Examining the link between terrorism and tourism demand: The case of Egypt

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Abstract

The current study explores the link between tourist demand and terrorism in Egypt using monthly data for the period from 1995 to 2018. We aim to investigate whether this relationship is unidirectional of bidirectional and whether it exhibits persistence in the long run. Terrorism is proxied by performing principal component analysis on the number of terrorist incidents and the number of resulting deaths and injuries. We test for cointegration employing a Vector Autoregressive Model with Error Correction. We find evidence of a long-term cointegrating relationship between tourism and terrorism. Our empirical results show that the direction of this causal relationship is from terrorism to tourism only, meaning that policymakers should not expect a rise in terrorist activity during periods of increased tourist arrivals. Our findings indicate that authorities should enforce strict measures against terrorism in order to promote safety and security within the tourism context.

Keywords: tourism; terrorism; tourist arrivals; Egypt; Principal Component Analysis; Vector Autoregressive Model

JEL Classifications: C32, L83

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1. Introduction

In the last two decades, terrorism has been at the epicentre public policy discussions, mainly due the destabilising effect that is can have on in societies, which spans across many different types of activities. The world has experienced a transformation in the face of terrorist activities, which have changed both in frequency and intensity and are gradually becoming an issue of increasing importance in countries in all regions. Terrorism in Africa has seen an increasing trend, while Egypt, in particular, has experienced a surge of terrorist incidents especially after the regime changes of the 2011-13 period. The volatility of the terrorist threat and the increased importance of tourism in Egypt make it a prime candidate for a study on the link between these two variables. In addition, Egypt is one of the top five African destinations for international tourists (UNWTO World Tourism Barometer, 2018) and thus a country-specific analysis can yield useful insights in the African context.

In this paper, we examine how terrorism and tourism are connected, both in terms of causality and in terms of the size of effect, by using monthly data from Egypt from 1995 to 2018. The period selected is long enough to cover different points in the country's history, while it captures important changes in tourism demand worldwide. We follow the methodology of Afonso-Rodríguez (2017) but proxy terrorism by three components, namely the number of incidents, deaths and injuries. The latter two components are necessary to the discussion in order to capture not only the frequency of the events but also their severity.

As per the UNWTO World Tourism Barometer (2018), Egypt is one of the top five African destinations for international tourist arrivals. Based on pre-COVID-19 data from the Africa Tourism Monitor (2018), tourism in Africa demonstrates an increasing trend. Arrivals totalled 62.9 million in 2016, a 0.64% increase from the previous year. The receipts from international tourism totalled $36.2 billion at the same year, comprising 3% of global tourism receipts. Travel and tourism in Africa continue to grow despite some unpredictable incidents like global terrorism and political instability. Africa's cultural heritage and natural assents make the region a preferred tourism destination (Africa Tourism Monitor, 2018).

Regarding, terrorism, there are known differences in its definition, which have been well established in the literature (Seabra, Reisb and Abrantesb, 2020). According to OECD (2020), there are vast variations in the definition of "terrorism" and "acts of terrorism" among OECD members. Agnew (2010, p. 132) points out that terrorism is defined as "the commission of criminal acts, usually violent, that target civilians or violate conventions of war when targeting military personnel; and that are committed at least partially for social, political, or religious ends". According to Tarlow (2002, p. 133), "terrorism is often defined as an indiscriminate destruction of property and life for the purposes of furthering a political agenda", while Meltzer (1983, p. 6) describes terrorism as the "exploitation of a state of intense fear, caused by the systematic use of violent means by a party of group, to get into power or to maintain power". Despite that fact that the link between tourism and terrorism has been examined in numerous papers (Araña and León, 2008; Raza and Jawaid, 2013; Samitas, Asteriou, Polyzos and Kenourgios, 2018; Veréb, Nobre and Farhangmehr, 2020), most exhibit mixed findings and there does not seem to be a consensus among researchers. In addition, adding further variables to proxy the severity of terrorist incidents has shown to result to different findings (Afonso-Rodríguez, 2017; Samitas et al., 2018).

The contribution of this paper is to identify the relationship between tourism and terrorism using Egypt as a case study. The paper adds to three strands of the existing literature. Firstly, it examines the link between terrorism and tourism, in a region where tourism plays in important role and where there have been significant variations in terrorist incidents and establishes the direction of causality from terrorism to tourism only, suggesting a unidirectional relation. Secondly, it shows that the negative economic outcomes of terrorism in Egypt are present both in the long and short run. Lastly, it demonstrates how the severity of terrorist incidents, as indicated by fatalities and injuries, should also be examined by researchers when discussing the relationship of terrorism with other variables.

The rest of this paper is structured as follows. Section 2 provides a review of the literature connecting terrorist occurrences with tourism. Section 3 discusses the methodology of our research and the data set used, Section 4 discusses the empirical results and Section 5 presents our conclusions and the policy implications.

2. Literature Review

Terrorist incidents are believed to be haphazard and scattered events, aiming at creating a strain on a wide audience (Öcal and Yildirim, 2010) and they are carried out daily worldwide (Coca-Stefaniak and Morrison, 2018). Terrorism can stem from refusal of political privileges, personal safety rights and essential rights for the humans (Callaway and Harrelson-Stephens, 2006), while it can be domestic or multinational (Enders, Sandler and Gaibulloev, 2011). Terrorism has repeatedly been the topic of policy discussions over the past decades, considering the increase of terrorist events globally (National Consortium for the Study of Terrorism and Responses to Terrorism, 2020). It is thus imperative that governments and organisations be prescient rather than reactive to terrorist occurrences (Paraskevas and Arendell, 2007). Terrorism should not be treated like a local problem in specific parts of a country, but as an important issue at a national level (Smith, 2006). What is more, in addition to the direct effects of terrorist attacks, other economic problems, such as increased unemployment may follow (Karsavuran, 2020).

One of the major concerns globally is the fact that terrorism appears to have a strong negative result on the tourism sector (Mansfeld and Pizam, 2006), despite the fact the determinants of tourism demand are found mainly in economic factors (Tatoglu and Gul, 2019). The target of terrorism has always been the tourism industry, according to Lennon and O'Leary (2004), while Faulkner (2001) and Israeli and Reichel (2003) argue that terrorism is among the most powerful detriments to tourism. Some researchers have examined the impact of terrorism on specific tourist destinations, like Goodrich (2002) who examines the 9/11 incidents in the United States of America. The turmoil in Nepal is examined by Bhattarai et al. (2005) and the Olso/Utøya slaughters in 2011 are discussed by Wolff and Larsen (2014). All studies show the negative effects of such events on tourist activities, while it must be noted that the sentiment of fear relates not only to terrorist incidents, but also to other types of violence, where indeed the effects can be gender- or culture-specific (Aschauer, 2010; Mura and Khoo-Lattimore, 2012). Farajat, Liu and Pennington-Gray (2017) examine the case of Jordan and show that the perception of safety is an important determinant in the country's marketing campaign on tourism.

Liu and Pratt (2017) extend these findings by quantifying the link between tourism and terrorism in 95 different countries. In their findings, they indicate that terrorism significantly influences only 29 of the 95 destinations. They conclude that terrorism does not have a ubiquitously negative impact on tourism arrivals in the long term, but that this effect may be particular to each country. Similar conclusions are presented by Barbhuiya and Chatterjee (2020) for different Indian states, who also show that there are differences in responses even among domestic and international tourists. Therefore, it is important to examine different data sets to establish the nature of this relationship in order to determine the suggested policy outcomes. The effects of terrorism on the tourism demand of Kenya have been studied by Buigut and Amendah (2016). The authors use a panel approach over the period 2010-2013 and conclude that terrorism affects the Kenyan tourism in a negative way.

Araña and León (2008) investigate the short-term effects of the attacks in the city of New York on preferences of tourists for competing destinations in the Canary Islands and the Mediterranean Sea. This study shows that the attacks result in strong adverse effects which in turn lead to a differentiation of the profile of destinations and in the tourists' utility. Additionally, some destinations were upgraded in popularity because of terror events, while some others deal with a firmly negative impact on their image and attractiveness. Similar findings are reported by Bowen, Fidgeon and Page (2014) for the cruise ship industry. Bristow and Jenkins (2019) analysed the geography of fear and amongst the fear measures of fright tourists, human-caused disasters, like terrorism, came first in their sample.

Regarding policy, Agiomirgianakis, Serenis, and Tsounis (2017) point out that government actions on tourism need significant, long-run preparation for quite a short-run objective. Kılıçlar, Uşaklı and Tayfun (2018) examine both the significance and the adequacy of experiences to obstruct terrorist activities in tourism destinations and claim that civilian authorities have a multitude of ways to prevent terrorism. Ryan (1993) supports that terrorism has significant results for both specific tourist destinations and tourism in general. Meierrieks and Schneider (2021) found that countries resort to less liberal international economic policies when facing the threat of terrorism and this effect is especially relevant to less populated countries. Another study discussed the tourism implications of online response to terrorism by analysing 154,390 tweets and the results demonstrated that people show more anger-related compared to fear-related emotions online after terrorist attacks (Ulqinaku and Sarial-Abi, 2020).

Bassil, Hamadeh and Samara (2015) and Bassil, Saleh and Anwar (2019) discuss tourism-led growth and destination substitution due to terrorist events among Lebanon, Turkey and Israel, while Saha and Yap (2014) show the interplay between terrorism and political instability on tourism growth for 139 countries from 1999-2009. Buckley and Klemm (1993) report that terror and lack of security are considerable hurdles to global travel. Raza and Jawaid (2013) examine the effect of terrorism activities on tourism in the region of Pakistan by using the annual time series data from the period of 1980 to 2010. The outcomes of their study show the importance of the negative effects of terrorism on tourism in the long and short term as well.

Raja and Raghu (2020) examine terrorism incidents and their impact on tourist destination countries. They pointed out that the tourists get nervous about the possibility of terror attacks and this can negatively impact their choice of destination.

Lanouar and Goaied (2019) analyse the effect of terrorist events and political force on the number of overnight stays and tourist demand in Tunisia concluding that regional shocks have a more significant impact than global shocks in affecting the tourism activities. Samitas et al. (2018) investigate the impact of terrorism on tourist demand in Greece for the period from 1977 to 2012 and find a persistent long-run negative effect. Akadiri, Eluwoleb, Akadiric and Avcib (2019) argue that terrorism can impact tourism worldwide, since tourists would normally select destinations where there is a strong perception of security and safety. On the other hand, Veréb et al. (2020) show that there is specific portion of tourists, namely those with cosmopolitan views of the world, whose demand is resilient to terrorist incidents in the destination they choose. Finally, it is important to note that not only terrorism but political instability in general can have harmful effects on tourism and economic growth (Ivanov, Gavrilina, Webster and Ralko, 2017).

In the African context, tourism is one of the industries that can contribute to long-term, sustainable growth (Nyarko, 2013). Countries like Egypt, Tunisia and Morocco are among the most popular tourist destinations, followed by Tanzania, Sierra Leone, Seychelles. South Africa is also an important player as it has also hosted important world events (Peeters, Matheson and Szymanski, 2014). For the case of Egypt, in particular, tourism and travel are significant for the domestic economy, as they offer a lot to national income and generate employment (Njoya, 2019). Tourism is one of the greatest income sources in Egypt giving jobs to millions of Egyptians (Ghany and Latif, 2012). According to the World Travel and Tourism Council (2019), the contribution of travel and tourism to GDP in 2019 was 11.9% of total output, an increase of 16.5% from 2018, whereas the contribution of tourism to total employment was 9.5%. The country has also suffered heavily from terrorism, with most of the attacks targeting the government buildings, tourism, security forces and hijacking. In March 2015, there were two major incidents in Tunisia, where members of Jund al-Khilafah attacked tourists, killing and injuring many people (Neagou, 2017).

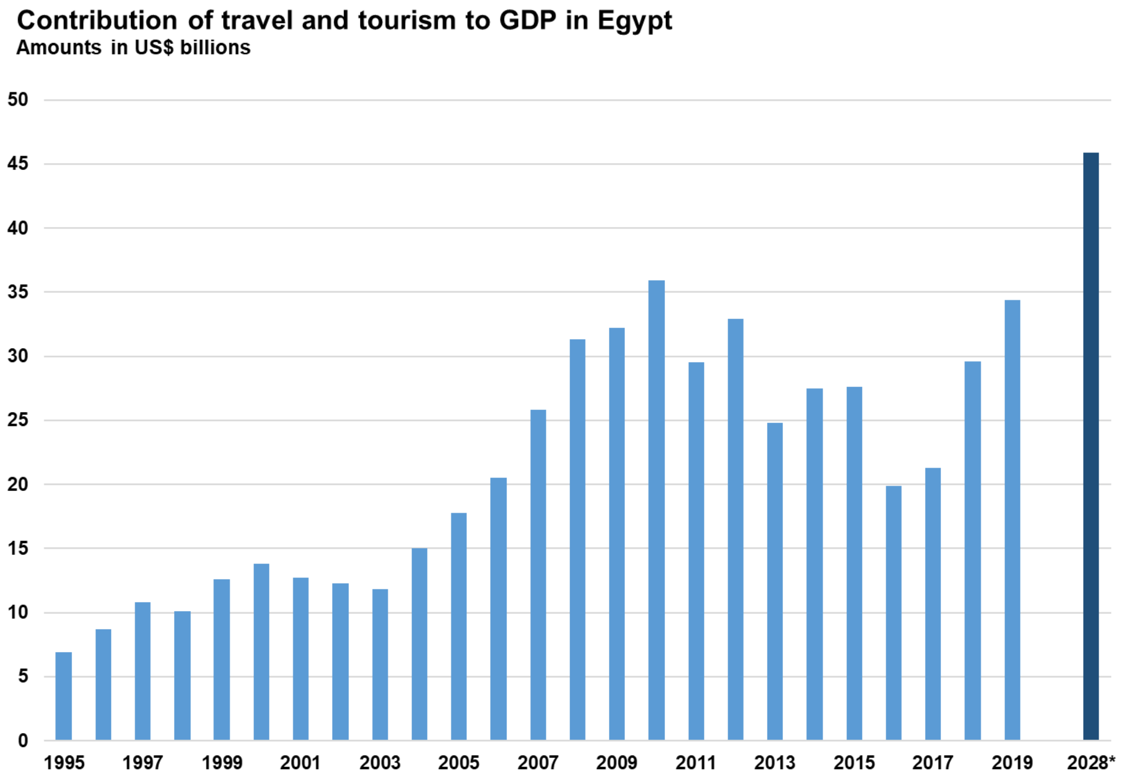

Figure 1. Total contribution of travel and tourism to GDP in Egypt from 1995-2019

Source: Statista, 2020

Figure 1 shows the overall contribution of tourism and travel to the Gross Domestic Product in Egypt from 1995 to 2019 with a projection for 2028. The last years since 2017, there has been an increase to the contribution and by 2028 this increase is expected to have doubled. According to Avraham (2016), Egypt is recognised as a powerful tourism brand, as it offers a variety in types of tourism that ulcerate millions of tourists yearly. Tourism is a dominant industry in Egypt, despite starting to develop in the 1970s (Dinnie, 2010; Mansfeld and Winckler, 2015). Avraham (2016) examines the marketing efforts of the Egyptian tourism professionals to revive the industry and hinder the decrease in the numbers of tourists in the following years. Njoya (2019) constructs a comparative static Computable General Equilibrium (CGE) model of Egypt which demonstrates the effects of service sector reforms in Egypt from an economic perspective.

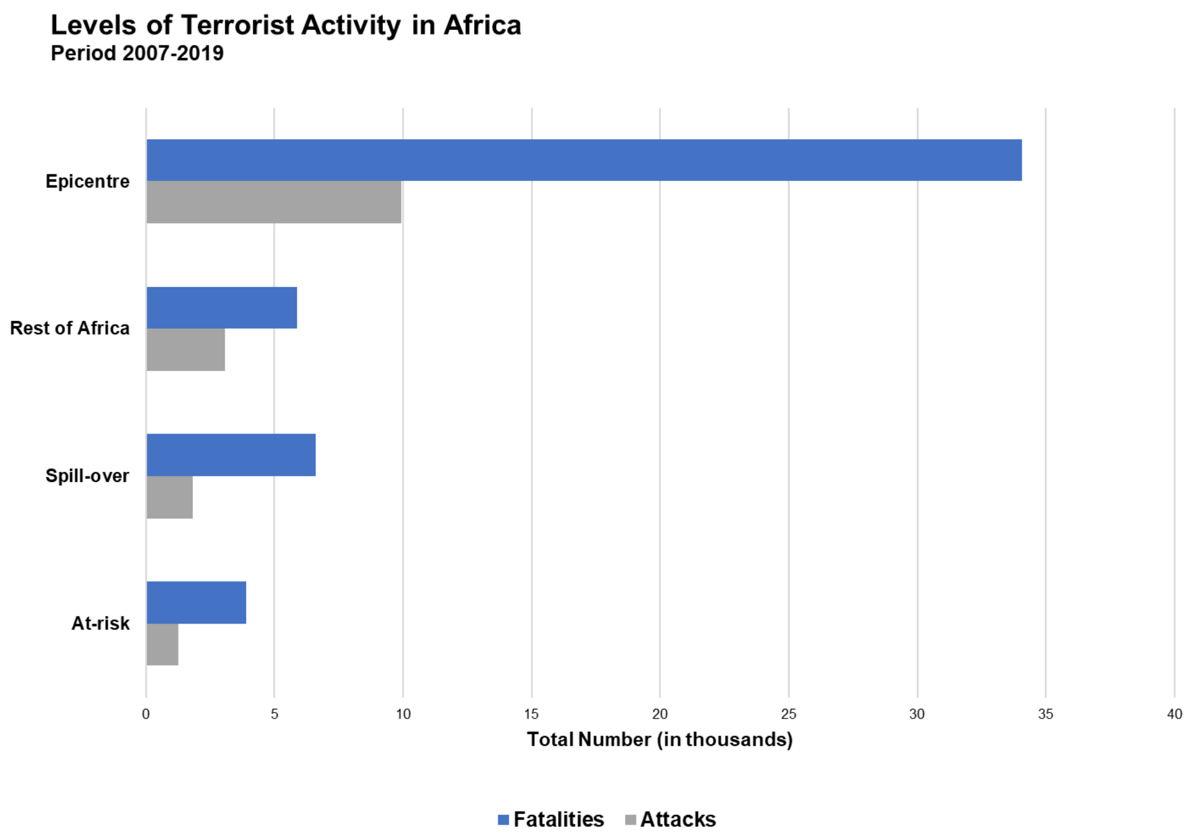

Figure 2. The levels of terrorist activity in Africa, 2007-2019

Source: Institute for Economics and Peace (2020)

Egypt has also experienced turmoil in the same period (Elshaer and Saad, 2017). According to the Institute for Economics and Peace (2020), there is an increase in the spread of terrorism in North and sub-Saharan Africa the last five years, while long-running armed conflicts in other regions have also had a detrimental effect on economic growth in general (Lopez and Wodon, 2005). The Sahel region has been facing a high increase in terrorist incidents, therefore including the above, the impact of terrorism in Africa is estimated at $171.7 billion in the last decade. In this context, Egypt has experienced a large drop in fatalities, with human losses from terrorism dropping by 90% in a single year (Institute for Economics and Peace, 2019). The decrease in deaths in the region of Egypt was the consequence of a significant reduction in attacks from the Sinai Province of the Islamic State following military operations by the Egyptian government. Figure 2 depicts the total number of terrorist attacks and fatalities in Africa between 2007-2019. Despite the fact that most of these attacks took place in the epicentre countries, namely Libya, Somalia, Nigeria and Mali, the economic impact of terrorism on the region increased from $661 million to $12.3 billion between 2007 and 2019. Terrorist attacks escalated from 228 to 1,577 over the same period.

3. Methodology

3.1. Data

Our study includes a cointegration analysis on monthly data regarding tourist arrivals to Egypt, as well as terrorist events in the country. The time span discussed covers the period from 1995 to 2018. This period is long enough to give us a wide range of events in the country's history, including the uprisings of 2011. Terrorism data was sourced from the National Consortium for the Study of Terrorism and Responses to Terrorism (2020) while tourist arrivals data was found in Statista (2020).

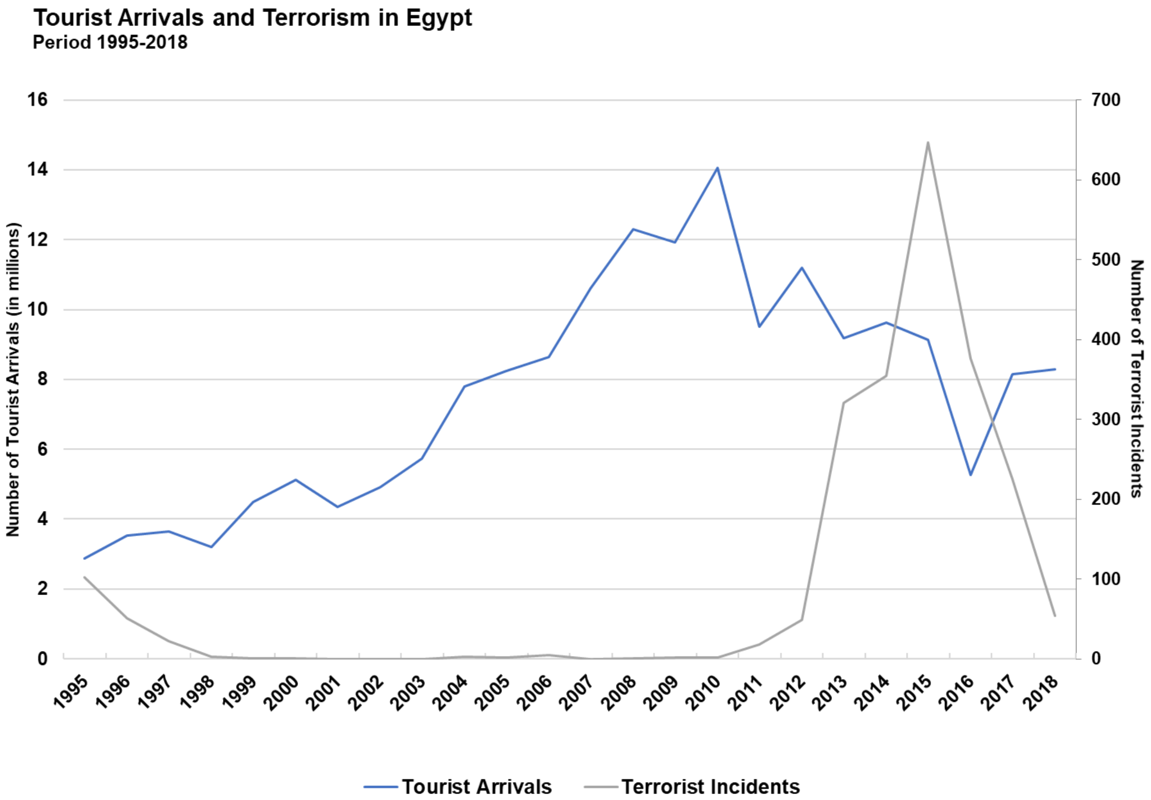

Figure 3. Tourist Arrivals and Terrorism in Egypt, 1995-2018

Source: Authors' calculations

The final data set includes 2,229 terrorist events, causing a total of 3,650 fatalities and some 4,520 injuries. Our time series includes 289 monthly observations of the above data series, as well as the tourist arrivals. Each monthly data node includes the total number of arrivals, the number of terrorist incidents and the resulting fatalities and injuries. Figure 3 demonstrates the times series of terrorism incidents (number of occurrences) and tourism arrivals in Egypt. We note the increasing trend of tourist arrivals while terrorist events remain low, but this trend changes after the uprisings of 2011 and the resulting instability, which in turn increase terrorist incidents. Tourism arrivals resume their increasing trend in the last months of the data set, once the reduction of terrorist incidents is evident.

Contrary to Samitas et al. (2018), we do not distinguish between the different types of incident outcomes, since the gravity of the events is captured in the total number of fatalities and injuries. However, we do conduct Principal Component Analysis to determine the common factor from the three terrorism proxies, namely number of incidents, fatalities and injuries, thus adding to Afonso-Rodríguez (2017). In this manner, we can avoid multicollinearity problems and capture the gravity of each month's events into a single variable that will then be used to test for cointegration and long-run Granger causality against tourism arrivals. Finally, we deseasonalise the tourist arrivals data series, since, as can be expected, it exhibits strong seasonality.

3.2. Principal Component Analysis

Principal Component Analysis (PCA) is a commonly used method, implemented particularly often on data with many dimensions which need to be reduced. Essentially, this is performed by projecting the data on fewer dimensions using linear combinations of the variables, in order to extract the directions where there is the most variance (Abdi and Williams, 2010). These variables are the principal components. In this manner, the output variables are uncorrelated with each other and are ordered so that the first projected variables explain the biggest share of the variation present in the original variable set.

The first step in this process is to calculate a function a'_1y for the observation vectors that exhibit the maximum variance. The vector a_1 is a vector of p constants corresponding to the p original variables. Thus, the linear function is defined as below:

$$a'_1 y = a_{11}x_1 + a_{12}x_2 + \cdots + a_{1p}x_p = \sum_{i=1}^{p} a_{1i}x_i \qquad (1)$$

For PCA, we compute a new linear function a'_2y, which is uncorrelated with Equation (1) and has maximised variance. This process is repeated in order to obtain as many principal components as is required, using the sample covariance matrix S. The goal of each step is to compute a'_jy so that the variance of $a'_jy\Sigma a_j$ is maximised under the constraint posed by the Lagrangean function:

$$a'_1 \sum \boldsymbol{a_1} - \lambda(a'_1 y \boldsymbol{a_1} - 1) \tag{2}$$

where λ is an eigenvector of the covariance matrix S and a_1 is the corresponding eigenvector.

Table 1. Results of Principal Component Analysis

	PC1	PC2	PC3
Standard deviation	1.5125	0.6854	0.4921
Proportion of Variance	0.7626	0.1566	0.0808
Cumulative Proportion	0.7626	0.9192	1.0000

Using the above process, we derive the principal components demonstrated in Table 1. Thus, we can explain most of the variance of the three variables in the first derived component, while the third component adds little to the explanatory power of the PCM. This is depicted graphically in Figure 4. This means that we can use PC1 as a proxy to the three terrorist variables, namely terrorist incidents, fatalities and injuries.

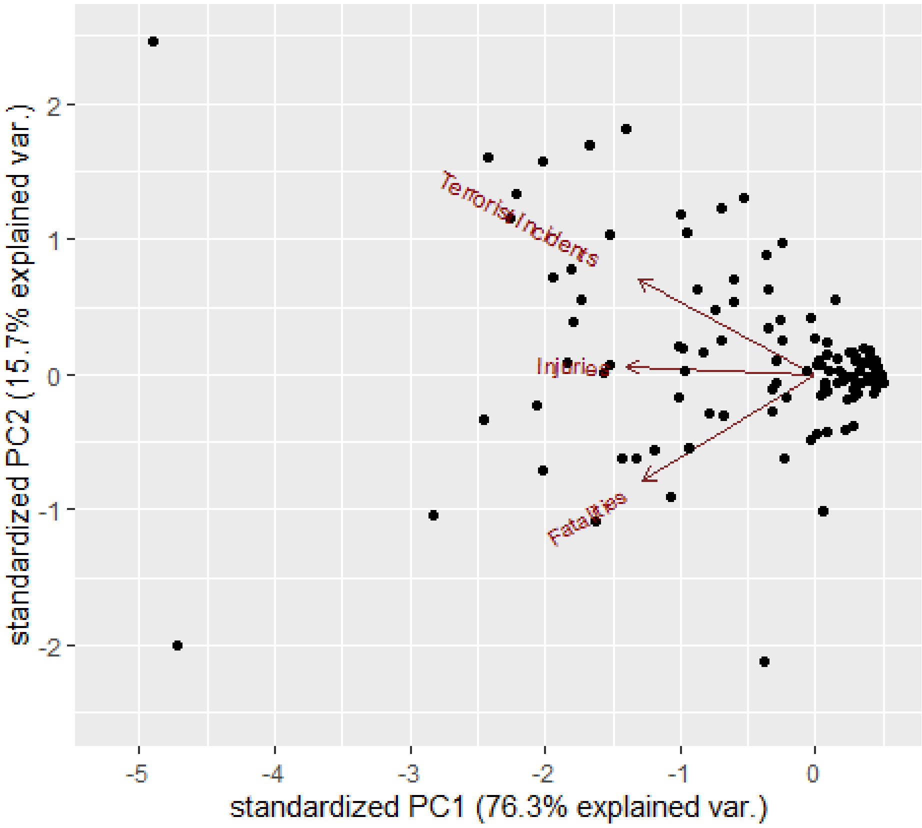

Figure 4. Contribution of Principal Component to Variation

3.3. Tests for Stationarity

The first step in this process is to confirm that the data series (terrorism, as proxied by PCA and tourist arrivals) are stationary, and we can do this by examining the order of integration in our two data series. This is done using the Augmented D-F test (Dickey and Fuller, 1979; Said and Dickey, 1984).

The equation for the ADF test is the following:

$$\Delta Y_t = \alpha + \beta t + \gamma Y_{t-1} + \sum_{i=1}^{n} \delta_i \Delta Y_{t-i} + \varepsilon_t \tag{3}$$

In Equation (3), Y_t is the data series under testing and ε_t is a stationary random error term, which is essentially a white noise process, given that n is assumed to be large enough. We use the Akaike Information Criterion to calculate the appropriate number of lags for each data series.

In this setup, our null hypothesis is that Y_t is a nonstationary time series while the alternative is that it is stationary. The null hypothesis can be rejected for $\gamma=0$, which would suggest that lagged values of the data series are uncorrelated with the current value. If $\gamma=0$ and if $\alpha=\beta=0$, then the data series is a random walk and, thus, not mean-reverting. In order to increase the robustness of our findings, we additionally employ the Phillips-Perron (PP) test (Phillips and Perron, 1988), which will identify potential issues of autocorrelation and heteroskedasticity in the error white noise process (Cang and Seetaram, 2012).

However, we also test against the Phillips-Ouliaris (PO) distributions (Phillips and Ouliaris, 1990), since it has been shown that ADF and PP unit root tests can show spurious results under the null hypothesis of no cointegration. This is because, in this case, the estimated cointegrating residual does not have the usual Dickey-Fuller distributions if the null hypothesis (i.e. no cointegration) is true. In this case, the tests would have asymptotic distributions and these distributions will be functions of Wiener processes[2] that depend on the particular deterministic terms used in equation (3) as well as the number of variables.

[2] A Wiener process is a continuous-time stochastic process taking only real values.

3.4. Cointegration Analysis with Error Correction

The next step is to perform the test for cointegration, that is for a long-term converging relationship between the two data series, a popular method for tourism research due to its ability to capture long-term dependencies (Tang and Abosedra, 2016; Gopy-Ramdhany, Seetanah and Bhattu-Babajee, 2021). Once we have established that they are integrated of the same order, we can employ the procedure of Johansen and Juselius (1990), implementing an unrestricted vector autoregression (VAR) model. This step is necessary before we can use the error correction model to test for long run persistence. The modelling approach is summarised by the equation below:

$$Y_t = \mu + \sum_{\mathrm{i}=1}^{n} \Pi_i Y_{t-i} + e_t \tag{4}$$

where Y_t is a single-column vector of n variables, μ is the single-column vector of constants, Π_i is the matrix of coefficients, n is the number of lags in the VAR model and e_t is the error term. The first difference is given by:

$$\Delta Y_t = Y_t - Y_{t-1} \tag{5}$$

Thus, if the two data series are integrated with order 1, combining Equations (4) and (5) yields the Error-Correction Model (ECM) as follows:

$$\Delta Y_t = \mu + \sum_{i=1}^{n} \Gamma_i \Delta Y_{t-\mathrm{i}} + \Pi Y_{t-1} + e_t \tag{6}$$

where Γ_i is the coefficient matrix describing Y_t.

In our setup, with only two variables in the model, the rank of matrix Π, which we will term as r, will determine how many cointegrating relations exist in the system. This must be less than the number of variables ($r<n$) and, given that the order of integration is 1, this means that either there exists no cointegration ($r=0$) between the two variables or that $r=1$, which suggests that there is cointegration between the two variables. Thus, cointegration is determined by calculating the rank of Π. Johansen and Juselius (1990) suggest employing the trace statistic and the maximum eigenvalue statistic for this task. These statistics are given by Equations (7) and (8) below:

$$\mathrm{LR_{trace}(r)} = -T \sum_{\mathrm{i=r+1}}^{\mathrm{p-2}} \log\left(1 - \hat{\lambda}_{\mathrm{i}}\right) \tag{7}$$

$$\mathrm{LR_{max}(r)} = -T \log\left(1 - \hat{\lambda}_{\mathrm{r+1}}\right) \tag{8}$$

where $\hat{\lambda}_{r+1}, \dots, \hat{\lambda}_p$ are the smallest eigenvalues in the *p-r* range.

Once non-stationarity and cointegration are confirmed, we can implement an ECM specification. The ECMs for the variables of tourism arrivals (*tourism*) and terror principal component (*TPCA*) are as follows, similarly to Samitas et al. (2018):

$$\Delta\mathrm{tourism_t} = \theta_{11}^{\mathrm{m}}(\mathrm{L})\Delta\mathrm{tourism_t} + \theta_{12}^{\mathrm{n}}(\mathrm{L})\Delta TPCA_{\mathrm{t}} + \pi_1 \mathrm{ECM_{t-1}} + \mathrm{a_1} + \mathrm{u_{1t}} \tag{9}$$

where $\theta_{\mathrm{ij}}^{\mathrm{m}}(\mathrm{L}) = \sum_{\mathrm{l=1}}^{\mathrm{M_{ij}}} \theta_{\mathrm{ijl}} \mathrm{L}^1$

$$\Delta TPCA_{\mathrm{t}} = \theta_{21}^{\mathrm{m}}(\mathrm{L})\Delta\mathrm{tourism_t} + \theta_{22}^{\mathrm{n}}(\mathrm{L})\Delta TPCA_{\mathrm{t}} + \pi_2 \mathrm{ECM_{t-1}} + \mathrm{a_2} + \mathrm{u_{2t}} \tag{10}$$

where $\Theta_{\mathrm{ij}}^{\mathrm{n}}(\mathrm{L}) = \sum_{\mathrm{l=1}}^{\mathrm{N_{ij}}} \theta_{\mathrm{ijl}} \mathrm{L}^1$

In both cases, L denotes the lag operator, such that $LY_t = Y_{t-1}$ and u_{1t} and u_{2t} are disturbances that are not serially correlated. Finally, ECM_{t-1} is the stationary error-correction term which is calculated from the long-run relationship.

Table 2. Results of Unit Root Tests

Variable	Type of Test	Lags	Result	p-value
Terror PC	ADF	4	-3.5435	0.03895
		5	-2.8926	0.2001
		6*	-3.0143	0.1487
	PP	5*	-4.24	0.175
		15	-2.437	0.118
Tourist Arrivals (deseasonalised)	ADF	4	-2.5411	0.3482
		5	-2.5654	0.3379
		6*	-2.0774	0.5435
	PP	5*	-3.272	0.1587
		15	-5.602	0.1298

Note: *This table denotes the test results of the two different procedures. ADF is the Augmented Dickey-Fuller test, PP is the Philips-Perron test. The p-values demonstrate the probability of error when rejecting the null hypothesis. The methodology is described in section 3.3. The star (*) denotes the optimal lag according to the Akaike criterion.*

4. Empirical Results

The empirical results of the unit root test, according to the different procedures described, are given in Table 2. In all cases, the null hypothesis of non-stationarity cannot be rejected. This means that the data series can be tested for a long run cointegrating relationship between them.

Table 3. Cointegrating Regression Results

Regression	Output		
lm(formula = tourism ~ terror)	Intercept		0.64237
	Coefficient		-0.09713
	ADF Test (k=1)	Statistic	-20.699
		p-value	<0.01
	Phillips-Ouliaris (PO) Cointegration Test (Lag=2)	Statistic	-69.855
		p-value	<0.01
	Phillips-Ouliaris (PO) Cointegration Test (Lag=6)	Statistic	-67.174
		p-value	<0.01
lm(formula = terror ~ tourism)	Intercept		0.19530
	Coefficient		- 0.03018
	ADF Test (k=1)	Statistic	-5.9914
		p-value	<0.01
	Phillips-Ouliaris (PO) Cointegration Test (Lag=2)	Statistic	-74.69
		p-value	<0.01
	Phillips-Ouliaris (PO) Cointegration Test (Lag=6)	Statistic	-134.97
		p-value	<0.01

Following this, we can run our cointegration tests. We run the Johansen cointegration test but also executed the Philips-Ouliaris test for cointegration, which tests for cointegration among the residuals. First, we execute a linear regression on the two variables, tourist arrivals (tourism) and the terror principal component (terror). To avoid causality discussions at this point, we execute regressions using both causality directions. We then run the ADF test on the residuals of these regression to determine if they are stationary. If so, then this is a sign of cointegrating relationship between them. In addition, the Phillips-Ouliaris test is also included to strengthen the robustness of our finding. The results are demonstrated in Table 3 and the residuals are demonstrated graphically in Figure 5. Both the Dickey-Fuller and the Phillips-

Ouliaris test statistics are very low in the two regressions, providing us with a p-value less than 0.01. Given the above, we can reject the null hypothesis that suggests the presence of a unit root. We thus conclude that we have stationary series in the residuals and hence a cointegrated set of data series in the original variables.

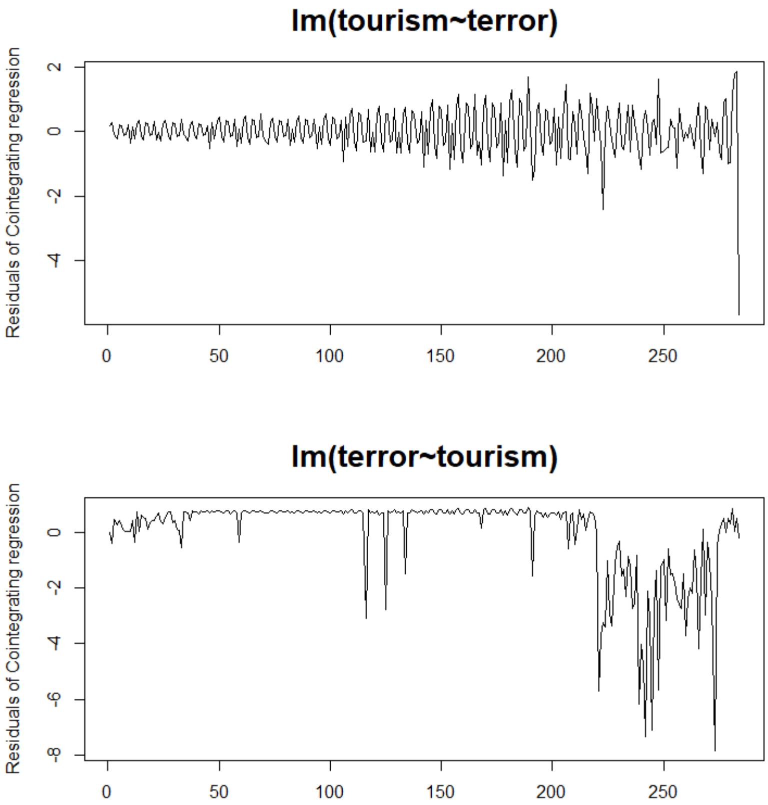

Figure 5. Residuals of Cointegrating regressions

Since we have evidence of a cointegrating relationship, we can move on with our error correction model. Since the differences between the two time series are stationary, then they and can be modelled in a Vector AutoRegressive (VAR) model which is augmented by the regressor $Y_{t-1} - \theta X_{t-1}$, where we will replace Y and X with both of our data series (i.e. we will again ignore causality direction for now). This is our vector error correction model (VECM) and the lagged values of the error correction term are useful for predicting changes in both variables. A VECM can be used to model our two data series and we specify the VECM to include up to 6 lags of both series as regressor (according to our ADF tests above), while θ has been computed in the previous step.

In Table 4,, we present the results of the first cointegrating regression, similarly to Johansen and Juselius (1990), including the error correction model. The tourist arrivals (tourism) series is regressed against up to six lagged instances of itself and of the terror principal component (terror), as well as against the error correction term. In this table, we can see clearly see the negative effect of terrorism on tourism both in the short and in the long run. This would imply that over the short term, a rise in terrorist incidents, casualties and injuries would immediately cause a decline in tourist arrivals. This effect is statistically significant both for L1 and for L2, which means that there is an instantaneous response from travellers to the affected region. This relationship appears to fade away temporarily and then in the long-run (L6), there again is a statistically significant negative coefficient, which confirms the existence of a long-run persistent effect. In addition, the autoregressive nature of the tourism variable is confirmed. Finally, the F-statistic is significant even at the 0.01 level.

Table 4. Results of the Cointegrating Regression on Tourism

	Coefficient	Std. Error	t statistic	p-value	
Intercept	0.0369	0.0150	2.4646	0.0144	*
Δ Terror L1	-0.0210	0.0122	-1.7152	0.0875	*
Δ Terror L2	-0.0197	0.0081	-2.4229	0.0161	**
Δ Terror L3	-0.0048	0.0100	-0.4748	0.6353	
Δ Terror L4	-0.0055	0.0138	-0.4004	0.6892	
Δ Terror L5	0.0044	0.0137	0.3219	0.7478	
Δ Terror L6	-0.0170	0.0065	-2.6071	<0.01	***
Δ Tourism L1	1.4257	0.0869	16.4012	<0.01	***
Δ Tourism L2	-0.8161	0.1549	-5.2668	<0.01	***
Δ Tourism L3	0.3807	0.1660	2.2937	0.0226	**
Δ Tourism L4	-0.7744	0.1399	-5.5362	<0.01	***
Δ Tourism L5	0.8714	0.1255	6.9449	<0.01	***
Δ Tourism L6	-0.4266	0.0598	-7.1281	<0.01	***
ECT L1	-0.0050	0.0031	-1.6130	0.1079	

Multiple R-squared: 0.8268
Adjusted R-squared: 0.8183
F-statistic: 96.95 on 13 and 264 DF
p-value: < 0.01

Note: *'***' Coefficient is significant for α<0.01*
*'**' Coefficient is significant for α=0.05*
'' Coefficient is significant for α=0.1*

This table presents the results of the Vector Error Correction Model, where tourism arrivals are regressed against lagged versions of itself and of terrorism principal components. Tourist arrivals have been deseasonalised, to remove the seasonal component and capture the underlying trend of the data series.

Table 5. Results of the Cointegrating Regression on Terrorism

	Coefficient	Std. Error	t statistic	p-value	
Intercept	-0.0926	0.0917	-1.0094	0.3137	
Δ Terror L1	-0.6517	0.0664	-9.8212	<0.01	***
Δ Terror L2	-0.5136	0.0848	-6.0547	<0.01	***
Δ Terror L3	-0.1642	0.1546	-1.0617	0.2893	
Δ Terror L4	-0.1659	0.0808	-2.0534	0.0410	**
Δ Terror L5	-0.1378	0.0967	-1.4242	0.1556	
Δ Terror L6	0.0459	0.0851	0.5390	0.5903	
Δ Tourism L1	1.0270	0.5407	1.8993	0.0586	*
Δ Tourism L2	-1.2240	0.5246	-2.3333	0.0204	**
Δ Tourism L3	0.6556	0.5972	1.0978	0.2733	
Δ Tourism L4	-0.1573	0.6063	-0.2595	0.7955	
Δ Tourism L5	-0.2115	0.5102	-0.4145	0.6788	
Δ Tourism L6	0.2725	0.4327	0.6297	0.5294	
ECT L1	0.0136	0.0201	0.6782	0.4983	

Multiple R-squared: 0.4301
Adjusted R-squared: 0.402
F-statistic: 15.33 on 13 and 264 DF
p-value: < 0.01

Note: *'***' Coefficient is significant for α<0.01*
*'**' Coefficient is significant for α=0.05*
'' Coefficient is significant for α=0.1*

This table presents the results of the Vector Error Correction Model, where the terrorism principal component is regressed against lagged version of itself and of tourism arrivals. Tourist arrivals have been de-seasonalised, to remove the seasonal component and capture the underlying trend of the data series.

Table 5 demonstrates the results of the cointegrating Johansen and Juselius (1990) regression of terrorism against tourism. Similarly, to the previous regression, the terrorism principal component is regressed against up to six lagged instances of itself and of the tourist arrivals, as well as against the error correction term. The results here are quite interesting. Firstly, we see that there is only a short-run autoregressive nature in the terror data series, up to L2. The effect is negative, which means that one can expect major terrorist events in the region to be spread out over more than two months. Regarding the relationship between terror and tourism, our empirical findings show that there is conflicting causality from tourism to terrorism. The L1 coefficient is positive (as could intuitively be expected) and the L2 to coefficient is negative.

Our findings are in line with existing literature, presenting similar work for different regions. Samitas et al. (2018) show the relationship between terrorism incidents and tourism to be unidirectional, from terrorism to tourism only. Karamelikli, Khan and Karimi (2019) and Raza and Jawaid (2013) corroborate these findings for Turkey and Pakistan respectively and show that there is a significant negative impact of terrorism on tourism in both the short and the long run. Finally, Seabra, Reis and Abrantes (2020) perform similar work using data from European countries and show the significant impact of terrorist attacks on tourist arrivals. On the other hand, other studies (e.g. Radić, Dragičević and Sotošek, 2018) have shown that there is a positive effect of tourism on terrorist events, suggesting that terrorists would choose to attack regions with high tourist flows. However, even in these studies, the results are mixed among different countries. Thus, the conflicting results in our findings are not unexpected and we are unable to definitively state that there is causality from tourism to terrorism.

5. Policy Implications

This paper has examined monthly data regarding tourism and terrorism in the North African country of Egypt in the period from 1995 to 2018. More specifically, we used the number of tourist arrivals, the number of terrorist incidents and the number of resulting fatalities and injuries. We employed principal component analysis to capture the variance of the three terrorism variables into one proxy, in order to avoid collinearity problems. Then, once we have established that the two data series are cointegrated of the same order, we employed cointegration analysis to confirm if there is a long-run converging relationship between the two variables and to examine the direction of causality.

Our findings show that there is a unidirectional causal relationship between terrorism and tourism, which is negative both in the short and in the long run. A surge of terrorist events will result in an immediate drop in tourist arrivals, within the next two months. The effect is again persistent in the long run, suggesting that terrorist events have negatively affected Egypt's tourism in the period under examination. These findings are in line with previous research on similar variables in other countries.

The above conclusions have important policy implications. In a country like Egypt, tourism can be a primary source of income not only for those directly employed in the industry, but also for surrounding industries (Elshaer and Saad, 2017). In Egypt, this spans all population classes who benefit either directly or indirectly from tourism activities (Ghany and Latif, 2012). Thus, protecting the tourism sector is beneficial not only in macroeconomic terms, but also for social equity, a component of the Egyptian society which is paramount in maintaining stability in general. Consequently, our findings stress the important role of governments in preventing terrorist activities in order to encourage tourism-led growth, promote social equity and safeguard their citizens' sense of security. In addition, our findings add to the importance of maintaining strong military forces to combat terrorism, as a strong national military force can act as strong deterrent to terrorist incidents (Asongu and Acha-Anyi, 2019). Future research could examine the link between military spending and tourism development, which would have increased impact in the African context.

The current research can be extended in various ways. As mentioned earlier, the relationship between tourism and terrorism is not the same in all regions and thus further regional research could yield interesting findings. Researchers could also examine global terrorist activity and its relationship to international tourism flows, thus performing a higher-level research on the topic. Finally, further work could be performed on the terrorism proxies regarding severity, where researchers could include different variables in the PCA methodology and examine the different outcomes in the analysis.

References

Abdi, H. and Williams, L.J., 2010. Principal component analysis. *Wiley interdisciplinary reviews: computational statistics*, *2*(4), 433-459.

Agiomirgianakis, G., Serenis, D. & Tsounis, N. (2017). Effective timing of tourism policy: The case of Singapore. *Economic Modelling*, 60, 29-38.

Agnew, R. (2010). A general strain theory of terrorism. *Theoretical Criminology*, 14(2), 131-153.

Afonso-Rodríguez, J. A. (2017). Evaluating the dynamics and impact of terrorist attacks on tourism and economic growth for Turkey. *Journal of Policy Research in Tourism, Leisure and Events*, *9*(1), 56-81.

Araña, J. E. & León, C. J. (2008). The impact of terrorism on tourist demand. *Annals of Tourism Research*, 35(2), 299-315.

Aschauer, W. (2010). Perceptions of tourists at risky destinations. A model of psychological influence factors. Tourism Review, 65(2), 4-20.

Asongu, S. A., & Acha-Anyi, P. N. (2019). Global tourism and waves of terror: perspectives from military expenditure. *Journal of Policy Research in Tourism, Leisure and Events*, 1-23.

Avraham, E. (2016). Destination marketing and image repair during tourism crises: The case of Egypt. *Journal of Hospitality and Tourism Management*, 28, 41-48.

Barbhuiya, M.R. and Chatterjee, D., 2020. Vulnerability and resilience of the tourism sector in India: Effects of natural disasters and internal conflict. *Tourism Management Perspectives*, *33*, p.100616.

Bassil, C., Hamadeh, M., & Samara, N. (2015). The tourism led growth hypothesis: the Lebanese case. Tourism Review, 70(1), 43-55.

Bassil, C., Saleh, A.S. and Anwar, S., 2019. Terrorism and tourism demand: A case study of Lebanon, Turkey and Israel. *Current Issues in Tourism*, *22*(1), 50-70.

Bhattarai, K., Conway, D. & Shrestha, N. (2005). Tourism, terrorism and turmoil in Nepal. *Annals of Tourism Research*, 32(3), 669-688.

Bowen, C., Fidgeon, P. and Page, S.J., 2014. Maritime tourism and terrorism: customer perceptions of the potential terrorist threat to cruise shipping. *Current Issues in Tourism*, *17*(7), 610-639.

Bristow, R. S. & Jenkins, I. S. (2019). Geography of fear: fright tourism in urban revitalization. *Journal of Policy Research in Tourism, Leisure and Events*, *12*(2), 262-275.

Buckley, P. J. & Klemm, M. (1993) The decline of tourism in Northern Ireland: The causes. *Tourism Management*, 14(3), 184-194.

Buigut, S. & Amendah, D. D. (2016). Effect of terrorism on demand for tourism in Kenya. Tourism Economics, 22(5), 928-938.

Callaway, R., & Harrelson-Stephens, J. (2006). Toward a theory of terrorism: Human security as a determinant of terrorism. *Studies in Conflict & Terrorism*, 29(7), 679-702.

Cang, S. & Seetaram, N. (2012). Time series analysis. In L., Dwyer, A., Gill, & N., Seetaram (Eds.). *Handbook of research methods in tourism: Quantitative and qualitative approaches*. Edward Elgar Publishing.

Coca-Stefaniak, A. & Morrison, Al. M. (2018). City tourism destinations and terrorism – a worrying trend for now, but could it get worse? *International Journal of Tourism Cities*, 4(4), 409-412.

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association*, 74(366a), 427-431.

Dinnie, K. (2010). *Nation branding: Concepts, Issues, Practice*. Routledge.

Elshaer, I.A. and Saad, S.K., 2017. Political instability and tourism in Egypt: Exploring survivors' attitudes after downsizing. *Journal of Policy Research in Tourism, Leisure and Events*, *9*(1), 3-22.

Enders, W., Sandler, T., & Gaibulloev, K. (2011). Domestic versus transnational terrorism: Data, decomposition, and dynamics. *Journal of Peace Research*, 48(3), 319–337.

Farajat, S.A., Liu, B. and Pennington-Gray, L., 2017. Addressing travel writers' role as risk brokers: the case of Jordan. *Journal of Policy Research in Tourism, Leisure and Events*, *9*(1), pp.23-39.

Faulkner, B. (2001). Towards a framework for tourism disaster management. *Tourism Management*, 22(2), 135–147.

Ghany, S. Y. A. & Latif, M. M. A. (2012). English language preparation of tourism and hospitality undergraduates in Egypt: Does it meet their future workplace requirements? *Journal of Hospitality, Leisure, Sport & Tourism Education*, 11, 93-100.

Gopy-Ramdhany, N., Seetanah, B., & Bhattu-Babajee, R. (2021). Analysing the relationship between foreign real estate investment and tourism development. *Journal of Policy Research in Tourism, Leisure and Events*.

Goodrich, J. N. (2002). September 11, 2001 attack on America: a record of the immediate impacts and reactions in the USA travel and tourism industry. *Tourism Management*, 23(6), 573-580.

Institute for Economics and Peace (2019). Global Terrorism Index 2019: Measuring the impact of terrorism. http://visionofhumanity.org/app/uploads/2019/11/GTI-2019web.pdf, [Accessed November 2020].

Institute for Economics and Peace (2020). Global Terrorism Index 2020: Measuring the impact of terrorism. https://www.visionofhumanity.org/wp-content/uploads/2020/11/GTI-2020-web-1.pdf, [Accessed November 2020].

Israeli, A., & Reichel, A. (2003). Hospitality crisis management practices: The Israeli case. *International Journal of Hospitality Management*, 22(4), 353–372.

Ivanov, S., Gavrilina, M., Webster, C., & Ralko, V. (2017). Impacts of political instability on the tourism industry in Ukraine. *Journal of Policy Research in Tourism, Leisure and Events*, *9*(1), 100-127.

Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration with applications to the demand for money. *Oxford Bulletin of Economics and Statistics*, 52(2), 169-210.

Karamelikli, H., Khan, A.A. and Karimi, M.S., 2019. Is terrorism a real threat to tourism development? Analysis of inbound and domestic tourist arrivals in Turkey. *Current Issues in Tourism*, 1-17.

Karsavuran, Z., 2020. Surviving a major crisis: the case of dismissed tourism and hospitality employees. *Journal of Policy Research in Tourism, Leisure and Events*, pp.1-23.

Kılıçlar, A., Uşaklı, A. & Tayfun, A. (2018). Terrorism prevention in tourism destinations: Security forces vs. civil authority perspectives. *Journal of Destination Marketing & Management*, 8, 232-246.

Lanouar, C. & Goaied, M. (2019). Tourism, terrorism and political violence in Tunisia: Evidence from Markov-switching models. *Tourism Management*, 70, 404-418.

Lennon, R., & O'Leary, B. (2005). A Comparison of the Effect of International Terror Attacks on German and American Consumers' Perceptions and Future Travel Plans. Journal Of Accounting & Finance Research, 13(2), 181-191.

Liu, A. & Pratt, S. (2017). Tourism's vulnerability and resilience to terrorism. *Tourism Management*, 60, 404-417.

Lopez, H. and Wodon, Q., 2005. The economic impact of armed conflict in Rwanda. *Journal of African economies*, *14*(4), 586-602.

Mansfeld, Y. & Pizam, A. (2006). Tourism, terrorism, and civil unrest issues. In Mansfeld, Y. & Pizam (Eds.). *Tourism, Security and Safety: From theory to practice*, 29-31, Oxford: Elsevier Butterworth-Heinemann.

Mansfeld, Y., & Winckler, O. (2015). Can this be spring? Assessing the impact of the "Arab Spring" on the Arab tourism industry. *Tourism: An International Interdisciplinary Journal*, 63(2), 205-223.

Meierrieks, D & Schneider, F. (2021). Terrorism and international economic policy. *European Journal of Political Economy*, doi: 10.1016/j.ejpoleco.2021.102011.

Meltzer, M. (1983). The terrorists. New York: Harper & Row.

Mura, P. and Khoo-Lattimore, C., 2012. Young tourists, gender and fear on holiday. *Current Issues in Tourism*, *15*(8), 707-724.

National Consortium for the Study of Terrorism and Responses to Terrorism (2020). Global terrorism database, https://www.start.umd.edu/gtd/, [Accessed January 2020].

Neagu, F. S. (2017) The impact of the terrorism on North African tourism, Proceedings of the International Conference on Business Excellence 11(1) DOI: 10.1515/picbe-2017-0111.

Njoya, E. T. (2019). An analysis of the tourism and wider economic impacts of price-reducing reforms in air transport services in Egypt. *Research in Transportation Economics*, Article 100795.

Nyarko, Y., 2013. Sustaining high economic growth in Sub-Saharan Africa: knowledge and the structure of the economy. *Journal of African Economies*, *22*(suppl_1), 77-101.

Öcal, N., & Yildirim, J. (2010). Regional effects of terrorism on economic growth in Turkey: A geographically weighted regression approach. *Journal of Peace Research*, 47(4), 477-489.

OECD (2020). Definition of terrorism by country in OECD countries. https://www.oecd.org/daf/fin/insurance/TerrorismDefinition-Table.pdf, [Accessed January 2020].

Paraskevas, A., & Arendell, B. (2007). A strategic framework for terrorism prevention and mitigation in tourism destinations. *Tourism Management*, 28(6), 1560–1573.

Peeters, T., Matheson, V. and Szymanski, S., 2014. Tourism and the 2010 World Cup: Lessons for developing countries. *Journal of African Economies*, *23*(2), 290-320.

Phillips, P. C. and Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, 75(2), 335-346.

Phillips, P.C. and Ouliaris, S., 1990. Asymptotic properties of residual based tests for cointegration. *Econometrica: Journal of the Econometric Society*, 165-193.

Radić, M.N., Dragičević, D. and Sotošek, M.B., 2018. The tourism-led terrorism hypothesis–evidence from Italy, Spain, UK, Germany and Turkey. *Journal of International Studies*, *11*(2), 236-249.

Raja, P. & Raghu, A. (2021). A critical review of terrorism effects and their impacts on tourist destination countries. *Materials Today*, *37*(2), 3461-3465.

Raza, S. A. & Jawaid, S. T. (2013). Terrorism and tourism: A conjunction and ramification in Pakistan. *Economic Modelling*, 33, 65-70.

Ryan, C. (1993). Crime, violence, terrorism and tourism: An accidental or intrinsic relationship? *Tourism Management*, 14(3), 173-183.

Saha, S., & Yap, G. (2014). The moderation effects of political instability and terrorism on tourism development: A cross-country panel analysis. *Journal of Travel Research*, 53(4), 509-521.

Said, S.E. and Dickey, D.A., 1984. Testing for unit roots in autoregressive-moving average models of unknown order. *Biometrika*, *71*(3), 599-607.

Saint Akadiri, S., Eluwole, K.K., Akadiri, A.C. and Avci, T., 2019. Does causality between geopolitical risk, tourism and economic growth matter? Evidence from Turkey. *Journal of Hospitality and Tourism Management*.

Samitas, A., Asteriou, D., Polyzos, S. & Kenourgios, D. (2018). Terrorist incidents and tourism demand: Evidence from Greece. Tourism Management Perspectives, 25, 23-28.

Seabra, C. Reisb, P. & Abrantesb, J. L. (2020). The influence of terrorism in tourism arrivals: A longitudinal approach in a Mediterranean country. *Annals of Tourism Research*, 80 102811.

Smith, C. K. (2006). Development of prototype guidelines for risk management against terror attack in the tourism industry: A Delphi study. https://core.ac.uk/download/pdf/4272706.pdf, [Accessed January 2020].

Statista (2020). Number of tourist arrivals in Egypt from 2012 to 2018, by month. https://www.statista.com/statistics/545102/number-of-tourist-arrivals-egypt-by-month/, [Accessed January 2020].

Tang, C. F., & Abosedra, S. (2016). Does tourism expansion effectively spur economic growth in Morocco and Tunisia? Evidence from time series and panel data. *Journal of Policy Research in Tourism, Leisure and Events*, 8(2), 127-145.

Tatoglu, F.Y. and Gul, H., 2019. Analysis of tourism demand using a multi-dimensional panel gravity model. *Tourism Review*. Doi: 10.1108/TR-05-2019-0147.

Tarlow, P.E. (2002). Event risk management and safety. New York: John Wiley & Sons.

Ulqinaku, A. & Sarial-Abib, G. (2020). Tourism implications of online response to terrorism. *Annals of Tourism Research*, doi: 10.1016/j.annals.2020.102914.

Veréb, V., Nobre, H. and Farhangmehr, M., 2020. Cosmopolitan tourists: the resilient segment in the face of terrorism. *Tourism Management Perspectives*, *33*, p.100620.

Wolff, K., & Larsen, S. (2014). Can terrorism make us feel safer? Risk perceptions and worries before and after the July 22nd attacks. *Annals of Tourism Research*, 44, 200-209.

World Travel and Tourism Council (2019). Egypt 2019 annual research: Key highlights.