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Abstract
This paper analyzes the relationship between terrorism and economic growth for Pakistan by incorporating capital and trade openness. We used the data from 1971-2010 and have applied ARDL bounds testing approach to cointegration to examine the long run relationship between the variables. The VECM Granger causality approach is used to detect the direction of causality between terrorism and economic growth.

Our empirical results confirm the existence of long run relationship between economic growth and terrorism. The Granger causality analysis indicates bidirectional causality between terrorism and capital, trade openness and capital, and terrorism and trade openness. However, unidirectional causality is found running from economic growth to terrorism.

JEL Classification: Terrorism, Economic Growth, Cointegration and Causality

I. Introduction

The question of economic consequences of war and internal conflicts has historically received much attention by academicians and researchers. However, a closely related but significantly different form of disruption, terrorism and its impact on economic growth is not as deliberated in economic literature. Theoretically a negative relationship should exist between events of terrorism and economic growth. Terrorism has the potential to impede economic activity through its multipronged affects including, but not limited to, redirection of government expenditures from growth-enhancing investment activities to less productive expenditures on defence related activities, reduction in foreign direct investment (FDI) and portfolio investment (PI) as a result of an increase in the perceived political and country risk of the economy, and destruction of physical infrastructure. Furthermore, with the increase in terrorist activities the probability of death also increases and the individuals tend to associate less utility with future consumption. As a result, individuals may substitute savings with current consumption which further weighs down the capital formation process and hence hinders economic growth. Conversely, low levels of economic development, unequal distribution of wealth, and high unemployment rate can reduce the opportunity cost of engaging in terrorist activities and thus may increase terrorism.

This study focuses on the causal relationship between terrorism and economic growth in the case of Pakistan. Our findings showed that economic growth is responsible for terrorists' activities as Granger causality is running from economic growth to terrorism in long run and feedback hypothesis exists in the short run. Feedback relationship is found between terrorism and trade openness and same inferences can be drawn for terrorism and capital, and capital and trade openness. This study provides new directions for policy implication to control terrorism by distributing fruits of economic growth equally to all segments of population. The rest of the study is organized as follows: Section I.I reports terrorism events in Pakistan; Section II highlights review of related literature; Section III details the estimation strategy; Section IV covers results and discussion and Section V concludes the study with policy implications.

I.I Terrorism in Pakistan

Pakistan shares its international borders with Afghanistan, China, Iran and India. Pakistan shares its longest border with India and the Indo-Pak relations have been marked by decades of severe adversary including three wars and frequent minor cross-border military infiltrations from both sides. The governments of both countries have blamed their counterparts for funding and supporting separatist/terrorist organizations' activities in their territories. Pakistan shares its second longest border with Afghanistan and the Pak-Afghan relations have been affected by the issues of Pashtunistan, the Soviet war, the advent of Taliban, the current war in Afghanistan and Afghanistan's relations with India. The America-Afghan war in the post 9/11 era has adversely affected security situation in Pakistan. Retreating from Afghan territory, Taliban were pushed in bordering zones of Pakistan. At present Khyber Pakhtunkhwah (KPK) province, border province with Afghanistan, is the source of almost all terrorist activities in Pakistan. There is a clear influx of terrorists across Pak-Afghan border in the wake of military operations against Al-Qaeda in Afghanistan led by U.S forces. In fact, Pakistan has been the largest sufferer of terrorist activities in the past decade. Table-1 below summarizes the terrorism events in Pakistan over the last seven years by type of terrorist activity.

Table-1: Terrorism Events in Pakistan

	2004	2005	2006	2007	2008	2009	2010	Total
Armed Attack	50	166	106	315	779	850	500	2,766
Arson/Firebombing	1	3	4	12	75	64	44	203
Assault		8	12	43	82	70	30	245
Assassination	3			1				4
Barricade/Hostage		1		7	9	22	8	47
Bombing	97	246	247	460	673	687	415	2,825
Hijacking				2	18	7	2	29
Kidnapping	2	15	19	96	312	284	112	840
Near Miss/Non-Attack Incident	1	2	1	7	18	23	18	70
Other			3	2	5	1	1	12
Suicide	1	1	5	41	58	84	40	230
Theft			2	12	12	18	2	46
Threat			1	15	1	1		18
Unknown		8	2	13	49	102	18	192
Vandalism		1		3		2		6
Total	155	451	402	1,029	2,091	2,215	1,190	7,533

Source: Worldwide Incidents Tracking System

The severity of terrorist activities in Pakistan has increased recently despite the number of terrorist incidents have been reduced. According to South Asia Terrorism Portal (SATP), a terrorism database, 2,654 civilians were killed in terrorist violence from January 2010 to May 2011, as compared to around 1,600 civilian deaths from 2003 to 2006. The reason behind this is the willingness of terrorists to engage in suicide bomb attacks. According to SATP, there were seventy-six suicide attacks in Pakistan in 2009 as compared to only two in 2003. From the post attack evidence, it has been observed that the terrorists are increasingly using younger children from financially deprived households to carry out suicide attacks. The terrorist activities have taken amass as a response to the antiterrorist military initiatives by the Government in certain areas of the KPK.

II. Literature Review

Terrorism is defined as use of violence and threat of violence to induce psychic fear in the noncombatant targeted audience(s) by an illicit and usually clandestine political, religious, ideological, revolutionist or separatist organization in order to induce political and economic disruption as a short term objective and to achieve other medium-to-long run objectives through this short term goal. The economic literature does not provide a conclusive answer regarding bi-directional causal linkage between terrorism and economic growth. In hindsight, an increase in economic growth rate should lead to decline in terrorism by increasing the opportunity cost of engaging in terrorist activities, however, on the other hand if benefits of economic growth are not widespread and there is unequal distribution of wealth, geographically or otherwise, it may cause

domestic terrorism to rise. Alternatively, an increase in terrorist activities may lead to a decline in economic growth. It is also possible that causality exists from both sides or there may be no causality at all between economic growth and terrorism.

Inter alia, Collier (1999), Frey et al. (2007), Enders and Sandler (2008), Eckstein and Tsiddon (2004) and Mirza and Verdier (2008) have discussed theoretical framework regarding channels through which terrorism impede economic growth. The potential costs of terrorism borne by an economy, in terms of hampered economic growth, can be classified as direct and indirect costs.

Collier (1999) identified the most obvious and direct peril of civil wars, of which terrorism can be considered a related phenomenon, as destruction of physical capital including devastation of public infrastructure and loss of human capital. Simultaneously, transaction costs are amplified as a result of reduced security and the effectiveness of government institutions is compromised. A key factor affecting economic growth is the share of GDP directed to investment spending. Blomberg et el. (2004) and, Gaibulloev and Sandler (2008) pointed out that terrorism diverges economic activity away from investment spending to government spending mainly for instituting non-productive defense mechanisms against terrorist activities. Knight et al. (1996) quantified the impact of military spending on gross domestic product (GDP) and showed that an additional 2.2 percent of GDP spent on the military, sustained over seven years that is the length of the typical conflict, would lead to a permanent loss of around 2 percent of GDP. Abadie and Gardeazabal (2008) showed that significant reductions exist in net foreign investment position in a country due to terrorist risk. Enders and Sandler (1996) investigated the impact of terrorism on the net foreign direct investment (NFDI) in Spain and Greece using VAR analysis. They found that terrorism reduced NFDI by 13.5% and 11.9% in these countries respectively as investors seek less violence-prone countries; however the impact is expected to be smaller for large diversified economies. In addition, Coe and Helpman (1995) identified that foreign direct investment (FDI) plays a vital role in technology transfer which enhances total factor productivity. Moreover, terrorism can adversely disrupt financial markets, thereby decreasing investment flows (Abadie and Gardeazabal 2003).

Collier et al. (2002) estimated the share of private wealth held abroad increases from 9% to 20% for countries experiencing sustained period of internal conflict. In addition to capital flight, the phenomena of human capital flight or brain drain, population displacement, destruction of social capital and psychological effects including depression and posttraumatic stress disorders are also associated with terrorism and internal conflicts. Eckstein and Tsiddon (2004) and Naor (2006) argued that terrorism increases perceived probability of untimely death and prompts people to substitute savings with current consumption to enhance utility in the present at the expense of future which is another cause of decline in economic activity. Araz-Takay et al. (2009) investigated the macroeconomic effects of terrorism by controlling for the possible non-linear and endogenous relationship between political conflict and economic activity. They confirmed that terrorism has a large significant negative impact on economic activity and the impact is more severe during expansionary periods, and that the impact of economic activity on terrorism is significant only in recessionary periods. Inter alia, Mirza and Verdier (2008) and Nitsch and Schumacher (2004) documented the negative impact of terrorism on bilateral international trade. In case of Pakistan, a potential cost is the loss of revenue that could be generated from serving as a trade route between India, China, Iran and other Middle Eastern states which is not possible at the moment because of massive terrorist activities in the bordering areas of Pakistan.

Terrorism can also impede economic growth through its detrimental effect on tourism, unarguably one of the largest industries in the world when taken into consideration with the allied businesses like airlines, hoteling, transportation and the products and services consumed by tourists. Enders et al. (1992) and Drakos and Kutan (2003) suggested that terrorism does have a significant negative impact on tourism. Other channels through which terrorism may impact economy include increased unemployment and increased future costs of disability, physical and mental injuries. Other studies including Enders and Sandler (1996), Abadie and Gardeazabal (2003), Tavares (2004), Chen and Siems (2004), and Gaibulloev and Sandler (2008) have shown that economic growth is negatively affected by terrorism albeit to different level in different economies.

On contrary, Sandler and Enders (2004) and Freytag et al. (2009) posited that terrorists are rational individuals and base their decisions on a cost-benefit analysis of terrorist activities. Therefore, lower levels of economic activity, associated with lower opportunity cost of terrorism, incentivize terrorist activities while high levels of economic activity are associated with higher opportunity costs of terrorism and reduced terrorist activity. Gries et al. (2011) investigated growth-terrorism causality by using data of Western European countries and revealed a profound impact of economic activity on terrorism for only three out of seven countries. Shahbaz and Shabbir (2011) discussed the feedback effect between terrorism and inflation suggesting that terrorism widens the demand-supply gap through destruction of public infrastructure that leads to inflation which further increases terrorist activities. Bravo and Dias (2006) have also shown that between 1997 and 2004 maximum number of terrorist attacks took place in less developed economies with low dependence on international trade as a confirmation of the 'deprivation' approach to causes of terrorism.

Piazza (2006) evaluated the deprivation hypothesis that poverty, inequality, poor economic development, and unemployment are the prime causes of terrorism. However, the results did not indicate any causality between economic growth and terrorism. Instead the structure of party politics was found to be the most significant predictor of terrorism. Similarly, Pinar (2011) scrutinized the causes of separatist terrorism in South-Eastern parts of Turkey where the government policies are geared to improve economic conditions in pursuance of the widely accepted hypothesis that poverty is the main driving force behind separatist terrorism. However, there was no causal relationship found between economic development and separatist terrorism in South-Eastern Turkey. Recently Nasir et al. (2008) investigated the direction of causal relationship between economic growth and terrorism and found no causality running either from economic growth to terrorism or from terrorism to economic growth[1]. Inter alia, Blomberg et al. (2004) and Enders and Sandler (2006) have found that the adverse economic effects of terrorism are not statistically significant for OECD countries and mature economies. Gries et al. (2011) found that in bivariate settings, the impact of economic performance on domestic terrorism is very strong but in trivariate settings the impact of growth on terrorism diminishes. Also, terrorism is almost never found to affect growth in bivariate or trivariate specifications.

[1] The findings by Nasir et al. (2007) may be less reliable because they used bivariate system to find out causality between the variables. However, they did not consider other potential and vital variables such as capital and trade openness in their analysis. Lütkepohl (1982) argued that omission of important variables would risk providing potentially biased and inappropriate results. No causal relation is found in the bi-variate system due to these neglected variables.

III. Estimation Strategy

The Autoregressive Distributed Lag Model or simply the ARDL bounds testing approach to cointegration developed by Pesaran et al. (2001) has been used to conduct cointegration analysis between terrorism, economic growth, capital and trade openness in case of Pakistan. The ARDL bounds testing approach to cointegration is preferred over traditional cointegration approaches due to its merits. For instance, ARDL can be applied regardless of whether the variables are integrated of order I(0) or integrated of order I(1). The ARDL bound testing approach to cointegration has better properties for small data sample. In addition, unrestricted error correction model (UECM) is derived from ARDL model using simple linear specification (Banerrjee and Newman, 1993) which integrates both long run as well as short run dynamics. The UECM model does not seem to lose information about long run relation. The unrestricted error correction model (UECM) of the ARDL bounds testing approach to cointegration version is as follows:

$$\Delta \ln G_t = \alpha_\circ + \alpha_T T + \alpha_G \ln G_{t-1} + \alpha_{TA} \ln TA_{t-1} + \alpha_K \ln K_{t-1} + \alpha_{TR} \ln TR_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta \ln G_{t-i} + \sum_{j=0}^{q} \alpha_j \Delta \ln TA_{t-j} + \sum_{l=0}^{m} \alpha_k \Delta \ln K_{t-l} + \sum_{n=0}^{n} \alpha_l \Delta \ln TR_{t-n} + \mu_t \quad \ldots\ldots. (1)$$

$$\Delta \ln TA_t = \beta_\circ + \beta_T T + \beta_G \ln G_{t-1} + \beta_{TA} \ln TA_{t-1} + \beta_K \ln K_{t-1} + \beta_{TR} \ln TR_{t-1} + \sum_{i=1}^{p} \beta_i \Delta \ln TA_{t-i} + \sum_{j=0}^{q} \beta_j \Delta \ln G_{t-j} + \sum_{l=0}^{m} \beta_k \Delta \ln GK_{t-l} + \sum_{n=0}^{n} \beta_l \Delta \ln TR_{t-n} + \mu_i \quad \ldots\ldots.. (2)$$

$$\Delta \ln K_t = \phi_\circ + \phi_T T + \phi_G \ln G_{t-1} + \phi_{TA} \ln TA_{t-1} + \phi_K \ln K_{t-1} + \phi_{TR} \ln TR_{t-1} + \sum_{i=1}^{p} \phi_i \Delta \ln K_{t-i} + \sum_{j=0}^{q} \phi_j \Delta \ln TA_{t-j} + \sum_{l=0}^{m} \phi_k \Delta \ln G_{t-l} + \sum_{n=0}^{n} \phi_l \Delta \ln TR_{t-n} + \mu_i \quad \ldots\ldots.. (3)$$

$$\Delta \ln TR_t = \varphi_\circ + \varphi_T T + \varphi_G \ln G_{t-1} + \varphi_{TA} \ln TA_{t-1} + \varphi_K \ln K_{t-1} + \varphi_{TR} \ln TR_{t-1} + \sum_{i=1}^{p} \varphi_i \Delta \ln TR_{t-i} + \sum_{j=0}^{q} \varphi_j \Delta \ln TA_{t-j} + \sum_{l=0}^{m} \varphi_k \Delta \ln K_{t-l} + \sum_{n=0}^{n} \varphi_l \Delta \ln G_{t-n} + \mu_i \quad \ldots\ldots(4)$$

Where $\alpha_\circ$, $\beta_\circ$, $\phi_\circ, \varphi_\circ$ and α_T, β_T, ϕ_T, φ_T are the drift components and time trends respectively while μ_i is assumed to be white noise error processes. In order to ensure that serial correlation does not exist, the Akaike Information Criteria (AIC) is used to select the optimal lag structure of first differenced regression. Pesaran et al. (2001) determined the upper and lower critical bounds to conclude that either cointegration for long run relationship exists or not among the running variables. The null hypotheses of no cointegration are:

$H_\circ : \alpha_G = \alpha_{TA} = \alpha_K = \alpha_{TR} = 0$ $\quad$ $H_\circ : \beta_G = \beta_{TA} = \beta_K = \beta_{TR} = 0$

$H_\circ : \phi_G = \phi_{TA} = \phi_K = \phi_{TR} = 0$ $\quad$ $H_\circ : \varphi_G = \varphi_{TA} = \varphi_K = \varphi_{TR} = 0$

The alternate hypotheses of cointegration are:

$H_1 : \alpha_G \neq \alpha_{TA} \neq \alpha_K \neq \alpha_{TR} \neq 0$, $H_1 : \beta_G \neq \beta_{TA} \neq \beta_K \neq \beta_{TR} \neq 0$,

$H_1 : \phi_G \neq \phi_{TA} \neq \phi_K \neq \phi_{TR} \neq 0$, $H_1 : \varphi_G \neq \varphi_{TA} \neq \varphi_K \neq \varphi_{TR} \neq 0$.

The calculated F-statistics have been compared with the lower critical bound (LCB) and upper critical bound (UCB) computed by Pesaran et al. (2001) as per follows:

F-statistic > UCB => cointegration exists,
F-statistic < LCB => no cointegration exists and
LCB < F-statistics < UCB => inconclusive results

The direction of causal relationship between terrorism, economic growth, capital, and trade openness has been determined by means of standard Granger causality test augmented with a lagged error-correction term. According to granger representation theorem if the variables are integrated of order I(1) and cointegration exists among the variables then at least unidirectional granger causality should exist.

Engle and Granger (1987) further elaborated that granger causality can produce misleading results if cointegrated variables are tested at first difference through vector auto regression (VAR). However the addition of another variable, error correction term can help to capture the long run relationships. Therefore, error correction term is included in the augmented version of Granger causality test and the result is a bi-variate *p*th order vector error-correction model (VECM) which is as follows:

$$\Delta \ln G_t = \alpha_{\circ 1} + \sum_{i=1}^{l} \alpha_{11} \Delta \ln G_{t-i} + \sum_{j=1}^{m} \alpha_{22} \Delta \ln TA_{t-j} + \sum_{k=1}^{n} \alpha_{33} \Delta \ln K_{t-k} + \sum_{r=1}^{o} \alpha_{44} \Delta \ln TR_{t-r} + \eta_1 ECM_{t-1} + \mu_{1i} \quad \text{.....(5)}$$

$$\Delta \ln TA = \beta_{\circ 1} + \sum_{i=1}^{l} \beta_{11} \Delta \ln TA_{t-i} + \sum_{j=1}^{m} \beta_{22} \Delta \ln G_{t-j} + \sum_{k=1}^{n} \beta_{33} \Delta \ln K_{t-k} + \sum_{r=1}^{o} \beta_{44} \Delta \ln TR_{t-r} + \eta_2 ECM_{t-1} + \mu_{2i} \quad \text{.....(6)}$$

$$\Delta \ln K_t = \phi_{\circ 1} + \sum_{i=1}^{l} \phi_{11} \Delta \ln K_{t-i} + \sum_{j=1}^{m} \phi_{22} \Delta \ln G_{t-j} + \sum_{k=1}^{n} \phi_{33} \Delta \ln TA_{t-k} + \sum_{r=1}^{o} \phi_{44} \Delta \ln TR_{t-r} + \eta_3 ECM_{t-1} + \mu_{3i} \quad \text{.....(7)}$$

$$\Delta \ln TR = \varphi_{\circ 1} + \sum_{i=1}^{l} \varphi_{11} \Delta \ln TR_{t-i} + \sum_{j=1}^{m} \varphi_{22} \Delta \ln G_{t-j} + \sum_{k=1}^{n} \varphi_{33} \Delta \ln TA_{t-k} + \sum_{r=1}^{o} \varphi_{44} \Delta \ln K_{t-r} + \eta_4 ECM_{t-1} + \mu_{4i} \quad \text{.....(8)}$$

Where difference operator is indicated by Δ; lagged of residual term generated from long run equation i.e. ECM_{t-1} and $\mu_{1i}, \mu_{2i}, \mu_{3i}$ and μ_{4i} are error terms assumed to be normally distributed with zero mean and finite covariance matrix. The existence of short run causal relation is indicated by significance of t-values of 1st differenced variables and significance of t-values relating to error correction term confirms long run causal relationship.

For example, $\alpha_{11,i} \neq 0 \forall_i$ indicates that causality is running from terrorism to economic growth in the short-run. The joint short-run and long-run Granger causality is investigated by the

significance of joint χ^2-statistic on the lagged error correction term and first difference lagged concerned independent variable. However, the causality should be interpreted in strict granger causality sense i.e., it is only predictive and not deterministic.

The data of terrorism (terrorist incidents) is collected from South Asian Terrorism Portal (SATP), maintained by Institute of Conflict Management, India[2]. The world development indicators (CD-ROM, 2011) has been used to obtain data for trade openness per capita, capital use per capita and real GDP per capita. The study covers time period of 1971-2010.

IV. Results and their Discussions

Finally, ARDL cointegration approach can only be used if the variables are stationary either at I(0) or I(1) or mutually cointegrated. In case where variables are integrated at I(2), calculated F-statistic cannot be used to determine the long run relationship. In order to verify whether any variable is integrated at I(2), ADF unit root test by Dickey and Fuller (1979), DF-GLS unit root test by Elliot et al. (1996) and Ng-Perron unit root test by Ng and Perron (2001) were applied[3]. Baum (2004) contested that ADF, DF-GLS and Ng-Perron unit root tests do not provide information about structural breaks in the series and their results may be biased. To resolve the issue, we used Clemente-Montanes-Reyes (1998) de-trended structural break unit root test with one and two structural breaks occurring in series. Clemente-Montanes-Reyes unit root test provides information abut two possible structural break points in the series through (1) an additive outliers (AO) model that points out a sudden change in the mean of a series and (2) an innovational outliers (IO) model that indicates gradual shifts in the mean of the series. As a result, the additive outlier model is more appropriate for series having sudden structural changes as compared to gradual shifts. The results of Clemente-Montanes-Reyes unit root test with one structural break are reported in Table-1 while the results for this test with two structural breaks are reported in Table-2.

Table-1: Clemente-Montanes-Reyes Unit Root Test with One Structural Break

Variable	Innovative Outliers			Additive Outlier		
	t-statistic	TB1	Decision	t-statistic	TB1	Decision
$\ln TA_t$	-2.941	1982	I(0)	-3.678**	1992	I(1)
$\ln G_t$	-1.848	1992	I(0)	-5.405*	1989	I(1)
$\ln K_t$	-3.806	1981	I(0)	-4.361*	1990	I(1)
$\ln TR_t$	-3.458	1984	I(0)	-5.438*	2006	I(1)

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

[2] SATP compiles terrorist attacks in Pakistan in the form of descriptive news arranged chronologically, derived from various news sources, separating suicide attacks provides a unique dataset, to study pure effect of terrorism as opposed to effect of others forms of conflict as studies, typically, clump together insurgencies and acts of warfare and crime under the umbrella of terrorism. Furthermore, as mentioned above suicide incidents does not suffer from same degree of reporting bias as compared to other terrorist incidents, due to their inherent spectacular nature

[3] Results of these tests are available upon request from authors.

Table-2: Clemente-Montanes-Reyes Unit Root Test with Two Structural Breaks

Variable	Innovative Outliers				Additive Outlier			
	t-statistic	TB1	TB2	Decision	t-statistic	TB1	TB2	Decision
$\ln TA_t$	-4.256	1982	1986	I(0)	-6.582*	1992	2002	I(1)
$\ln G_t$	-2.155	1992	1992	I(0)	-6.020*	1989	2001	I(1)
$\ln K_t$	-4.743	1981	1986	I(0)	-6.087*	1990	2004	I(1)
$\ln TR_t$	-3.746	1984	1989	I(0)	-5.570**	2004	2006	I(1)

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

The results of Clemente-Montanes-Reyes unit root test show that terrorism, economic growth, capital and trade openness have unit root problem at I(0) while the variables become stationary at I(1). The results of Clemente-Montanes-Reyes unit root test lead us to investigate the long run relationship between the series by applying ARDL bounds testing approach to cointegration. The ARDL bound testing approach requires the selection of appropriate lag length as the F-statistic is very sensitive to lag order of the variables (Feridun and Shahbaz, 2010). We followed AIC criterion to choose appropriate lag length that provides appropriate information regarding lag order selection. Lag length is shown in third row of Table-3.

Table-3: The Results of ARDL Cointegration Test

Bounds Testing to Cointegration				
Dependent Variable	$G_t = f(TA_t, K_t, TR_t)$	$TA_t = f(G_t, K_t, TR_t)$	$K_t = f(G_t, TA_t, TR_t)$	$TR_t = f(G_t, K_t, TA_t)$
Optimal Lag Length	(2, 2, 2, 1)	(1, 1, 2, 2)	(2, 1, 1, 2)	(2, 2, 2, 1)
F-statistics	1.222	9.896*	6.862**	6.775**
	Critical values (T = 38)			
	Lower bounds $I(0)$	Upper bounds $I(1)$		
1 per cent level	7.397	8.926		
5 per cent level	5.296	6.504		
10 percent level	4.401	5.462		
Diagnostic tests				
R^2	0.5887	0.6823	0.7214	0.7642
F-statistics	1.6101 (0.1645)	2.8638 (0.0147)	3.280 (0.0081)	3.6475 (0.0049)
J-B Normality test	0.5555 (0.7545)	0.9671 (0.6166)	1.0746 (0.5842)	0.3394 (0.8438)
Breusch-Godfrey LM test	2.4172 (0.1210)	2.2035 (0.1393)	1.5722 (0.2363)	0.8113 (0.4334)
ARCH LM test	0.2037 (0.6548)	1.5427 (0.2230)	0.2222 (0.6405)	0.8730 (0.3571)
W. Heteroskedasticity Test	0.9319 (0.5520)	0.9572 (0.5263)	1.6571 (0.1485)	0.9905 (0.5039)
Ramsey RESET	0.0318 (0.8604)	0.0008 (0.9774)	0.5020 (0.4877)	0.0561 (0.8144)
Note: A 1%, 5% and 10% level of significance is indicated by *, ** and*** respectively.				

Table-3 provides results of ARDL bound testing approach to cointegration. The calculated F-statistics are 9.896, 6.862 and 6.775 greater than upper critical bounds generated by Turner (2006) at 1% and 5% level of significance when terrorism, capital and trade openness are treated as dependent variables. The critical bounds developed by Pesaran et al. (2001) and Narayan (2005) are not suitable for small sample data. Our analysis indicates that there are three

cointegrating vectors which validate the existence of long run relationship between economic growth, terrorism, capital, and trade openness in case of Pakistan for period of 1971-2010.
At the 5% significance level, all diagnostic tests do not exhibit any evidence of violation of the classical linear regression model (CLRM) assumptions. Specifically, the Jarque-Bera (J-B) normality test cannot reject the null hypothesis, meaning that the estimated residuals are normally distributed and the standard statistical inferences (i.e. t-statistic, F-statistic, and R-squares) are valid. At the same level of significance, both the Breusch-Godfrey LM test and ARCH LM test consistently reveal that the residuals are not serially correlated, and are also free from heteroskedasticity problem. There is no specification problem with the models.

It is indicated that all series such as economic growth, terrorism, capital, and trade openness have unit root problem at their level form while they are found to be stationary at 1st difference. It implies that the variables are integrated at I(1). This unique level of integration leads us to use Johansen multivariate approach to cointegration for robustness of long run relationship. The findings show that there are two cointegration vectors between economic growth, terrorism, capital, and trade openness in case of Pakistan for the period of 1971-2010 which confirm the robustness of long run relation.

The next step is to investigate the direction of causality between economic growth, terrorism, capital, and trade openness after finding evidence of cointegration. The VECM granger causality approach should be conducted when variables are cointegrated. The VECM granger causality approach provides short-run and long-run causal relationship between economic growth, terrorism, capital, and trade openness. The statistical significance of lagged residual term i.e. ECM_{t-1} indicates long-run Granger causality while the joint significance of the lagged explanatory variables shows the short-run causal relationship between the variables. The results of the Granger causality test are reported in Table 4.

Table-4: Results of Test of Cointegration

Hypothesis	Trace Test Statistic	5% CV	Hypothesis	Maximum Eigen Value	5%CV
$R = 0$	90.9337*	47.8561	$R = 0$	50.8150*	27.5843
$R \leq 1$	40.1187*	29.7970	$R = 1$	26.8379*	21.1316
$R \leq 2$	13.2807	15.4947	$R = 2$	10.9689	14.2646
$R \leq 3$	2.31176	3.8414	$R = 3$	2.3117	3.8414

The results point out that there is bidirectional causal relation between terrorism and capital, trade openness and terrorism and, capital and trade openness in long run. The feedback effect between terrorism and capital reveals that terrorism activities lead to an increase in public capital loss by destroying public infrastructure such as roads, schools, hospitals, telecommunications and banks etc. which leads to a decline in production and increases the gap between demand and supply. This increase in gap leads to a hike in inflation which in resulting increases terrorist activities (Shahbaz and Shabbir, 2011). From other side, rising inflation increases poverty that further promotes terrorism in the country. The bidirectional casual relation between terrorism and trade openness indicates that a rise in terrorism granger causes international capital and trade flows by lowering foreign direct investment as well as domestic output and increases capital outflow from the country (Shahbaz et al. 2010). This leads to lower exports share in international markets. The threat of terrorism not only declines public investment but also lowers foreign direct investment in the host country. This leads to an increase in unemployment which in turn increases terrorist activities.

Unidirectional causality is found running from economic growth to terrorism[4]. The rise in per capita income (economic growth) contributes to terrorism. The main reason is unequal distribution of income indicating that economic growth benefits the elite class as compared to bottom 20% segment of population leading to huge poverty[5]. In such environment, poor people are motivated for terrorist acts against some heavy lump-sum amounts (Shahbaz and Shabbir, 2011).

[4] These findings are contrast with the view by Nasir et al. (2007) who reported no causal relationship between economic growth and terrorism using bivariate system.

[5] The recent wave of inflation is hitting the poor segments of population significantly and more than 40% population of Pakistan is living below the poverty line.

Table-5: VECM Granger Causality Analysis

Dependent variable	Type of Granger causality								
	Short-run				Long-run	Joint (short- and long-run)			
	$\Delta \ln G_t$	$\Delta \ln TA_t$	$\Delta \ln K_t$	$\Delta \ln TR_t$	ECM_{t-1}	$\Delta \ln G_t, ECM_{t-1}$	$\Delta \ln TA_t, ECM_{t-1}$	$\Delta \ln K_t, ECM_{t-1}$	$\Delta \ln TR_t, ECM_{t-1}$
	F-statistics [p-values]				[t-statistics]	F-statistics [p-values]			
$\Delta \ln G_t$	–	3.3439** [0.0499]	0.1059 [0.8998]	0.7608 [0.4767]	0.0345 [0.6916]	–	2.2293 [0.1068]	0.2007 [0.8950]	0.5278 [0.6668]
$\Delta \ln TA_t$	3.4095** [0.0473]	–	0.3298 0.7218]	1.6949 [0.2019]	-0.9149* [-4.8043]	8.2315* [0.0004]	–	5.7403* [0.0034]	7.2372* [0.0010]
$\Delta \ln K_t$	1.3120 [0.2853]	0.2623 [0.7711]	–	0.3040 [0.7402]	-0.3948* [-3.0578]	4.8695* [0.0075]	3.4437** [0.0300]	–	3.8744** [0.0195]
$\Delta \ln TR_t$	2.3616 [0.1128]	3.3626** [0.0491]	0.1062 [0.8996]	–	-0.6172* [-3.2310]	7.3363* [0.0009]	5.1608* [0.0058]	3.9605** [0.0180]	–
Note: The asterisks ***, ** and * denote the significant at the 1, 5 and 10 per cent levels, respectively.									

In short run, terrorism and economic growth granger cause each other and unidirectional causality is found running from terrorism to trade openness. In addition to that, the significance of ECM_{t-1} also exhibits that if the system exposes to shock it will converge to the long-run equilibrium at a relatively high speed for terrorism (-0.9149), and trade openness (-0.6172) compared to the convergence speed for capital (-0.3948) where the numbers in parentheses are the VECM (vector error correction term).

The main drawback of causality tests pointed out by Wolde-Rufael, (2009) is that Granger causality tests do not seem to determine the relative strength of causality effects beyond the selected time period. In such circumstances, causality tests are inappropriate because these tests are unable to indicate that how much feed back has existed from one variable to other. To examine the feedback from one variable to another and to check the relative effectiveness of causality effects ahead of sample period, we have applied variance decomposition to examine direction of causality between economic growth, terrorism, capital, and trade openness following Wolde-Rufael, (2009). It is noted that variance decomposition is applied to investigate the response of the dependent variable to shocks stemming from independent variables. The variance decomposition method is an alternate of impulse response function. This process explains how much of the predicted error variance for any variable is described by innovations generated throughout each independent variable in a system over various time horizons. The results reported in Table-6 show that economic growth is explained predominantly by its own innovative shocks (73.60%) while terrorism, capital and trade openness explain economic growth through their innovative shocks accounting for 8.16%, 14.15%, and 4.07% respectively.

Table-6: Variance Decomposition Approach

Variance Decomposition of $\ln G_t$:					
Period	S.E.	$\ln G_t$	$\ln TA_t$	$\ln K_t$	$\ln TR_t$
1	0.0171	100.000	0.0000	0.0000	0.0000
2	0.0253	95.7342	2.8060	0.0692	1.3905
3	0.0330	96.7350	1.6677	0.7440	0.8530
4	0.0407	96.1298	2.7252	0.5642	0.5806
5	0.0473	95.1751	3.7285	0.4189	0.6773
6	0.0525	93.3076	5.2813	0.7203	0.6906
7	0.0569	91.0538	6.4447	1.8698	0.6315
8	0.0608	88.1688	7.1042	4.0138	0.7131
9	0.0640	85.1269	7.2361	6.4328	1.2040
10	0.0666	82.1263	7.4313	8.2954	2.1467
11	0.0687	79.5296	7.8269	9.5986	3.0446
12	0.0704	77.4896	8.2190	10.7047	3.5865
13	0.0719	75.9137	8.3708	11.9178	3.7975
14	0.0733	74.6402	8.3041	13.1586	3.8969
15	0.0746	73.6039	8.1660	14.1595	4.0704
Variance Decomposition of $\ln TA_t$:					
Period	S.E.	$\ln G_t$	$\ln TA_t$	$\ln K_t$	$\ln TR_t$
1	0.6900	5.4220	94.5779	0.0000	0.0000
2	0.7019	7.1714	91.4084	1.2269	0.1932
3	0.7483	10.7323	80.7862	4.8748	3.6065
4	0.8125	17.8724	69.0423	7.6839	5.4012
5	0.8258	20.0889	66.8357	7.7768	5.2985
6	0.8477	21.3290	64.5516	7.8932	6.2260
7	0.8799	23.0665	61.6154	7.8159	7.5020
8	0.9005	24.8782	58.8754	9.0799	7.1663

9	0.9129	24.7805	57.3249	9.8869	8.0075
10	0.9199	24.4275	56.7778	9.7738	9.0207
11	0.9280	24.0202	57.0035	9.6041	9.3720
12	0.9307	23.9243	57.0034	9.7536	9.3185
13	0.9358	23.7635	56.3904	10.4764	9.3695
14	0.9419	23.6115	55.7122	11.3785	9.2976
15	0.9461	23.5472	55.2757	11.7250	9.4518

On the other hand, empirical evidence indicates that economic growth explains a substantial portion of terrorism by its innovative shocks i.e. 23.54% while 55.27% of terrorism is due to its own innovative shocks. Capital and trade openness also contribute to terrorism through their shocks but their impact is minimal i.e. 11.72% and 9.45% respectively. This implies that a unidirectional causal relationship running from economic growth to terrorism. This finding is consistent with VECM Granger causality analysis.

Table-7: Variance Decomposition Approach

Variance Decomposition of $\ln K_t$:					
Period	S.E.	$\ln G_t$	$\ln TA_t$	$\ln K_t$	$\ln TR_t$
1	0.0202	0.0574	0.4537	99.4887	0.0000
2	0.0268	1.3251	0.6134	95.8849	2.17641
3	0.0333	10.3992	2.0542	73.2559	14.2905
4	0.0395	20.6573	1.8938	53.9265	23.5222
5	0.0434	30.4922	2.1242	44.9182	22.4653
6	0.0457	36.2967	1.9242	40.9874	20.7915
7	0.0474	36.7957	2.5334	39.5615	21.1093
8	0.0489	35.9262	5.6525	38.3846	20.0366
9	0.0500	35.6094	7.7441	36.7781	19.8682
10	0.0511	35.2184	7.5349	37.1354	20.1111
11	0.0522	34.3994	7.3861	38.8720	19.3423
12	0.0529	33.6161	7.2977	39.1623	19.9237
13	0.0536	32.7548	7.2059	38.1137	21.9254
14	0.0541	32.2947	7.6842	37.5023	22.5186
15	0.0543	32.1494	8.1173	37.3022	22.4309
Variance Decomposition of $\ln TR_t$:					
Period	S.E.	$\ln G_t$	$\ln TA_t$	$\ln K_t$	$\ln TR_t$
1	0.0303	0.0571	6.1017	5.3815	88.4595
2	0.0364	14.8940	6.0544	9.7008	69.3507
3	0.0427	24.7292	16.9535	7.3253	50.9918
4	0.0469	26.2910	16.6550	14.5289	42.5249
5	0.0530	27.3962	18.2140	20.7428	33.6469
6	0.0578	33.4392	18.0210	19.3849	29.1547
7	0.0608	38.5589	16.4629	17.6675	27.3105
8	0.0629	40.7007	15.3884	17.6156	26.2952
9	0.0643	42.0356	14.9876	17.8063	25.1703

10	0.0656	41.7727	14.7717	17.5682	25.8873
11	0.0666	40.8587	14.9653	17.1698	27.0060
12	0.0670	40.3330	15.8227	17.0508	26.7933
13	0.0676	39.8850	16.0814	17.5435	26.4899
14	0.0684	39.3574	15.7107	18.9732	25.9585
15	0.0691	38.8366	15.5478	20.0502	25.5652

Table-7 reveals that a substantial portion (32.14%) of capital is explained by shocks in economic growth while 37.30% is due to its own innovative shocks. Trade openness and terrorism explain capital by 22.43% and 8.11% respectively. This implies that economic growth and trade openness Granger cause capital. Finally, 25.56% of trade openness is explained by its own innovative shocks while 38.83%, 15.54% and 20.05% is due to economic growth, terrorism and capital. There is unidirectional causality that runs from economic growth to trade openness validating growth-led-trade hypothesis in Pakistan.

V. Conclusions and Policy Implications

This paper aims to investigate the causal relationship between terrorism and economic growth by incorporating capital and trade openness as potential variables in the period of 1971-2010. The ARDL bounds testing approach to cointegration and VECM granger causality approaches have been applied to test long run relationship and direction of causality between the variables.

Our empirical results confirm long run relationship between economic growth, terrorism, capital, and trade openness in case of Pakistan. The bidirectional causality is found between terrorism and capital, trade openness and capital, and terrorism and trade openness. The unidirectional causality is running from economic growth to terrorism.

In the context of policy implications, the government of Pakistan needs to sketch a plan to counter the problem of terrorism. In order to curb the growth of terrorism, it needs to focus on forces that work against it. Initiation of productive programs that stimulate economic activity and offer business and employment opportunities in the terrorist-struck regions will help rejuvenate hopes of the people. The government should restructure its policies to address the problem of unemployment, poverty, illiteracy in the North-West regions of Pakistan. The national budget should be allocated equally to education, health, agriculture and industry to meet the long-neglected demands of the tribal people. Equal distribution of resources and fair treatment will help to build confidence in people for the government and will arouse a sense of patriotism in them.

The government should take some drastic steps to erase terrorism in Pakistan: it should develop new programs and policies to encourage industrialists to invest in Khyber Pakhtunkhwah and Baluchistan. Setting up a platform for new businesses in these regions will bring a change in the mindset of the people. Moreover, the government can also resolve another issue of low income distribution in this region by giving them opportunity to work in the new business market. It needs to establish some effective incentive systems like tax free zones to convince the investors and businessmen to set up their businesses in the north-western regions and Baluchistan. New businesses would address the issue of unemployment and poverty in these regions which are the driving forces of terrorism.

Pakistan is a land enriched with natural resources. However, the unequal distribution of energy resource has been a point of contention between the provincial and federal governments,

not to mention the rising conflict among ethnic groups representing the local sentiment of the people of Khyber Pakhtunkhwah and Baluchistan. Unfair distribution of sources arouses a negative sentiment which has been exploited by the anti-Pakistan forces working in Khyber Pakhtunkhwah and Baluchistan.

Punjab and Sindh have been the industrial hubs for all the investors and in resulting, more people from remote areas are migrating to these areas every year for employment opportunities. The government should also initiate projects for engineering a well-designed infrastructure to support the business activity in remote areas. The north-western region is a densely populated area and has no direct access to the larger markets of central and southern Punjab and interior and southern Sindh. These projects should aim at constructing a network of roads extending to the remote areas so as to build a connection between the markets and the consumers of both the regions. Furthermore, vocational and technical training centers should also be launched for the illiterate masses so that they learn advanced skills and earn better jobs. Moreover, developing cottage industry will also provide them with an opportunity to earn their livelihood. Using sports industry of Sialkot, textile industry of Faisalabad, furniture industry of Gujranwala and Gilgit as models will be beneficial for constructing a strategy for establishing businesses in these regions. Such small scale businesses will also provide opportunities for women, who are bound by the constraints of culture. The aforementioned recommendations are crucial to the economic development in Pakistan and provide an alternative yet productive approach to eliminate terroristic influences in north western region of Pakistan.

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