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THE NEXUS BETWEEN TERRORISM AND ECONOMIC GROWTH IN PAKISTAN: AN EMPIRICAL ANALYSIS USING THE AUGMENTED SOLOW GROWTH MODEL

Minhaj Ud Din[1], Ali Raza[2], Nayab Karim[*3]

[1]*Assistant professor, Department of Economics, Faculty of Business & Economics, Abdul Wali Khan University Mardan*
[2]*Assistant Professor, Institute of Management Sciences, The University of Haripur.*
[*3]*Head/Assistant Professor, Department of Economics, Women University Swabi.*

[1]minhaj_din@awkum.edu.pk, [2]aliraza@uoh.edu.pk, [*3]nayabkarim111@gmail.com.

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Nayab Karim

Abstract

This research investigates the link between terrorism and economic growth in Pakistan through the use of yearly data for the period 1991–2026. The analysis adopts the Augmented Solow Growth Model and includes foreign direct investment, human capital and workers' remittances as the primary factors of economic growth. We apply the Autoregressive Distributed Lag (ARDL) bounds testing approach to estimate the short-term and long-term relationships among variables. The results show a detrimental impact of terrorism on economic development and foreign direct investment and a positive impact of human capital and workers' remittances on the long-run economic performance. Only the workers' remittances have a substantial positive impact on economic growth at the short run. The error correcting process confirms the presence of a stable long-run equilibrium connection and diagnostic tests establish the resilience and reliability of the calculated model. The study updates the empirical evidence on the economic consequences of terrorism in Pakistan and stresses the need to strengthen security, promote investment, enhance human capital and facilitate the productive use of remittance inflows for sustainable economic growth.

1. INTRODUCTION

Terrorism is one of the gravest threats to international peace, security and sustainable development in the twenty-first century. The direct and devastating costs of terrorism on human lives and social fabric are well established. But terrorism also has major and persistent macro-economic consequences on the afflicted economies. This has caused development economists, policy makers and international financial institutions to pay increasing attention to the correlation between terrorism and economic growth (Blomberg et al, 2004; Enders & Sandler, 1996; Abadie & Gardeazabal, 2003).

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Recent estimates suggest that the global economy loses more than $50 billion annually to terrorism, with emerging nations incurring a disproportionate part of the cost due to poor economic resilience and weaker institutional capability (Ali, 2019; Gaibulloev & Sandler, 2009).

Pakistan is a particularly interesting case study in this wider setting. Pakistan has been at the receiving end of one of the worst and longest waves of terror attacks in the last three decades. It is located in a sensitive geopolitical space and has been a frontline ally in the global fight on terror. According to the Global Terrorism Database, Pakistan has always been one of the most afflicted countries by terrorism in terms of deaths and damage to physical and social infrastructure, with thousands of lives lost. The South Asian country's experience is particularly instructive in illustrating how the complex interaction of geopolitical dynamics, domestic security issues and macroeconomic performance plays out in a developing economy with weak institutional capacity and persistent political instability.

The attacks of September 11, 2001, dramatically altered the worldwide political and economic environment. Some war economies and defence sectors gained greatly from the subsequent global war on terror. However, the vast majority of economies, particularly those in conflict-prone regions, suffered prolonged instability, increased security costs and economic disruption. Pakistan first enjoyed the benefits of massive inflows of international aid and debt relief and relaxations that briefly improved its macroeconomic indices. However, with the prolongation of the war and it eventually spilling over the Durand Line into Pakistan's tribal areas, the initial economic gains were quickly eroded, plunging the economy into a deep abyss of instability, institutional paralysis, and a severe drought of domestic and foreign investment (Shahbaz et al., 2013; Hyder et al., 2015).

The size of Pakistan's economic losses from terrorism is staggering. According to the State Bank of Pakistan Annual Report 2015-16, the economy faced a colossal cumulative loss of $118.3 billion during 2002 to 2016, including both direct and indirect costs due to violence, destruction of infrastructure and the wider economic disruption caused by persistent insecurity. These losses are manifested in many ways such as loss of productive capacity, fall in investor confidence, increase in defence and security expenditure, destruction of physical infrastructure, disruption of trade and commerce and decline in human capital which collectively erode the long-run economic growth potential (Gupta et al., 2004; Mehmood, 2014).

The association between peace, stability and economic success is described in the economic literature. The Gross Domestic Product (GDP) is one of the most significant metrics of economic success. Historically the maintenance of peace and political stability has been directly tied to the GDP. The empirical evidence confirms this association. Gaibulloev and Sandler (2009), for example, find that one additional terrorist incident per million inhabitants affects growth in gross domestic product per capita by about 1.5%. Similarly, the negative effect of terrorism on investment is especially high. Terrorism in Spain is projected to have lowered the annual total investment inflow by an average of 13.5% during the period 1975–1991 (Enders & Sandler, 1996). These results are supported by Abadie and Gardeazabal (2003) who, in a cross-section analysis of 110 countries using a measure of terrorism risk constructed by an international risk agency, find a large and statistically significant negative effect on countries' net stock of total investment that is robust across different specifications.

Beyond the macroeconomic aggregates, the human and social costs of terrorism are incalculable. Perhaps the most damaging has been the relentless assault on education, the most effective tool against fanaticism and violence. As Malala Yousafzai so beautifully put it, "a pen, a book and a teacher can change the world"

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(Yousafzai and Lamb; 2013) However, terrorists have been attacking educational facilities, teachers and students at an alarming rate, with a particular focus on girls' education. This devastation is enormous. As per Pakistan Economic Survey (2016), terrorists demolished a total of 758 schools in different districts of Khyber Pakhtunkhwa and 360 schools in three of the seven areas of the Federally Administered Tribal Areas (FATA).

The situation has deteriorated with the onslaught on academic institutions. According to Human Rights Watch (2017), 25 million children in Pakistan are out of school. The number is aggravated by terrorist attacks that still target educational facilities. Statistics show that academic institutions are targeted in about 10% of all terrorist strikes. The attack on the Army Public School (APS) in Peshawar on 16 December 2014, in which 136 kids were killed, was widely condemned. It led to a sharp decline in school attendance and widespread worry, particularly in conflict-affected areas. However, Pakistan's investment in education is abysmally low, with only 2.9% of the country's GDP being spent on the sector in the fiscal year 2016, ranking it 153rd out of 186 countries (Pakistan Economic Survey, 2017).

Terrorism has far-reaching impacts beyond significant financial crises and the shutdown of educational institutions. An unstable atmosphere breeds religious intolerance, sectarian conflict and ethnic hatred, encouraging a mood of deep mistrust, alienation and dread. These social and political variables cause business interruptions, loss of faith in new company ideas and deceleration of economic development. Risk-averse investors are slowly shifting their assets to safer countries and therefore, the private sector is seeing a sharp decline in foreign direct investment, high security costs and capital flight, all of which impede the sector's potential to innovate and expand. The private sector is finding these things more tough. These elements work together and enhance the chances of extremism and violence and also slow down the economic growth (Naz et al., 2021; Sarwar et al., 2025). There is no single metric that can contribute to long-term stability or recovery. All this requires a comprehensive policy framework to break the vicious loop of mutually reinforcing problems. This framework has to address simultaneously governance challenges, socioeconomic disparities and security deficits.

The effects of terrorism on the society of Pakistan in general are complex and far-reaching. Therefore, it is necessary that the government authorities to examine the nexus between terrorism and economic progress. "The timing, transmission channels and macro-economic effects of this volatile time are essential to stabilize the domestic economy and the welfare of a population that has suffered the most from protracted war. Structural weaknesses, fiscal imbalances and inflationary pressures are already afflicting the Pakistani economy. Now, security generated uncertainty is giving an added push to the flames by raising uncertainties in the minds of investors, interrupting supply chains and diverting public finances into counter-insurgency measures. There is an urgent need for research-led identification and evaluation of these economic restrictions and evidence-based policy actions to mitigate the harmful impacts of ongoing concerns about security. Without such specific research, recovery efforts may be inadequate or wrong, keeping the economy in a low-growth equilibrium and the population subject to recurrent shocks (Nawaz et al., 2026). Therefore, thorough empirical study is needed to build resilient institutions, promote sustainable development and finally break the region's long-standing cycle of violence and underdevelopment.

Although a great deal of study has been conducted on the link between terrorism and economic development, there are a number of theoretical, empirical and methodological gaps. A large proportion of previous studies use information collected before the significant

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macroeconomic, security and geopolitical changes of the last decade and are thus limited in their capacity to reflect the changing economic implications of terrorism. Furthermore, the existing literature has focused on the direct effects of terrorism on economic growth with little attention to the interaction of terrorism with important determinants of growth such as foreign direct investment, human capital and workers' remittances within the framework of the Augmented Solow Growth Model. Moreover, empirical studies using the Autoregressive Distributed Lag (ARDL) approach with annual data up to 2026 are scarce. The mixed results regarding the magnitude and persistence of the economic impacts of terrorism are due to the variations in terrorism measures, model specifications, estimation approaches, and sample periods.

The negative effect of terrorism on economic development, investment and macroeconomic stability continues to be confirmed by recent research (Naz et al., 2021; Sarwar et al., 2025; Nawaz et al., 2026). However, there is no integrated theoretical framework with the latest data that describes the main factors of economic development in an integrated way. Thus, this study revisits the relationship between terrorism and economic growth in Pakistan by employing annual data until 2026, including foreign direct investment, human capital and workers' remittances in the Augmented Solow Growth Model and using the ARDL approach to estimate both the short run and long run relationship.

In view of the research gaps identified, this study answers the following research questions:

- Is the economic development of Pakistan significantly influenced by terrorism?
- How do workers' remittances affect Pakistan's economic growth?
- Does secondary school enrolment (human capital) significantly influence economic development in Pakistan?
- What is the impact of foreign direct investment on economic development in Pakistan?

The main aims of this investigation are:

- To study the effect of terrorism on economic development in Pakistan.
- To analyze the impact of workers' remittances on economic development in Pakistan.
- To examine the role of secondary school enrollment (human capital) on economic development of Pakistan.
- To study the influence of foreign direct investment on the economic growth of Pakistan.
- To explore the short-run and long-run linkages between terrorism, foreign direct investment, human capital, workers' remittances and economic development in Pakistan.

This study contributes to the literature on terrorism and economic growth in Pakistan in four folds. Second, it presents new empirical evidence by extending the analysis to 2026 and so covering recent economic and security trends. Second, it expands the Augmented Solow Growth Model by integrating foreign direct investment, human capital and workers' remittances to explore the mechanisms via which terrorism influences economic growth. Third, the Autoregressive Distributed Lag (ARDL) approach is applied to estimate the short and long term relationships which allow robust empirical analysis. Finally, the findings provide policy-relevant evidence in support of integrated strategies to improve security, attract investment, strengthen human capital and make good use of remittance inflows to generate sustainable economic growth.

The rest of this paper is structured as follows. Section 2 covers the relevant literature and the research gap. Section 3 gives the theoretical framework. Section 4 develops the conceptual framework and research assumptions. Section 5 describes the research methodology. Section 6 shows and examines the empirical findings: ARDL, ECM and diagnostic tests outcomes. Finally, Section 7 closes with several major findings and policy implications of the study.

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2. Literature Review

2.1 Theoretical Perspectives on the Terrorism-Growth Nexus

The bulk of the empirical work on the link between terrorism and economic development is based on the neoclassical and endogenous growth theories. Long-run economic growth is based on the Solow Growth Model (Solow, 1956) and the Augmented Solow Growth Model (Mankiw et al., 1992) where the accumulation of physical capital, human capital, labour and technical advancement are factors that determine economic growth (Minhaj-ud-Din et al. 2020a; Minhaj-ud-din et al. 2020b). Terrorism undermines these determinants of growth by increasing economic uncertainty, discouraging domestic and foreign investment, damaging infrastructure, disrupting production, reducing labour productivity and diverting public expenditure from productive sectors such as education, health and infrastructure towards security and defence (Blomberg et al., 2004; Enders & Sandler, 1996; Gupta et al., 2004; Murdoch & Sandler, 2004).

According to the augmented Solow growth model, four key channels of the negative impact of terrorism on economic growth are identified. Some of these channels are decreasing productivity through the destruction of infrastructure and economic activity, inhibiting people from accumulating capital by making investments more risky, inhibiting people from acquiring human capital by making it harder for them to go to school, and increasing transaction costs to inhibit trade and investment. However, the extent to which these impacts rely on country-specific factors such as political stability, institutional quality, and economic strength (Naz et al., 2021; Sarwar et al., 2021). That is how Shahbaz et al. (2013) put it: communication in this friendship is in both directions. Terrorist strikes hinder progress. Economic problems like poverty, unemployment and inequality may also facilitate terrorists to carry out their activities at the same time. The link between terrorism and economic growth is so complicated that a full-fledged empirical investigation is needed to find out the true nature of the relationship.

2.2 Global Evidence on the Terrorism-Growth Nexus

There is a highly consistent body of empirical work that shows that terrorism has enormous economic effects in terms of inhibiting investment, reducing productivity and postponing economic progress. Initial studies, such as Enders and Sandler (1996) and Abadie and Gardeazabal (2003), have shown that terrorism has a detrimental impact on foreign direct investment, investment levels and per capita income, by increasing uncertainty and diminishing investors' trust. These results provide the empirical foundation for the literature on the link between terrorism and poor economic performance.

And this is not simply idle theory; there is an expanding body of cross-country evidence that supports it strongly. For example, Blomberg et al. (2004) analyzed data from 177 countries and found that terrorism decreases GDP by decreasing investment, consumption and productivity, with the largest drops happening in rising economies and nations with weak institutions. Turning to Asia, Gaibulloev and Sandler (2009) find similar results with terrorist activities considerably reducing the per capita GDP growth in the region. Gupta and co-authors also found a specific pressure point: terrorism drives governments to boost defense expenditure, squeezing out private investment and generating budgetary strains that can weigh on GDP for years. More recently, Ali's research drives home the fact that terrorism hampers capital development, reduces productivity of workers and erodes investor confidence, especially in countries that lack the institutional capacity to weather the storm.

There is consensus in the international literature from afar on the notion that terrorist strikes harm economic production. The procedures are

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well documented and hard to ignore. They restrict investment, impede productivity, throw government finances into disarray and deter investors.

But the story is not one size fits all. Damage does not fall equally across nations. Naz et al. (2021) and Nawaz et al. (2026) emphasize how much a country's genuine level of impact is shaped by its underlying institutional fabric, such as the overall macroeconomic stability, strength of institutions, and quality of governance. To summarize, a well-governed nation with good policies is better able to absorb the shock than one that is already weak. Put another way, governments may affect and sometimes alter the broader environment, therefore the economic costs of terrorism are not set.

2.3 Evidence from Pakistan

Pakistan has been a major focus of the terrorism and growth literature due to its extensive experience of terrorist activity and the macroeconomic ramifications of that activity. Early empirical work has identified a persistent harmful impact of terrorism on economic growth, including its effect in lowering investment, interrupting economic activity and creating macroeconomic uncertainty. Shahbaz (2013) used the ARDL technique and established a long-run link between inflation, terrorism and economic development, whereas Shahbaz et al. (2013) revealed a long-run correlation as well as bidirectional causation between terrorism and economic growth using a Vector Error Correction Model (VECM). The research showed that terrorism effects economic performance through many pathways such as trade, investment and capital accumulation.

Later research confirmed the reproducibility of the results. Hyder et al. (2015) and Mehmood (2014) also acknowledged that the terrorism has a continual detrimental influence on the economic growth of Pakistan. In contrast, human capital and external finance resources stimulate the expansion. The new study, however, has incorporated political and macroeconomic instability in its analytical frameworks and so has embraced more thorough frameworks. The study results of Naz et al. (2021) show that terrorism has a substantial correlation with political and financial instability. Thus, the economic consequences of terrorism are conditioned by the institutional framework of the economy. Likewise, Sarwar et al. (2025) found terrorist incidents, deaths and injuries to have substantial long-run economic and fiscal implications. Nawaz et al. (2026) again found that terrorism is an impediment to the entrance of foreign direct investment and long-run economic growth. These two results are in line with the previous study. There is ample evidence that terrorism has had negative economic implications for Pakistan. But the research has utilized diverse metrics of terrorism, estimate procedures and sample time periods which have led to differing empirical results. This requires a new study using the most recent data and a complete theoretical set-up.

2.4 The Role of FDI, Human Capital, and Remittances in the Terrorism-Growth Nexus

Foreign direct investment (FDI) is very crucial in encouraging economic growth through capital creation, knowledge transfer, employment generation and productivity improvement. Continued terrorist activity, however, creates uncertainty and raises the cost of conducting business, lowering a country's appeal to local and foreign investors alike (Abadie & Gardeazabal, 2003; Enders & Sandler, 1996). Empirical research conducted in Pakistan shows that FDI has a favorable influence on economic growth while security situations are deteriorating, investor confidence is reduced and long term investment is discouraged (Farooq & Khan, 2014; Raza et al., 2020). Thus, terrorism may impede economic growth not just via its direct economic costs but also indirectly by lowering investment inflows.

In the Augmented Solow Growth Model (Mankiw et al. 1992) human capital is a

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determinant of long-run economic growth. Investment in education improves the abilities of workers, increases productivity and technical advancement and innovation and hence leads to sustainable economic growth. However, terrorism disrupts the educational activities, diminishes the school enrollment and worsens the human capital development especially in the conflict-affected areas (Afzal et al., 2010; Afzal et al., 2012). Thus, terrorism may hinder long-term economic progress by reducing the accumulation of human capital.

Workers' remittances are a significant source of foreign earnings for Pakistan and play an important role in supporting economic progress. They supplement household income, generate consumption and investment, decrease poverty and encourage financial stability (Hussain & Anjum, 2014; Jebran et al., 2016; Ashraf et al., 2023). While remittances are economically important, there has been little empirical investigation on the relationship between remittances and terrorism. Considering Pakistan's strong reliance on remittance inflows, the inclusion of remittances in the research gives a more thorough picture of the factors affecting economic growth.

2.5 Research Gap

There is a large literature on terrorism and economic growth, however there are still some gaps in the studies. Several researches on Pakistan have used obsolete datasets that do not include the new security and socioeconomic trends. Secondly, much of the extant literature has mostly concentrated on the direct impact of terrorism on economic growth, but little attention has been paid to the combined roles of FDI, human capital, and workers' remittances in the Augmented Solow Growth Model. Thirdly, empirical investigations with updated yearly data and the Autoregressive Distributed Lag (ARDL) technique are still limited. The diverse empirical findings are also attributed to the differences in terrorist metrics, model parameters, and estimate approaches.

This research seeks to fill this gap by examining the effect of terrorism on Pakistan's economic growth from 1991 to 2026. This paper, based on the Augmented Solow Growth Model, mixes foreign direct investment, human capital and workers' remittances into a single empirical framework and applies the ARDL bounds testing technique to assess the short run and long run correlations. The study provides new empirical information and contributes to the existing literature on Pakistan by better understanding the factors of economic development in the context of terrorism.

3. Theoretical Framework

3.1 The Augmented Solow Growth Model

The Augmented Solow Growth Model, which was developed by Mankiw et al. (1992), is the foundation around which this work is built. This model expands the neoclassical growth model developed by Solow in 1956 by include human capital as an essential component of long-term economic development. While the fundamental model explains growth in terms of physical capital, labor, and external technological innovation, the enhanced model acknowledges that investments in education and skills promote labor productivity and result in long-term economic development. This is in contrast to the basic model, which uses these three factors to explain growth. Due to the robust theoretical foundation that it possesses, the Augmented Solow Growth Model has been utilized widely in providing an explanation for economic growth, particularly in developing countries.

The aggregate production function of the Augmented Solow Growth Model is expressed as:

$$Y_t = A_t K_t^{\propto} H_t^{\beta} L_t^{1-\alpha-\beta}$$

Here, Y is the symbol for real output, A is the symbol for total factor productivity (TFP), K is the symbol for physical capital, H is the symbol for human capital, L is the symbol for labor, and

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α and β are the symbols for the output elasticities of physical and human capital, respectively. The notion states that the potential for long-term economic growth is determined by three elements: the accumulation of capital, improvements in human capital, and technological innovation. These three components, in order, define the potential for economic growth.

Although terrorism is not explicitly included in the original version of the Augmented Solow Growth model, it may be seen as a factor that weakens the major drivers of economic growth. Terrorist activities create uncertainty in the economy, discourage domestic and foreign investment, damage infrastructure, disturb production and business activities, weaken human capital formation, and divert public resources from the productive sectors to security-related expenditures (Abadie & Gardeazabal, 2003; Enders & Sandler, 1996; Gupta et al., 2004). The two effects combined reduce total factor productivity and inhibit capital accumulation, hence constraining economic development in the long run. Hence, it is projected that terrorism would adversely and persistently affect the growth of the economy.

In contrast, it is expected that human capital, Foreign direct investment (FDI) and remittance of workers are expected to have positive contribution to economic growth through different but complementary channels. Foreign direct investment (FDI) promotes capital accumulation, facilitates transfer of knowledge and increases productivity (Borensztein et al, 1998). Mankiw et al. (1992) states that, human capital enhances the capability of workers, have an influence on productivity in the labor force and stimulate the adoption of the latest technologies. Similarly, remittances from workers enhance household income, reduce financial constraints, and promote investment in education, health and other productive activities (Azam, 2015; Hussain & Anjum, 2014). The combination of these variables is expected to be a positive contribution towards the expansion of the economy in the long term.

The theoretical link underpinning this study is defined based on the Augmented Solow Growth Model:

$$GDPPC_t = f(TERR_t, FDI_t, HC_t, REM_t)$$

Here, GDPPC signifies real GDP per capita, TERR shows terrorism incidence, FDI stands for foreign direct investment inflows, HC is human capital proxied by secondary school enrollment, and REM is workers' remittances. The model indicates that terrorism has a negative influence on economic growth, whereas foreign direct investment, human capital and workers' remittances have favorable benefits. These theoretical expectations form the basis for the empirical study that follows in the next sections.

4. Conceptual Framework

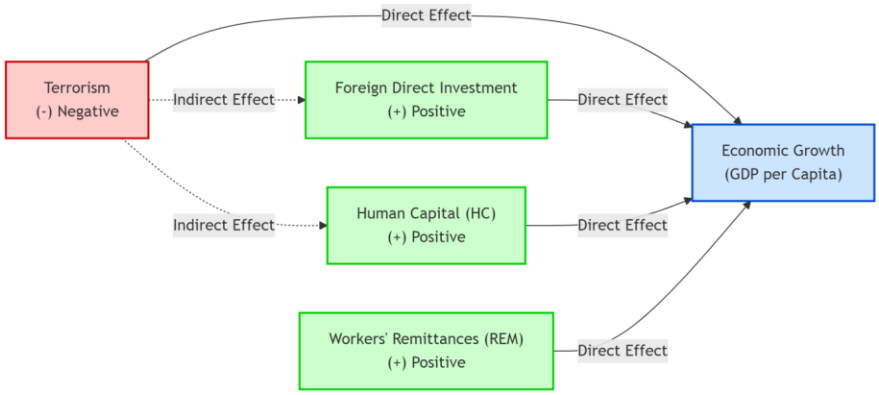
Drawing on the Augmented Solow Growth Model, this study conceptualizes economic growth as a function of physical capital, human capital, and productivity, while extending the model by incorporating terrorism as a factor that adversely affects total factor productivity and capital accumulation. Terrorism is expected to impede economic growth through the disruption of productive activities, higher economic uncertainty, lower FDI, and degradation of human capital formation. Alternatively, FDI stimulates economic growth by means of capital accumulation, knowledge transfer and productivity improvement (Borensztein et al., 1998). Human capital, as indicated by secondary school enrollment, increases labour productivity and facilitates technological progress (Mankiw et al., 1992). Conversely, remittances from workers contribute to growth through an increase in household income, easing of financial constraints and promotion of investment in education, health and other productive activities (Azam, 2015; Hussain & Anjum, 2014). Consequently, the envisioned connections between terrorism, FDI, human capital, worker remittances, and GDP growth are shown in the conceptual

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framework. Figure 1 presents the study's conceptual framework.

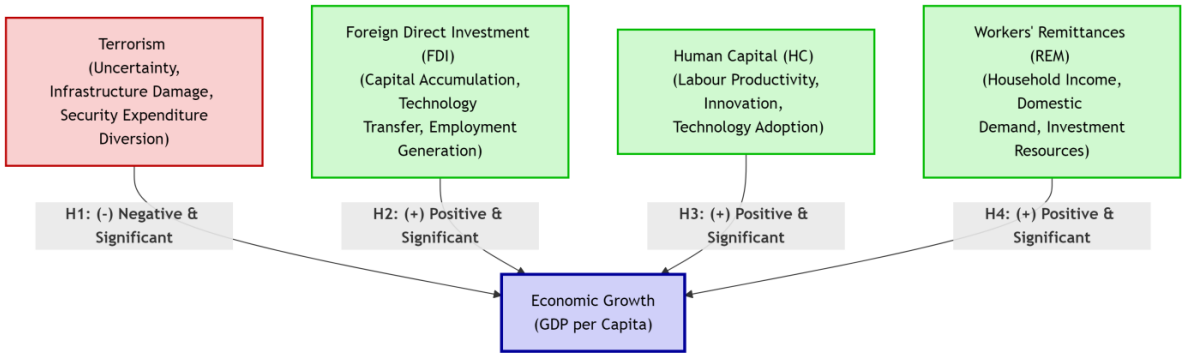
Framework of the Study



Source: Developed by the authors based on the Solow Growth Model

Remittances from workers are a significant source of foreign funding for developing economies such as Pakistan. Remittance inflows augment household income, promote investment in education and health care, boost domestic consumption, and reduce financial limitations, so contributing favorably to economic growth (Azam, 2015; Hussain & Anjum, 2014). It is envisaged that remittances will cushion some negative economic consequences of terrorism through enhanced household welfare and investment. On the basis of these theoretical considerations, the conceptual framework presumes that terrorism has a negative impact on Pakistan's economic growth, whereas foreign direct investment, human capital and workers' remittances have a favorable impact on long-run economic performance. Figure 2 summarizes the hypotheses explored in this work, converting these conceptual linkages into experimentally testable assertions.

Figure 2: Hypothesis Development



Source: Developed by the authors based on the theoretical framework

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5. Data and Empirical Methodology

5.1 Research Design

The current study uses a quantitative research technique to investigate the link between terrorism and Pakistan's economic growth. We assess the short-run and long-run link between terrorism and economic growth using annual time series data for the period 1991-2026. The study employed the Augmented Solow Growth Model as its theoretical framework to explain economic growth using physical capital, human capital and productivity variables. Terrorism is introduced into the model as a factor that reduces productivity and influences investment decisions, the allocation of resources and the overall economic performance.

The ARDL Bounds Testing Approach developed by Pesaran et al. (2001) is employed in this study due to the dynamic character of macroeconomic linkages. The ARDL approach is especially relevant as it is capable of estimating long-run equilibrium and short-run dynamic connections while allowing variables integrated of order I(0) and I(1). Moreover, ARDL is acceptable for small sample numbers and is therefore appropriate for yearly macroeconomic data.

5.2 Data Sources

The data for the empirical study are annual statistics from reputable international and official national sources. Economic indicators such as GDP per capita, foreign direct investment and workers' remittances are obtained from the World Bank's World Development Indicators (WDI). The data on terrorist incidents are obtained from the Global Terrorism Database (GTD), maintained by the National Consortium for the Study of Terrorism and Responses to Terrorism (START). The Pakistan Economic Survey (various themes) includes statistics on secondary school enrollment, which is used as a proxy of human capital.

We employ globally recognized data sources to increase the reliability, consistency and comparability of the empirical study.

5.3 Measurement of Variables

The dependent variable used is real GDP per capita (GDPPC) which is a typical indicator of economic growth. The primary explanatory variable is terrorism (TERR), which is quantified by the annual number of terrorist occurrences in the Global Terrorism Database. FDI is proxied by foreign capital accumulation, HC is assessed by secondary school enrolment, and workers' remittances (REM) reflect personal contributions from Pakistanis employed overseas. FDI, human capital and remittances are projected to stimulate economic development through capital accumulation, productivity improvement and higher household investment.

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Table 1: Description of Variables

Variable	Symbol	Measurement	Expected Sign	Source
GDP per capita	GDPPC	Natural logarithm of real GDP per capita	Dependent	World Development Indicators
Terrorism	TERR	Annual terrorist incidents	–	Global Terrorism Database
Foreign Direct Investment	FDI	Net FDI inflows (% of GDP)	+	World Development Indicators
Human Capital	HC	Secondary school enrolment (%)	+	Pakistan Economic Survey
Workers' Remittances	REM	Personal remittances (% of GDP)	+	World Development Indicators

5.4 Model Specification

The empirical model is based on the Augmented Solow Growth Model including terrorism as a driver of productivity and long-run economic success.

The theoretical connection is given by:

$$GDPPC_t = \beta_0 + \beta_1 TERR_t + \beta_2 FDI_t + \beta_3 HC_t + \beta_4 REM_t + \epsilon_t$$

The estimable log-linear model is specified as:

$$lnGDPPC_t = \beta_0 + \beta_1 lnTERR_t + \beta_2 FDI_t + \beta_3 HC_t + \beta_4 REM_t + \epsilon_t$$

Here: β1−β4 are the long-run elasticity and εt is the error term.

The coefficient of terrorism is projected to be negative, whereas coefficients of FDI, human capital and remittances are expected to be positive.

5.5 Unit Root Test

Before estimating the ARDL model, initially we have to evaluate the stationarity qualities of our variables. That is, we have to run the Augmented Dickey-Fuller (ADF) unit root test (Dickey & Fuller, 1979). This is not just a tick-box activity, this stage is vital to ensure our model is solid. Why for?" Because if our variables aren't stable, each regression we run risks producing nonsense - spurious correlations that look plausible but mean nothing. Granger and Newbold (1974) made this argument forcefully and it is as valid today as it was then. Thus, in ADF approach we estimate a special regression equation to test for unit roots.

$$\Delta Y_t = \alpha + \beta t + \gamma Y_{t-1} + \sum_{i=1}^{p} \delta_i \Delta Y_{t-1} + \varepsilon_t$$

The question the ADF test tries to answer is rather simple: does our variable have a unit root or not? The null hypothesis is that it is (γ = 0) and the alternative hypothesis that the series is stationary (γ < 0). Also we need to set a proper lag length to conduct the test appropriately and we utilize Akaike information criterion (AIC) to get a good trade-off between catching the main dynamics and keeping things simple .

A key requirement for the ARDL approach is that none of the variables should be integrated of an order higher than one. No, simply said, no I(2) variables. Therefore, pre-testing for these unit roots is not just a technical need but also a practical requirement. This gives us the

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confidence that our data fits the criteria for the ARDL framework and we are standing on firm footing even before we start estimating the model.

5.6 ARDL Bounds Testing Approach

The ARDL Bounds Test is employed to test the presence of a long-term link among the variables as suggested by Pesaran et al. (2001).

The unconstrained error correction form of the ARDL model is given as:

$$\Delta Y_t = \alpha_0 \sum_{i=1}^{p} \alpha_i \, \Delta Y_{t-1} + \sum_{i=1}^{p} \beta_i \, \Delta X_{t-1} + \lambda_1 Y_{t-1} + \lambda_2 X_{t-1} + \varepsilon_t$$

Here, Yt is economic growth and Xt is a vector of independent factors. The null hypothesis of no cointegration is:

$$H_0 : \lambda_1 = \lambda_2 \ldots\ldots\ldots = 0$$

against the alternative hypothesis:

$$H_1 : \lambda_1 \neq 0, \lambda_2 \neq 0$$

After we have estimated our F-statistic we do not interpret it in isolation, but compare it with a pair of benchmark critical values (lower and upper bound) given in Pesaran et al. (2001). Consider a traffic signal system with three different zones. If our F-statistic is greater than the upper bound, we're in good shape: there is strong evidence that the variables truly do move together in a significant long-run connection. If it is not more than the lower bound we are in the red. We really cannot rule out the possibility that no cointegration is at play given the conditions. But what if it's someplace in the middle? That's the amber zone, an inconclusive outcome. This is when the data does not offer us a strong enough signal to make a certain judgment.

5.7 Error Correction Model (ECM)

The short-run dynamics are estimated using the Error Correction Model (ECM) after establishing the existence of cointegration. The ECM is a measure of the speed of transition to long-run equilibrium from short-run disequilibrium after a shock. The ECM may be written as:

$$\Delta Y_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \, \Delta Y_{t-1} + \sum_{i=1}^{p} \beta_i \, \Delta X_{t-1} \emptyset ECT_{t-1} + \varepsilon_t$$

Where, ECTt−1 is the lagged error correction term which is obtained from estimated long run cointegrating relationship.

That is a bad sign the system is self-correcting. And it is working hard to reduce that deficit and put things back toward equilibrium. And the value of ϕ informs us how fast that correction occurs: it gives us the precise fraction of the previous period's imbalance that is smoothed out in this period. The bigger the absolute value, the faster the recovery. The lower the absolute value, the more slow the correction.

5.8 Diagnostic and Stability Tests

Some post estimation diagnostic tests have been carried out to check the reliability of the estimated model.

The Breusch-Godfrey LM Test is used to test for serial correlation while the White Heteroskedasticity Test is used to test for heteroskedasticity. The Ramsey RESET Test is used to test for functional form misspecification while the Jarque-Bera Test is used to test for normalcy of residuals.

Finally, the stability of the derived coefficients is tested using the CUSUM and CUSUMSQ tests introduced by Brown et al. (1975). The stable coefficients suggest that the predicted long-run association is stable during the whole sample period.

6. ARDL Estimation Results and Discussion

The ARDL estimate results are shown in Tables 2 and 3. The estimated model has high explanatory power with R square 0.9806, which means that approximately 98.06 percent of the variation in Pakistan's GDP per capita is explained by terrorism, foreign direct investment (FDI), workers' remittances and secondary school

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enrolment. The modified R 2 of 0.9772 also indicates robustness of the calculated model after considering the number of exogenous variables. In addition, the aggregate F-statistic of 289.9986 is highly significant ($p < 0.001$) demonstrating that the explanatory factors collectively explain variances in economic development. The Durbin-Watson value of 1.5183 indicates that there is no major evidence of autocorrelation in the calculated model.

Table 2: Long-Run ARDL Estimates and Model Statistics

Long-Run Estimates					Long-Run Model Statistics	Value
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	***P*-value**		
C	2.5171***	0.2891	8.7059	0.0000	R-squared	0.980558
Terr	-0.00971***	0.000899	-10.8009	0.0000	Adjusted R-squared	0.977177
FDI	0.0215***	0.0051	4.1971	0.0003	F-statistic	289.9986
Rem	0.0216***	0.0043	4.9232	0.0001	Prob. (F-statistic)	0.0000
SS	0.2906***	0.0209	13.8612	0.0000	Durbin-Watson Statistic	1.5183

Note. *** denotes significance at the 1% level.

Table 3: Short-Run ARDL Estimates and Model Statistics

Short-Run Estimates					Short-Run Model Statistics	Value
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	***P*-value**		
C	-0.0402	0.027836	-1.443409	0.1637	R-squared	0.495160
D(Terr)	1.83E-08	2.17E-06	0.008445	0.9933	Adjusted R-squared	0.374960
D(FDI)	0.0176	0.009788	1.798431	0.1428	F-statistic	4.119474
D(Rem)	0.00973**	0.003993	2.436764	0.0216	Prob. (F-statistic)	0.0091
D(SS)	0.1426	0.084047	1.696678	0.1547	Durbin-Watson Statistic	1.7283
ECM(-1)	-0.4568**	0.187881	-2.431330	0.0214		

Note. ** denotes significance at the 5% level.

Turning to our long-run calculations, the conclusion is clear: terrorism has a considerably negative impact on economic development, providing convincing validation of Hypothesis H1. This is not altogether unexpected if we see the world through the Augmented Solow model – terrorism lowers investment, nibbles away at productivity and erodes the foundations of long-term success. We're not the first ones to notice this. It mirrors the trends that scholars such as Hyder et al. (2015), Mehmood (2014), Abadie and Gardeazabal (2003) and Blomberg et al. (2004) have been flagging for years.

But on the much brighter side, foreign direct investment tells a totally different story. It is constantly revealed as a good and major driver of growth. This offers quite a bit of evidence for hypothesis H2. The logic is rather straightforward: FDI is not just money flowing in; rather it brings new technology, knowledge transfers and productivity-increasing techniques that may lift the overall economy. This is consistent with the ideas of Raza et al. (2020) and Aziz et al. (2023) who have long argued for the growth-promoting effect of foreign capital in emerging settings.

The enrolment in secondary schools as a proxy for human capital likewise shows a positive and highly significant influence on economic growth, confirming Hypothesis H3. This conclusion verifies the expectations of the Augmented Solow Growth Model and is compatible with the findings as presented by Afzal, et al., (2012) and Raza et al. (2024).

Workers' remittances have also a beneficial and large impact on economic growth, validating the Hypothesis H4. This conclusion demonstrates that remittance inflows promote economic activity through household income and investment. This finding is similar with the

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findings of Hussain and Anjum (2014), Jebran et al. (2016), Raza et al. (2021) and Rovidad et al. (2024). Similarly secondary school enrollment has positive impact, and this result is in line with the findings of Khan et al. (2024).

The short term estimations show that only workers' remittances have considerable beneficial influence on economic growth. Conversely, terrorism, foreign direct investment, and human capital are statistically negligible, indicating that their impacts are slow and become apparent in the long term.

The ECM(-1) coefficient of -0.4568 is significant at the 5% level, which indicates that there is a stable long-term equilibrium connection between variables. The coefficient means that about 45.68% of the short-term imbalance is adjusted in each year. This means that the adjustment to the long-term equilibrium is rather slow.

A series of post estimation diagnostic tests were run to assess the reliability of the estimated ARDL model in the light of serial correlation, heteroskedasticity and normality of residuals. The coefficients obtained were checked for stability using the CUSUM and CUSUMSQ tests.

Table 4 and Table 5 summarize the diagnostic tests. The CUSUM and CUSUMSQ graphs confirm the stability of the coefficients of the variables since they stay under the 5% crucial bounds as seen in Figure 3 and Figure 4.

Table 4: Summary of the Diagnostic Tests

Test	Results	Inference
Breusch-Godfrey LM Test	The resulted value was insignificant	No issue of serial correlation
White Test	The resulted value was insignificant	No issue of heteroskedasticity
Jarque-Bera Test	The resulted value was insignificant	Residuals were normally distributed
CUSUM & CUSUMSQ	All estimates stay inside the 5% critical boundaries	Model is stable

Table 5: Diagnostic Tests

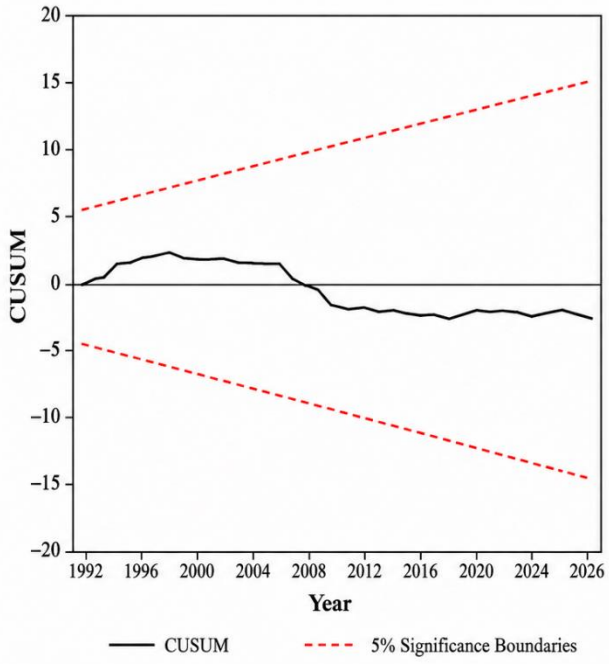
Test	Estimate	F-Statistic (*P*-value)
DW	1.5183	---
Breusch-Godfrey LM Test	---	0.5029 (0.7341)
White Test	---	0.6687 (0.7697)
Jarque-Bera Test	1.4528 (0.4837)	---
R^2	0.9806	---
Adjusted R^2	0.9772	---

Note. Values in parentheses are probability values.

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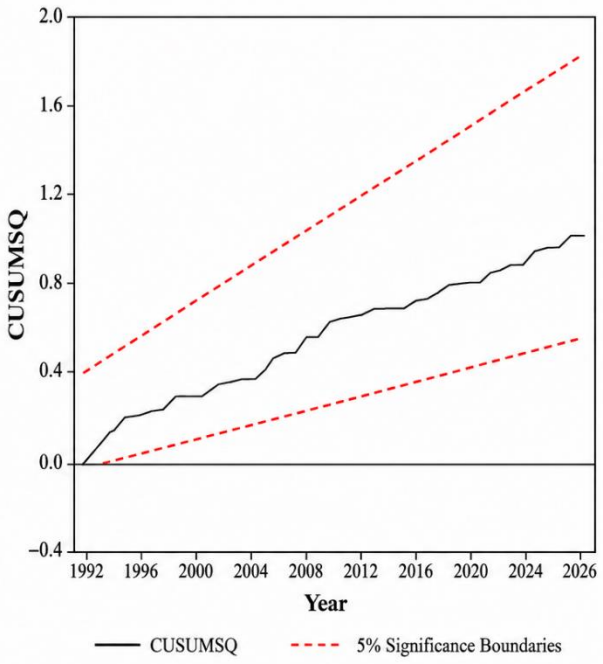
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Figure 3: CUSUM Test for Stability



Note: The CUSUM plot lies within the 5% critical boundaries, indicating parameter stability.

Figure 4: CUSUMSQ Test for Stability



Note: The CUSUMSQ plot lies within the 5% critical boundaries, indicating parameter stability.

7. Conclusion and Policy Implications

This paper investigates the impact of terrorism on Pakistan's economic growth over the period 1991–2026 using Augmented Solow Growth Model and Autoregressive Distributed Lag (ARDL) method. Terrorism, foreign direct investment, human capital and workers' remittances were also integrated in the research as significant predictors of economic growth.

The empirical results demonstrate that terrorism has a significantly negative impact on the long-run economic growth of Pakistan, indicating that continuing insecurity constrains economic performance. However, foreign direct investment, human capital and workers' remittances have considerable beneficial benefits underscoring the significance of these variables in enhancing sustainable economic growth. The short-run results reveal that only workers' remittances have an immediate positive effect on economic growth, while the effects of terrorism, foreign direct investment and human capital are uncovered in the long-run. Moreover, the ECM examines the presence of long run equilibrium stable relationship among the variables of the research and the diagnostic and stability tests show the resilience and reliability of the estimated model.

Overall, the research reveals that the strengthening of security is crucial to support the economic growth in Pakistan. At the same time, measures that promote foreign direct investment, build human capital and ease the influx of remittances may improve the country's long-run economic prospects. This study adds to the existing literature on terrorism and development by providing recent empirical evidence on the determinants of Pakistan's economic growth by incorporating terrorism, foreign direct investment, human capital, and workers' remittances in the Augmented Solow Growth Model and using the latest data up to 2026.

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The conclusions of this study emphasize the need of strengthening the security environment as a pre-condition for sustainable economic growth in Pakistan. In the long run, decreasing terrorism may increase investor confidence, increase productive economic activity, and promote growth. Good governance, macroeconomic stability and infrastructure development strategies for strengthening the investment climate can further boost the growth-enhancing impacts of foreign direct investment.

The positive contribution of human capital and workers' remittances suggest the need of continuing to invest in education and of policies that foster and encourage their productive usage. Good quality education and skills development increase productivity, innovation and long-term growth. Financial inclusion, access to formal banking channels and incentives for remittance-financed investment in productive sectors, such as manufacturing, agriculture and small companies, can boost the growth of such inflows. The findings show the need for a broad and well-coordinated policy framework for robust economic growth by Pakistan that should promote investment, human capital, security and the mobilization of worker remittances for productive economic activity. An integrated strategy would foster economic growth, resilience and long-term development.

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