	2.05167	1.855672	1.776825	200.135443
2010	3.7021796	N/A[41]	1.3155552	2.38662[P]	
2011	3.7745054	N/A	0.3984027	3.37610[P]	
			Total Loss with available data:	**2.954957**	**305.080427**
			Predicted Loss till 2011	**10.49451**	

[41] N/A represents data not available.

Table-C: Clemente-Montanes-Reyes Detrended Structural Break Unit Root Test

Variable	Innovative Outliers				Additive Outlier			
	t-statistic	TB1	TB2	Decision	t-statistic	TB1	TB2	Decision
$\ln RGDP_t$	-4.179	1980	1996	I(0)	-6.145*	1996	2002	I(1)
$\ln FDI_t$	-6.115*	1977	1984	I(0)	-8.111*	1984	1994	I(1)
$\ln RCon_t$	-1.246*	1992	2001	I(0)	-3.225	1990	2000	I(1)
$\ln GovExp_t$	-4.212	1980	1996	I(0)	-4.117	1982	1996	I(1)
$TerIndex_t$	-5.871**	1977	1984	I(0)	-3.426	1983	1987	I(1)
$\ln REXP_t$	-3.495	1980	1996	I(0)	-6.655*	1978	2002	I(1)
$\ln RInv_t$	-3.675	1980	1996	I(0)	-5.861**	1978	2002	I(1)
$RInte_t$	-4.621	1996	2000	I(0)	-5.908**	1977	2000	I(1)
$\ln Wrem_t$	-6.761*	1994	2000	I(0)	-5.590**	1980	2000	I(1)
$\ln Inflation_t$	-2.480	1996	2002	I(0)	-2.608	1991	1995	I(0)

Note: * & ** indicates significant at 1% & 5% level of significance respectively.

Result: Five variables are I(0) while rest are I(1).

Table D: Bi-variate VAR with Terrorism and RGDP according to AIC[42]

Vector Autoregression Estimates
Sample (adjusted): 1973-2008
Included observations: 36
Standard errors in ( ) & t-statistics in [ ]

	RGDP	TERRORINDEX
RGDP(-1)	0.640044	0.368662
	(0.18647)	(1.14380)
	[3.43246]	[0.32231]
RGDP(-2)	0.285456	-0.662509
	(0.23268)	(1.42730)
	[1.22679]	[-0.46417]
RGDP(-3)	-0.083049	0.873512
	(0.16968)	(1.04084)
	[-0.48944]	[0.83924]
TERRORINDEX(-1)	**-0.089462**	0.624053
	(0.03021)	(0.18533)
	[-2.96102]	[3.36726]
TERRORINDEX(-2)	0.026554	-0.191223
	(0.03807)	(0.23355)
	[0.69744]	[-0.81878]
TERRORINDEX(-3)	0.075168	0.298993
	(0.03207)	(0.19672)
	[2.34380]	[1.51986]
C	0.519956	-0.313985
	(0.16195)	(0.99342)
	[3.21054]	[-0.31606]
R-squared	0.932532	0.782539
Adj. R-squared	0.916962	0.732355
F-statistic	59.89422	15.59358
Akaike AIC	-0.797249	2.830456
Schwarz SC	-0.479808	3.147897

[42] According to BIC lag length of 1 is optimal, with insignificant terrorism coefficients. Again, terrorism does not Granger-Cause RGDP with F-statistic: 1.48.

Table E1: Johansens Cointegration Test: Real GDP series

Sample : 1973- 2008
Included observations: 36
Trend assumption: No deterministic trend
Series: RGDP TERRORINDEX LOGFDI RINTRATE LOGEXPP
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.714500	100.2195	76.97277	0.0003
At most 1 *	0.491826	57.60003	54.07904	0.0235
At most 2	0.406257	34.58437	35.19275	0.0581
At most 3	0.302582	16.85990	20.26184	0.1378
At most 4	0.126729	4.607321	9.164546	0.3292

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.714500	42.61951	34.80587	0.0048
At most 1	0.491826	23.01566	28.58808	0.2188
At most 2	0.406257	17.72447	22.29962	0.1929
At most 3	0.302582	12.25258	15.89210	0.1718
At most 4	0.126729	4.607321	9.164546	0.3292

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table E2: Johansens Cointegration Test: Worker Remittances series

Sample: 1973-2008
Included observations: 36
Trend assumption: No deterministic trend
Series: LOGWREMC TERRORINDEX LOGFDI RINTRATE INFLATION
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.658743	87.97938	76.97277	0.0057
At most 1	0.556253	51.42535	54.07904	0.0845
At most 2	0.287747	23.80030	35.19275	0.4757
At most 3	0.256076	12.26336	20.26184	0.4255
At most 4	0.062812	2.205624	9.164546	0.7365

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.658743	36.55403	34.80587	0.0306
At most 1	0.556253	27.62505	28.58808	0.0660
At most 2	0.287747	11.53694	22.29962	0.6997
At most 3	0.256076	10.05774	15.89210	0.3291
At most 4	0.062812	2.205624	9.164546	0.7365

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table F: VAR with first differences

VARIABLES	(1) RInv	(2) DFDI	(3) RExp	(4) WRem	(5) GovExp	(6) RCon	(7) RGDP
LD.RGDP							0.65
							(0.777)
LD.terrorindex	**-0.05**	**0.04**	**-0.06****	**-0.18**	**-0.02****	**0.00**	**-0.07****
	(0.032)	(0.035)	(0.031)	(0.202)	(0.068)	(0.001)	(0.031)
LD.FDI	0.02	-0.05	0.09	0.09	0.50*		0.15
	(0.013)	(0.146)	(0.112)	(0.084)	(0.273)		(0.110)
LD.Rintrate	0.09	-0.07		0.00	0.17		0.05
	(0.118)	(0.129)		(0.754)	(0.239)		(0.113)
LD.RExp			-0.68				-0.74
			(0.572)				(0.738)
LD.RInv	-0.04	-0.08	0.60			0.00	
	(0.549)	(0.601)	(0.511)			(0.003)	
LD.Inflation	0.00	-0.00		-0.05	0.00		
	(0.026)	(0.029)		(0.098)	(0.051)		
LD.WRem				0.41**			
				(0.194)			
LD.GovExp					-0.01		
					(0.442)		
LD.RCon						-0.31*	
						(0.173)	
Constant	0.07	0.07	0.05	0.13	0.13	0.00***	0.05
	(0.041)	(0.045)	(0.036)	(0.218)	(0.089)	(0.001)	(0.037)
Observations	36	36	36	36	36	36	36
R-squared	0.22	0.09	0.23	0.27	0.31	0.12	0.30
F test (p-values)	0.08	0.08	0.12	0.14	0.19	0.03	0.17

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

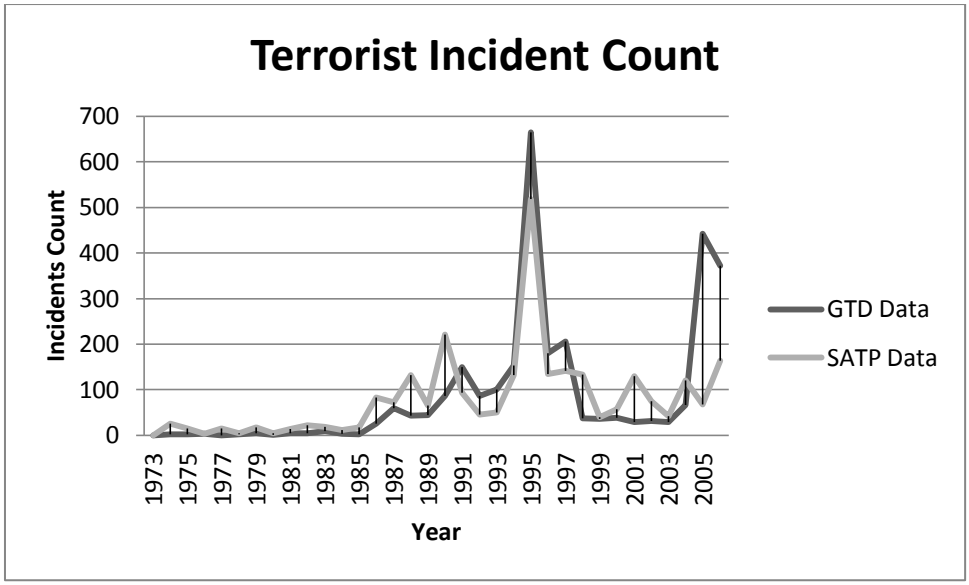


Figure G: Yearly plot terrorist incidents in Pakistan for GTD and SAPT dataset, correlation coefficient: 0.77.

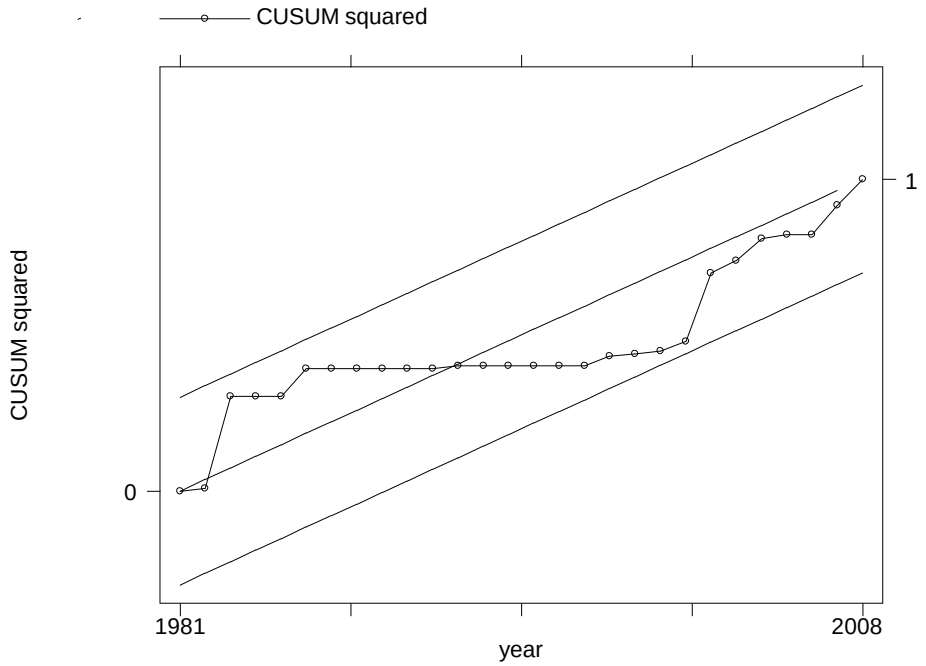


Figure H1: CUSUM of square graph for Investment and terrorism

Note: The straight lines represent critical bounds at 5% significance level

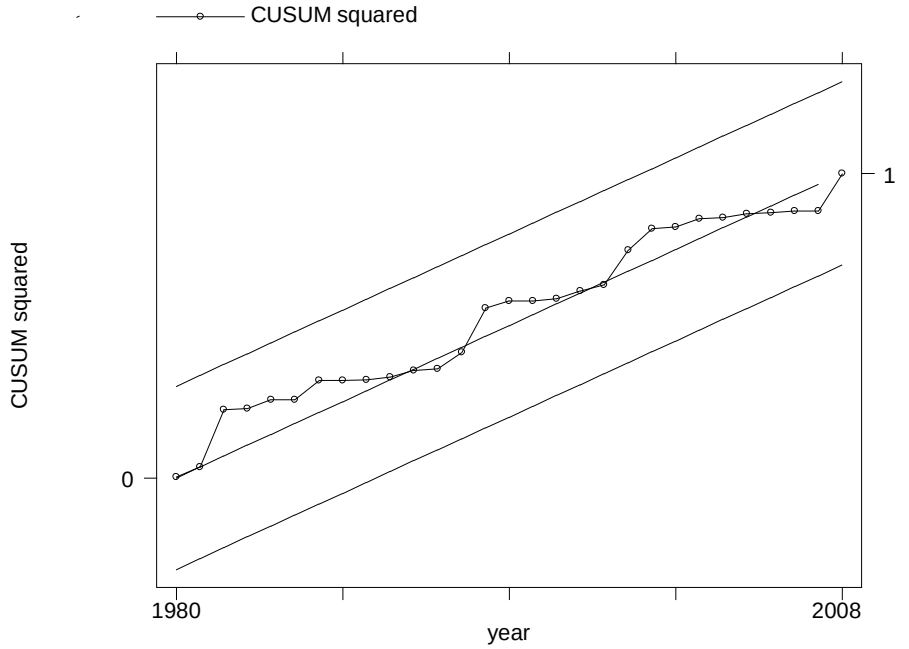


Figure H2: CUSUM of square graph for RGDP and terrorism Regression

Note: The straight lines represent critical bounds at 5% significance level

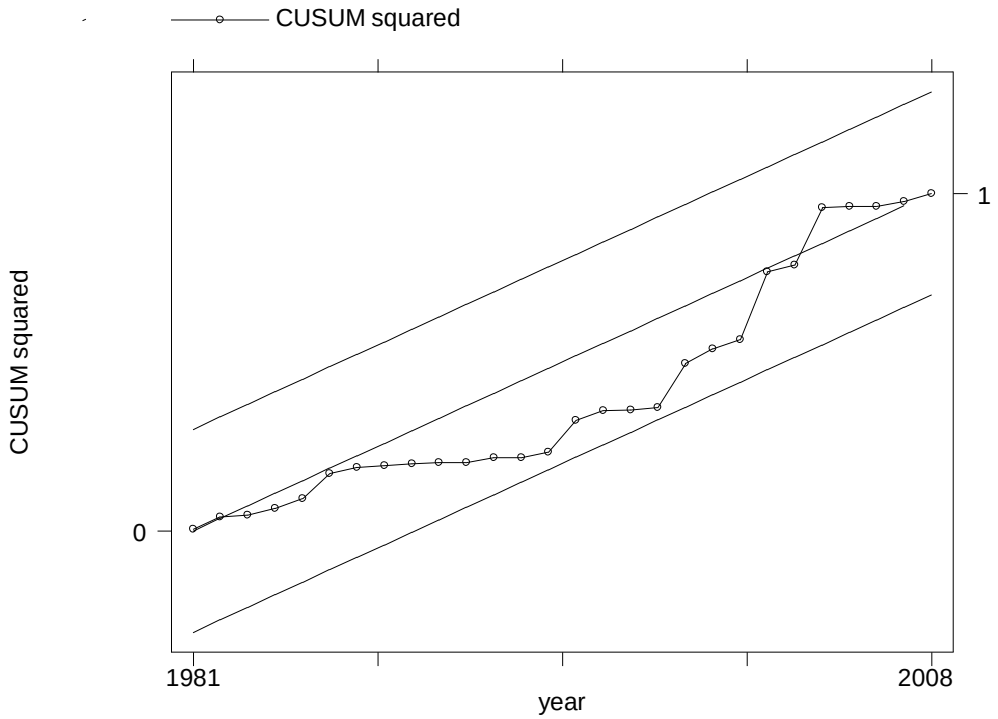


Figure H3: CUSUM of square graph for Wrem and terrorism Regression

Note: The straight lines represent critical bounds at 5% significance level

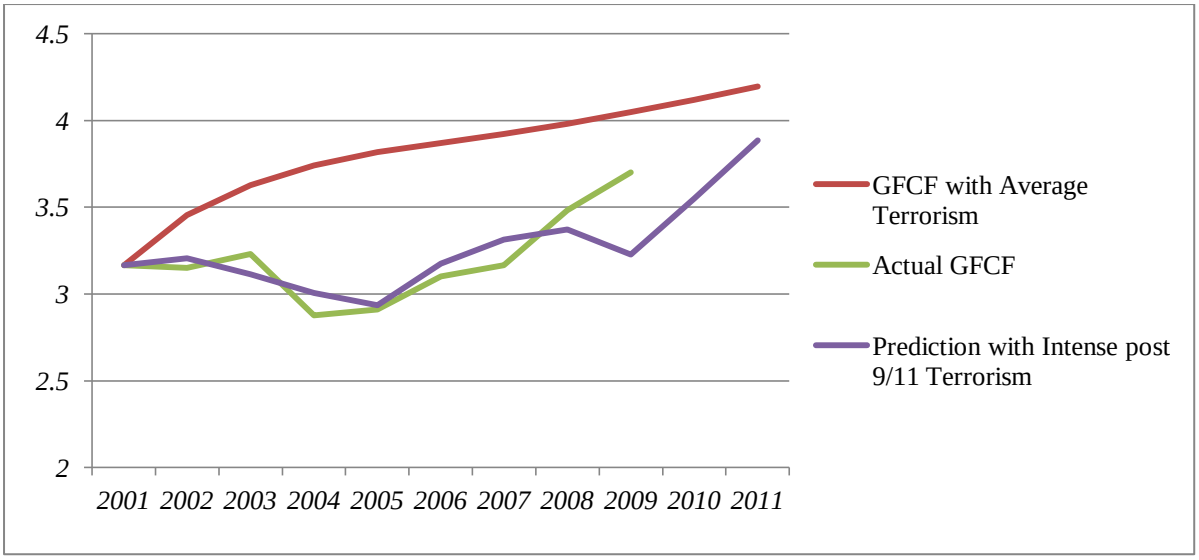


Figure I. Real Gross Fixed Capital formation growth predicted and actual patterns [Source: SBP].

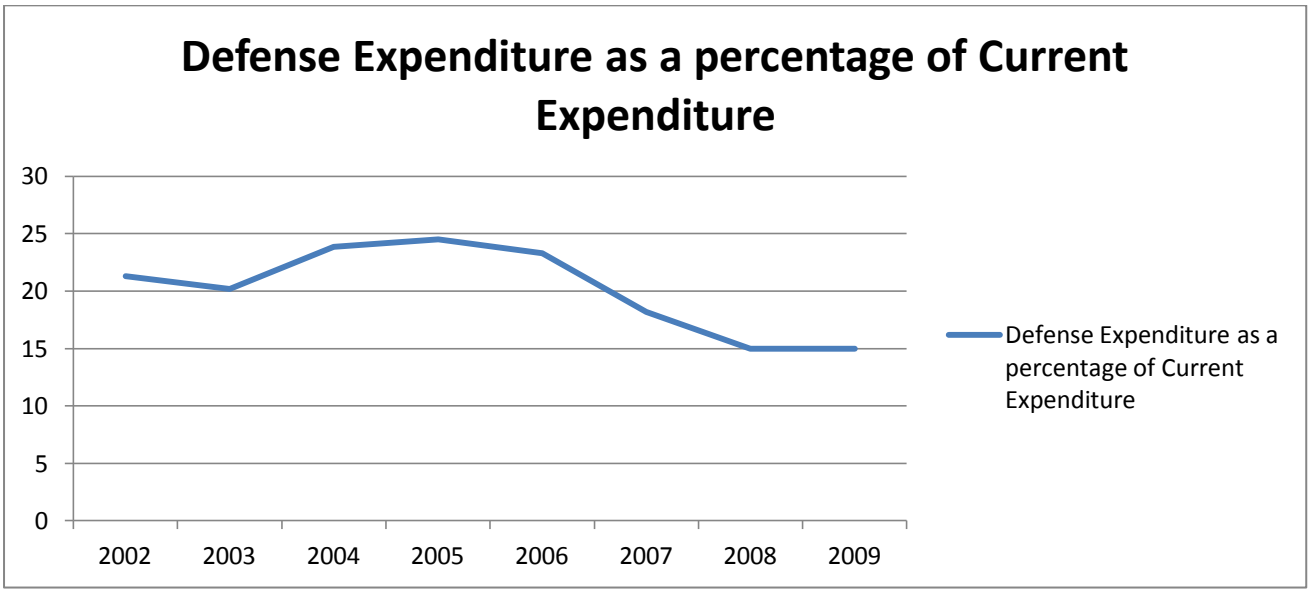
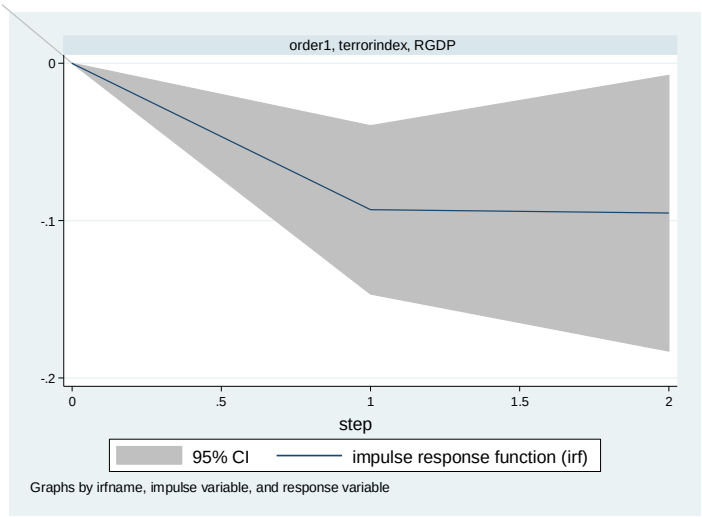
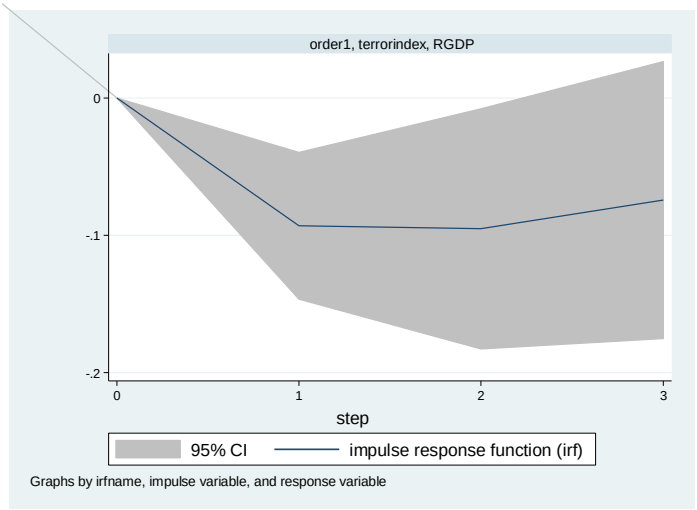


Figure J: Defense consumption as a percentage of Current Expenditure [Source: SBP].





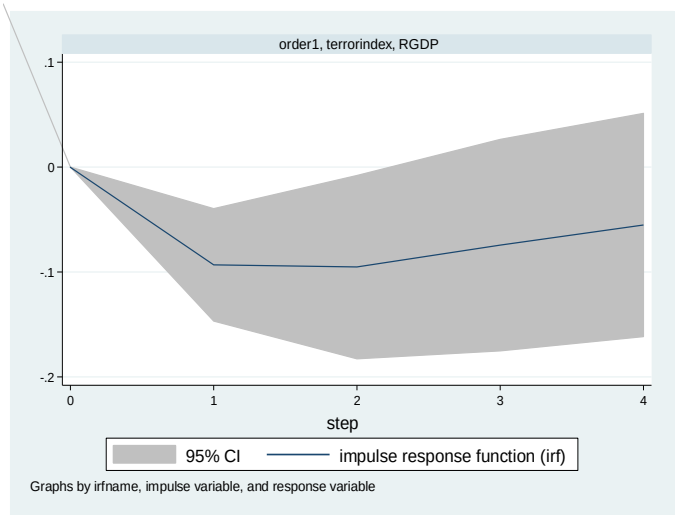
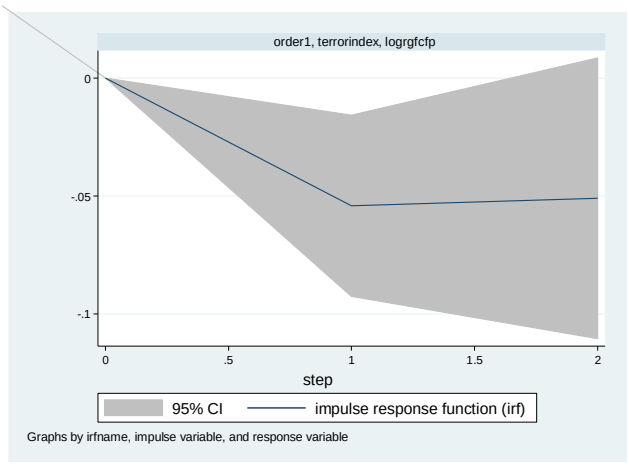


Figure K1: Impulse Response of RGDP on Terrorism with 2, 3 and 4 steps ahead[43].



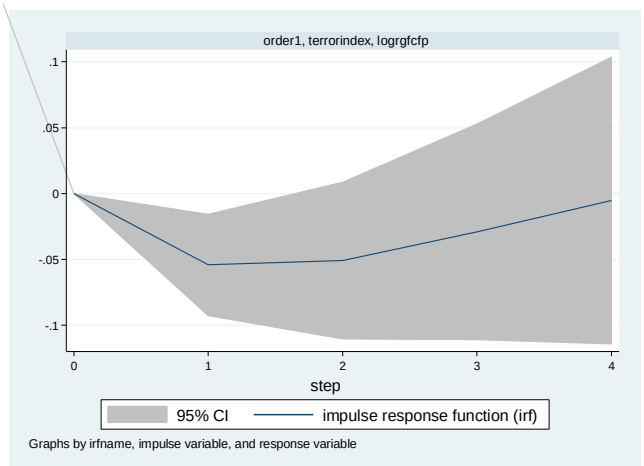


Figure K2: Impulse Response of Real Investment on Terrorism with 2 and 4 Steps ahead.

[43] The same conclusions for all macroeconomic variables hold when we consider larger steps of 10 years ahead.

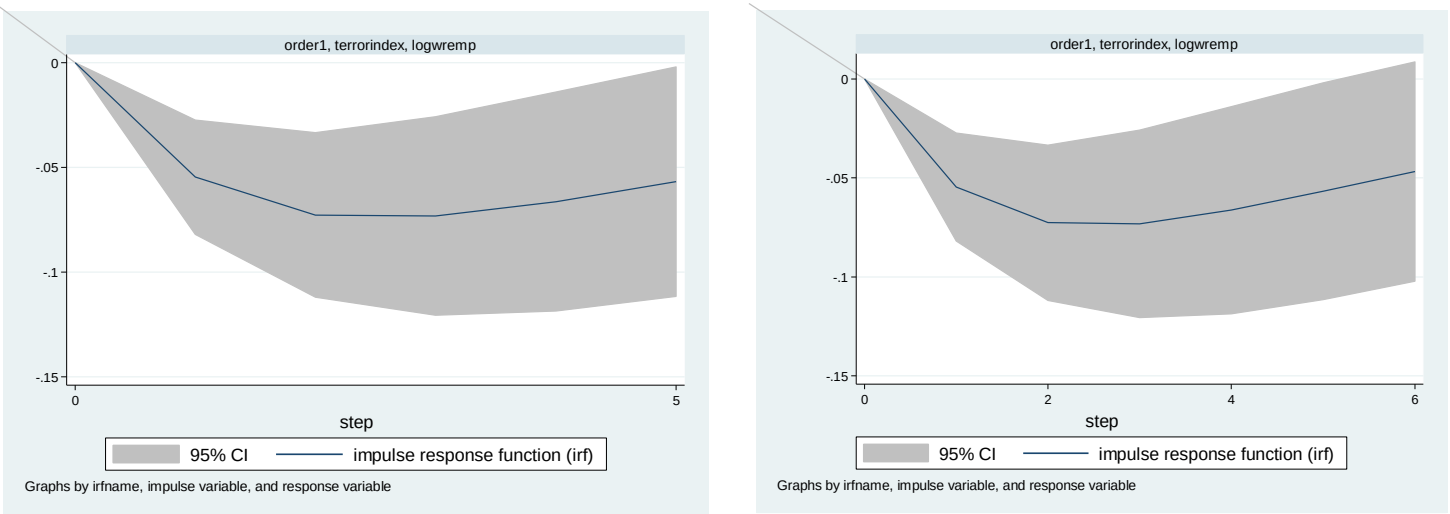


Figure K3: Impulse Response of Worker Remmitances on Terrorism 5 and 6 Steps ahead.

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