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Terrorism and Tourism: a time-series analysis for the case of Israel

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Abstract

This paper will provide an analysis of the influence of terrorism on tourism in Israel. Data from the Global Terrorism Database on the number of terrorist attacks and the Bank of Israel on the number of tourist arrivals have been used to construct a multivariate vector autoregression (VAR) model. The data has been employed in a monthly format from January 2002 until December 2017. After transforming the variables where needed a VAR(2) model including two lags of the number of terrorist attacks and two lags of the number of tourist arrivals is preferred. This model indicates that there is a negative effect of terrorism on tourism and that this can be approximated by a 433 decrease in tourist arrivals compared to the previous month following a month after the attack. The effect is persistent up to 5 months characterized by a bounce-back effect. Furthermore, Granger causality tests indicate a one-sided influence of terrorism on tourism. Robustness tests strengthen the tendency of the result found in the research but point towards the importance of big terroristic events. The economic costs of terrorism should therefore also include any effects on lost tourist visits.

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Introduction

Contemporary history has shown many events related to terrorism impacting nations, societies and the daily lives of many people. The 9/11 attacks, terrorist groups in Africa, shootings in Paris, civil wars and uprisings in the Middle East and the recent shooting in Christchurch New Zealand are only but a few instances of terrorist incidents that can be driven by religious, political or social revolutionary motives. The effects on security, stability and social coherence seem to be straightforward and are often highlighted in popular media sources and public image building (Institute for Peace and Economics, 2018). If the influence of terrorism is however not limited to the destruction of a social order but also has an impact on the actual performance of the economy, it could even be a more dangerous source of violence.

This paper will consider the case of the State of Israel. After acquiring independence in 1948 the country has experienced a tremendous amount of violence and terrorism having its roots in the long-lasting conflict between Israel and the Palestinian territories. The predominantly Jewish majority in Israel and the Arab majority living in the Palestinian territories have on both sides justified violence in order to try to influence political decisions and harm the social structures. The presence of holy grounds such as Jerusalem, Bethlehem and Hebron only complicates matters as different religious groups claim possession of these grounds. Together with the fact that all neighboring countries have shown their disagreement with the founding of the State of Israel this creates a hotbed for violence and terrorism within and against the only democracy and non-Arab state in the Middle East.

As Israel has experienced a violent history influenced by destructive terror it is of utmost importance to protect the country against further attacks and threats in the region (Amidror, 2010). Due to the severity of the terrorist threat mainly security and stability are considered when evaluating the influence of terrorism on the country. Israel therefore serves as an interesting case to consider the economic impact of terrorism. The presence of popular heritage as well as well-known religious places attracting large flows of tourists and pilgrims make Israel an attractive tourist destination. Estimates from 2000-2013 indicate that the tourist sector comprised an average share of around 2-3% of GDP and providing employment for about 3% of the Israeli working population (The Central Bureau of Statistics, 2015). If tourists respond to terrorism by avoiding Israel as a holiday destination and substituting it for another country this might have an influence on the tourist sector and therefore on the Israeli economy. This research will therefore focus on the following research question:

“What is the effect of terrorism on the number of tourists entering Israel?”

The results of this inquiry are scientifically relevant as it extends the literature that currently exists on the impact of terrorism on different aspects of academia. Existing research has focused on macroeconomic growth (Blomberg, Hess & Orphanides, 2004; Eckstein & Tsiddon, 2004), international trade (Nitsch & Schumacher, 2004) and Foreign Direct Investment (Enders & Sandler, 1996). The impact of terrorism on tourism has already been analyzed using ARIMA modelling (Enders, Sandler & Parise, 1992). For the case of Spain, a vector-autoregression (VAR) approach has been used in the literature (Enders & Sandler, 1991). This analysis will use a slightly adjusted VAR model with a different focus on the data for which a significant negative effect of terrorism on tourism has been found for the case of Israel.

This paper also has a distinctive social relevance as it allows the results to be used for policy considerations and advice. The results indicate what the impact of terrorism is beyond the social disorder that it generates and therefore contributes to a further understanding of the impacts of terrorism. Government agencies and intelligence services can use the results while developing strategies in handling terrorism and counterterrorism in order to protect their citizens against the threat of violence that is also shown to have a significant impact on the tourist sector. It will also shed a light on the tourist responses that can be expected after a terrorist attack which can be valuable for travel agencies to develop strategic and marketing policies.

The paper continues with a description of the data that will be employed and the sources from which the data has been acquired. Thereafter, summary statistics will be presented followed by a detailed discussion of the econometric techniques and methodology used. The results will subsequently be provided together with robustness tests after which the research will be concluded and a suggestion for further research will be given.

Literature Review

As has already been briefly mentioned in the introduction, the literature regarding the economic consequences of terrorism encompasses a wide variety of subjects that have been investigated in their relation to terrorism. On the consequences of macroeconomic growth, a significant negative effect on growth has been found, together with a redirection of economic activity away from investment spending and towards government spending by Blomberg, Hess and Orphanides (2004). For the case of Israel, Eckstein and Tsiddon (2004) have found that terrorism significantly decreased consumption by about 5% and that terroristic events help explain the observed patterns in the Israeli business cycle. Over specific time periods, terrorism has caused the output per capita to be 10% lower than it could have potentially been.

In relation to international trade, Nitsch and Schumacher (2004) have applied an augmented gravity model to investigate the effects of terrorism on trade volumes. Terrorism and large-scale violence have been associated with a decrease in bilateral trade of 4%. Heo (1999) has shown that defense spending in the context of the conflict with North Korea has decreased exports for South Korea thereby having negative effects for the overall economy.

Apart from physical trade relations, also the scope relation to Foreign Direct Investment (FDI) might be effected by terrorism. Research by Enders and Sandler (1996) has shown that terrorism had a significant negative impact on the foreign investment inflows in Greece and Spain due to a reduced confidence in these countries. Abadie and Gardeazabal (2003) find a 10 percentage point reduction in the investment position of the Basque country which can be attributed to the plagued nationalist terrorism that it experienced.

Another factor that might be heavily influenced by terrorism and which is also the scope of this research paper is tourism. Enders, Sandler and Parise (1992) have found large losses in tourist revenue for Greece, Italy and Austria amounting to $16 billion in present value terms related to terrorist attacks since the 1970s. For the case of Spain, Enders and Sandler (1991) found a significant negative impact on tourist arrivals due to the impact of terrorist attacks. Drakos and Kutan (2003) also find a reduction in tourist arrivals for Greece, Turkey and Israel and indicate that substitutability between these countries results in spillover effects.

Data

In order to analyze the relationship between terrorism and the number of tourists entering Israel it is necessary to use clear measures for both factors. This research will use the Global Terrorism Database that has been set up by the University of Maryland. Researchers from this university obtained a large database that was originally collected by Pinkerton Global Intelligence Services. Trained researchers at Pinkerton, the majority being retired Air Force employees, were asked to identify and record terrorist accidents from numerous information sources in order to perform risk analyses for clients doing business with Pinkerton. From 1970 until 1997 the database has been under Pinkerton control and terrorist attacks were added to the database on an ongoing basis. The institution used a specific definition of terrorism to establish a baseline that classified incidents as having terrorist motives. An attack is considered to be terroristic in nature when the aim is to obtain a political, economic, religious, or social goal. In addition, the attack has to fall outside of the context of legitimate warfare activities thereby excluding state-actors. Finally, the attackers must have the intention to convey a message to an audience larger than the immediate victims (Global Terrorism Database, 2018). Ambiguous cases, for which it is unclear whether or not they met all the criteria, were included as tourists might consider them as terrorism. Due to an office move the data from the year 1993 have been lost and could never been fully recovered.

In 2006 the National Consortium for the Study of Terrorism and Responses to Terrorism (START) received funding to extend the Global Terrorism Database. As the database had not been updated after 1997, the researchers now had to update the database on the basis of archival documents on terrorist attacks instead of recording incidents immediately after they occurred. In order to correct for the possible complications that can arise because of the unavailability of reliable archival data or incomplete information the researchers started to expand the database and include variables specifying the source that the information has been taken from, the potential motivation of the attack, the victims of the attack, the weapons used in the attack and further specifications that describe all the information about a specific terrorist attack in detail. The information and media sources that have been used also expanded in order to test the reliability of these sources and to include a complete amount of observation. Machine learning has recently been attached to the database in order to track all information on terrorist incidents which have been added to the database after a reliability check by the researchers.

The final dataset thus comprises a complete overview of terrorist attacks from the years 1971 until 2017. The sample of Israel contains data from 1971 until 2017 with the exception of 1993 as previously mentioned. In the analysis that will follow, the number of terrorist attacks has been taken as the proxy for terrorism. Using the number of terrorist attacks per month allows us to examine the impact of these accidents on the confidence factor that plays an important role in deciding whether to go on holiday in a certain country. For this reason the number of terrorist attacks is the most credible factor that can influence tourism to Israel as media or information reporting about these attacks can have a deterring influence on deciding to go to a specific holiday destination. Not every terrorist attack causes people to be wounded or killed meaning that the number of victims of terrorist incidents could largely misreport the influence that a terrorist attack can have on number of visiting tourists of a country. Due to the limited availability of monthly tourist arrival data only from 2002 onwards, the monthly number of terrorist attacks in 2002 until 2017 in Israel will be used as the terrorism variable in the analysis.

Data on tourist arrivals has been taken from the Bank of Israel (2019). Monthly data on the number of tourist arrivals is available from 1985 onwards. This database is build up of basic data that is acquired from the Central Bureau of Statistics and is seasonally adjusted by the Bank of Israel. At the same time, the Israel Ministry of Tourism (2019) publishes statistical reports on a yearly basis from 2002 onwards containing first hand recorded data on tourist arrivals. In order to ensure that the data used for this research is robust in its definition and seasonally adjusted to filter out predictive yearly tourist patterns data from January 2002 until December 2017 will be used. This ensures that the time series has the same time range as the series for terrorism and that the data is truly the correct data for tourist arrivals as it can be compared to the data of the Israel Ministry of Tourism.

As a definition of tourists, the Central Bureau of Statistics (2017) uses: “Visitors with a foreign passport, who enter Israel under a tourist visa and leave it on a date other than the entry date (not the same day); does not include immigrants, immigrant citizens, potential immigrants, foreign workers, and day visitors”. This description fits well with the objective of this research as day visitors are not included in the tourist arrival data. A large share of the day visitors to Israel are cruise passengers who have no sovereignty over the destinations their cruise ship will visit. Furthermore, travel agencies offering cruises may decide not to avoid Israeli territory as their guests sleep aboard of the cruise ship which might have a less deterring effect for their passengers. Recognizing the strict security policy of the State of Israel it is unlikely that there are any significant misreports concerning the number of tourists arrivals in Israel.

It is common practice in tourist data to use a seasonal adjustment of the data; such as has been applied to Spanish tourism by Sutcliffe and Sinclair (1980). By filtering out this recurrent seasonality which is often highly visible in tourist data the analysis will not be biased by explaining recurrent cycles of tourist arrivals. The adjusted data for the case of Israel has been adjusted for important Jewish holidays which attract high numbers of tourists visiting family as well as the international holiday seasons and vacation periods. Structural breaks have also been identified with the significant ones appearing after July 2006 and July 2014. The seasonally adjusted data for these periods were estimated after the time series data were adjusted to the low levels obtained during the first months of these mentioned breaks and applying Henderson's method for the estimation of a trend (Central Bureau of Statistics, 2017). The method for seasonal adjustment that has been applied is based on the X-12-ARIMA method (Findley, Monsell, Bell, Otto & Chen, 1998). The adjusted data will serve as a valid representation of tourist numbers and can be applied in a meaningful analysis of the effect of terrorism on tourism in Israel.

Summary Statistics

Table 1 reports summary statistics of the variables incorporated in the research. The average number of tourist arrivals in Israel from January 2002 until December 2017 is 220893 per month. As the data has been seasonally adjusted there are no big fluctuations around specific months each year. However, an increasing trend throughout the years can be observed with a considerable stable period between 2010 and 2014 as displayed in graph 1. The number of terrorist attacks shows a more irregular pattern with large differences between the months under investigation (graph 1). On average Israel experiences 5 to 6 terrorist attacks per month between January 2002 and December 2017, with some months experiencing no attacks while others count more than 10. The number of attacks appears to have a less systematic trend and seems to fluctuate around a mean different from zero.

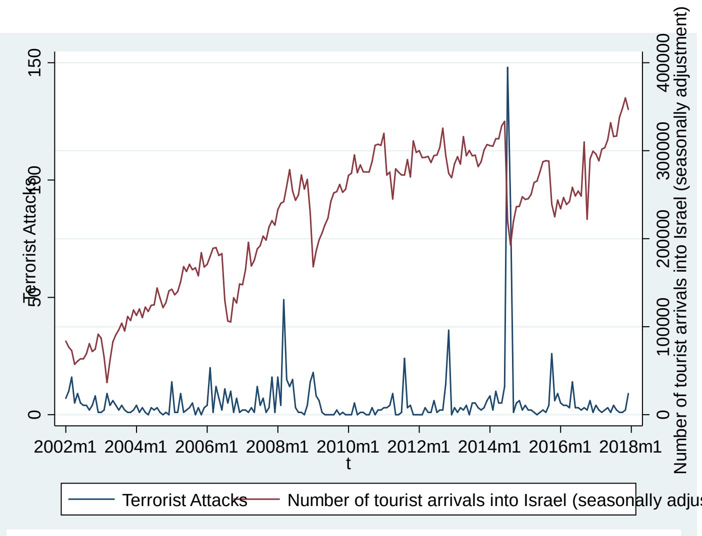
The development of tourism flows contains numerous ups-and-downs which can be related to specific events. For example, the downturn observed around mid-2006 will likely be related to the Lebanon War which started in July 2006 and was an eruption of violence between Hezbollah and the Israeli Defence Forces (IDF). A drop in the number of tourist arrivals in 2008-2009 can be related to the Great Recession which depressed worldwide economic development and tourism strengthened by the Gaza War which started in 2008 and continued until 2009. In the same way, the 2014 drop could be influenced by the start of Operation Protective Edge which resulted in Israeli forces invading the Gaza Strip under Hamas rule increasing the political instability in the region.

Graph 2 shows the development of terrorist attacks in Israel and shows a different pattern compared to the development of tourist arrivals. As seems to be valid, the number of terrorist attacks does not follow a specific trend or pattern but a more random evolution. Spikes in the number of terrorist attacks can be observed around years of increased political instability. Around 2008-2009 the attacks by Hamas during and in the aftermath of the Gaza resulted in the number of terrorist attacks increasing rapidly. The same pattern can be seen at the end of 2012 when the IDF started the operation Pillar of Defence in response to Hamas rocket fire attacks in the Negev which considerably increased the number of terrorist incidents. The biggest jump can be seen in 2014, exactly the time when the Operation Protective Edge started and the violence from Hamas and related terrorist activities against Israel surged and a period of rocket attacks followed.

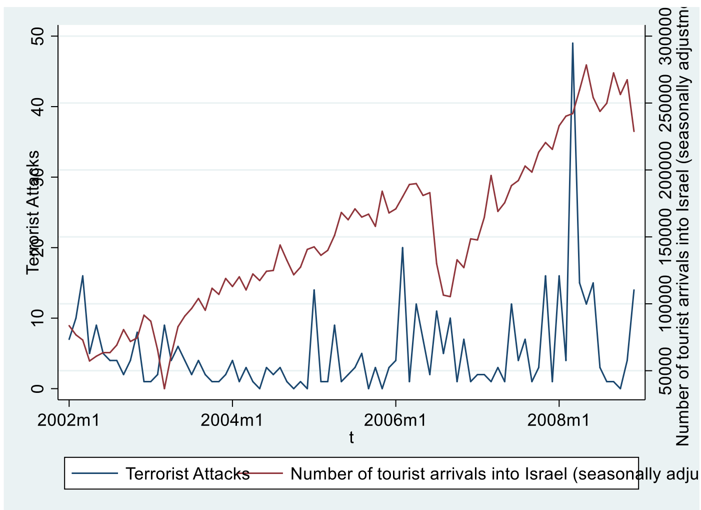
A mostly negative correlation between the amount of terrorist attack and the number of arriving tourists can be observed in Graph 1. The amount of terrorist attacks before 2008 appears reasonably constant as the scale of the second y-axis is not adapted to smaller fluctuations. Graph 2, only shows the plots between 2002 and 2008, highlighting the smaller fluctuations in the number of terrorist attacks, which appear to move in the opposite direction from the number of tourist arrivals.

Table 1. Summary Statistics

Variable	Observations	Mean	Std. Dev.	Minimum	Maximum
Tourist_arrivals	192	220892.6	79901.7	36580	359945
Terr_Attacks	192	5.615	13.439	0	148



Graph 1. Monthly time series plot of the number of terrorist attacks and the number of visitors entering Israel from January 2002 until December 2017



Graph 2. Monthly time series plot of the number of terrorist attacks and the number of visitors entering Israel from January 2002 until December 2008

Methodology

Existing research on the influence of terrorism on tourism for Israel has employed numerous techniques of which time series analysis is also an often used method. These analyses are however restricted to the use of univariate models (Pizam & Fleischer, 2002; Drakos & Kutan, 2003; Karl, Winder & Bauer, 2016). This research is unique in that it applies a multivariate model to the case of Israel. As in Enders and Sandler (1991) this paper uses monthly data on terrorist attacks and tourist arrivals but not limiting terrorism to transnational terrorism and therefore including aggregate terrorist acts in the analysis. In order to investigate the interrelatedness of these two time series this research will perform a vector autoregression analysis (VAR). The availability of monthly data is suitable for a dynamic analysis as responses can be quickly visible in the data due to the small time span in the time series. The estimation of a system of equations will provide a realistic model in which the two series co-determine each other and lagged values can be tested for their persistent effects. Therefore, this econometric technique allows for the influence of preceding months of both series to be present in the methodology used in this research.

To be able to use the variables in a VAR model they need to satisfy the assumption of stationarity. Dickey-Fuller tests are used to test the stationarity of both variables that will be included in the analysis that will follow. Autoregressive models up to 30 lags have been constructed for both variables to determine the lag length to be included in the Dickey-Fuller tests using the Akaike information criterion (AIC). A period of 2,5 years, or 30 lags, has been used to test the models to ensure a broad bandwidth when building the autoregressive models.

As previously mentioned, the variable of tourist arrivals shows an upward trend meaning that a Dickey-Fuller test including a trend will be performed while the number of terrorist attacks will be treated as fluctuating around a mean which is different from zero (graph A.1. & A.2.). An autoregressive model including six lags has the lowest AIC for the number of terrorist attacks while two lags gives the lowest AIC for the number of tourist arrivals meaning that the Dickey-Fuller tests will be performed including these amounts of lags per variable. As an extra robustness check the variables have also been tested using 12 lags in the Dickey-Fuller tests as it is common to test for year-round autocorrelation when using monthly time series data. The results of the tests can be found in the appendix tables B.1. until B.6.

The results show that the number of terrorist attacks is a stationary variable while the number of tourist arrivals is non-stationary. Therefore, first difference of the number of tourist arrivals will be taken and included in another Dickey-fuller statistic to check if the variable is stationary after the transformation. Considering appendix plot A.3. the values fluctuate around a mean of zero meaning that a Dickey-Fuller test excluding the constant is justified. Testing autoregressive models of the variable up to 30 lags gives the lowest AIC for a model including one lag of the differenced variable of tourist arrivals. Appendix tables B.7. up to B.9. indicate that the first difference of the number of tourist arrivals ensures that the data is stationary and can be employed in a time-series analysis. Robustness tests for up to 12 lags provide the same evidence.

Only the variable of tourist arrivals will be used as a first difference to ensure stationarity and the variable of terrorist attacks will be kept its original levels specification to not transform the data beyond necessity. Therefore, the two stationary variables will be employed in the multivariate VAR model of the following form:

$$\text{Terr\_num}_t = \alpha_{10} + \sum_{i=1}^{n}(\beta_{11i}\text{Terr\_num}_{t-i} + \beta_{12i}\Delta\text{Tourist\_num}_{t-i}) + \epsilon_{1t} \tag{1}$$

$$\Delta\text{Tourist\_num}_t = \alpha_{20} + \sum_{i=1}^{n}(\beta_{21i}\text{Terr\_num}_{t-i} + \beta_{22i}\Delta\text{Tourist\_num}_{t-i}) + \epsilon_{2t} \tag{2}$$

where Terr_num_t represents the monthly number of terrorist attacks and $\Delta\text{Tourist\_num}_t$ the first difference of the monthly number of tourist arrivals in Israel. Furthermore, α_{10} and α_{20} indicate the constant terms of the regression represented by the 1 x 12 vectors containing a constant and 11 seasonal monthly dummy variables. The betas, represented by β_{xyi}, indicate the partial effect of the i^{th} lag of variable y on variable x and ε_{1t} and ε_{2t} being the error terms of the respective regressions. The amount of lags n to be included in this VAR model will be established using the AIC.

When constructing a VAR it is important to assess the validity of the model by investigating the stability and the autocorrelation of the residuals. Checking the eigenvalue stability condition and using a Lagrange multiplier test allows for the assessment of these criteria. A stable VAR model ensures that the variables included are covariance stationary and therefore validly handled by the model. Autocorrelation, on the other hand, occurs when the error terms in a regression are correlated, rendering it non-random. Therefore, autocorrelation leads to an obvious omitted variable bias that weakens the validity of the estimated VAR model. The Lagrange multiplier test will be performed to test for autocorrelation in the residuals of the estimated VAR model using a 12 month lag length as has also been done in the Dickey-Fuller tests to ensure the robustness of the results.

After an assessment of the validity of the VAR model, it can be used to perform Granger Causality Wald tests to determine the predictive value of the variables employed in the analysis. In this way it is possible to evaluate the direction of the relationship between terrorism and tourism as it might be possible that both variables influence each other in both ways; more tourism could have an influence on terrorism as well as vice versa. A Granger Causality test can formally investigate the predictive power of each variable in an equation of the VAR system making it a variable test in the light of this paper.

An Impulse Response Function will also be estimated using the results of the VAR model employed. To be able to construct this function, the following moving average representation of equations (1) and (2) will be used:

$$\text{Terr\_num}_t = C_0 + \sum_{i=1}^{\infty}(C_{1i}\epsilon_{1t-i} + C_{2i}\epsilon_{2t-i}) + \epsilon_{1t} \qquad (3)$$

$$\Delta\text{Tourist\_num}_t = D_0 + \sum_{i=1}^{\infty}(D_{1i}\epsilon_{1t-i} + D_{2i}\epsilon_{2t-i}) + \epsilon_{2t} \qquad (4)$$

where C_0 and D_0 are the vectors containing the constants and the 11 seasonal monthly dummies. In the same logic as in the specification of the VAR model, C_{1i} , C_{2i}, D_{1i} and D_{2i} are the parameters indicating the influence of the specific equation on lagged values of the error terms ε_{1t} and ε_{2t} taken from the VAR model as specified in equations (1) and (2) and used as variables in the moving average representation above. The resulting impulse response functions sketch a dynamic interpretation of a one-time shock to one of the variables employed in this research and their persistence in the multivariate VAR model.

Results

The first step in the described order of analysis is the construction of a VAR model for the monthly number of terrorist attacks in Israel and the first difference of the monthly number of tourist arrivals in Israel. 30 lags have been tested for the selection of the AIC information criterion of the VAR models to ensure consistency with the lag selection procedure employed for the Dickey-Fuller tests. Appendix table B.10. reports the AICs for the VAR(p) models and indicates that the lowest value can be found at two lags meaning that the preferred model is a VAR(2). Table 2 shows the results that are obtained from this model. The first lag of the number of terrorist attacks has a significant positive impact on the current number of terrorist attacks ($p = 0.000$) while the number of tourist arrivals has no significant impact on terrorism. At the same time, the first lag of the number of terrorist attacks has a significant negative impact on the first difference of tourist arrivals ($p=0.001$) while the second lag of the number of terrorist attacks has a significant positive effect on tourist arrivals ($p=0.016$). The first lag of the first difference of tourist arrivals also indicates a significant negative relationship ($p=0.000$). These results indicate that terrorist attacks appear to have a significant influence on the current number of tourist arrivals compared to last month as approximated by the difference estimator of tourist arrivals.

Table 2. VAR(2) model of the number of terrorist attacks and the first difference of the number of visitors entering Israel (N=189)

Terrorist Attacks	Coefficient	P-score
Lag Terr_num	0.467*** (0.083)	0.000
Lag2 Terr_num	-0.094 (0.079)	0.234
Lag d_VisitorsintoIsrael	0.000 (0.000)	0.918

Lag2 d_VisitorsintoIsrael	0.000 (0.000)	0.174
Constant	3.347*** (1.074)	0.002
First difference of the number of visitors entering Israel	Coefficient	P-score
Lag Terr_num	-433.879*** (127.237)	0.001
Lag2 Terr_num	291.920** (121.125)	0.016
Lag d_VisitorsintoIsrael	-0.309*** (0.082)	0.000
Lag2 d_VisitorsintoIsrael	-0.036 (0.082)	0.661
Constant	2740.009* (1652.231)	0.097

In order to assess the VAR(2) model of its validity to employ it in further analyses appendix tables B.11. and B.12. report the results of an Eigenvalue stability test and a Lagrange-multiplier test for autocorrelation of the residuals. The modulus of each eigenvalue is strictly less than 1 meaning that the model satisfies the eigenvalue stability condition. Furthermore, no significant autocorrelation of the residuals has been detected rendering the VAR(2) model as valid for interpreting its coefficients and performing further analyses based on it.

Table 3 contains the results of a Granger causality Wald test performed after constructing the VAR(2) model. The first test shows that there is no statistical evidence against the null hypothesis that the first difference of the number of visitors entering Israel Granger causes the number of terrorist attacks (*p=0.378*). However, the second test indicates that this null hypothesis can be rejected and therefore that the number of terrorist attacks Granger causes the change in tourist numbers in this month compared to last month. This provides evidence for a one-directional influence of terrorism on tourism as the number of terrorist attacks is a significantly useful predictor for tourism arrivals while tourism arrivals are not significantly useful in modelling terrorist attacks. Therefore, equation (2) is a robust regression of tourism on the lagged values of terrorism and tourism in the context of this VAR(2) model.

Table 3. Granger Causality Wald tests based on a VAR(2) model of the number of terrorist attacks and the first difference of the number of visitors entering Israel (N=189)

Equation	Excluded	X^2 test statistic	P-score
Terrorist Attacks	First difference of the number of visitors entering Israel	1.946	0.378
First difference of the number of visitors entering Israel	Terrorist Attacks	13.668	0.001

Impulse response functions have been obtained from the model as can be seen in appendix graphs A.4. and A.5. where plots of the functions are provided. A month following a terrorist attack immediately decreases the number of tourist arrivals compared to last month which increases again in the second period after the one-time shock in terrorism. This increase in tourist arrivals is followed by a decrease in the periods afterwards converging towards 0 in approximately 5 months. A negative effect of terrorism is therefore to be expected up to 1,5 month after a terrorist attack and having no significant influence after 5 months. Plot A.5.

shows a robustness test for an impulse in tourism and shows that the 95% confidence interval for terrorism does not fall outside the value of 0 therefore having no significant impact on terrorist attacks.

Robustness Tests

As depicted in graph A.1. the number of terrorist attacks has a peak around July and August 2014 related to operation Protective Edge and its impact on the safety in the region. Therefore, the results that have been obtained in the previous section can in part be driven by the effects generated around this specific time span. They inevitably contributed to the consequences that were experienced by the tourist industry which make it unreasonable to remove them from the sample used in the analysis. In order to test the robustness of the results as they have been obtained from the full sample, the analysis will be repeated using a sample from January 2002 until December 2013 to investigate whether the periods before the major wave of terrorism as experienced in 2014 provide similar results. Eigenvalue stability tests and the Lagrage Multiplier tests will be omitted as the sole purpose is to test whether the exact same VAR(2) model yields the same results when applied to a reduced time series of the total sample.

Appendix table B.14. report the results generated by a VAR(2) model using the reduced sample size. The coefficients in the equation for tourism show the same tendency; negative effect of the first lag of terrorism and a positive effect at the second lag of terrorism. However, the coefficients have lost their significance in the reduced sample. Also, Granger causality tests do not reject the null hypothesis of no Granger causality for both of the variables, likely due to the insignificant effects found by the coefficients, which is different from the results found in the full sample (Table B.15.).

A representation of the impulse response function of a one-time shock of terrorism as shown in appendix table A.6. indicates the tendency that has been seen in the other robustness tests; the shape of the impulse response function with firstly a decline in tourism while thereafter a jump can be observed which bounces back and fades away in approximately 5 months is similar to the analysis involving the complete sample but the 95% confidence interval contains the value of 0 therefore not resulting in any significance in the analysis.

As the robustness tests presented in this section have shown, a repeated analysis employing the same VAR(2) model for a subsample yields results which indicate a similar pattern as the analysis based on the complete sample but are not statistically significant. This does not undermine the results obtained in the full analysis but points to the importance of big terroristic events in relation to tourism, being the Gaza conflict in the full sample used.

Conclusion

This paper reports on the relationship existing between the number of terrorist attacks in Israel from 2002 to 2017 and the corresponding change in the number of tourist arrivals in the country. The design of this paper was aimed at obtaining the best suited VAR model describing this dynamic relationship. A VAR(2) model with two lags of the number of terrorist attacks and two lags of the change in tourist arrivals compared to the month before reported the lowest AIC of 30.423, rendering it the most applicable. A negative correlation on the first difference of tourist arrivals was found for the lagged number of terrorist attacks and a positive effect was found for the second lag of the number of terrorist attacks that appears to be related to a bounce-back effect as displayed by the estimated impulse reponse functions. The effects of a terrorist attacks appear to be persistent until 5 months after the attack. Furthermore, terrorism proved to be a valuable predictor to be taken into account when analyzing tourist arrivals in Israel. Robustness tests have shown that it is likely that big terroristic events drive the effects found by this research, being the consequences of Operation Protective Edge in the sample used.

In answering the research question the next month's effect of every terrorist attack is a decrease of approximately 434 tourist arrivals in Israel compared to the previous month. With Israel suffering 5 to 6 terrorist attacks on average per month, this would amount to an average loss in the absolute growth of tourist arrivals of 2172 to 2604 following the month after the tourist attacks.

In terms of policy implications, this paper highlights a possible un-, or under-analyzed cost to terrorism which might justify increased spending on national security, especially in Israel where terrorism is a frequent occurrence. Incurred costs on counter-terrorism might be offset by the potential gains generated by tourist arrivals to the country.

As tourist arrivals are determined by a wide range of factors this research only addresses the threat terrorism can impose on it. This analysis is therefore too simplistic to capture all the effects of terrorism on tourism as numerous other domestic factors such as the price level of accommodation, the political situation, the accessibility of the country for tourists and the influence of government regulation might also have a strong influence. As there are no controls that have been included in the VAR model there is an obvious omitted variable bias that limits the results of this research to approximations rather than the establishment of causal relations.

Future research can apply control variables to the VAR model to try to isolate the effect of terrorism on tourism. Furthermore, if comparable data for a longer time span is available the analysis could be repeated over a longer time-span as well as test the influence of specific types of attacks on tourist numbers. In addition, the effect in other countries can be considered and compared. Signs of causality can be strengthened by the use of an instrumental variable. Interdisciplinary research might also be able to provide a bigger picture concerning terrorism constructing a bigger scope for the economic effects of terrorist incidents.

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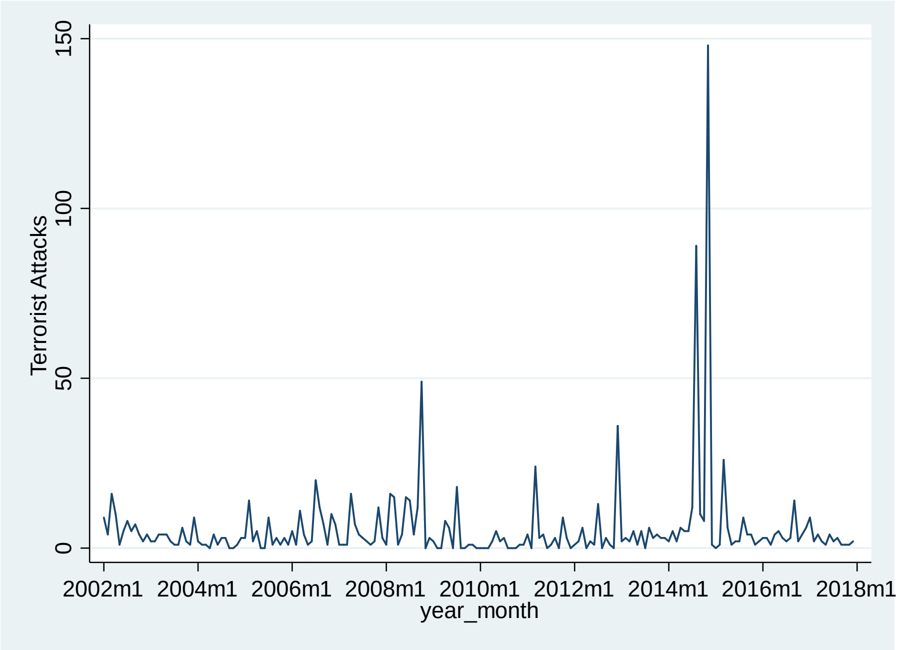
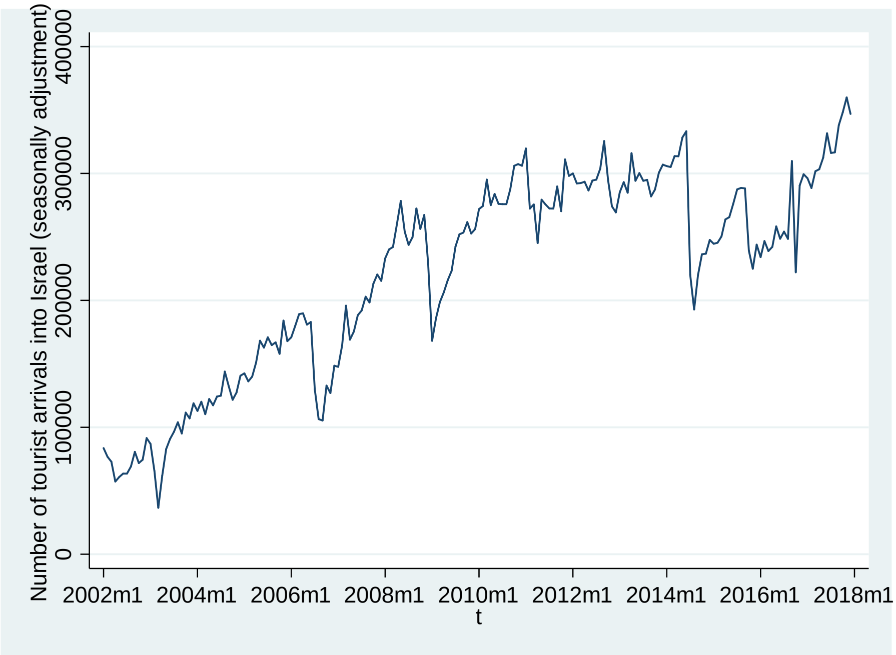
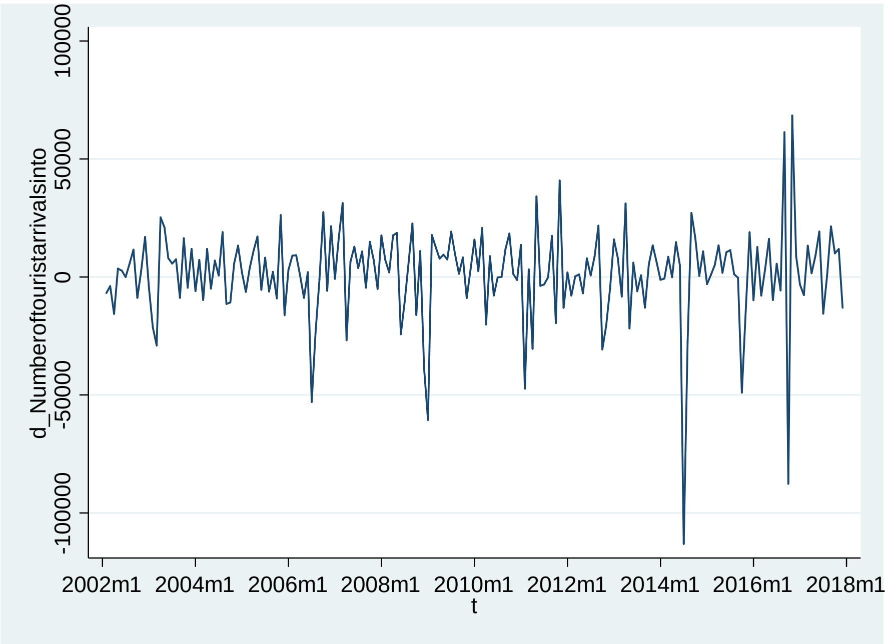
Appendix A



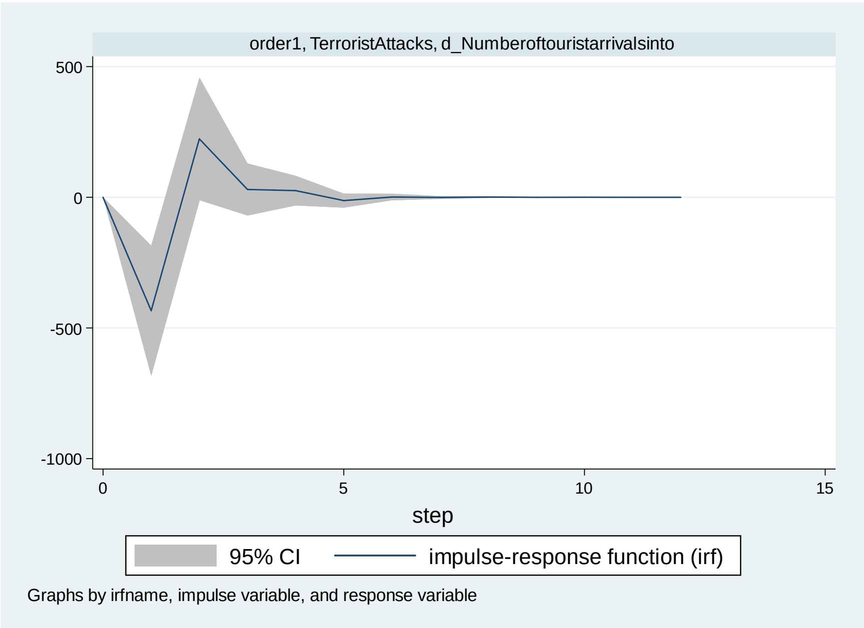
Graph A.1. Monthly time series plot of the number of terrorist attacks in Israel from January 2002 until December 2017



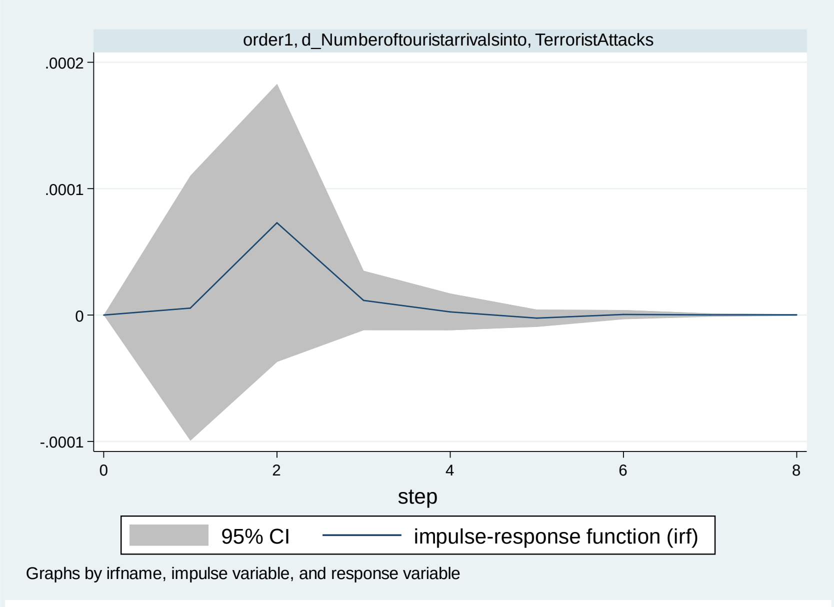
Graph A.2. Monthly time series plot of the number of tourists entering Israel (seasonal adjustment) from January 2002 until December 2017



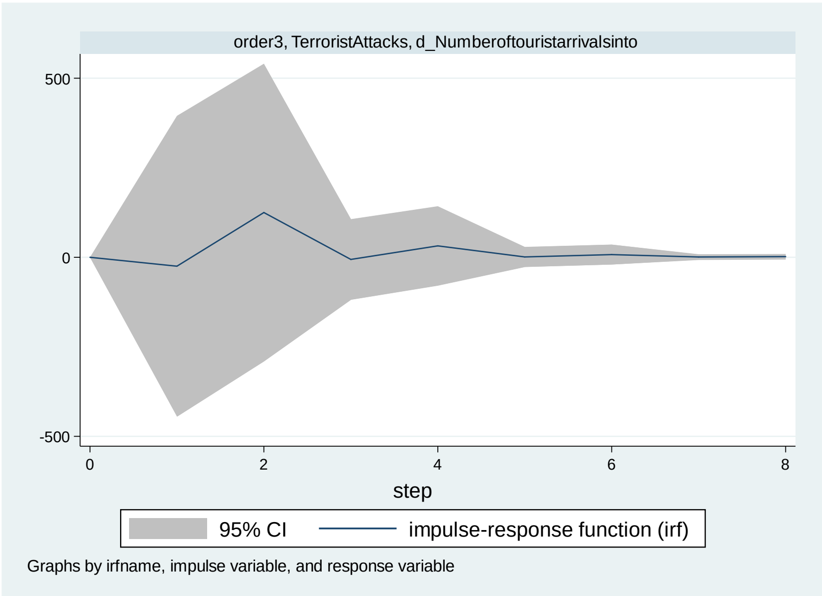
Graph A.3. Monthly time series plot of the first difference of the number of visitors entering Israel from January 2002 until December 2017



Graph A.4. Line plot of the impulse-response function (irf) of terrorism on tourism based on a VAR(2) model of the number of terrorist attacks and the first difference of the number of visitors entering Israel from January 2002 until December 2017



Graph A.5. Line plot of the impulse-response function (irf) of tourism on terrorism based on a VAR(2) model of the number of terrorist attacks and the first difference of the number of visitors entering Israel from January 2002 until December 2017



Graph A.6. Line plot of the impulse-response function (irf) of terrorism on tourism based on a VAR(2) model of the number of terrorist attacks and the first difference of the number of visitors entering Israel from January 2002 until December 2013

Appendix B

Table B.1. AICs for AR(p) models of the variable TerroristAttacks (N=162)

Lag	AIC	Lag	AIC	Lag	AIC	Lag	AIC
0	8.198	10	8.139	20	8.244	30	8.336
1	8.210	11	8.151	21	8.257		
2	8.222	12	8.154	22	8.269		
3	8.111	13	8.165	23	8.276		
4	8.109	14	8.177	24	8.281		
5	8.121	15	8.189	25	8.294		
6*	8.104	16	8.201	26	8.297		
7	8.115	17	8.214	27	8.309		
8	8.126	18	8.225	28	8.321		
9	8.127	19	8.237	29	8.332		

Table B.2. Dickey-Fuller test (nonzero mean, 12 lags) for unit root for the variable TerroristAttacks (N=179)

	Test Statistic	1% Critical value	5% Critical value	10% Critical value
(t)	-3.698	-3.484	-2.885	-2.575

Table B.3. Dickey-Fuller test (nonzero mean, 6 lags) for unit root for the variable TerroristAttacks (N=185)

	Test Statistic	1% Critical value	5% Critical value	10% Critical value
(t)	-4.619	-3.482	-2.884	-2.574

Table B.4. AICs for AR(p) models of the variable VisitorsintoIsrael (N=162)

Lag	AIC	Lag	AIC	Lag	AIC	Lag	AIC
0	24.837	10	22.752	20	22.833	30	22.856
1	22.701	11	22.761	21	22.841		
2*	22.687	12	22.770	22	22.850		
3	22.699	13	22.782	23	22.828		
4	22.702	14	22.778	24	22.838		
5	22.714	15	22.789	25	22.837		
6	22.719	16	22.797	26	22.842		
7	22.731	17	22.809	27	22.848		
8	22.743	18	22.816	28	22.837		
9	22.743	19	22.826	29	22.844		

Table B.5. Dickey-Fuller test (trend, 12 lags) for unit root for the variable VisitorsintoIsrael (N=179)

	Test Statistic	1% Critical value	5% Critical value	10% Critical value
(t)	-2.061	-4.014	-3.439	-3.139

Table B.6. Dickey-Fuller test (trend, 2 lags) for unit root for the variable VisitorsintoIsrael (N=189)

	Test Statistic	1% Critical value	5% Critical value	10% Critical value
(t)	-2.880	-4.010	-3.438	-3.138

Table B.7. AICs for AR(p) models of the variable d_VisitorsintoIsrael (N=161)

Lag	AIC	Lag	AIC	Lag	AIC	Lag	AIC
0	22.729	10	22.771	20	22.852	30	22.845
1*	22.706	11	22.780	21	22.860		
2	22.717	12	22.791	22	22.841		
3	22.716	13	22.787	23	22.850		
4	22.727	14	22.799	24	22.852		
5	22.730	15	22.806	25	22.860		
6	22.742	16	22.819	26	22.870		
7	22.755	17	22.827	27	22.853		
8	22.753	18	22.837	28	22.862		
9	22.761	19	22.845	29	22.873		

Table B.8. Dickey-Fuller test (noconstant, 12 lags) for unit root for the variable d_VisitorsintoIsrael (N=189)

	Test Statistic	1% Critical value	5% Critical value	10% Critical value
(t)	-4.467	-2.950	-1.950	-1.615

Table B.9. Dickey-Fuller test (noconstant, 1 lags) for unit root for the variable d_VisitorsintoIsrael (N=189)

	Test Statistic	1% Critical value	5% Critical value	10% Critical value
(t)	-10.816	-2.588	-1.950	-1.616

Table B.10. AICs for VAR(p) models of the variables TerroristAttacks and d_VisitorsintoIsrael (N=161)

Lag	AIC	Lag	AIC	Lag	AIC	Lag	AIC
0	30.681	10	30.750	20	31.034	30	31.083
1	30.431	11	30.789	21	31.066		
2*	30.423	12	30.835	22	31.066		
3	30.465	13	30.861	23	31.110		
4	30.513	14	30.882	24	31.145		
5	30.549	15	30.885	25	31.182		
6	30.578	16	30.926	26	31.217		
7	30.635	17	30.971	27	31.183		
8	30.665	18	31.001	28	31.130		
9	30.709	19	31.019	29	31.146		

Table B.11. Eigenvalue stability test for the VAR(2) model of the number of terrorist attacks and the first difference of the number of visitors entering Israel (N=189)

Eigenvalue		Modulus
-0.4026733		0.402673
0.1192817	0.3496993i	0.369483
0.1192817	-0.3496993i	0.369483
0.3221006		0.322101

Table B.12. Lagrange multiplier test for the VAR(2) model of the number of terrorist attacks and the first difference of the number of visitors entering Israel (N=189)

Lag	Chi-square statistic	P-score
1	2.443	0.655
2	1.854	0.763
3	1.980	0.740
4	0.735	0.947
5	1.648	0.800
6	1.272	0.866
7	1.933	0.737
8	1.890	0.756
9	0.154	0.997
10	2.162	0.706
11	1.460	0.834
12	0.582	0.965

Table B.13. VAR(2) model of the number of terrorist attacks and the first difference of the number of visitors entering Israel from January 2002 until December 2013 (N=141)

Terrorist Attacks	Coefficient	P-score
Lag Terr_num	0.122 (0.084)	0.146

Lag2 Terr_num	0.217*** (0.083)	0.009
Lag d_VisitorsintoIsrael	0.000 (0.000)	0.469
Lag2 d_VisitorsintoIsrael	0.000 (0.000)	0.739
Constant	2.857*** (0.725)	0.000
First difference of the number of visitors entering Israel	Coefficient	P-score
Lag Terr_num	-24.847 (214.173)	0.908
Lag2 Terr_num	125.14 (212.121)	0.555
Lag d_VisitorsintoIsrael	-0.118 (0.087)	0.173
Lag2 d_VisitorsintoIsrael	0.027 (0.087)	0.752
Constant	1359.157 (1852.966)	0.463

Table B.14. Granger Causality Wald tests based on a VAR(2) model of the number of terrorist attacks and the first difference of the number of visitors entering Israel (N=141)

Equation	Excluded	X^2 test statistic	P-score
Terrorist Attacks	First difference of the number of visitors entering Israel	0.713	0.700
First difference of the number of visitors entering Israel	Terrorist Attacks	0.348	0.840