ภัยก่อการร้ายและการเติบโตทางเศรษฐกิจ กรณีศึกษาใน 32 ประเทศ การวิเคราะห์ด้วยข้อมูลพาแนล

TERRORISM & ECONOMIC GROWTH IN 32 COUNTRIES USING PANEL DATA APPROACH

โซร์ฟีนา เด่นสุมิตร[1]
Sorfina Densumite

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บทคัดย่อ

การศึกษาครั้งนี้มีวัตถุประสงค์เพื่อวิเคราะห์ความสัมพันธ์ระหว่างภัยก่อการร้ายและการเติบโตทางเศรษฐกิจ โดยใช้ข้อมูลภาคตัดขวางแบบต่อเนื่องหรือข้อมูลพาแนล จำนวน 32 ประเทศ เริ่มตั้งแต่ ปี ค.ศ. 2005 – 2019 และวิเคราะห์ด้วยวิธีการทางเศรษฐมิติ ได้แก่ การทดสอบความหยุดนิ่งด้วยวิธี Unit Root การประมาณค่ากำลังสองน้อยที่สุด การทดสอบความเป็นเส้นโค้งปกติ การทดสอบความสัมพันธ์เชิงเส้น และการทดสอบความแปรปรวนแบบไม่คงที่ ผลการวิจัยพบว่า ภัยก่อการร้ายส่งผลต่อการเติบโตทางเศรษฐกิจในทิศทางตรงกันข้าม จำนวนภัยก่อการร้ายที่เพิ่มขึ้น 1 เปอร์เซ็นต์ส่งผลต่อ GDP ที่ลดลง 0.0016 เปอร์เซ็นต์ การประมาณค่าสัมประสิทธิ์การตัดสินใจชี้แนะพบว่ามีค่ากำลังสองที่สูง พบความแปรปรวนแบบคงที่ ไม่มีอัตสัมพันธ์ ไม่มีความสัมพันธ์กับตัวแปรอิสระ และมีการกระจายแบบเส้นตรงปกติ

คำสำคัญ: ภัยก่อการร้าย ข้อมูลพาแนล การเติบโตทางเศรษฐกิจ จีดีพี เศรษฐกิจและสังคม

Abstract

The aim of this study is to examine the relationship between terrorism and economic growth in 32 countries. For empirical analysis, a panel study is conducted applying annual data for the period 2005 – 2019, and a multiple linear regression least square is estimated. Panel unit root, panel least squares estimation, panel normality, panel multicollinearity as well as panel heteroskedasticity approaches are employed, respectively. The results of the study reveal that the impact of terrorism on economic growth is significantly negative. A one percent increase in terrorism decreases real GDP by 0.0016 percent. Moreover,

[1] อาจารย์ประจำ, คณะมนุษยศาสตร์และสังคมศาสตร์ มหาวิทยาลัยสงขลานครินทร์ วิทยาเขตปัตตานี
Lecturer, Faculty of Humanities and Social Sciences, Prince of Songkla University, Pattani Campus.
Corresponding Author Email: sorfina.d@psu.ac.th,

the estimated model shows a high R square value, no serial correlation nor heteroskedasticity in the residuals, no multicollinearity, and the residuals are normally distributed.

Keywords: Terrorism, Panel Data, Economic Growth, GDP, Socioeconomics

Introduction

The classical theory of economic growth mentions that economic growth is determined by endogenous factors such as innovation, knowledge investment, and human capital as well as exogenous factors i.e., the level of technological progress and the number of laborers. But there are many efforts that try to investigate other factors, especially socioeconomic and political factors, that affect economic growth.

Socioeconomic and political factors, particularly terrorism is a major issue to fill this gap. This is because terrorism has direct and indirect relationships with progress and regress in economic and social development. Therefore, to study the nexus between terrorism and economic growth, this paper mainly focuses on the relationship between them using different approaches. Starting from this point of view, the study attempts to build an alternative growth model to inspect the socioeconomic and political factors, especially terrorism, on economic growth.

The study objective is to conduct the research by using a panel data approach from the World Bank and the Vision of Humanity in which to empirically examine the association between terrorism and economic growth for 32 countries over 15 years for the sample period of 2005 to 2019. The hypothesis of the study is that there is a negative relationship between terrorism and economic growth. Hence, the Terrorism Index is a significant explanatory variable in the GDP equation for this study.

This study tests the link between terrorism and economic growth following the model proposed by Kasperowicz (2014). The study employs panel unit root, panel least squares estimation, panel normality, panel multicollinearity as well as panel heteroskedasticity approaches that show a limited study in the literature for the relationship between terrorism and economic growth.

The paper is arranged as follows. The first part is the introduction. The second part explains the literature review followed by the model in the third part. The methodology and the data are proposed in the fourth and fifth parts, respectively. The last two parts describe the empirical results as well as conclusions.

Literature Review

There are several empirical studies on the relationship between terrorism and economic growth. Most of the study findings appeared that terrorism had a negative impact on economic growth (Freytag et al., 2011; Chuku et al., 2019; and Khan et al., 2016). Gupta et al. (2004) used data from 1985 – 1999 to investigate 22 terror incidents. According to their research results, terrorism negatively affected growth significantly. Saleem et al. (2020) used the data set during the period of 1981 to 2016, their result showed that terrorism had a negative impact on economic growth in both the short and long terms. As indicated by Araz-Takay et al. (2009), there was a significant negative impact of terrorism on the economy.

In accordance with Gaibulloev and Sandler (2008) applied the growth model using a two-way random effect estimation method in 18 Western European countries from 1971 – 2004. They argued that terrorism was the cause of the shrinking economy because both domestic and transitional terrorism showed a negative impact on per capita income growth. Fatima et al. (2014) analyzed the impact of terrorism on the GDP growth rate in Pakistan using 7-year data. They concluded that when the terrorist activities expanded the growth rate declined significantly. Likewise, Eckstein and Tsiddon (2004), an increase in terrorist activities reduced economic activities i.e., current consumption and saving.

The study about the causative relationship between terrorism and economic growth by Meierrieks and Gries (2013) used a panel data set including 160 countries with 1970 – 2007 data. The Granger causality test result demonstrated that there was a causal association between terrorism and economic growth. The results from the Granger Causality test as studied by Malik and Zaman (2013) using the data from 1975-2011 confirmed that terrorism negatively impacted macroeconomic factors such as poverty, price level, and economic growth. Shahbaz et al. (2013) applied the VECM and ARDL models to examine the cointegration and causality relationship between terrorism and economic growth in Pakistan using the data from the 1971 to 2010 period. They found that there was a one-way relationship between terrorism and economic growth in both the short run and long run. Identically, Densumite (2013) applied a simple regression analysis employing the VECM and Granger Causality test to determine the impacts of violence on economic growth as represented by raw rubber production in Yala province, Thailand. Her study demonstrated that there was a statistically significant negative relationship between violence and economic growth. Her results obtained from the Granger Causality test indicated that violence caused economic growth with no feedback. Similarly, Gillani et al. (2009) conducted the granger causality test employing the data from 1975 to 2009 to explore the effect of crime on poverty, unemployment, and inflation. Their study revealed that there was a positive relationship among these variables.

Blomberg et al. (2004) conducted structural VAR models, and cross-sectional and panel growth regression analysis employing an unbalanced panel data set of 177 countries during the period of 1968 to 2000. They found that terrorism exhibited a negative effect on growth by causing economic activities diverted from investment to government spending. Enders and Sandler (1996) employed VAR to explore the impact of terrorism and net foreign direct investment in Spain and Greece. They concluded that terrorism dropped the net foreign direct investment by 13.5% in Spain and 11.9% in Greece.

Bravo and Dias (2006) studied the relationship between terrorism and international trade using data from 1997 to 2004 in less developed countries. Their study found that there was a diverse effect between terrorism and international trade. Mirza and Verdier (2008) verified the negative link between transnational terrorism and international trade in which the data was covered from the period 1968-1999. As supported by Nitsch and Schumacher (2004) studied the relationship between terrorism and international trade by collecting data from 1960 to 1993 in 200 countries. Their evidence showed that terrorism decreased the volume of trade by 4%. Polacheck (1980) applied the cross-sectional data to analyze the association between conflict and international trade in 30 countries. The empirical result showed that terrorism caused trade to decrease by 20%. This is encouraged by Nisar et al. (2015), there was a negative impact of growth and trade balance on terrorism. Their study also indicated that terrorism showed a positive impact on inflation. Correspondingly, A GARCH-EVT approach, an event study approach, and a non-parametric methodology were employed by Chesney et al. (2011) to investigate the link between terrorism and the financial market using the data over 11 years period in 25 countries. Their study affirmed that financial market crashes were caused by terrorism.

Moreover, terrorism showed undesirable economic consequences on foreign direct investment as suggested by Collier et al. (2003). This is because terrorism demolished public investment funds and infrastructure development. Kinyanjui (2014) used the time series data during the period of 2010 to 2013 to investigate the association between terrorism and foreign direct investment in Kenya. The study found that there was a negative effect of terrorism on foreign direct investment in Kenya.

On the other hand, Nasir et al. (2008) found no relation between terrorist activities and economic development in Pakistan.

According to the classical theory of economic growth, the socioeconomic and political determinants, particularly terrorism, are neglected as a major determinant of economic growth. Therefore, the basic gap of this study is the model gap. The study tries to establish an alternative growth model to examine the socioeconomic and political factors, specifically terrorism, influencing economic growth.

Model

In this study, the panel data approach is employed to inspect the relationship between terrorism and economic growth. To consider the relationship between terrorism and economic growth, a framework based on the aggregate production function is adopted. The growth model of terrorism in the following is developed from the Solow Growth Model (Solow , 1956) and Safdar (2020), where Capital (K), Total Unemployment (L), Total Consumption (CS), and Terrorism Index (T), as separate inputs in the GDP equation. In this research article, I restrict my analysis to four indicators of GDP growth. I choose these four factors for two reasons: first, they are assessed dependently on macroeconomic variables such as capital, unemployment, and consumption, and independently of macroeconomic variables such as terrorism. Second, this study tends to adopt a more eclectic approach since Solow's model deliberately ignores some important aspects of macroeconomics, such as terrorism. The relationship among these variables can be written as:

$$GDP = f(K, L, CS, T) \quad (1)$$
$$GDP_{it} = \beta_{it} + \beta_{1i}K_{it} + \beta_{2i}L_{it} + \beta_{3i}CS_{it} + \beta_{4i}T_{it} + \mu_{it} \quad (2)$$

where:

GDP = Natural log of Gross Domestic Product of country *i* in the time period *t* at a constant price of 2015 (USD).

K = Natural log of Gross Fixed Capital or investment of country *i* in the time period *t* at a constant price of 2015 (USD).

L = Natural log of Total Unemployment of country *i* in the time period *t* represents as a percentage of the total labor force. Total unemployment refers to the share of the labor force that is without work but available for and seeking employment.

CS = Natural log of Total Consumption of country *i* in the time period *t* at a constant price of 2015 (USD).

T = Natural log of Terrorism Index of country *i* in the time period *t* represented by the scores 0.00 to 10.00. Lower scores denote no impact of terrorism, and higher scores denote a very high impact of terrorism. The Terrorism Index is measured by four indicators namely incidents, fatalities, injuries, and property damage.

Methodology

Panel Unit Root Tests

The basic feature of the panel unit root test is described in the following. Consider an AR (1) process:

$$y_{it} = \rho_i y_{it-1} + x_{it}\delta_{it} + \varepsilon_{it} \quad (3)$$

where i is cross-section series and $i = 1,2,\dots,N$; t is time periods and $t = 1,2,\dots,T$; x_{it} is optional exogenous regressors which may consist of constant, or a constant and trend; ρ_i and δ_i are parameters to be estimated; and ε_{it} is the white noise or the error term; y is a nonstationary series or contains a unit root when $|\rho| \geq 1$; and y is a (trend-) stationary series when $|\rho| < 1$.

Panel Least Squares

The basic model of pool object applies to estimate panel least squares can be written as:

$$y_{it} = \alpha + X'_{it}\beta_{it} + \delta_i + \gamma_t + \varepsilon_{it} \quad (4)$$

where y_{it} defines the dependent variable; α defines the overall constant in the model; X_{it} defines a k-vector of regressors; β defines the coefficient; δ_i and γ_t define the period specific effects (fixed or random) or cross-section; and ε_{it} define the error terms for cross-sectional units observed, $i = 1,2,\dots,M$, and $t = 1,2,\dots,T$ for dated periods.

Panel Normality Test

Skewness is an evaluation of asymmetry of the distribution of the series around its mean which is estimated as:

$$S = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{y_i - \bar{y}}{\hat{\sigma}}\right)^3 \tag{6}$$

where $\hat{\sigma}$ presents an estimator for the standard deviation based on $\hat{\sigma} = s\sqrt{(N-1)/N}$ that is the biased estimator for the variance.

Kurtosis is the flatness or peakedness of the distribution of the series which is calculated as:

$$K = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{y_i - \bar{y}}{\hat{\sigma}}\right)^4 \tag{7}$$

where $\hat{\sigma}$ presents the biased estimator for the variance.

Jarque-Bera is applied to test the series of normally distributed which measures the difference of the kurtosis and skewness of the series with those from the normal distribution. *Jarque-Bera* is represented as:

$$Jarque - Bera = \frac{N}{6}\left(S^2 + \frac{(K-3)^2}{4}\right) \tag{8}$$

where S denotes the skewness; K denotes the kurtosis; and the null hypothesis presents a normal distribution.

Panel Multicollinearity Test

The centered VIF represents the ratio of the variance of the coefficient estimate from the original equation divided by the variance from a coefficient estimate from an equation with only that regressor and a constant. The centered VIF is computed as:

$$Centered\ VIF = \frac{1}{(1-R^2)} \tag{9}$$

where R^2 denotes the R-squared from the regression of that regressor on all the other regressors in the equation.

Panel Heteroskedasticity Test

To test for a range of specifications of heteroskedasticity in the residuals of an equation, the Breusch-Pagan-Godfrey test (Breusch-Pagan, 1979; and Godfrey, 1978) as a Lagrange multiplier test is employed. The null hypothesis is homoskedasticity (no heteroskedasticity). According to equation (2), the following auxiliary regression of a BPG test could be performed as

$$resid^2 = \Delta K + \Delta L + \Delta CS + \Delta T \tag{10}$$

where $resid^2$ is the residuals-squared; K is the Natural log of Gross Fixed Capital or investment; L is the Natural log of Total Unemployment; CS is the Natural log of Total Consumption; T is the Natural log of Terrorism Index; and Δ is the first-difference operator.

Data

The study examines the secondary data during the period 2005 to 2019, applying a balanced panel. The data are converted to logarithms which allow presenting the relationships between variables in an equation. Table 1 represents the data for calculation collected from the World Bank and Vision of Humanity. According to equation (2), the relationship of GDP to gross fixed capital (K) or investment is expected to be positive because the higher the gross domestic fixed investment, the higher the economic production will be. Total consumption (CS) has a direct relationship with the GDP because the upper consumption rate denotes a greater level of production and economic growth. Instead, there is a negative relationship between total unemployment (L) and GDP since an increase in the unemployment rate will decelerate economic growth. Also, a higher terrorism index (T) and lower economic growth.

Table 2 shows the hypotheses of the study. There are four major determinants of GDP growth rate i.e., gross fixed capital (K), total unemployment (L), total consumption (CS), and terrorism index (T).

Table 3 shows 32 countries under investigation such as Nigeria, Pakistan, India, Philippines, Egypt, Turkey, Cambodia, United States, United Kingdom, Saudi Arabia, Indonesia, France, Russia, New Zealand, Mexico, Greece, Iran, Germany, Canada, Belgium, Italy, Sweden, Ireland, Spain, Australia, Malaysia, Japan, Denmark, Norway, Kazakhstan, Vietnam, and Colombia ranking from highly terrorized to very low, respectively. These countries are selected because each country is representative of a different continent such as Asia, Africa, Australia, South America, North America, and Europe, and there is abundantly available data that includes all years of study (2005 – 2019).

Table 4 shows the descriptive statistics of the data.

Table 1 Variables, Sources, and Expected Signs

Variable	Description	Source	Expected Sign
GDP	Gross Domestic Product in real prices	World Bank	Dependent Variable
K	Gross Fixed Capital in real prices	World Bank	Positive (+)
L	Total Unemployment	World Bank	Negative (-)
CS	Total Consumption in real prices	World Bank	Positive (+)
T	Terrorism Index	Vision of Humanity	Negative (-)

Table 2 Hypotheses

Number	Hypotheses
H1	There is a positive relationship between gross fixed capital and economic growth.
H2	There is a negative relationship between total unemployment and economic growth.
H3	There is a positive relationship between total consumption and economic growth.
H4	There is a negative relationship between terrorism index and economic growth.

Table 3 Countries under Investigation

Country Name	Score* (0.00 – 10.00)	Terrorism Impact*
Australia	2.148	Low
Belgium	3.043	Low
Cambodia	0.000	Very Low
Canada	3.171	Low
Colombia	6.100	High
Denmark	1.484	Very Low
Egypt	6.419	High
France	4.614	Medium
Germany	3.965	Low
Greece	4.182	Medium
India	7.353	High
Indonesia	4.629	Medium
Iran	4.157	Medium
Ireland	2.845	Low
Italy	3.043	Low
Japan	2.014	Low
Kazakhstan	0.901	Very Low
Malaysia	2.090	Low
Mexico	4.316	Medium
New Zealand	4.337	Medium
Nigeria	8.314	Very High
Norway	1.297	Very Low
Pakistan	7.541	High
Philippines	7.099	High
Russia	4.542	Medium
Saudi Arabia	5.000	Medium
Spain	2.810	Low
Sweden	2.892	Low
Turkey	6.110	High
United Kingdom	5.161	Medium
United States	5.260	Medium
Vietnam	0.420	Very Low

Source: Vision of Humanity (2019)

* Year 2019

Table 4 Descriptive Statistics

Variables	Obs.	Mean	Std. Dev.	Min.	Max.
1. The logarithmic form of real gross domestic product					
LNGDP	457	27.18	1.28	22.95	30.63
2. The logarithmic form of gross fixed capital					
LNK	457	25.65	1.33	21.15	29.08
3. The logarithmic form of total unemployment					
LNL	457	1.75	0.70	-1.97	3.31
4. The logarithmic form of total consumption					
LNCS	457	26.90	1.29	22.76	30.42
5. The logarithmic form of terrorism index					
LNT	457	0.77	1.39	-4.61	2.23

Source: Own calculation.

Empirical Results

To investigate the relationship between terrorism and economic growth, there are five steps were conducted in the study. The first step is conducted by unit root tests to verify the order of integration for the variables. The unit root tests are necessary since the applied panel least squares approach method is the stationarity of the analyzed time series. The second step is to inspect the relationship between terrorism and economic growth by employing the panel least squares approach. In the third step, the normality test is applied to test for the normality of residuals. The multicollinearity test and the heteroskedasticity test are presented in the fourth and fifth steps, respectively.

Panel Unit Root Tests

The study employs Levin, Lin & Chu t*, Im, Pesaran and Shin W-stat, Augmented Dickey-Fuller (ADF), and Phillips-Perron (PP) to explain the results of panel unit root tests as shown in Table 5. The tests for each variable are operated in tests including the intercept. The first and second halves of the table exhibit the results of panel unit root tests in levels as well as in the first differences for all variables, respectively.

Table 5 presents the null hypothesis that each variable has a unit root that cannot be rejected at the level. In the first half of the table, almost all tests of each variable have unit roots that cannot be rejected the null hypotheses in their levels. Only in the case of Gross Fixed Capital (K), and Total Unemployment (L), according to Levin, Lin & Chu t*'s results, are stationary at the 0.01 level of significance. Also, Total Consumption (CS), Terrorism Index (T), and Phillips-Perron's results show that they are stationary in the level at the 0.05 and 0.01 level of significance, respectively. However, most of the evidence of unit root tests on each variable cannot reject the null hypothesis which confirms that Gross Fixed Capital (K), Total Unemployment (L), Total Consumption (CS), and Terrorism Index (T) are non-stationary since they have a unit root. This can conclude that all variables are non-stationary in their levels.

After applying the first difference of each variable, all statistics of these five variables meet the requirements of the study and can reject the null hypothesis at the 0.01 level of significance. Therefore, all variables are stationary for the 99 percent confidence interval. This shows that all variables are stationary in their first differences. Thereby, all these variables are integrated into order one, i.e.; I (1).

Table 5 Panel Unit Root Tests Results

Method	*GDP*			ΔGDP		
	Statistic	**Prob.**	**Obs**	**Statistic**	**Prob.**	**Obs**
Null: Unit root (assumes common unit root process)						
Levin, Lin & Chu t*	-1.30299	0.0963	431	-12.9218***	0.0000	402
Null: Unit root (assumes individual unit root process)						
Im, Pesaran and Shin W-stat	6.04505	1.0000	431	-10.1161***	0.0000	402
ADF – Fisher Chi-square	32.7602	0.9996	431	212.694***	0.0000	402
PP – Fisher Chi-square	66.4864	0.3914	448	199.319***	0.0000	416
Method	*K*			ΔK		
	Statistic	**Prob.**	**Obs**	**Statistic**	**Prob.**	**Obs**
Null: Unit root (assumes common unit root process)						
Levin, Lin & Chu t*	-3.75064***	0.0001	432	-10.2482***	0.0000	396
Null: Unit root (assumes individual unit root process)						
Im, Pesaran and Shin W-stat	1.47884	0.9304	432	-8.14703***	0.0000	396
ADF – Fisher Chi-square	66.7101	0.3840	432	181.459***	0.0000	396
PP – Fisher Chi-square	83.5324	0.0511	448	191.310***	0.0000	416
Method	*L*			ΔL		
	Statistic	**Prob.**	**Obs**	**Statistic**	**Prob.**	**Obs**
Null: Unit root (assumes common unit root process)						
Levin, Lin & Chu t*	-3.77972***	0.0001	430	-11.9696***	0.0000	405
Null: Unit root (assumes individual unit root process)						
Im, Pesaran and Shin W-stat	-0.97260	0.1654	430	-9.29382***	0.0000	405
ADF – Fisher Chi-square	79.9406	0.0862	430	198.956***	0.0000	405
PP – Fisher Chi-square	44.3899	0.9706	448	184.993***	0.0000	416

Method	CS			ΔCS		
	Statistic	Prob.	Obs	Statistic	Prob.	Obs
Null: Unit root (assumes common unit root process)						
Levin, Lin & Chu t*	-1.28369	0.0996	432	-11.5884***	0.0000	409
Null: Unit root (assumes individual unit root process)						
Im, Pesaran and Shin W-stat	3.54982	0.9998	432	-8.12759***	0.0000	409
ADF – Fisher Chi-square	68.8296	0.3173	432	177.190***	0.0000	409
PP – Fisher Chi-square	84.8653**	0.0416	448	161.933***	0.0000	416
Method	T			ΔT		
	Statistic	Prob.	Obs	Statistic	Prob.	Obs
Null: Unit root (assumes common unit root process)						
Levin, Lin & Chu t*	-1.57949	0.0571	409	-14.2470***	0.0000	367
Null: Unit root (assumes individual unit root process)						
Im, Pesaran and Shin W-stat	-1.14121	0.1269	409	-10.5381***	0.0000	367
ADF – Fisher Chi-square	75.7575	0.1125	409	224.200***	0.0000	367
PP – Fisher Chi-square	116.712***	0.0000	417	286.224***	0.0000	383

Source: Own calculation.

Note: *** and ** indicate the rejection of the null hypothesis at 0.01 and 0.05 levels of significance, respectively. Δ is the first-difference operator.

Panel Least Squares

This study applies the panel least squares method to examine the relationship between terrorism and economic growth. The final form of the estimated equation is:

$$\Delta GDP_{it} = \beta_0 + \beta_{1i}\Delta K_{it} + \beta_{2i}\Delta L_{it} + \beta_{3i}\Delta CS_{it} + \beta_{4i}\Delta T_{it} + \mu_{it} \tag{11}$$

Table 6 presents the econometrical tests of the estimated model which reports the results of modeling the equation. To meet the assumptions of regression, the panel EGLS (Cross-section weights) is employed to calculate. The panel least squares estimation in the first-difference form can be written as:

$$\Delta GDP_{it} = 0.011260 + 0.174157K_{it} - 0.013208L_{it} + 0.397277CS_{it} - 0.001624T_{it} \tag{12}$$

The panel least squares estimate for the coefficients is reported in Table 6. As expected, Gross Fixed Capital (K), and Total Consumption (CS) are positive and highly significant since they can reject the null hypothesis at the 0.01 level of significance. On the other hand, Terrorism Index (T) and Total Unemployment (L) are negative and highly significant since they can be rejected the null hypothesis at the 0.05 and 0.01 level of significance, respectively. As a result, all variables are significant to explain the real GDP.

According to the panel least squares estimation result from Table 6, implying that an increase of 1 percent in the Terrorism Index, will decrease the real GDP by 0.001624 percent. Instead, if the rate of the Gross Fixed Capital increases by 1 percent, the real GDP will grow by 0.174157 percent. Similarly, if the Total Consumption goes up by 1 percent, the real GDP will go up by 0.397277 percent. Likewise, a rise of 1 percent in the Total Unemployment, will reduce the real GDP by 0.013208 percent.

The estimated Durbin-Watson test statistic for the model shown in Table 6 is 2.159690, which can conclude that the residuals are uncorrelated. In other words, there is no serial correlation or autocorrelation in the residuals.

In this model, the R-squared value as presented in Table 6 shows that the model is nicely fitted. This is because of the R-squared of 88.15 percent.

Moreover, F-statistic from Table 6 is significant at the 0.01 level of significance.

Table 6 Panel Least Squares Estimation Results

ΔGDP equation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ΔK	0.174157	0.010254	16.98510***	0.0000
ΔL	-0.013208	0.003799	-3.476403***	0.0006
ΔCS	0.397277	0.032220	12.33024***	0.0000
ΔT	-0.001624	0.000665	-2.442891**	0.0150
C	0.011260	0.000930	12.10154	0.0000
Effects Specification				
Cross-section fixed (dummy variables)				
Weighted Statistics				
R-squared	0.881527		Mean dependent var	0.048543
Adjusted R-squared	0.870701		S.D. dependent var	0.056729
S.E. of regression	0.018508		Sum squared resid	0.131189
F-statistic	81.42301		Durbin-Watson stat	2.159690
Prob(F-statistic)	0.000000			
Unweighted Statistics				
R-squared	0.683984		Mean dependent var	0.027899
Sum squared resid	0.142867		Durbin-Watson stat	2.381745

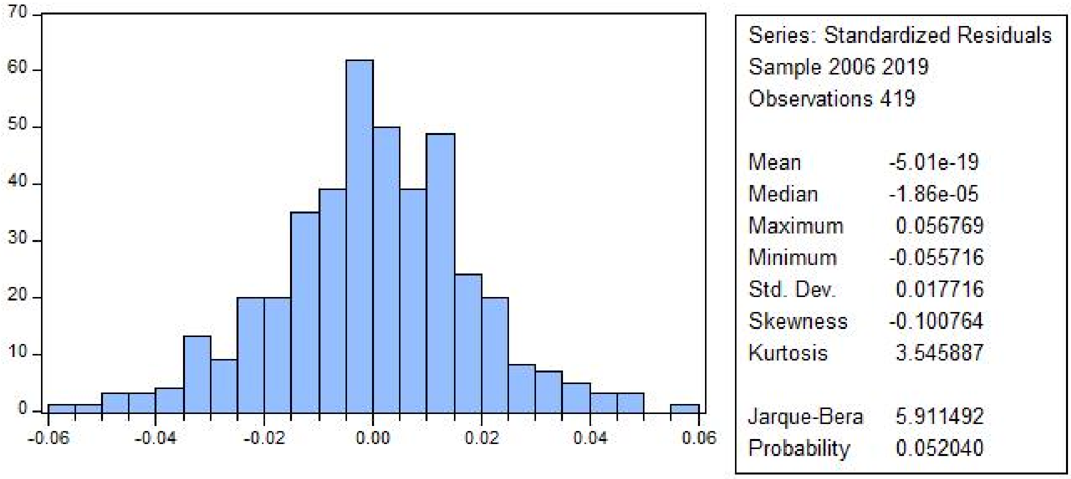
Source: Own calculation.

Note: *** and ** indicate the rejection of the null hypothesis at 0.01 and 0.05 levels of significance, respectively. Δ is the first-difference operator.

Panel Normality Test

This study conducts a test for the normality of residuals (Diagram 1). The Jarque-Bera statistic shows that it does not reject the hypothesis of normal distribution since the p-value is 0.052040. So, it indicates that the null hypothesis is confirmed. In addition, the histogram shows bell-shaped, therefore, the residuals are normally distributed.

Diagram 1 Normality of Residuals



Source: Own calculation.

Panel Multicollinearity Test

To test for multicollinearity, the variance inflation factor (VIF) is the main criterion to check the relationship between or among two or more variables. Since the VIF statistics displayed in Table 7 are less than 10, meaning that there is no multicollinearity between and among the variables used. According to the results, all independent variables in a model are uncorrelated. Implying that unemployment, consumption, investment, and terrorism have no correlation with one another, for example, investment cannot be predicted from terrorism in a model.

Table 7 Multicollinearity Estimation Results

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
ΔK	0.000105	2.344880	1.810746
ΔL	1.44E-05	1.536274	1.532639
ΔCS	0.001038	5.811362	1.456863
ΔT	4.42E-07	1.007878	1.002647
C	8.66E-07	4.557533	NA

Source: Own calculation.

Panel Heteroskedasticity Test

To investigate the violation of the assumption of homoskedasticity, the residual diagnostic i.e., heteroskedasticity test using the Breusch-Pagan-Godfrey (BPG) method is employed to examine the residuals of the equation. The p-values of each variable represented in Table 8 are bigger than 5 percent implying that there is no heteroskedasticity in the residuals.

Table 8 Heteroskedasticity Estimation Results

$RESID$^2 equation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ΔK	-1.11E-07	1.47E-07	-0.756927	0.4496
ΔL	-4.35E-09	4.90E-08	-0.088787	0.9293
ΔCS	-3.54E-07	4.84E-07	-0.730696	0.4654
ΔT	-1.42E-09	8.65E-09	-0.163650	0.8701
C	3.95E-07	1.28E-08	30.91460	0.0000
Effects Specification				
Cross-section fixed (dummy variables)				
Weighted Statistics				
R-squared	0.133370		Mean dependent var	2.70E-07
Adjusted R-squared	0.054174		S.D. dependent var	1.37E-06
S.E. of regression	1.35E-06		Sum squared resid	7.00E-10
F-statistic	1.684046		Durbin-Watson stat	2.364424
Prob(F-statistic)	0.010478			
Unweighted Statistics				
R-squared	0.114204		Mean dependent var	3.82E-07
Sum squared resid	3.75E-09		Durbin-Watson stat	2.357325

Source: Own calculation.

Conclusions

The aim of this study is to inspect the relationship between terrorism and economic growth. In this paper, terrorism, and the growth rate of 32 countries from 2005 to 2019 are investigated using a panel data approach.

In accordance with the empirical results, terrorism seems to have a significant negative effect on economic growth as represented by the panel least squares estimation.

Meaning that an increase of 1 percent in the terrorism index, will reduce the real GDP by 0.0016 percent. Furthermore, the results from the R square value, panel serial correlation, panel heteroskedasticity, panel multicollinearity, and panel normality tests display significant relationships.

We can conclude that the empirical results of this study correspond to the conventional belief of presuming that terrorism and unemployment rates are disadvantageous for economic growth as well as investment and consumption advantageous for economic growth. Empirical evidence shows the significant negative relationships between terrorism, and the unemployment rate on economic growth as well as the significant positive relationships between investment, and consumption on economic growth. These indicate that all variables generate significant effects to boost economic growth.

This study reveals the socioeconomic and political determinants like terrorism as well as economic determinants like investment, unemployment, and consumption that impact economic growth. Overall, understanding the relationship between terrorism and economic growth leads to more efficient policymaking and forecasting. Thus, suggesting that policies to alleviate terrorism would have a considerable impact on economic growth.

Discussion

According to research results, the relevant implications should be paid attention to inhibit the effects of terrorism on economic growth. This must be aware since terrorism brings inefficiency in aggregate economic development, therefore, the anti-terrorism schemes as represented by the government will lessen this problem which will reflect a huge effect on the aggregate economy.

The previous study finding by Meierrieks and Gries (2013) demonstrates that it is better to understand the conflicting evidence on the terrorism–economy nexus in order to give more solid counter-terrorism advice. The role of economic performance in determining terrorist violence appears to have been important for some countries, whereas all attacked economies have been successful in adjusting to the threat of terrorism (Gries, Krieger, & Meierrieks, 2011). To increase economic growth more resources must be allocated to improve law and order to attract foreign investment, complementary domestic investment must be increased (Zakaria, Jun, & Ahmed, 2019).

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