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Tourism's vulnerability and resilience to terrorism

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HIGHLIGHTS

- In general, international tourism is resilient to terrorism.
- Globally, there is no long run effect of terrorism on international tourism and the short run effect of terrorism on international tourism is quite small.
- 9 countries out of 95 show a long run impact of terrorism on international tourism and 25 of 95 countries show a short run effect of terrorism on international tourism.
- The impact of terrorism varies by political regime, income and tourism intensity.

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ABSTRACT

Personal security is a major concern for tourists. Most tourists will seek safe and secure destinations and avoid those that have been plagued by terrorism. This research quantifies the relationship between terrorism and tourism in 95 different countries and territories using international tourism demand models. After controlling for income, we find there is no long run effect of terrorism on international tourism demand and the short run effect is quite limited from a global perspective using panel data models. Only nine countries out of the 95 show a long run impact of terrorism on tourism and 25 countries out of the 95 show a short run impact using time series models, implying that international tourism is resilient to terrorism. The influence of terrorism is diverse in destinations with different political instability, income levels and tourism intensities.

1. Introduction

Fear and insecurity are major barriers to international travel (Buckley & Klemm, 1993). Terrorism has evolved into a major global concern for the tourism industry, tourists, and for host communities (Mansfeld & Pizam, 2006). The impact of 9/11 attacks left a legacy on international tourism (International Air Transport Association, 2011). Although 15 years have been passed, the tragedy of the 9/11 attacks continues to affect international tourism, through more thorough security checks at airports and more stringent visa processing. The mind-set of international tourists fundamentally changed. International arrivals to the US decreased 8.5% in 2001 and it took three years for the inbound market to recover to the same level as 2000 (World Bank, 2016). The legacy of that terrorism attack spread across the world. Compared to the previous year, international air passengers and revenue of airlines declined 2.7% and 6.7%, respectively, in 2001 (International Air Transport Association, 2011).

Terrorist attacks have been occurring with regular frequency. As recently as 28th June 2016, 41 people were killed and 239 wounded in a gun and bombing attack on the Ataturk international airport in Istanbul. 13 of the 41 dead are foreign nationals, including five from Saudi Arabia, two from Iraq, and one each from Tunisia, Uzbekistan, China, Iran, Ukraine and Jordan (The Guardian, 2016). The attack was believed to be carried out by the Islamic State in Iraq and Syria (ISIS). Another recent terrorist attack which also significantly affected international tourism demand was the attack in Paris in December 2015. Although the influence of the attack in Paris was not as severe as the 9/11 attacks, the European tourism industry is expected to lose between €800 million and €1 billion as a result (Bremner, 2015; Morris, 2015). As argued by Khan and Ruiz Estrada (2015), the emergence of ISIS has not only created terror and tension in Iraq and Syria but also created fear and insecurity in the rest of the world.

Despite numerous case studies being conducted on the impact of tourism and terrorism, the impact of terrorism on tourism

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demand is still under-researched (Arana & Leon, 2008). Although scholars have investigated the influence of terrorism attacks on different destinations, such as Goodrich (2002) for the 9/11 attacks in the USA, Bhattarai, Conway, and Shrestha (2005) for Nepal and Wolff and Larsen (2014) for the 2011 Olso/Utøya massacres, such studies are all ex-post studies. This research goes beyond the ex-post approach by examining the impact of terrorism on international tourism demand from 1995 to 2012 for 95 countries/regions. Terrorism is measured using the Global Terrorism Index (GTI), developed by the Institute for Economics and Peace (IEP), to capture the trends and changes of terrorism attacks throughout the world. Rather than using case study analysis and small-sample quantitative research to examine the relationship between terrorism and tourism demand, this research takes a comprehensive global perspective. The findings provide valuable and useful information for governments and tourism stakeholders to manage future terrorism crises. To the best of the authors' knowledge, this is the first paper to undertake such a systematic and rigorous analysis of the nexus between tourism and terrorism.

The remainder of the paper is as follows: studies focusing on the relationship between terrorism and tourism are reviewed in the next section, followed by the introduction of data and variables and method. The findings of the research are subsequently presented and the final section concludes the study.

2. Tourism and terrorism

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" (Agnew, 2010, p. 132). Terrorism has been greatly under-theorized (Roche, 2004). Recently, there has been attempts to correct this. Agnew (2010) theorized that terrorism is most likely to occur when people experience 'collective strains' that have a large impact on civilians; are unjust; and are inflicted by those in power. Examples of 'collective strains' include absolute and relative material deprivation, problems associated with globalization/modernization, territorial, ethnic and religious disputes, denial of basic human rights, economic, political, and other discrimination based on race, ethnicity or religion.

Callaway and Harrelson-Stephens (2006) theorized that terrorism arises because of the denial of three types of human rights: political rights, personal security rights and basic human rights. In terms of political rights, Callaway and Harrelson-Stephens argued that as the level of political openness decreases, the likelihood that individuals will resort to terrorism activity increases. For security rights, the same authors argued that where the level of repression (government sanctioned violations of security rights, such as the use of torture, disappearances and summary executions) increases, there is a greater likelihood of terrorism. However, after a certain threshold, extremely repressive regimes will quash any terrorist activities. Lastly, with respect to basic human needs, there is a non-linear relationship between basic needs and terrorism. Individuals in less developed countries or low income countries who struggle for daily survival will have little time or finances to devote to terrorism activities. Individuals in high income countries are generally satisfied with their material needs and hence less likely to engage in terrorist activities while those individuals in middle income countries may be exposed to wealth but are unable to attain a standard of living they would like and maybe more susceptible to use terrorism to express their protestations.

The rationale of the impact of terrorism on tourism demand is straightforward. From the perspective of demand side, places where terrorist attacks are committed damage destination image and deter tourists from visiting (Pizam & Mansfeld, 2006). Potential tourists either defer their travel or choose perceived safer destinations. Tourists aim to minimize the risk of a terrorist attack by substituting a more risky destination for safe ones (Arana & Leon, 2008). The more severe and the more frequent the terrorist attack is, the greater is the (negative) impact on tourist demand due to the higher perceived risk (Pizam, 1999). Along with the loss of tourism receipts, there may also be a decrease in foreign direct investment as business confidence falls, reducing the future capital stock necessary for continued economic growth (Enders & Sandler, 1996). Terrorist attacks may target and destroy public infrastructure, such as airports, roads and bridges, which have a disabling flow-on effect.

Terrorism has serious consequences for both tourists and tourist destinations (Ryan, 1993). Sonmez (1998) provides a descriptive account of the relationship between tourism, political instability and terrorism, throughout the 1990s. She goes as far to suggest that more countries around the world face some sort of political conflict as those who enjoy peace and stability. Sonmez and Graefe (1998) chronicled 29 international terrorist incidents that involved tourists between 1993 and 1996. The growth of tourism, particularly poorly planned mass tourism, may become a political issue which may exacerbate ideological differences amongst political factions (Richter & Waugh Jr, 1986). Terrorist attacks on international tourists may be less likely to alienate popular support than attacks on domestic targets, hence legitimizing their political objectives (Richter & Waugh Jr, 1986). Although the tourism industry is increasingly vulnerable to terrorism, the size of the threat to tourists may depend upon the objectives of the terrorists and the role tourism and tourists might play in helping the terrorists achieve their objectives (Buckley & Klemm, 1993). Attacks on international tourists are more likely to grab international headlines and achieve media attention that would disseminate their political propaganda. These targeted international tourists may be symbols of hostile or unsympathetic foreign governments. The impact of terrorist attacks on tourism tends to be short and sharp, gaining significant media coverage and public attention while domestic political turmoil tends to have a lingering effect that may create a lasting barrier to international tourism (Sonmez, 1998).

The literature on tourism and terrorism is replete with analyses of various case studies. Wolff and Larsen (2014) reveal that perceived risk among tourists to Norway remained unchanged from 2004 to 2011, and did not change immediately after the July 22nd, 2011 Olso/Utøya massacres. Wolff and Larsen propose that this is because Norway is perceived as a relatively safe destination with little history of terrorist attacks, civil unrest or systematic violence. Unlike terrorist organizations such as ETA in Spain, IRA in Northern Ireland, Al Qaida in the US, or Hamas in the Middle East, the perpetrator of the Olso/Utøya massacres was a "lone wolf" who no longer posed a threat to society, after his arrest.

Buckley and Klemm (1993) examine the impact of terrorism on tourism to Northern Ireland across the 1970s, 1980s and into the 1990s. The authors notes that while destinations can recover from individual incidents, the continued reinforcement of a destination as a constant trouble spot slowly deteriorated the destination's image. Goodrich (2002) summarized the immediate impact and reactions in the USA travel and tourism industry of the 9/11 attacks on the World Trade Center in New York. Goodrich found that the cost of the tragedy, in terms of rebuilding, was estimated at US$ 105 billion and there were declines in airline passenger loads and hotel occupancy rates of approximately 50% or more immediately after the attacks. Arana and Leon (2008) demonstrated that the 9/11 attacks on the USA also affected German tourists' demand for beach holidays in the Mediterranean and Canary Islands. When there is a

high degree of substitutability between destinations, the impact of a terrorist attack on tourists' behaviour is also high (Arana & Leon, 2008; Becker & Rubinstein, 2004). Peace and safety would seem to be a necessary prerequisite to attract tourists to a destination.

Several studies examined the relationship between tourism and terrorism for multiple countries using panel data. Saha and Yap (2014) analysed the effects of interaction between political instability and terrorism on tourism development using panel data from 139 countries for the period 1999–2009. They found the effect of political instability on tourism is far more severe than the effects of one-off terrorist attacks. While the interaction of political volatility and terrorism together can cause serious damage to the tourism industry, their results surprisingly reveal that terrorist attacks actually increase tourism demand in low to moderate political-risk countries. They attributed this to tourism demand for dark tourism – tourists wanting to see the terrorism-impacted destination in a low political-risk country. Different to the current study, Saha and Yap (2014) use the own countries' real GDP per capita as a measure for income in their tourism demand model. This would seem less than ideal as tourism demand is more dependent on tourists' income than the host countries' income. Llorca-Vivero (2008) evaluated the difference in routine tourist flows and international arrivals following terrorism from the G-7 countries to 134 destinations for the years 2001–2003, using a cross-sectional augmented gravity model. In Llorca-Vivero's research, both domestic and international terrorism have a moderate but significant negative influence on tourist flows. The impact of terrorism on tourism is greater in developing countries.

Turning the causality around, Goldman and Neubauer-Shani (2016) sought to answer the question: does international tourism affect transnational terrorism? Using a set of panel/zero-inflated negative binomial regression models of the incidence of transnational terrorism with a country-year database of between 98 and 146 countries and comparing foreign and local attackers and victims, they conclude that there is an inverse U relationship between number of arrivals and number of attacks perpetrated by foreigners. Further, there is a significant relationship between number of arrivals to a country and terror attacks in which both the attacker and the victim are foreigners.

Other scholars have noted the effects that events of this nature have had on tourists' decision-making and travel behaviour. These include substituting riskier destinations for safer ones, avoiding regions where one or two countries experience terrorism or delayed demand for travel (Martin & Gu, 1992; Richter & Waugh Jr, 1986; Rittichainuwat & Chakraborty, 2009; Sonmez, 1998). This spill-over effect may explain why a terrorist attack in one country deteriorates the destination image in surrounding countries in the same region (Enders, Sandler, & Parise, 1992). The degree to which potential tourists are affected by the threat of a terrorist attack depends on their attitude to international travel, their risk perception level and income (Sonmez & Graefe, 1998). Rittichainuwat and Chakraborty (2009) note that risk perceptions of tourists, rather than actual risk circumstances, impact their decision-making and behaviour. In the case of Thailand, these authors found that tourists familiar with the destination affirm they would continue to travel as the threat of terrorism is part of life nowadays. Further, perceived terrorism risks deter tourists in the short run but do not have a long term impact on tourists' decision to travel internationally, as noted above by Sonmez (1998).

In response to a potential terrorist attack, several authors argue destination marketing organizations should formulate destination-specific anti-terrorism strategies (Drakos & Kutan, 2003; Paraskevas & Arendell, 2007). Paraskevas and Arendell (2007) argue that tourism destinations are 'soft target' for terrorist activities and, as such, propose a framework for developing a destination anti-terrorism strategy to prevent and mitigate terrorist attacks.

As this brief literature review shows and has been summarized elsewhere (Mansfeld & Pizam, 2006), frequent and severe terrorist attacks have a more detrimental impact on tourism demand than less frequent or severe incidents. The longer a security crisis lasts, the higher is its aggregated negative impact on a tourist destination. Terrorists maximize their impact by targeting mass tourist destinations because tourist destinations are soft targets. International tourists and destinations can be symbols of national and cultural identity. Targeting tourists makes a bigger 'statement' and attracts wider international media attention. Further, targeting the tourism economy can have a larger impact on the wider regional, state, and national economies. In many situations, the media exaggerates the severity of the terrorist incident. This negatively affects the destinations' image and can cause a decline in tourist arrivals. Tourists have different levels of risk aversion to terrorist incidents. Some tourists may be less concerned with security threats and will continue to travel to affected destinations, while others may either avoid them altogether or postpone their trips until the security situation improves (Mansfeld & Pizam, 2006).

Much of the literature in this area either is descriptive in nature or focuses on a particular case to examine the relationship between tourism and terrorism. This research is underpinned by the economic theory of international tourism demand models and estimates the impact of terrorism on tourism for as many countries for which there were data, 95 in all.

3. Data and variables

3.1. International tourism & GDP

International tourism demand and terrorism of a destination are measured by tourist arrivals and GTI respectively. As the income of a source market is one of the most significant determinants of tourism demand (Li, Song, & Witt, 2005; Lim, 1999; Song & Li, 2008) and the focus of this study is at the destination level, an averaged Gross Domestic Product (GDP) index (Y_{it}) is used to represent the income level of the origin countries/regions for destination i in period t as shown in Equation (1). Y_{st} is the GDP index (2010 = 100) of the sth (s=*1,2,3 … 10*) largest source market of destination i in period t. w_{is} is the market share of the arrivals from the s*th* origin countries/regions in the top 10 source markets in 2012, used as a weight in the calculation of Y_{it}. According to United Nations World Tourism Organization (UNWTO. (2014), the top 10 source markets account for 72.9% market share of a destination, on average. Hence, it is reasonable to use as the weights to calculate Y_{it}.

$$Y_{it} = \sum_{s=1}^{10} w_{is} Y_{st} \quad (1)$$

Although the annual international tourist arrivals of 236 destinations from 1995 to 2012 are collected from the World Bank, GDP of 189 countries/regions from the International Monetary Fund and GTI of 209 countries/regions from IEP, respectively, only 95 common destinations in the three databases are included in UNWTO. (2014) with available top ten source markets to calculate the average GDP. As a result, the 95 destinations were selected as the sample to further analyse the impact of terrorism on international tourism. The full list of the 95 destinations can be found in Appendix 1.

The geography distribution of the destinations by region is presented in Table 1. The sampled destinations cover all the regions in the world. Thirty of the 95 countries/regions are located in Europe and Central Asia, followed by Latin America & Caribbean

Table 1
Geographic distribution of destinations in the sample.

Region	Frequency	Percentage
East Asia & Pacific	15	15.79%
Europe & Central Asia	30	31.58%
Latin America & Caribbean	16	16.84%
Middle East & North Africa	14	14.74%
North America	2	2.11%
South Asia	4	4.21%
Sub-Saharan Africa	14	14.74%
Total	95	100%

(16), East Asia & Pacific (15). There are 14 destinations in Middle East & North Africa and Sub-Saharan Africa regions respectively, four from South Asia and another two from North America.

3.2. Global Terrorism Index

The measurement for terrorism is the GTI produced by IEP. The GTI is an attempt to capture the direct effects of terrorist-related violence. The GTI is based on data from the Global Terrorism Database (GTD) which is an open-source database including information on terrorist events around the world from 1970 through 2013. Following the methodology proposed by IEP (2014), the GTD is transformed into a GTI based on four factors to give a country's annual index. The four factors are: the total number of terrorist incidents in a given year; the total number of fatalities caused by terrorism in a given year; the total number of injuries caused by terrorism in a given year; and the approximate level of total property damage from terrorist incidents in a given year. A five-year weighted average is applied to reflect the lingering psychological effect of terrorist acts over time. As one of the aims of a terrorist attack is to instil fear and terror among a population, events in previous years have an influence on a country's score in the current year. This is the rationale for taking previous years' incidents into account for the current year. The weights were determined by consultation with the GTI Expert Panel and the details of the weighting could be found in IEP (2014).

Based on the methodology of the GTI explained above, the world index (a summation of each country's GTI) started at a score of 674,343 in 1995 falling to 398,603 in 2005, a decrease in terrorism of 40.9%, although there were reversals to this downward trend in 1997 and 2001. However, since 2005 there has been a general increase in terrorism across the world. From the low in 2005, the GTI increased gradually year on year to 647,889 in 2011 and then increased 45.2% in 2012 to 940,726. Across the 18 years, the average GTI across the 95 countries was 6320. The countries with the lowest levels of terrorism, on average across the 18 years, were Uruguay (20.4), New Zealand (23.9) and Denmark (25.1). The countries with the highest levels of terrorism across the 18 years were Pakistan (92,508), India (81,900) and Algeria (66,043).

The GTI is a relatively new construct and has only recently been used in the academic literature. Hyslop and Morgan (2014, pp. 97–114) outline the rationale and methodology behind the development of the GTI. Berkebile (2015) uses the underlying terrorism data found in the GTD to examine the issue of domestic terrorism. Procasky and Ujah (2016) use the GTI to examine terrorism and its impact on the cost of debt. The GTI is used as one of the variables by Bader and Schuster (2015) examining expatriate social networks in terrorism-endangered countries. Further, it is one of the indices Estes and Sirgy (2013) use to examine the relationship that exists between acts of terrorism and quality of life for a select group of 27 member states of the Organization for Islamic Cooperation.

4. Method

An autoregressive distributed lag (ARDL) model is selected to estimate the impact of terrorism on tourism demand. ARDL models are widely adopted in the tourism field by using both panel data and time series data (Lin, Liu, & Song, 2015; Song & Lin, 2010; Song, Lin, Witt, & Zhang, 2011). This model can investigate both long run and short run influences of terrorism on tourism demand. In this research, a panel data model is employed to explore the overall effect of terrorism on tourism demand from a global view, while time series models are introduced to look closely at the impact on specific destinations.

The ARDL model employed in this study can be expressed as

$$\begin{aligned}\Delta \ln Q_{it} = {} & \alpha_{0,i} + \sum_{j=1}^{m_1} \psi_{Qj,i} \Delta \ln Q_{i,t-j} + \sum_{j=0}^{m_2} \psi_{Yj,i} \Delta \ln Y_{i,t-j} \\ & + \sum_{j=0}^{m_3} \psi_{Terj,i} \Delta \ln Ter_{i,t-j} + \pi_{1,i} \ln Q_{i,t-1} + \pi_{2,i} \ln Y_{i,t-1} \\ & + \pi_{3,i} \ln Ter_{i,t-1} + dummies + \varepsilon_{it} \end{aligned} \quad (2)$$

where Q_{it} is the total tourist arrivals to destination i at time t, Y_{it} is the weighted GDP index of the top 10 source markets to destination i at time t and Ter_{it} is the GTI index of destination i at time t respectively. After taking the first order difference (Δ) and natural logarithm (ln), ψ_i represents the impact of the growth rates of independent variables on the growth rate of tourism arrivals which can be considered a type of short run effect of income or terrorism on tourist arrivals. π_i specifies the long run influence among variables. If π_i is not significant, it indicates that there is no long run relationship between the relevant variables. In contrast, if π coefficients are significant, the income and terrorism elasticity can be expressed as $-\pi_{2,i}/\pi_{1,i}$ and $-\pi_{3,i}/\pi_{1,i}$ respectively. Tourism demand elasticities are useful tools to both scholars and policy decision-makers, as these elasticities quantify the percentage change in tourism demand as a result of a percentage change in the determinants (Song et al., 2011).

Dummy variables are included in the time series models to capture the impact of one-off events such as 2009 global financial crisis, the 2008 typhoon disaster in Myanmar and the outbreak of the Syrian Civil War in 2011. ε_{it} is a random error term which is assumed to follow a normal distribution of $N(0, \sigma^2)$. In previous tourism demand modelling studies such as Lin et al. (2015), the impact of terrorism attacks, for instance, the 9/11 attack, are captured by a dummy variable. As discussed earlier, this uses an ex-post method that only focuses on the influence on the demand in the past. By introducing the GTI into the model, stakeholders could simulate the effect of various levels of terrorism attacks on tourism demand in destinations.

Price variables such as the relative price between the destination and source market and substitute price are excluded from the model in this research. As the tourism demand is measured by the aggregated international tourist arrivals rather than the arrivals from a specific source market to a destination, it is impossible to calculate the relative price for each destination. Additionally, the research objective of this study is to investigate the impact of terrorism on international tourism not the exploration of the factors of tourism demand, thus it is not necessary to include all determinants in the model. When the most important factor of tourism demand, income of the source market (Li et al., 2005; Lim, 1999; Song & Li, 2008) has been employed and other factors could be presented by the constant term, the goodness of fit of the model would be acceptable.

Considering the data frequency and sample size, the original

Table 2
Unit root test and cointegration test for panel data and time series models.

	Panel data model	Time series model
Unit Root Test	Im-Pesaran-Sin (IPS)	Augmented Dicky-Fuller (ADF) Kwiatkowski-Phillips-Schmidt-Shin (KPSS) Ng-Perron (NP)
Cointegration	Method of Westerlund (2007)	Bounds test

lagged order of difference terms is set at two. The general to specific approach (Hendry, 1995) is employed in the estimation procedure to eliminate the variables which are insignificant or where the sign of the coefficient is not consistent with economic theory (Song, Witt, & Li, 2003). The optimal lagged order of variables is determined by the Akaike information criterion (AIC). Hausman test and *F*-test are carried out to choose the appropriate model type for panel data models from pooled (Pooled), fixed effect (FE) and random effect (RE) models. The difference among the three types of models is due to the independence of the unobserved factors with explanatory variables. The details of the model selection could be found in Pratt and Liu (2016). The cluster-robust covariance estimator is applied in the estimation of panel data model to correct the correlation of standard errors in cross-sectional and time series dimensions. For time series models, after the model estimation, a number of diagnostic tests are carried out to examine the reliability of the models, including serial correlation, normality and heterosedasticity of the residuals. To avoid spurious regression relationships, long run relationships (cointegration) among the relevant variables are examined by using different techniques for panel data and time series models respectively (see Table 2).

Unit root tests are conducted to examine the integration order of the variables. As there are missing data in some destinations, the structure of the panel data is not balanced; thus, only Fisher's test and IPS test can be used. The null hypothesis of the two tests are the same: all panels contain unit roots. However, the alternative hypothesis of Fisher's test is at least one panel is stationary while the alternative hypothesis for IPS is that some panels are stationary.

Consequently, IPS is selected for this study as the alternative hypothesis is more general. In terms of the time series models, considering the short time period of the series, three unit root tests, ADF, KPSS and NP tests, are employed to obtain more robust results. The null hypothesis of ADF and NP test is that there is a unit root in the series while the null hypothesis for KPSS test is that the series is stationary. The integration order of a variable is decided only if at least two types of the unit root test arrive at the same conclusion. If the results of the three tests conflict, the integration order of the variable is decided by NP test as it is more robust than the other two tests when the sample size is small.

In Equation (2), if $\pi_{2,i}$ and $\pi_{3,i}$ is written as $\pi_{2,i} = -\pi_{1,i}\beta_{2,i}$ and $\pi_{3,i} = -\pi_{1,i}\beta_{3,i}$ respectively, where $\beta_{2,i}$ and $\beta_{3,i}$ are also two vectors, Equation (2) can be expressed as

$$\begin{aligned}\Delta \ln Q_{it} = {} & \alpha_{0,i} + \sum_{j=1}^{m_1} \psi_{Qj,i} \Delta \ln Q_{i,t-j} + \sum_{j=0}^{m_2} \psi_{Yj,i} \Delta \ln Y_{i,t-j} \\ & + \sum_{j=0}^{m_3} \psi_{Terj,i} \Delta \ln Ter_{i,t-j} \quad + \pi_{1,i} (\ln Q_{i,t-1} \\ & - \beta_{2,i} \ln Y_{i,t-1} - \beta_{3,i} \ln Ter_{i,t-1}) + dummies + \varepsilon_{it} \end{aligned} \tag{3}$$

Equation (3) can be used to examine the long run relationship for panel data models. In Equation (3), $\pi_{1,i}$ is the coefficient of the error-correction term which measures the speed that the model converges to the equilibrium state. If $\pi_{1,i} < 0$, there is a cointegration relationship among the variables. In contrast, if $\pi_{1,i} = 0$, no cointergration relationship exists. Two pairs of statistics are developed by Westerlund (2007). The null hypothesis is $\pi_{1,i} = 0$ for all i, while the alternative hypothesis are $\pi_{1,i} < 0$ and $\pi_{1,i} = \pi_1 < 0$ respectively. Thus a long run relationship exists if either pair of the statistics rejects the null hypothesis.

The bounds test, proposed by Pesaran, Shin, and Smith (2001), is implemented to examine the long run relationship between the dependent and independent variables for time series models. *F*-test and *t*-test are employed to examine the null hypothesis in Equation (2) that $\pi_{1,i} = \pi_{2,i} = \pi_{3,i} = 0$ and $\pi_{1,i} = 0$ respectively. If both of the hypotheses are rejected, there is a long run relationship among the variables in the finalized model. The details of the application of bounds test in tourism demand modelling can be found in Song and Lin (2010) and Song et al. (2011).

5. Findings

Panel data models and time series models for each country are estimated. From a global view, there is no long run impact of terrorism and only a limited short run impact on international tourism. However, if the influence of terrorism is examined destination by destination, terrorism significantly influences 29 of the 95 destinations including four destinations which have only long run effects (π_i in Equation (2) are significant) and 20 with only short run effects ($\psi_{Ter,i}$ in Equation (2) are significant). Five destinations have both long run and short run effects.

5.1. Unit root test

Table 3 presents the results of the unit root test for the overall panel data model and one of the time series model, namely Columbia.[1] In the panel data model, $\ln Q_{it}$ and $\ln Y_{it}$ reject the null hypothesis after taking the first order difference, indicating that the integration order of the two variables are I(1). In contrast, $\ln Ter_{it}$ rejects the null hypothesis directly, thus this variable is I(0). As a result, the three variables can be used in Equation (3) to examine the long run relationship. For the data of Columbia, ADF and NP tests reject the null hypothesis at the first difference order while KPSS test rejects the null hypothesis at the level order but cannot reject the null hypothesis at the first order for ln*Q* and ln*Y*. Thus all the three tests suggest that ln*Q* and ln*Y* are I (1). Although ADF test indicates that ln*Ter* is I(0), the KPSS and NP tests confirm it is I(1). Thus, it is believed that ln*Ter* of Columbia is I(1). As the integration orders of all the variables are less than two, they can be used for the bounds test.

5.2. Long run impact of terrorism on tourism demand

The cointegration test of Westerlund (2007) and the bounds test are conducted to examine the long run relationship among the relevant variables for panel data and time series data respectively and the results are shown in Table 4. The null hypothesis of Westerlund test is there is no cointegrating relationship among the

[1] The results of the unit root tests for other models are available from the authors upon request.

Table 3
Results of the unit root test.

	All samples of panel data			Columbia						
	Level	First difference	Result	Level			First difference			Result
	IPS	IPS		ADF	KPSS	NP	ADF	KPSS	NP	
$\ln Q_{it}$	6.595	−30.819***	I(1)	−0.748	0.397*	11.070	−1.657*	0.278	4.218*	I(1)
$\ln Y_{it}$	24.117	−13.555***	I(1)	0.254	0.565**	11.083	−2.079**	0.069	0.069***	I(1)
$\ln Ter_{it}$	−2.144**	–	I(0)	−1.570*	0.468**	6.731	–	0.150	4.257*	I(1)

Note: (1) *, ** and *** represent reject the null hypothesis at 10%, 5% and 1% significance level respectively. (2) The optimal lagged order of the model is determined by AIC.

Table 4
Results of cointegration tests and terrorism elasticity.

Westerlund test of all samples	Statistics	*Z*-value	Robust *p* value
Gt	−3.551	−14.346	0.555
Ga	−26.476	−7.106	0.955
Pt	−25.625	−0.015	0.01
Pa	−14.213	−8.491	0.995
Bounds Test			
	F-test	*t*-test	Terrorism Elasticity
Columbia	10.856***	−4.630***	−0.456
France	18.197***	−5.706***	−0.033
Hong Kong	297.592***	−26.337***	−0.018
Guyana	7.620***	−4.585***	−0.048
Ireland	8.247***	−3.648*	−0.020
Latvia	7.815***	−3.897**	−0.031
Nepal	10.039***	−5.202***	−0.064
Saudi Arabia	11.595***	−5.891***	−0.020
Thailand	12.082***	−4.013**	−0.031

Note: In bounds test, the criteria interval of *F*-test with unrestricted intercept and no trend at 90%, 95% and 99% significance level is [3.17, 4.14], [3.79, 4.85] and [5.15, 6.36] respectively. The criteria interval of *t*-test with unrestricted intercept and no trend is [-2.57, −3.21], [-2.86, −3.53] and [-3.43, −4.10] respectively (Pesaran et al. 2001).

variables. *Gt* and *Ga* are two statistics developed by Westerlund (2007) for the alternative hypothesis of $\pi_{1,i} < 0$ while *Pt* and *Pa* for $\pi_{1,i} = \pi_1 < 0$. *Z*-statistics show that neither pair of statistics can reject the null hypothesis, thus overall, there is no long run relationship among international tourism demand, the income of source markets and terrorism. This means terrorism does not have an impact on international tourism demand in the long run from a global perspective.

In contrast, three long run relationships between tourism demand and terrorism and six long run relationships among tourism demand, income and terrorism are found in time series models. In these nine destinations, the impact is limited, with elasticity coefficients ranging from −0.018 to −0.456 (See Table 4).[2] Excluding Colombia (elasticity of −0.456), the absolute value of other elasticities are less than 0.04. The interpretation of this is that if terrorism (as measured by the GTI) of the nine countries increases 1%, tourism demand will decrease by less than 0.04% (except Columbia).

As a result, there is a minimal long run impact of terrorism on tourism demand, as overall, the long run relationship is not significant and only nine significant relationships are found in 95 destinations. Even in the nine destinations, the elasticities indicate that the impact of terrorism is quite small. Such a finding is easy to understand. Take the USA as an example. The inbound tourist arrivals to the USA suffered a three-year downturn since 2001 but recovered back to its growth path in 2004. This means tourism demand can recover even after a catastrophic shock such as the 9/11 terrorist attacks. As noted in the literature review by Pizam and Fleischer (2002), the frequency of terrorist attacks has a much more significant destructive force on tourism demand than severity. In contrast, according to the GTD, 150 terrorist attacks per year occurred in Columbia from 1995 to 2012. As a result, the terrorism elasticity of Columbia is −0.456 which is the largest of the nine destinations showing a significant long run relationship. Thus, as terrorist attacks are infrequent in most destinations, the effect of terrorism in the long run is not apparent. Notably, several of the countries where this research finds terrorism has a long run effect of tourism demand have been highlighted in the literature, namely Ireland (Buckley & Klemm, 1993), Nepal (Bhattarai et al., 2005) and Thailand (Rittichainuwat & Chakraborty, 2009).

Furthermore, tourists tend to be optimistic regarding the likelihood of potential security crises, even though for some destinations, there is a possibility of terrorist attacks. Uriely, Maoz, and Reichel (2007) found that Israeli tourists reduce their perceived risk when they visit Egypt by believing that the security of the destination is acceptable or the probability of terrorist attacks is negligible. If the destination does a good job of crisis management after an attack and rebuilds the destination image as soon as possible, the impact of terrorism on tourism will be minimized. Thus, terrorism is not a consideration for tourists when selecting their travel destinations unless the destination has a long history of being unsafe or has continuously suffered terrorist attacks, such as Iraq, Afghanistan or Colombia (Pizam & Mansfeld, 2006).

5.3. Short run impact of terrorism on tourism demand

While Table 4 shows there is no long run relationship between terrorism and tourism demand from a global perspective using all countries and territories in a panel data model, Table 5 shows the estimates of the short run terrorism effect on tourism demand. X^2 test shows a good model fit and by using the general to specific approach, only $\Delta \ln Ter_{i,t}$, the difference of the log of terrorism is left in the finalized model. The coefficient indicates that, on average, if the growth rate of terrorism (measured by the GTI) increases 1%, the growth rate of tourism demand decreases by 0.015% in the short run. Thus from a global view, the impact of terrorism on tourism demand is also very limited.

Furthermore, significant short run impacts are observed in 25 of the 95 destinations. The mean of the coefficients of GTI terms in each model ranges from −0.013 for Hong Kong to −0.752 for Yemen (See Table 6 - all the coefficients of the time series models presented are significant at 90% significant level or above and the details of the estimation results are presented in Appendix 2). The mean of these coefficients across the 25 destinations is −0.178 but 19 of the 25 average significant terrorism coefficients range between −0.2 and −0.0 which also indicates the limited impact of terrorism on tourism demand in the short run. Caution is needed when interpreting the results. The coefficients in the models capture the impact of the general level of terrorism in a country on tourism demand, not a particular terrorist attack. For instance, according to the GTD, terrorist attacks in Yemen increased from 112 in

[2] The estimation results and diagnostic tests of the models are presented in Appendix 2.

Table 5
Results of the panel data model for all countries and territories.

Model type	All samples FE
$\Delta \ln Q_{i,t-1}$	−0.073
(-2.31)**	
$\Delta \ln Q_{i,t-2}$	−0.075
(-1.67)*	
$\Delta \ln Y_{i,t}$	1.171
(5.35)***	
$\Delta \ln Ter_{i,t}$	−0.015
(-2.60)**	
Constant	−5.328(-2.20)**
Hausman test	120.10***
Panel *F*-test	1.29**
X^2 test	10.83***

Note: Figures in parenthesis are *Z*-statistics. *, ** and *** denote significant at 10%, 5% and 1% significance level respectively.

2010 to 118 in 2011, but the number of people injured from terrorism doubled between 2010 and 2011 to 415. As a result, arrivals to Yemen decreased 20% in 2011. However, if we look at the data of tourist arrivals to Yemen from 1995 to 2012, the short run impact of terrorism on the tourism demand of Yemen is −0.752, indicating that a 1% increase of the growth rate of GTI would cause 0.752% decrease of the growth rate of international arrivals to Yemen.

5.4. The impact of terrorism on tourism under different political regimes

Previous research has theorized that there is a relationship between political freedom and terrorism (Abadie, 2004; Krueger & Malečková, 2003). To look at the impact of terrorism on tourism demand by political regimes, destinations are split into four groups based on the 2012 democracy index developed by *The Economist's* Intelligence Unit (The Economist, 2012). The four categories, depending of the degree of democracy are: Full Democracy; Flawed Democracy; Hybrid Regimes; and Authoritarian Regimes. The estimation results of panel data models and statistically significant terrorism coefficients of the 25 time-series models, grouped by political regime based on the democracy index, are shown in Table 7 and Fig. 1 respectively. In the whisker plot of Fig. 1, the average is shown by the larger circle with the two smaller circles shown at the end of the line representing the maximum and minimum values in that category.

Clearly, there is a negative relationship between the degree of democracy and the impact terrorism has on tourism. Although the coefficients in panel data models are quite small, the pattern is obvious: the more democratic the country is, the lower the impact of terrorism on tourism demand. The mean value of the terrorism effect in authoritarian regimes is −0.250 while the average coefficient for full democracies is −0.047. There is also less variability in the terrorism estimates for more democratic countries. This finding is consistent with the study of Callaway and Harrelson-Stephens (2006) who argue that as the level of political openness decreases, the likelihood that individuals will resort to terrorism activities increases. Collier (2008) makes an important point that causation between impact of terrorism and political openness can be bi-directional. The fact that countries are more democratic may mean these countries are more resilient to terrorism attacks. Similarly, terrorism attacks may have less of an impact because of the democratic nature of these countries and their ability to deal with attacks. Furthermore, more authoritarian countries and regions may find it more difficult to restore the image of a safe tourist destination. In this paper, we note the correlation between political openness and impact of terrorism on tourism.

Table 6
Short run Terrorism Coefficients of Time Series Models.

	Country	Coefficients		Country	Coefficients
1	Yemen	−0.752	14	Germany	−0.070
2	Haiti	−0.675	15	Bahrain	−0.069
3	Mozambique	−0.527	16	Sri Lanka	−0.067
4	Central Africa Republic	−0.517	17	Turkey	−0.048
5	Colombia	−0.376	18	Japan	−0.045
6	Israel	−0.361	19	Cyprus	−0.043
7	Pakistan	−0.166	20	Norway	−0.037
8	Philippines	−0.136	21	Bolivia	−0.034
9	Thailand	−0.101	22	Ethiopia	−0.028
10	Nigeria	−0.091	23	Niger	−0.029
11	Myanmar	−0.088	24	Panama	−0.026
12	Guyana	−0.087	25	Hong Kong	−0.013
13	Latvia	−0.073			

5.5. The impact of terrorism on tourism by national income

In line with Agnew (2010) and Callaway and Harrelson-Stephens (2006), we examine the short run terrorism coefficients by national income as designated World Bank's income groupings, based on 2012 gross national income (GNI) per capita. Low income countries have a GNI per capita of US$1035 or less; middle income countries have GNI per capita between US$1036 and $12615; and high income have per capita income of US$12,616 or more. As can be seen in Table 8 and Fig. 2 below, both panel data and time series models show that the impact on tourism for high income countries tends to be more resilient than in medium income countries, which in turn, tends to be more resilient than low income countries. These results are corroborated by Collier (2008). However, these results somewhat conflict with those of Callaway and Harrelson-Stephens (2006) and Pratt and Liu (2016) who predicted that middle income countries may be more vulnerable to terrorism impacts than low income or high income countries.

5.6. The impact of terrorism on tourism by tourism intensity

The extent to which a destination is dependent on tourism may also impact the degree of vulnerability and resilience terrorism has on tourism. As with the type of political regime and national income, causation could flow both ways. A history of terrorism in the destination may result in lower tourism. A well-known tourism destination may also attract terrorism activities if the terrorists believe they can attract more international media attention and promote their cause. The relationship could be positive: those destinations with many tourists may be the target for terrorism. Conversely, the relationship could be negative: those destinations that are dependent on tourism may have better security measures and risk management procedures in place, enabling them to be resilient to terrorist attacks. The answer comes down to empirics.

Table 9 and Fig. 3 show short run impact of terrorism on tourism for panel data models and the 25 time-series models by tourism intensity. An index for tourism intensity was calculated by taking an average from 2008 to 2012 of ratio of international tourist arrivals to population (average number of tourists per population). Three categories were developed Low (0.00–0.25); Medium (0.26–0.99) and High (1.00+). Panel data models indicate that the short run impact of terrorism on destinations with low tourism intensity is stronger than medium intensity although the size of the coefficients are small. Furthermore, no significant influence of terrorism is observed in destinations with high tourism intensity. The pattern is as same for the time series models. Fig. 3 shows that those destinations that

Table 7
Results of panel data models grouped by political regimes.

Model type	Authoritarian regimes RE	Hybrid regimes FE	Flawed democracies RE	Full democracies Pooled
$\Delta \ln Q_{i,t-1}$			0.151(3.07)***	
$\Delta \ln Q_{i,t-2}$	−0.109(-2.10)**			
$\Delta \ln Y_{i,t}$		1.400(6.80)***	0.475(2.65)***	1.754(6.84)***
$\Delta \ln Y_{i,t-1}$			−0.377(-2.32)**	
$\Delta \ln Ter_{i,t}$	−0.021(-3.30)***	−0.014(-2.39)**		
$\Delta \ln Ter_{i,t-1}$				
$\Delta \ln Ter_{i,t-2}$	−0.013(-2.14)**		−0.007(-1.66)*	
Constant	0.101(13.83)***	0.046(7.06)***	0.027(4.20)***	−0.113(-1.73)
Hausman test	0.27	50.90***	2.34	4.40**
Panel *F*-test		1.58**		1.14
X^2 test	16.13***	24.89***	33.06***	4.73***
Westerlund Test				
Gt	−1.699(4.411)	−3.074(-3.042)	−3.626(-8.659)	−3.346(-5.083)
Ga	−1.828(7.201)	−2.707(6.990)	−18.747(-5.640)	−11.129(0.476)
Pt	−7.698(2.808)**	−22.207(-12.723)	−11.916(-0.041)	−11.530(-3.283)
Pa	−4.455(3.991)	−11.035(-0.380)	−11.169(-2.032)	−13.743(-3.307)

Note: Figures in parenthesis are *Z*-statistics. *, ** and *** denote significant at 10%, 5% and 1% significance level respectively.

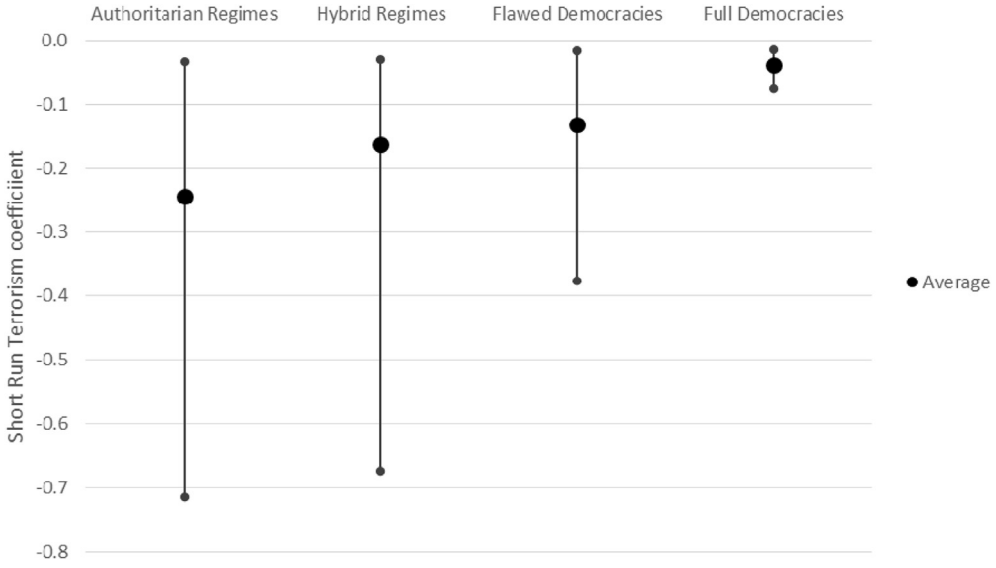

Fig. 1. Short run impact of terrorism by political regime.

Table 8
Results of panel data models grouped by national income.

Model type	Low income RE	Middle income FE	High income RE
$\Delta \ln Q_{i,t-1}$			0.108(2.08)**
$\Delta \ln Y_{i,t}$	0.939(1.87)*	1.078(4.87)***	1.242(11.55)***
$\Delta \ln Y_{i,t-1}$			−0.268(-2.12)**
$\Delta \ln Ter_{i,t}$	−0.020(-1.80)*	−0.016(-2.84)***	−0.005(-2.20)**
$\ln Ter_{i,t-1}$			−0.002(-1.7)*
Constant	0.064(3.41)***	0.045(5.94)***	0.014(1.78)*
Hausman test	3.03	78.81***	1.78
Panel *F*-test		1.61***	
X^2 test	17.87***	16.93***	156.93***
Westerlund Test			
Gt	−2.880(1.386)	−2.330(-1.599)	−3.059(-5.030)
Ga	−0.615(5.889)	−2.463(10.333)	−12.989(-0.943)
Pt	−2.301(5.861)	−19.503(-4.421)	−14.163(-2.360)
Pa	−0.723(4.791)	−7.093(3.406)	−12.411(-3.325)

Note: Figures in parenthesis are *Z*-statistics. *, ** and *** denote significant at 10%, 5% and 1% significance level respectively.

are highly tourism dependent are less impacted by terrorism than those countries that are less dependent on tourism. This supports the hypothesis that countries highly dependent on tourism may have better security measures and risk management procedures in place, enabling them to be resilient to terrorist attacks.

6. Conclusions

This paper explores the impact of terrorism on international tourism demand. Eleven panel data models and 95 different ARDL models were built to examine the impact of terrorism on both the long run and short run for the period of 1995–2012. The main finding is that from a global view, terrorism does not have an adverse impact on tourism demand in the long run, as no long run relationship is found with the panel data model using the data of all 95 destinations. Only nine out of 95 destinations exhibit significant long run relationships between terrorism and international tourism arrivals. Furthermore, the tourism demand elasticities of terrorism range between −0.018 and −0.064 (except for Colombia: −0.456), indicating terrorism has minimal impact on tourism demand. Thus, for the large majority of destinations, international tourism demand is resilient to terrorism. The notable exceptions, such as Colombia, Thailand and Nepal, have been noted in the literature.

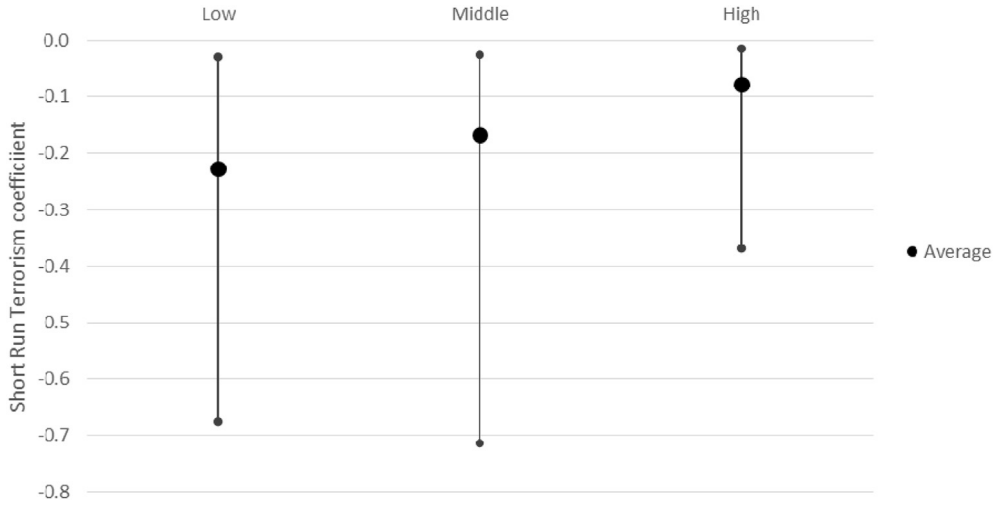

Fig. 2. Short run impact of terrorism by national income.

Table 9
Results of panel data models grouped by tourism intensity.

Model type	Low tourism intensity Pooled	Medium tourism intensity Fixed	High tourism intensity Random
$\Delta \ln Q_{i,t-1}$			0.174(3.04)***
$\Delta \ln Q_{i,t-2}$		−1.723(-2.32)**	
$\Delta \ln Y_{i,t}$	0.844(2.66)***	1.678(6.42)***	0.990(7.39)***
$\Delta \ln Y_{i,t-2}$			−0.468(-3.46)***
$\Delta \ln Ter_{i,t}$	−0.020(-2.27)**	−0.012(-1.88)*	
Constant	0.040(3.57)***	0.025(3.33)***	0.011(2.24)**
Hausman test	37.60***	84.65***	–
Panel *F*-test	0.9	1.73**	
X^2 test	5.53***	14.64***	88.75***
Westerlund Test			
Gt	−2.441(0.711)	−3.385(-7.019)	−2.871(-3.459)
Ga	−1.873(10.997)	−18.670(-5.576)	−3.469(-5.187)
Pt	−10.708(5.516)	−14.297(-3.173)	−17.726(-11.364)***
Pa	−4.091(6.487)	−12.477(-3.231)	−27.775(-11.790)

Note: Figures in parenthesis are *Z*-statistics. *, ** and *** denote significant at 10%, 5% and 1% significance level respectively.

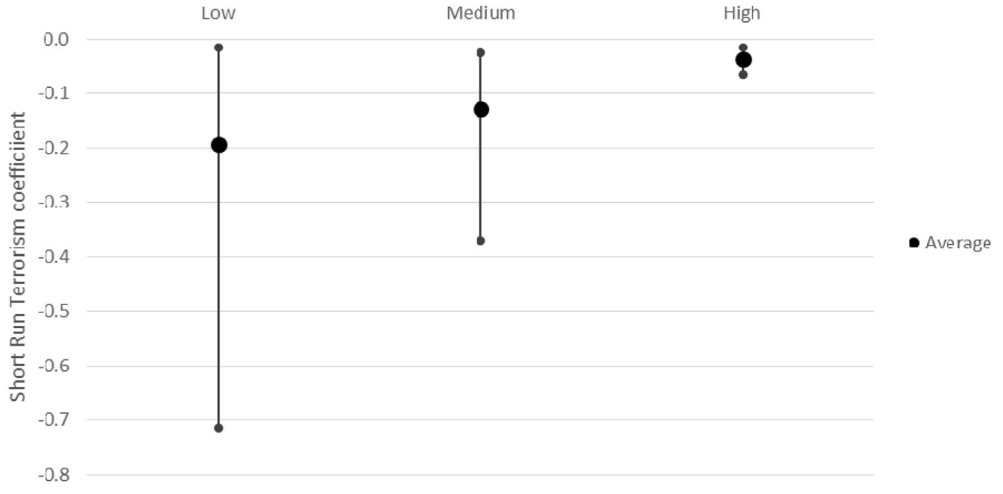

Fig. 3. Short run impact of terrorism by tourism intensity.

A significant short run impact of terrorism is found using the panel data of all the 95 destinations, although the coefficient is small (−0.015). However, significant short run impacts of terrorism are found in 25 individual destinations using time series models. A 1% change in the growth rate in terrorism (as measured by the GTI) may cause around a 0.2% decrease of the growth rate of international tourist arrivals in most of the 25 destinations with the exception of Central Africa Republic, Columbia, Haiti, Israel, Mozambique and Yemen. The strongest effect is observed in Yemen where terrorism may cause the growth rate of tourist arrivals to decrease by an average of 0.752% following a 1% increase in terrorism. This is followed by Haiti with the impact around −0.675%.

Both panel data and time series models show that those destinations that are more politically open are likely to be more resilient to the impact of terrorism than nations who are more authoritarian. Those destinations who have higher per capita income are also

likely to be more resilient to the impacts of terrorism compared to middle income countries, which in turn are more resilient than low income countries (Llorca-Vivero, 2008). This can create the type of 'trap' where low income countries, who are in need of tourism to boost their economy and provide much needed foreign exchange, are impacted to a greater extent if terrorism activities take place, which in turn, deters international tourists from travelling to these countries. Along similar lines, those countries who have low dependency on tourism are more vulnerable to the impacts of terrorism than those countries who are more tourism dependent. Again, this can create a vicious cycle, where those nations with lower tourism density, if they are looking to increase tourism, are the countries that are impacted to a larger degree than those countries who are more tourism-dependent. These countries tend to be more resilient to terrorism.

Regardless of the political regime, dependence on tourism and level of national income, all tourism stakeholders (including destination marketing organizations, local media, host governments and the tourism industry) need to work together in operationalizing their risk and crisis management plans to prevent, reduce and mitigate the impacts of terrorism attacks (Mansfeld & Pizam, 2006). More importantly, given the insignificant long run impact and the limited short run influence of terrorism on tourism demand found by this study, it is suggested that the stakeholders should prepare the crisis management plan in advance. If a terrorist attack does take place, these stakeholders need to work together, implementing their recovery methods to minimize the impact of terrorism on tourism and restore the destination image. Destinations with lower income and lower dependency on tourism need to invest more resources in rebuilding their destination image, as they are more vulnerable to the influence of terrorism. International cooperation is also helpful and important for them to recover from the damage of terrorist attacks and to promote the destination globally.

The main limitation of this study is the data availability. The data set adopted in this study is short (Gujarati, 2011), composed of 95 destinations but only 18 years. We incorporated all the countries for which there was available data to build both panel data and time series models. However, many countries affected by terrorism did not have the associated tourism data and another significant group of countries did not have tourism data for the time period we examined. Compared with countries with available GDP data published by International Monetary Fund, 47 countries did not have a set of international tourism arrival data including many nations in Africa (such as Senegal, Libya, Rwanda and Sudan) and in the Middle East/Central Asia (such as Afghanistan, Iraq, Turkmenistan, Uzbekistan). There are ten countries where terrorism data was not available. Many of these nations were small island states in the Caribbean or the Pacific. The length of the time series may weaken the robustness of the estimation results of time series models, so caution is needed when interpreting the coefficients. Another limitation is that the GTI only focuses on the impact of terrorism of individual countries, the spill-over effect of the terrorist attacks from one country to another is not taken into consideration. Thus future studies with a longer time series and a regional terrorism index covering the spill-over effects may provide further insights into the impact of terrorism on tourism demand. Nevertheless, we are able to quantify the relationship between terrorism and tourism in 95 different countries and territories, noting that, in general, international tourism is resilient to terrorism attacks. Further research is needed in this important topic.

Appendix 1. List of Selected Destinations

East Asia & Pacific	Europe & Central Asia	Latin America & Caribbean
Australia	Albania	Argentina
China	Armenia	Bolivia
Hong Kong SAR, China	Austria	Brazil
Indonesia	Azerbaijan	Chile
Japan	Belgium	Colombia
Cambodia	Bulgaria	Ecuador
Korea, Rep.	Bosnia and Herzegovina	Guyana
Lao PDR	Belarus	Honduras
Myanmar	Cyprus	Haiti
Malaysia	Germany	Mexico
New Zealand	Denmark	Panama
Philippines	Spain	Peru
Papua New Guinea	Estonia	Paraguay
Thailand	France	Trinidad and Tobago
Taiwan	Georgia	Uruguay
Middle East & North Africa	Greece	Venezuela, RB
Morocco	Croatia	**Sub-Saharan Africa**
Bahrain	Ireland	Angola
Algeria	Italy	Central African Republic
Egypt, Arab Rep.	Kyrgyz Republic	Congo, Rep.
Iran, Islamic Rep.	Latvia	Ethiopia
Israel	Moldova	Madagascar
Jordan	Macedonia, FYR	Mali
Kuwait	Netherlands	Mozambique
Lebanon	Norway	Niger
Qatar	Russian Federation	Nigeria
Saudi Arabia	Sweden	Swaziland
Syrian Arab Republic	Turkey	Tanzania
Tunisia	UK	Uganda
Yemen, Rep.	Ukraine	South Africa
South Asia	**North America**	Zimbabwe
India	Canada	
Sri Lanka	USA	
Nepal		
Pakistan		

Appendix 2. Estimation Results of Time Series Models

	Bahrain	Bolivia	Central Africa Republic	Columbia	Cyprus	Ethiopia
$\Delta \ln Q_{i,t-1}$		1.193	1.530	−0.383	0.470	−0.211
		(5.403)***	(2.610)*	(-2.046)*	(3.960)***	(-2.922)**
$\Delta \ln Q_{i,t-2}$		0.860	1.343	−0.369		
		(2.081)*	(3.091)**	(-2.107)*		
$\Delta \ln Y_{i,t}$	6.276	1.432				
	(4.663)***	(2.554)**				
$\Delta \ln Y_{i,t-1}$			−34.642	4.067		
			(-3.218)**	(2.253)*		
$\Delta \ln Y_{i,t-2}$	−2.390		−48.063	5.404		
	(-2.109)*		(-4.052)**	(5.405)*		
$\Delta \ln Ter_{i,t}$	−0.086	−0.037		−0.376		
	(-4.521)***	(-3.606)***		(-2.018)*		
$\Delta \ln Ter_{i,t-1}$	−0.075	−0.031	−0.726			
	(-3.895)**	(-2.161)*	(-4.393)**			
$\Delta \ln Ter_{i,t-2}$	−0.036		−0.297		−0.043	−0.028
	(-2.400)*		(-4.646)***		(-4.469)***	(-2.297)**
$\mathrm{Ln}Q_{i,t-1}$	−1.352	−1.583	−1.931	−0.892		−0.906
	(-4.599)***	(-3.924)***	(-3.979)**	(-4.414)***		(-10.694)***
$\mathrm{Ln}Y_{i,t-1}$	4.040	2.810	9.337		−0.587	2.836
	(4.729)***	(4.096)***	(6.195)***		(-5.389)***	(10.284)***
$\mathrm{Ln}Ter_{i,t-1}$				−0.826	0.003	
				(-4.630)***	(0.402)	
Constant	3.337	8.368	−19.241	20.677	8.601	−1.347
	(3.416)***	(3.624)***	(-7.185)***	(4.580)***	(5.383)***	(-2.404)**
DUM05						0.237
						(5.583)***
DUM10	−0.837					
	(-11.067)***					
BD *F*-test	11.395***	6.046**	27.123***	10.856***	14.543***	58.844***
BD *t*-test	−4.599***	−3.924**	−3.979**	−4.630***	−5.389***	−10.694***
R^2	0.981	0.888	0.957	0.861	0.864	0.954
adjusted R^2	0.951	0.775	0.872	0.722	0810	0.928
F-test	32.876***	7.898***	11.259***	6.200**	15.878***	37.350***
LM	13.768***	1.565	7.551*	1.17	0.927	0.025
JB	0.983	0.89	1.153	5.088*	0.472	1.560
White	0.638	0.504	1.741	2.106	2.120	0.914
ARCH	0.269	2.829	0.009	0.174	0.484	0.548

	France	Germany	Guyana	Haiti	Hong Kong	Ireland
$\Delta \ln Q_{i,t-1}$				0.698	0.313	0.504
				(2.644)**	(9.228)***	(2.750)**
$\Delta \ln Q_{i,t-2}$	0.603			0.760	0.167	
	(3.530)***			(4.117)***	(5.869)***	
$\Delta \ln Y_{i,t}$	1.124				1.328	
	(2.931)**				(6.916)***	
$\Delta \ln Y_{i,t-1}$			−4.085	−10.400		
			(-2.194)*	(-2.123)*		
$\Delta \ln Y_{i,t-2}$		−1.372(-3.013)**			2.302(11.116)***	−1.295(-2.806)**
$\Delta \ln Ter_{i,t}$		−0.070	−0.087	−0.573	−0.018	
		(-3.359)***	(-3.500)***	(-3.761)***	(-6.841)***	
$\Delta \ln Ter_{i,t-1}$						
$\Delta \ln Ter_{i,t-2}$				−0.777	−0.013	
				(-4.300)***	(-4.745)***	
$\mathrm{Ln}Q_{i,t-1}$	−0.681		−0.954	−2.009	−1.437	−0.309
	(-5.707)***		(-4.585)***	(-5.103)***	(-26.337)***	(-3.648)***
$\mathrm{Ln}Y_{i,t-1}$			2.500	1.541	1.442	
			(4.185)***	(2.139)*	(18.469)***	
$\mathrm{Ln}Ter_{i,t-1}$	−0.056		−0.094		−0.043	−0.026
	(-5.465)***		(-2.310)**		(-9.424)***	(-2.532)**
Constant	12.676	0.053	0.422	16.967	27.945	5.012
	(5.717)***	(4.077)***	(0.347)	(2.888)**	(17.981)***	(3.726)***
DUM04					0.178	
					(11.881)***	
DUM09					0.403	
					(15.319)***	
BD *F*-test	18.197***	–	7.620***	30.276***	297.592***	8.247***
BD *t*-test	−5.706***	–	−4.585**	−4.299*	−26.337***	−3.648*
R^2	0.685	0.583	0.790	0.884	0.998	0.713
adjusted R^2	0.811	0.513	0.684	0.769	0.99	0.58

(*continued*)

	France	Germany	Guyana	Haiti	Hong Kong	Ireland
F-test	16.021***	8.388***	7.508***	7.669***	137.600***	6.204***
LM	0.269	0.598	0.630	0.917	2.629	1.378
JB	0.365	0.761	0.204	3.599	0.546	1.746
White	0.599	0.495	1.515	0.124	1.794	37.627
ARCH	1.67	0.415	0.003	0.264	0.021	0.01

	Israel	Japan	Latvia	Mozambique	Myanmar	Nepal
$\Delta \ln Q_{i,t-1}$		−0.464 (-2.685)**	0.792 (3.137)**	0.551 (2.770)*	0.589 (2.420)**	
$\Delta \ln Q_{i,t-2}$	−0.271 (-1.816)*	0.748 (3.040)**				
$\Delta \ln Y_{i,t}$		3.122 (3.473)***		9.343 (3.927)**		
$\Delta \ln Y_{i,t-1}$			−1.843 (-2.181)*	−9.201 (-3.243)**		
$\Delta \ln Y_{i,t-2}$						
$\Delta \ln Ter_{i,t}$	−0.361 (-5.246)***		−0.073 (-2.895)**	−0.527 (-4.117)**	−0.096 (-3.622)***	
$\Delta \ln Ter_{i,t-1}$		−0.045 (-2.542)**				
$\Delta \ln Ter_{i,t-2}$					−0.080 (-2.139)*	
$\ln Q_{i,t-1}$			−0.962 (-3.897)***	−1.758 (-5.548)**	−0.988 (-3.595)***	−0.892 (-5.202)***
$\ln Y_{i,t-1}$			1.052 (2.273)*	14.128 (5.589)**	1.159 (5.868)***	1.214 (5.311)***
$\ln Ter_{i,t-1}$			−0.061 (-2.520)**			−0.121 (-4.473)***
Constant	0.017 (0.450)	−0.152 (-2.778)**	8.779 (4.660)***	−39.861 (-5.550)**		7.520 (4.634)***
Dum02						−0.286 (-3.400)***
DUM04-06			0.266 (2.898)**			
DUM08					−0.355 (-5.153)***	
DUM11						
DUM12					0.487 (4.686)***	
BD *F*-test	–	–	7.815***	15.625***	20.198***	10.039***
BD *t*-test	–	–	−3.897**	−5.548***	−3.595**	−5.202***
R^2	0.731	0.856	0.784	0.945	0.949	0.799
adjusted R^2	0.686	0.798	0.595	0.836	0.898	0.732
F-test	16.300***	14.857***	4.149**	–	18.650***	11.924***
LM	0.639	0.233	4.583*	85.571***	0	0.178
JB	0.048	0.431	0.476	2.372	0.1	0.581
White	0.169	0.094	0.383	0.33	2.212	1.004
ARCH	0.585	0.025	0.005	0.041	0.39	0.029

	Niger	Nigeria	Norway	Pakistan	Panama	Philippines
$\Delta \ln Q_{i,t-1}$			−0.781 (-5.543)***			
$\Delta \ln Q_{i,t-2}$			−1.189 (-8.902)***			
$\Delta \ln Y_{i,t}$			1.716 (6.182)***			2.256 (3.150)***
$\Delta \ln Y_{i,t-1}$			1.718 (4.794)***			
$\Delta \ln Y_{i,t-2}$	−4.877 (-2.551)**	−5.286 (-2.616)**		−4.389 (-3.294)**		
$\Delta \ln Ter_{i,t}$	−0.029 (-2.278)**	−0.091 (-2.365)**		−0.166 (2.063)*	−0.026 (-2.079)*	−0.136 (-3.734)***
$\Delta \ln Ter_{i,t-1}$			−0.043 (-7.154)***			
$\Delta \ln Ter_{i,t-2}$			−0.030 (-5.228)***			
$\ln Q_{i,t-1}$	−1.088 (-6.525)***	−1.290 (-7.849)***	−0.363 (-3.282)**	−0.471 (-2.487)*	−0.773 (-2.339)**	
$\ln Y_{i,t-1}$	2.573 (5.428)***	4.364 (7.394)***	1.053 (5.035)***	1.301 (2.610)**	1.811 (2.333)**	
$\ln Ter_{i,t-1}$				−0.122 (-3.255)**	−0.022 (-2.854)**	
Constant	0.319 (0.137)	0.601 (0.898)	0.890 (0.423)	2.122 (1.760)	2.700 (2.305)**	−0.012 (-0.439)

(*continued on next page*)

(*continued*)

	Niger	Nigeria	Norway	Pakistan	Panama	Philippines
DUM01			−0.247	−0.273		−0.155
			(-8.046)***	(-4.983)***		(-2.758)**
DUM06						
DUM11		−0.897				
		(-6.419)***				
BD *F*-test	27.353***	30.931***	18.018***	11.674***	3.890	–
BD *t*-test	−6.525***	−7.849***	−3.282	−2.287	−2.339	–
R^2	0.870	0.906	0.969	0.876	0.521	0.680
adjusted R^2	0.812	0.854	0.898	0.783	0.362	0.606
F-test	15.014***	17.393***	13.762***	9.410***	3.273**	9.212***
LM	0.484	3.837*	0.755	6.360**	0.001	4.316**
JB	4.026	1.156	4.163	0.845	2.956	0.599
White	1.428	0.368	0.345	0.706	0.714	0.383
ARCH	0.188	1.312	0.058	0.344	1.063	0.673

	Saudi Arabia	Sri Lanka	Thailand	Turkey	Yemen
$\Delta \ln Q_{i,t-2}$	0.890		1.703	−0.404	−0.453
	(3.261)**		(4.808)***	(-4.381)**	(-2.071)*
$\Delta \ln Y_{i,t}$			0.769		
			(3.692)**		
$\Delta \ln Y_{i,t-1}$			2.853	2.060	11.596
			(3.538)**	(4.751)***	(3.293)***
$\Delta \ln Y_{i,t-2}$		−7.129		1.783	
		(-5.739)***		(3.947)***	
$\Delta \ln Ter_{i,t}$		−4.185	3.369	0.876	
		(-3.160)***	(2.584)**	(2.080)**	
$\Delta \ln Ter_{i,t-1}$		−0.067	−0.101	−0.048	−0.849
		(-2.138)*	(-2.666)**	(-2.537)**	(-4.187)***
$\Delta \ln Ter_{i,t-2}$					−0.654
					(-3.204)***
$\ln Q_{i,t-1}$					
$\ln Y_{i,t-1}$	−2.392		−3.798		
	(-5.891)***		(-5.749)***		
$\ln Ter_{i,t-1}$	2.971		4.754		
	(5.634)***		(5.669)***		
Constant	−0.067	−0.063	−0.148		
	(-2.228)*	(2.867)**	(-4.013)***		
$\Delta \ln Q_{i,t-2}$	25.890	1.127	35.798		−0.173
	(5.778)***	(4.912)***	(5.723)***		(0.272)
DUM99				−0.355	
				(-7.634)***	
DUM06					0.819
					(3.247)***
DUM12				−0.256	
				(-5.330)***	
BD *F*-test	11.595***	–	12.082***	–	–
BD *t*-test	−5.891***	–	−4.013**	–	–
R^2	0.872	0.874	0.887	0.961	0.690
adjusted R^2	0.787	0.824	0.734	0.922	0.535
F-test	10.219***	17.392***	5.867**	24.769***	4.454**
LM	1.724	0.036	0.361	0.854	0.023
JB	1.651	2.301	1.255	20.413***	7.768**
White	0.461	0.29	0.535	0.913	2.006
ARCH	0.122	0.67	0.456	1.413	0.226

Notes: 1. BD *F*-test and BD *t*-test represent the *F*-test and *t*-test in bounds test respectively. The criteria interval of *F*-test with unrestricted intercept and no trend at 90%, 95% and 99% significance level is [3.17, 4.14], [3.79, 4.85] and [5.15, 6.36] respectively. The criteria interval of *t*-test with unrestricted intercept and no trend is [-2.57, −3.21], [-2.86, −3.53] and [-3.43, −4.10] respectively (Pesaran et al. 2001). 2. LM, JB, White and ARCH indicate Breusch-Godfrey Lagrange multiplier serial correlation test, Jarque-Bera normality test, White heteroscedasticity test and autoregressive conditional heteroscedasticity test respectively. 3. Figures in parenthesis are *Z*-statistics. *, ** and *** denote significant at 10%, 5% and 1% significance level respectively.

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