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TERRORISM RISK AND ITS IMPACT ON TOURISM

SHARON REGEV TEITLER • BENJAMIN BENTAL

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Mailing address: Samuel Neaman Institute, Technion City, Haifa 32000, Israel
Phone: 972-4-8292329
Fax: 972-4-8231889
e-mail: info@neaman.org.il
Website : http://www.neaman.org.il/Neaman/

Terrorism Risk and Tourism

Benjamin Bental
Department of Economics
University of Haifa
bbental@econ.haifa.ac.il

Sharon Regev Teitler*

Kinneret College at the Sea of Galilee
sharonregevt@gmail.com

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Terrorism Risk and Tourism

Abstract

Tourism is very sensitive to the occurrence of terror attacks. This stands in stark contrast to the extremely low probability of getting hurt in an act of terror. The study suggests that the high sensitivity of tourists to acts of terror is due to substitution among tourist destinations rather than risk aversion. This conclusion is based on a structural model in which tourists optimally choose among destinations which are potentially subject to terror activity. The parameters of the model are estimated exploiting data pertaining to nine major countries of origin over a period of seven years. The estimated parameters are used to perform some counterfactual experiments which enable us to assess the elasticities of tourism with respect to terror probabilities and visit costs. Furthermore, the welfare loss due to terror is calculated, both to countries of origin and tourist destinations.

1. Introduction

The impact of terrorism on the tourist industry was dramatically demonstrated by the events of September 11, 2001. The World Travel and Tourism Council (WTTC 2002) has estimated that the USA lost 92 billion dollars in travel and tourism, followed by Germany with a loss of 25 billion dollars and the UK with a loss of 20 billion. Another example is provided by Israel. There the number of tourists dropped from 2.4 million in 2000, to 1.2 million in 2001, following the outbreak of the El-Aktza Intifada in October 2000.

The huge impact terror has on tourism stands in contrast to the actual probability of suffering damage due to an act of terrorists, even in places with high levels of terror. For example, the probability of getting hurt by a terror attack in the USA was 0 in 2000, and 0.0000119 in 2001.[1] In Israel, which is regarded as a dangerous destination, the probability was 0.0000292 in 2000 and 0.000175 in 2001. The main purpose of this research is to answer why, despite the small probability of getting hurt by a terror attack, the effect of a potential attack is so big.

We will try to answer this question by applying a standard model of decision making under uncertainty to the choice of destinations by potential tourists. This approach is designed to identify the impact of risk aversion on one hand, and substitution effects among destinations on the other, in order to explain the high sensitivity to events which happen with very low probability.

The theoretical literature concerning the effects of terror is rather sparse. Becker and Rubinstein (2004) tried to find why the impact of terror on tourism seems to be so large, given the small likelihood of a tourist to be affected by a terror event. They extend the usual theory of behavior under risk by introducing “fear” into the utility function. This extension helps explain why the use of terror-stricken transportation modes, such as flights in the US, and buses in Israel, had decreased significantly after terror attacks. Eckstein and Tsiddon (2003) ask why terror impacts everyday life, including tourism. Based on their estimations, the wave of terror in 2002-2003 in Israel caused a 5% decrease in per capita consumption and depressed output per capita by 10% relative to its level absent terror. The model is driven by the assumption that as terror increases, life becomes less certain and shorter on average, which leads to a decreased incentive to save.

[1] The probability is computed as the number of people that got hurt in terror attacks divided by the size of the population in that country.

Empirically, the effect of terrorism on tourism has been extensively studied since the 1980's. Lim (1997) summarized some of those efforts. He surveyed one hundred papers discussing international tourism demand models. Around 60 percent of the papers surveyed contained different qualitative factors including terror or political instability. Unfortunately, the paper does not provide details about the finding of all those studies. Enders and Sandler (1992) found that terrorism (measured as the number of incidents in the country) has a negative effect on tourism and that the effect is externalized, so that an incident in one nation acts to deter tourism in neighboring nations. They also found that tourists do not begin to respond to the terrorist incident until six to nine months later. The reason may be that it takes tourists time to change their plans, whereby last minute cancellations do not qualify for a full refund. Studying the Middle-East, Mansfeld (1996) concluded that not all security events affected the countries in the inner circle (i.e., countries that are part of the Israel-Arab conflict) and those of the outer ring in the same way. The outer ring countries usually enjoyed positive "spill-over" effects, whereby tourists chose to go to those countries instead of going to the inner ring countries. The impact of terror on the "inner ring" countries depended on the level of involvement of any particular country in the event.

None of the aforementioned studies addressed the question as to why the impact of terror on tourism seems to be so large, given the small likelihood that a tourist will be affected by a terror event. To address this question, the current paper develops a model in which countries are assumed to be populated by representative households. In each country, the household chooses the utility-maximizing allocation of income between purchasing a composite tourism good and an all-purpose alternative good. This allocation depends on the riskiness of the composite tourist good. The "tourist good" itself is, in effect, a portfolio composed of a variety of tourist destinations. Each destination is characterized by a probability of experiencing a terror attack which diminishes the utility derived from a visit to the terror stricken destination. Accordingly, the household's choice among the different destinations is affected by the extent to which these unsafe destinations are substitutable by safe ones, as well as by the household's aversion to risk. In such an environment the substitutability of the different potential destinations may potentially explain the seemingly excessive sensitivity to terror events, even with moderate risk aversion.

This theoretical structure is empirically estimated using aggregate yearly data for the years 1998-2004.[2] The study focuses on the USA, Germany, UK, Japan, France, Italy, The

[2] It is not possible to find aggregate data for all the countries in question on a monthly or quarterly basis, let alone individual data. Furthermore, analyzing data on a yearly basis allows us to ignore the effect of seasonality.

Netherlands, Canada, and Belgium as countries of origin. These are the top tourism spenders in per capita terms, among the countries populated by more than 10 million people. As destination countries we use nine countries that suffered from recurring terror attacks: Israel, Egypt, Spain, USA, Turkey, The Philippines, Thailand, Greece and India.

The estimated parameters reveal that the reason for the high sensitivity to events of terror is not the high aversion to risk of the tourists, but the high elasticity of substitution among the different tourist destinations. The model's parameters are used to find the optimal responses of the representative households to some counterfactual scenarios. These experiments reveal that both the own elasticities of tourism with respect to the probability of terror events and to the cost of visiting a given destination are negative and quite large in their absolute value. On the other hand, the cross elasticities with respect to the probability of terror events and the cost of visiting a given destination are zero or small.

Due to its properties, the model can be also used to carry out normative analyses. As an example, the welfare loss of an American representative consumer resulting from a 10% increase in the probability of encountering a terror attack in an aggregate risky tourist destination is estimated to be equivalent to a 0.2% loss in U.S. GDP. On the other hand, the loss of the terror-stricken destination countries due to the same increase in terror probabilities may reach up to 4% of GDP.

The rest of the paper is organized as follows. Section 2 presents the theoretical model, and section 3 describes the data. Section 4 discusses the results and the implication of the results and section 5 summarizes the paper.

2. The Theoretical Model

We consider a country which is populated by a representative household. That household consists of a continuum of members normalized to unity. Every period, the household chooses how many of its members (that is - a fraction of its size of unity) will visit different tourist destinations, and how much of an all-purpose good to consume.

Let s_{ij} denote the "number" of household members residing in country i who visit destination j during a given period. The household derives utility from the *effective* number of visits in destination j. That number depends on the occurrence of an act of terror. Specifically, if no act of terror has occurred, the effective number of visits is just s_{ij}. However, if such an act has occurred, the effective number of visits is δs_{ij}, where $0 < \delta < 1$.

The ex-post utility enjoyed by the household is specified to be:

$$\frac{1}{\beta}\{\sum_{j=1}^{N}(s_{ij}x_j)^{\mu}\}^{\frac{\beta}{\mu}}+\frac{1}{\gamma}\alpha Q_i^{\gamma} \qquad .1$$

where x_j is an indicator taking the value of 1 if no terror event takes place in destination *j*, and δ otherwise, N is the number of destinations in the portfolio, Q_i is the amount of an all-purpose alternative good purchased by the household, α is the weight of the alternative good in the utility, $\frac{1}{1-\mu}$ is the elasticity of substitution between tourist destinations, β-1 is the relative risk aversion parameter, and γ the curvature of utility with respect to the all- purpose good.

The household faces the following budget constraint:

$$\sum_{j=1}^{N}p_j s_{ij}+Q_i=y_i, \qquad .2$$

where y_i is the household's income. The prices p_j denote the per-visit cost at destination *j*. That cost is specified as:

$$p_i=m_i+\phi d_i \qquad .3$$

where m_j is the destination-specific visit cost, d_j is the distance (in miles) between the country of origin and the destination, and ϕ_j is the mileage cost.

2.1 Optimality Conditions

We assume that each tourism destination j has a probability π_j of being affected by a terror event during the period. Assume for now that there are just two potential destinations, where destination 1 may be affected by terror the second destination is safe.[3] Omitting the country of origin index, and substituting the budget constraint, the representative household chooses (non-negative) s_1 and s_2 in order to maximize its expected utility, as follows:

$$\frac{1}{\beta}[\pi((\delta s_1)^{\mu}+s_2{}^{\mu})^{\frac{\beta}{\mu}}+(1-\pi)(s_1{}^{\mu}+s_2{}^{\mu})^{\frac{\beta}{\mu}}]+\frac{1}{\gamma}\alpha[y-((m_1+\phi d_1)s_1+(m_2+\phi d_2)s_2)]^{\gamma} \quad .4$$

The first order conditions are:

$$\frac{\partial U}{\partial s_1}=\pi((\delta s_1)^{\mu}+s_2{}^{\mu})^{\frac{\beta}{\mu}-1}\delta^{\mu}s_1{}^{\mu-1}+(1-\pi)(s_1{}^{\mu}+s_2{}^{\mu})^{\frac{\beta}{\mu}-1}s_1{}^{\mu-1}$$
$$-\alpha[y-((m_1+\phi d_1)s_1+(m_2+\phi d_2)s_2)])^{\gamma-1}(m_1+\phi d_1)=0 \quad .5$$

$$\frac{\partial U}{\partial s_2}=\pi((\delta s_1)^{\mu}+s_2{}^{\mu})^{\frac{\beta}{\mu}-1}s_2{}^{\mu-1}+(1-\pi)(s_1{}^{\mu}+s_2{}^{\mu})^{\frac{\beta}{\mu}-1}s_2{}^{\mu-1}$$
$$-\alpha[y-((m_1+\phi d_1)s_1+(m_2+\phi d_2)s_2)]^{\gamma-1}(m_2+\phi d_2)=0 \quad .6$$

These conditions determine the per capita visits to the different destination (s_i). In order to maximize its utility, the representative household compares the marginal utility gained from adding another unit of s_1 (or s_2) to the marginal cost of that unit in terms of foregone consumption. The two conditions reflect the fact that destination 1's marginal contribution to utility is lower than that of destination 2's, because destination 1 may be hit by an act of terror. In addition, the destinations may differ in their visit-costs.

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[3] For parsimony, the conditions are derived for a two-destination case. Generalization to N destinations is straight-forward.

The empirical approach is to estimate the preference parameters by fitting the appropriate first order conditions to the data.

2.2 Estimation Strategy

The estimation procedure exploits panel data of 7 years and 9 origin countries. We assume that these data were generated by the above model and uses the seemingly unrelated regression structure to estimate the parameters.[4]

To take care of the error term, it is assumed that the relative weight of the all-purpose good in the utility function is a random variable, specified as follows:

$$\alpha = \overline{\alpha} e^{u} \qquad .7$$

with log(u)~N(0,1).

To demonstrate the implementation of the model, we again use the two-destination case. Taking logs, the above first-order conditions (5) and (6) are rewritten here in the following way:

$$\begin{aligned} \log(u) = {} & \log[\pi((\delta s_1)^{\mu} + s_2{}^{\mu})^{\frac{\beta}{\mu}-1} \delta^{\mu} s_1{}^{\mu-1} + (1-\pi)(s_1{}^{\mu} + s_2{}^{\mu})^{\frac{\beta}{\mu}-1} s_1{}^{\mu-1}] \\ & - \log[\overline{\alpha}] - (\gamma - 1)\log[y - ((m_1 + \phi d_1)s_1 + (m_2 + \phi d_2)s_2)] - \log(m_1 + \phi d_1) \end{aligned} \qquad .8$$

$$\begin{aligned} \log(u) = {} & \log[\pi((\delta s_1)^{\mu} + s_2{}^{\mu})^{\frac{\beta}{\mu}-1} s_2{}^{\mu-1} + (1-\pi) * (s_1{}^{\mu} + s_2{}^{\mu})^{\frac{\beta}{\mu}-1} s_1{}^{\mu-1}] \\ & - \log[\overline{\alpha}] - (\gamma - 1)\log[y - ((m_1 + \phi d_1)s_1 + (m_2 + \phi d_2)s_2)] - \log(m_2 + \phi d_2) \end{aligned} \qquad .9$$

.

The estimation package finds parameter values that on average set the RHS of these equations to zero. The specific parameters that are estimated include the elasticity of substitution μ, the

[4] Implementing GMM or maximum likelihood in this model does not seem feasible. The seemingly unrelated regression model can handle the cross-equation restrictions implied by the first-order conditions.

risk aversion β, the weight of the all purpose good α, the curvature of utility of the all purpose goods γ. The mileage cost parameter ϕ, and the terror loss parameter δ which determines how much terror affects utility are set by us and not estimated.

3. Data and Descriptive Statistics

3.1 Income (y)

The real income of the representative household is the per-capita Gross Domestic Product of the origin country using purchasing parity exchange rates, expressed in 2000 U.S. dollars, as reported by the OECD.

3.2 Probability of an Act of Terror (π)

The probability of an act of terror is computed using data based on the Global Terrorism Database that includes both international and domestic events during the period 1998-2004. As stated above, our preference specification depends on the occurrence of an act of terror during a visit to the destination. This subsection explains how the probability that a tourist will be exposed to an act of terror with injuries during his visit is calculated.

Assume that the occurrence of a terror event with injuries follows a Poisson process. Let the intensity parameter of the Poisson process, λ, be the average number of events over a year in any given year and country. Let π denote the probability of experiencing at least one event with injuries during the duration of a tourist's visit to that destination. Following the above assumption, this probability is given by:

π = (1- Prob{not experiencing a terror event during the tourist's visit}) =
1-EXP(-λ*duration/365)
where λ is the number of yearly terror events, and "duration" is the average length of stay (in days) of the tourist at the destination (see Appendix A)..

3.3 Visits in Tourist Destinations (s_{ij})

The "number" of household members residing in country i visiting destination j is computed as the number of tourists arriving from country i in destination j divided by the population of country i (based on the Yearbook of Tourism Statistics, see Appendix A).

3.4 Visit Costs (p_i)

The empirical investigation below necessitates the calculation of the costs faced by tourists traveling to the various destinations. Such costs are not directly reported. To compute this cost, the total expenditures of international tourists in any given destination (in 2000 U.S. dollars) are first divided by the total number of tourists in that destination. The latter number is measured by the number of tourists crossing the national borders in some countries, and by the number of tourists registered in their first place of accommodation in others.[5] Since these are expenditures incurred outside the country of residence, the resulting amount is divided by the PPP exchange rate (expressed in 2000 dollars) to get the amount in units of "real" income that needs to be given up in any country of origin for the trip.

3.5 Aggregation

To make estimation feasible, the number of destinations needs to be reduced. For this purpose, two types of composite tourist destinations have been constructed – a safe destination, and terror-stricken destination(s).

3.5.1 The Safe Composite Destination

For each country of origin a single composite safe destination is constructed. The Safe destination is based on the five safe most popular destinations of the corresponding country of origin. For most countries the five most popular destinations cover almost 60% of the tourists originating from that country.

The list of the origin countries and their most popular destinations is detailed in Appendix B.

[5] All countries except France, Austria and Germany count tourist at the borders. France, Austria and Germany count tourists checking in at different types of accommodations. Despite these differences in reporting practices, it is common to treat these data as being equivalent. See additional discussion at Section 5.1.2 below.

3.5.1.1 Per-Capita Visits to the Destination

The per-capita number of tourists traveling to the safe destination is the sum of tourists from a given country of origin to its five most popular destinations divided by the size of the population in that country.

3.5.1.2 Visit Cost

The cost per visit in the safe destination is calculated as the average of the visit costs in the five most popular destinations for each country of origin. Similarly, the distance of the safe destination is taken to be the average of distances from the origin country to each of the five most popular destinations.

3.5.2 A Composite Terror -Stricken Destination

As indicated above, the complexity of the model and data restrictions necessitate a reduction in the number of destinations.[6] We report below a case where there are two terror-stricken destinations: Israel, and a composite of all other (terror affected) destinations. We found it useful to treat Israel separately because of its particularly high probability of experiencing a terror event. Leaving Israel in the composite destination would create an excessive dependence of tourism to terror events in Israel which is unreasonable, given the small size of the Israeli market.

3.5.2.1 Per-Capita Visits to the Destination

The per-capita visits to the composite terror-stricken destination is the sum of tourists from each country of origin to all terror destinations divided by the size of the population in that country of origin.

3.5.2.2 Visit Cost

The distance and the per-visit cost of a visit to the composite terror stricken destination are calculated as the average of the distance and the visit-cost in each of the terror-stricken destinations.

[6] Remember that there is a first order condition for each destination. Thus it is necessary to reduce the number of these conditions by appropriately aggregating destinations.

3.5.2.3 Probability of terror

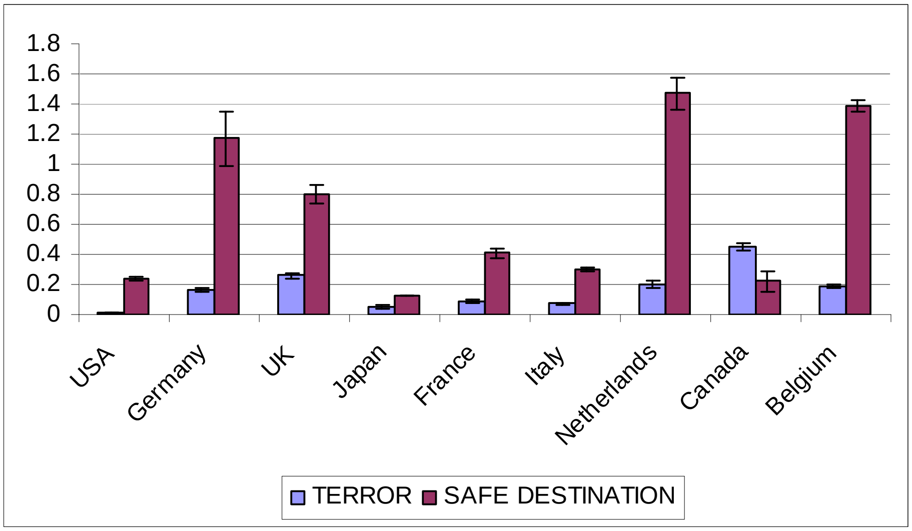
The probability of encountering a terror event with injuries during a visit in the composite destination is defined as the complement to encountering *no* terror event in *any* of the destinations included in the composite.

3.6 Some Descriptive Statistics

3.6.1 Visits to Safe and Terror-Stricken Destinations

Figure 1 gives some insight concerning the per capita visits from the different origin countries to the composite terror-stricken destination (including Israel) and the safe destination over the sample period.

Figure 1: Per-Capita Visits



The bars in the chart represent the average per capita visits to the terror-stricken and safe destinations. The standard errors are represented by the lines at the top of each bar.

According to this Figure there is a big difference in the per capita visits from the different origin countries to the terror-stricken destination, and to the safe destination. There are very few visits from the USA to the terror-stricken destination (0.01 visits per capita), while from Canada this number is very high. This is due to the fact that the USA belongs to the set of terror-stricken destinations, and most Canadians go to USA.

The standard errors are very small, especially where the terror-stricken destination is concerned.

3.6.2 Number of Terror Events and the Probability of Terror

The destinations vary from one another by the length of stay and the number of terror events. As indicated above, both variables are required to compute the probability of experiencing terror. The following table compares the different destinations regarding these variables and the implied probabilities.

Table 1: Average Events, Visit Duration and Probabilities of Experiencing Terror

DESTINATION	NUMBER OF TERROR EVENTS	DURATION OF STAY (days)	TERROR PROBABILITY
India	11 (2.7)	31 (0.07)	0.6098 (0.0985)
Greece	0.1 (1.4)	10 (0)	0.039 (0.0095)
Thailand	2 (3)	8 (0.19)	0.04 (0.06)
Philippines	8 (4.9)	9 (0.2)	0.157 (0.1)
Turkey	10 (6.6)	10 (0.4)	0.2295 (0.125)
Spain	2 (2)	13 (0.14)	0.069 (0.063)
USA*	1.3 (1.4)	16 (0.6)	0.0535 (0.0582)
Israel	17 (15.2)	19 (3.2)	0.4218 (0.344)
Egypt	0.4 (0.72)	7 (1.47)	0.0098 (0.018)

Standard deviations appear in parentheses
* The numbers for the USA are driven mainly by the 9/11 event. In three out of the seven years there are no reported terror events with injuries in the USA. The 9/11 event is counted as four different events in the data. Due to this counting method the USA seems to be riskier than Egypt. We have not changed the counting method aiming at giving the 9/11 events a higher weight, reflecting their uniqueness.

Table 1 reveals there is a big difference between the average probabilities of encountering an act of terror in the different countries. India has the highest average of 0.6, followed by Israel with 0.4. The probability of experiencing a terror attack in India is surprisingly high. This happens not just because of the high number of events (Israel has more events, and Turkey has almost the same number of events), but also due to the duration of stay, which is significantly longer in India than in other countries. The destination with the lowest probability of terror is Egypt with 0.0098. The standard deviations are relatively high, in some cases as large as the average. This means that there is big variation among countries, but also within countries over time.

3.6.3 Terror and Visits

Table 3 reports the simple correlation coefficients between the exposure to terror and the number of per-capita visits from country i (in the rows) in destination j (in the columns).

Table 3: Exposure to Terror and Per-Capita Visits

	INDIA	GREECE	THIALAND	PHILIPPINES	TURKEY	SPAIN	USA	ISRAEL	EGYPT
USA	0.290	0.207	0.517	-0.535	-0.653	0.618		-0.957	-0.145
GERMANY	-0.429	-0.114	0.765	-0.663	0.025	0.305	-0.321	-0.928	-0.903
UK	0.107	-0.292	0.371	-0.665	0.322	0.073	-0.030	-0.930	-0.928
JAPAN	-0.610	0.753	0.542	-0.135	-0.864	-0.061	-0.123	-0.913	-0.828
FRANCE	-0.296	-0.357	0.165	-0.648	-0.332	0.056	-0.101	-0.913	-0.854
ITALY	-0.420	-0.242	0.077	-0.540	-0.493	0.150	-0.232	-0.858	-0.889
NETHERLANDS	-0.486	-0.296	0.850	-0.556	0.194	0.490	0.009	-0.921	-0.943
CANADA	0.563	-0.121	0.305	-0.608	-0.587	0.211	-0.262	-0.941	-0.572
BELGIUM	-0.648	-0.225	0.610	-0.559	-0.081	-0.079	-0.234	-0.929	-0.875

As expected, most entries in this table are negative. Notable exceptions are Thailand and Spain. It seems that in Thailand terror was not directed towards tourists and was focused on certain areas of the country. The tourists could simply avoid these areas. In Spain too the media succeeded in creating the impression that terror is focused on Catalonia. Tourists may have believed that by avoiding northern Spain they could avoid exposure to terror.

4. Estimation Results

We turn next to the estimation results of a model which contains (for each country of origin) three destinations: A composite terror-free destination, a composite terror-stricken destination, and Israel. The following table describes the estimation results. The numbers in brackets are the standard errors of the estimated parameters.

The parameters that are predetermined appear in bold font. These parameters include the terror loss parameter δ, which represents how much the utility is affected by terror (when δ is small the loss is large). This parameters was set at different levels ranging from 1 to 0.2. The mileage cost Φ is constant at 0.1. The table reports representative results, indicating the general pattern obtained. [7]

Table 4: Estimated Parameters

δ	α	μ	1/(1-μ)	β	l1-βl	γ	1-γ
			Elasticity of Substitution		Risk aversion		
1	0.0006 (0.00001)	0.963 (0.0047)	27	0.988 (0.025)	0.012	1 (0.00000064)	0
0.8	0.0006 (0.000014)	0.946 (0.0045)	18.5	0.988 (0.025)	0.012	1 (0.00000061)	0
0.4	0.0004 (0.0000008)	0.91 (0.0064)	11.1	0.968 (0.026)	0.032	1 (0.00000083)	0
0.2	0.0003 (0.0000089)	0.875 (0.0085)	8	0.95 (0.027)	0.05	1 (0.0000011)	0

As can be seen, all estimated parameters are highly significant.[8]

The elasticity of substitution runs between 27, when terror does not affect the utility (i.e. – δ=1), to 8, when it has a large effect (δ=0.2). The model adjusts the elasticity of substitution to accommodate the size of the impact of terror in the preferences. When terror is unimportant, the observed high sensitivity to terror is generated by very high elasticities of substitution, meaning that the tourist can easily replace one destination for another, should the destination become terror-stricken. As the effect of terror grows, the model reduces the elasticity of substitution to accommodate the data. Specifically, if that high elasticity of substitution was to be maintained, the increased terror-associated loss would imply that the

[7] The value of δ was allowed to vary between 0.1 to 1 with 0.1 intervals. The table reports only representative results

[8] Second order conditions were checked for the average sample data and found to hold.

tourist's aversion towards terror-stricken destinations should be even greater than that indicated by the data. Thus, if tourists nevertheless choose to visit such destinations, it must be the case that these destinations are in some sense "unique", enticing tourists to continue going there despite the higher potential loss. In other words, the terror-stricken destination is not so easily substituted by alternative destinations.

The measure of relative risk aversion is about zero (so that in effect people are risk-neutral) and increases slightly when terror has a larger effect on the utility. These results stand in contrast to the normally expected level of about 2.[9] In any case, the model does not associate the sensitivity of tourism to terror with high degrees of risk-aversion.

The parameter γ equals unity and does not change at all as the effect of terror on the utility changes. This indicates that the alternative good also enters the utility function linearly.

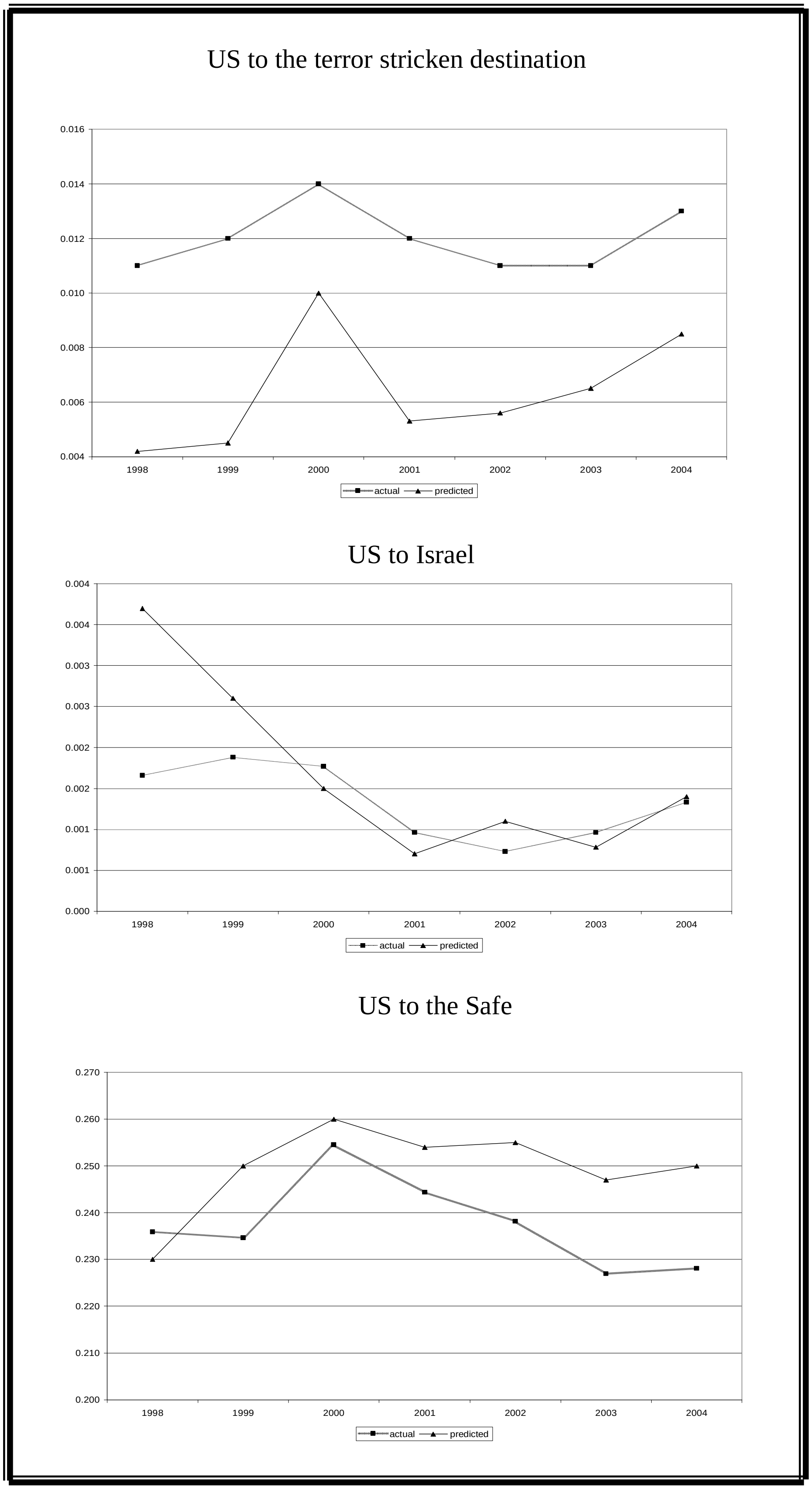
4.1. Goodness of Fit

In order to check how well the model fits the data, the predicted per capita visits to the composite terror-stricken destination, Israel and the composite safe destination are plotted alongside the data. This is done for each of the sample years and for three particular countries of origin (that seem to have specific features representing the rest of the sample-countries, like distance to the terror stricken destination, and income. Thus the USA is very similar in its (per-capita) characteristics to Canada. The UK represents the other European countries). The terror-loss parameter δ is fixed at 0.8.

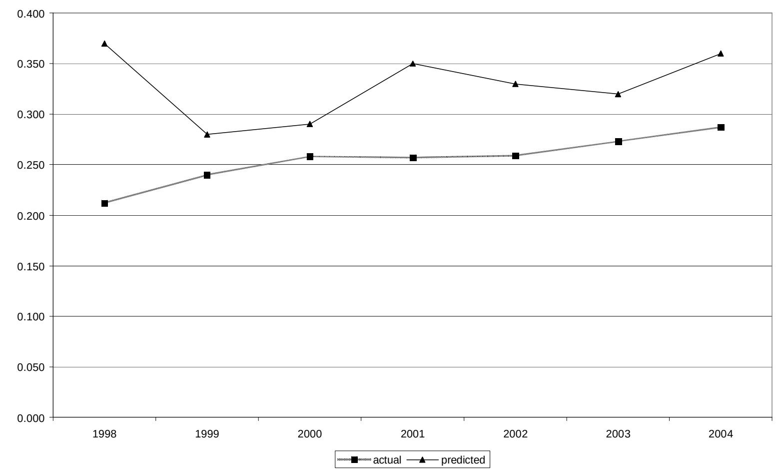
The general outcome of these forecasts reveals that while the model often underestimates the per capita visits, the patterns of the predicted values usually follows the data quite closely. Visits to Israel seem to provide an exception - except for the US as the country of origin, the model consistently over-predicts visit rates to Israel. This may indicate that the visit cost to Israel is under-measured. Travelers to Israel do not enjoy an "open sky" policy and competition among carriers is limited. Thus, using the world-average per-mile travel cost of 10 cents as a proxy may not apply to Israel. On the other hand, the larger distance to the U.S., which implies high non-monetary travel costs, may mitigate this distortion.

[9] See, for example, Mehra and Prescott (1985).

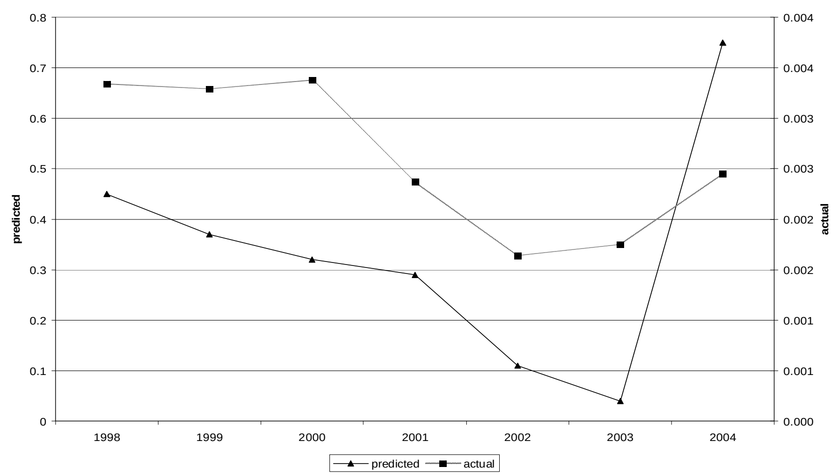
Figure 2: Actual and Predicted Per-Capita Visits



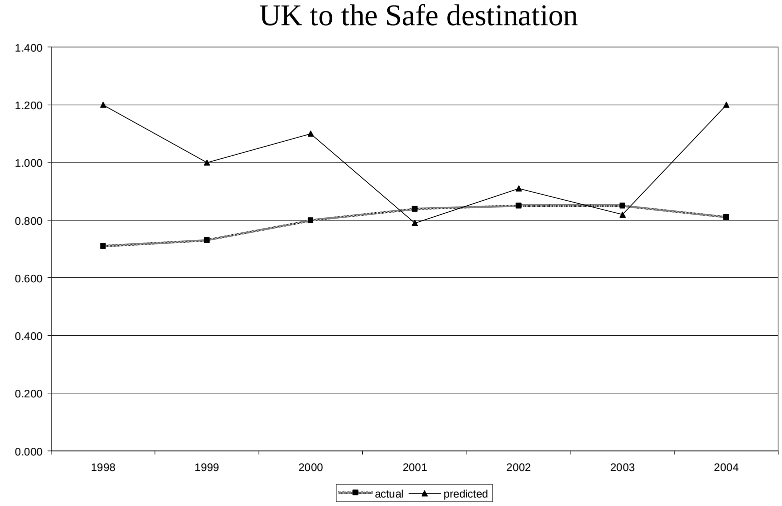
UK to the terror stricken destination



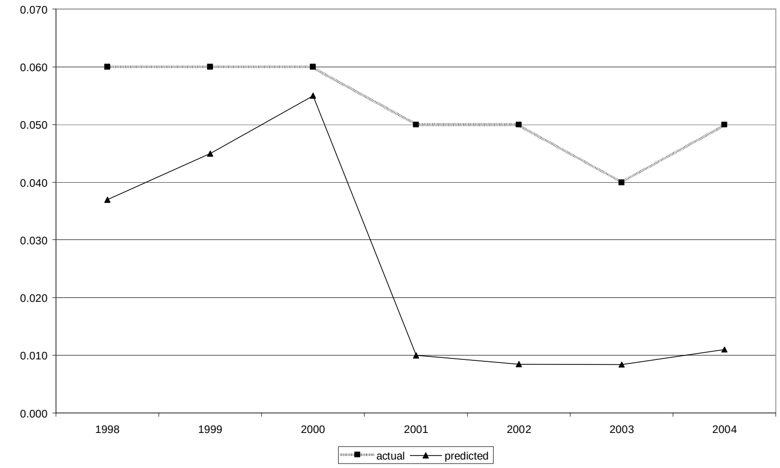
UK to Israel



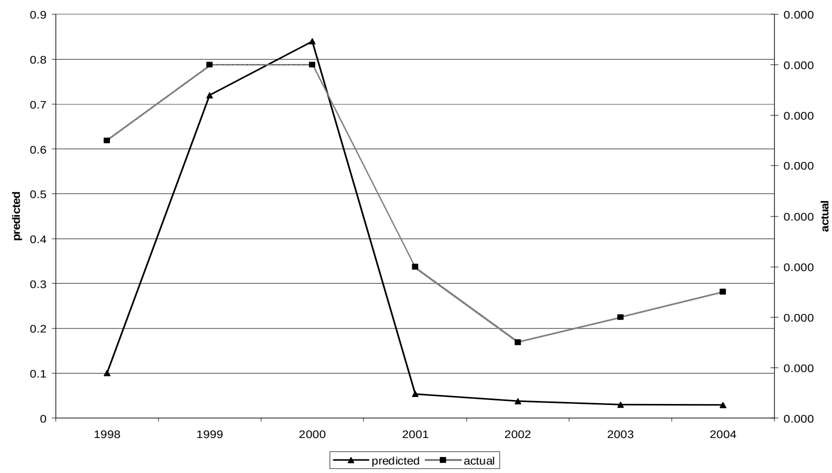
UK to the Safe destination



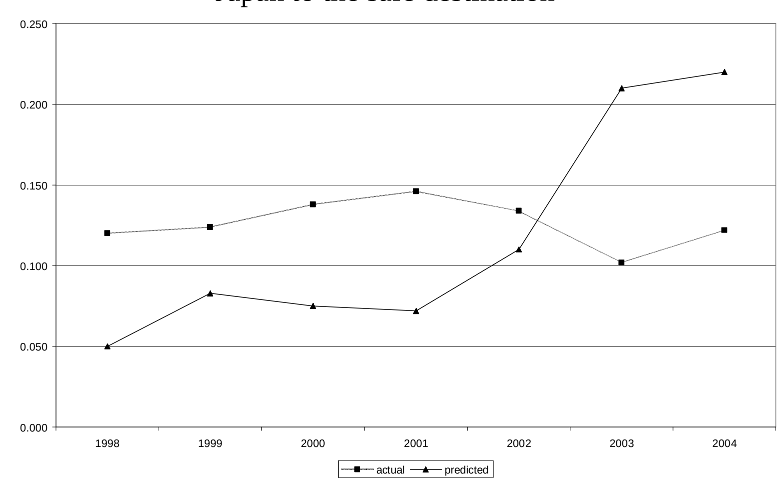
Japan to the terror stricken destination



Japan to Israel



Japan to the safe destination



Some special features need to be pointed out:

In the case of Japan the model consistently under-predicts the number of visits to the composite terror-stricken destination. Furthermore, as of the year 2000 the model predicts a strong and constant decline in the number of tourists to that destination. This is explained by an increase in the price of visits to the terror-stricken countries which resulted from the depreciation in the Japanese Yen expressed in PPP values. (The ratio between the PPP Yen-dollar exchange rate rose from 0.7 to 0.8). This implies that the Japanese consumer who purchased goods abroad had to increase the payment by over 10% in terms of Japanese goods. While the depreciation manifests itself in the case of the terror-stricken country, it cannot be discerned at the same time in the safe destination. It seems that the visit cost there adjusts downwards and matches the depreciation of the Yen. For this reason, the model does not predict a noticeable change in the number of visits to this destination. This stands in contrast to the actual data which shows a slight decline.

The conflict between the model's predictions and the actual data emerges again when the following years are considered. Between 2001 and 2003 the cost per visit in the safe destination (in PPP terms) has decreased significantly. The model shows a corresponding sharp increase in tourism to that destination, which is not matched by the data. In fact, the actual data show a reversed trend, as the Japanese traveled less. The total number of Japanese traveling to *all* destinations decreased from 2001 to 2003 by 2%, 7% and 20% respectively. This cannot be explained by changes in income, either. Accordingly, a satisfactory explanation of the Japanese data requires further investigation.[10]

4.2. Implications

After establishing that the large effect of terror is due to the substitution effect, the model is used to analyze several counterfactual scenarios. Specifically, the point-estimates of the parameters are used to solve for the optimal solution of the representative household is the same three countries of origin mentioned above. The exogenous variables are set at their seven year average values and the error term (in log) is set to zero..

[10] It is also possible that for the Japanese case the composite safe destination should include more countries, as the amount of the total traffic captured by the current composite is somewhat smaller than that of the other two countries of origin (52% compared to 60% and more in the other countries)

4.2.1 The Probability of Terror

For each destination the probability of getting exposed to a terror attack is increased by 10% relative to the average probability during the seven-year period. The terror-loss parameter, δ, is fixed at two levels: 0.4, indicating that terror has a large impact on the utility, and 0.8, where it has a smaller effect on the utility.

The results are summarized in Table 5. The own elasticities are in bold font.

Table 5: Effect of Terror on Per-Capita Visit

Country of origin	Place of change	δ	Change in tourism to aggregate terror stricken destination	Change in tourism to Israel	Change in tourism to safe destination
USA	terror stricken destination	0.8	**-14%**	-	-
USA	terror stricken destination	0.4	**-40%**	2%	-
UK	terror stricken destination	0.8	**-30%**	-3%	-3%
UK	terror stricken destination	0.4	**-79%**	-	-
Japan	terror stricken destination	0.8	**-21%**	-	-
Japan	terror stricken destination	0.4	**-60.5%**	-	-
USA	Israel	0.8	-	**-10%**	-
USA	Israel	0.4	+1%	**-16%**	
UK	Israel	0.8	-1%	**-16%**	-1%
UK	Israel	0.4	-	**-17%**	-
Japan	Israel	0.8	-	**-16%**	-
Japan	Israel	0.4	-	**-17%**	

A change in the probability of terror in the aggregate terror-stricken destination or in Israel influences mainly the affected destination. In some cases it affects also the per capita visits to the other destinations. This effect is either negative or positive, but rather small.[11]

The sensitivity of the aggregate terror stricken destination to a 10% change in the probability of experiencing an act of terror is much higher than that of Israel. This may be due to the fact that the probability of terror in Israel is much lower than that in the composite terror-affected destination.[12]

[11] In this case, the model generates a small spill-over effect. Mansfeld (1996) reports such effects of much larger magnitudes.

[12] Remember that the probability of experiencing an act of terror in the aggregate destination is defined as the complement to the probability of not experiencing an act of terror in *any* of the destinations composing the aggregate one. Thus, a composite destination is characterized by higher terror probabilities.

An interesting result is that the visit elasticities with respect to terror in Israel are quite insensitive to the size of the utility-loss parameter. This may be due to the fact that Israel is a destination with relatively low per capita visits, and those tourists who visit Israel go there because of its uniqueness. Therefore the tourists to Israel may be less sensitive to the severity of terror.

4.2.2 The Visit Costs

Table 6 presents the results pertaining to a 10% increase in the visit-cost to the terror stricken destination, Israel and the safe destination.

Table 6: The Changes in the Predicted Per-Capita Visits Following an Increase in the Visit Cost

Country of origin	Place of change	δ	Change in tourism to aggregate terror stricken destination	Change in tourism to Israel	Change in tourism to safe destination
USA	terror stricken destination	0.8	**-35%**	+1%	-
USA	terror stricken destination	0.4	**-24%**	-	-
UK	terror stricken destination	0.8	**-30%**	-3%	-3%
UK	terror stricken destination	0.4	**-24%**	-	-
Japan	terror stricken destination	0.8	**-41%**	-	-
Japan	terror stricken destination	0.4	**-15%**	-	-
USA	Israel	0.8	1%	**-56%**	-
USA	Israel	0.4		**-31%**	
UK	Israel	0.8	-3%	**-77%**	-3%
UK	Israel	0.4	-	**-35%**	-
Japan	Israel	0.8	-	**-87%**	-
Japan	Israel	0.4		**-20%**	
USA	safe destination	0.8	-48%	-48%	**-88%**
USA	safe destination	0.4	-	4%	**-5%**
UK	safe destination	0.8	-84%	-84%	**-97%**
UK	safe destination	0.4	-	8%	**-4%**
Japan	safe destination	0.8	-67%	-67%	**-93%**
Japan	safe destination	0.4	-	3.5%	**-3.5%**

The own-elasticities are in bold font.

In the case of a cost change in the terror stricken destination, in Israel, and in the safe destination the own-elasticities are negative and range from 1.5 to 3.5, 2 to 9, and 3.5 to 10, respectively. However, the cross cost elasticities are zero if the terror-loss effect is large and very small if terror hardly impacts utility. The reason is probability due to the low elasticity of substitution implied by the model when utility is terror-dependent. As indicated above, it is this low elasticity that enables the model to accommodate the fact that people travel to terror-stricken destinations despite the risk.

For all countries of origin, the own cost elasticities are lowest at the terror–stricken destination, somewhat higher for Israel and are highest for the safe destination. This indicates that when terror is less important, cost factors become more important in affecting demand.

In case of a price change in the safe destination, the responses depend heavily on the effect of terror on the utility. If utility is not too terror-dependent the own-elasticities and cross-elasticities are negative and high in their absolute value. On the other hand, when terror has a large effect on utility, the own-elasticities are negative and small in absolute value, while the cross elasticities are positive and small. Again, it can be seen that the model "explains" why tourists keep visiting the terror stricken destination by reducing the elasticity of substitution. Accordingly, when utility is terror-dependent the response to a change in the economic environment is small, and when terror has a large effect on utility the response is significant.

The cross elasticities of trips to Israel with respect to the cost of trip to the safe destination are positive and those of trips to the composite terror stricken destination are zero. This implies that if the travel costs to the composite safe destination increase, there is a spill-over effect which Israel enjoys. The composite terror-stricken destination, which has a higher level of terror than Israel, is basically unaffected.

4.3 Some Welfare Implications

Another way to look at the effect terror is to consider the welfare loss of the potential tourists due to increased likelihood of terror. We demonstrate this effect using the USA as a country of origin.

The exercise involves computing the additional income that is required to compensate the American representative household for an increase of 10% in the likelihood of terror events in the terror-affected destination. The aforementioned elasticities are used to compute the reduction in tourism in the terror-stricken, Israel and safe destinations, and the corresponding increase in the consumption of the all-purpose good. These changes are fed into the utility function (using its estimated parameters at δ=0.8 and the average values of the exogenous variables). Finally, the aforementioned elasticities are used one more time, to reallocate any additional income among the tourist destinations and the all-purpose good and compute the required compensating change in income.

The results of this computation indicate that for the U.S., a 10% increase in the probability of terror events in the composite terror-affected destination is equivalent to a very small loss of 0.05% in GDP. This is a result both of the relatively small importance of outward tourism is the U.S., and of the ease of substituting away from the terror-stricken destination.

On the other hand, looking at the loss from the point of view of the destination countries, the income loss relative to their GDPs is much more significant.

Using the aforementioned elasticities, a 10% increase in the probability of terror leads to about 20% decrease in the number of tourists to the terror stricken destination. This means that for countries like Israel, where tourism income accounts for about 4% of the GDP, the loss amounts for a bit less than 1% of the GDP. In Egypt, where tourism income accounts for 6% of GDP, the loss would amount to 1.2% of the GDP. In a highly tourism dependent country like Spain, where tourism accounts for more than 10% of the GDP, the impact of an increase in the terror probabilities implies a 2% loss in GDP.

5. Summery

Looking at the decline in the number of tourists visiting different destinations after a terror attack, it seems that the potential tourists are very sensitive to terror. This effect is very high compared to the likelihood of getting involved in such an attack, and is inconsistent with the behavior in other potentially risky situations (i.e. car accidents).

To try and understand this phenomenon the paper proposes a choice model whereby a potential tourist chooses the allocation of income between tourism goods and an alternative all-purpose good. The tourism goods are characterized by probabilities of loss due to terror attacks. According to this model, the reason for the high sensitivity to events of terror is not the high aversion to risk of the tourists, but the high elasticity of substitution among the different tourist destinations.

The model was used to analyze some counter-factual scenarios. The results of these calculations show that increasing the probability of terror in one destination decreases the number of per capita visits in the other terror-stricken destination as well. The model also delivers negative own-elasticities of visits with regard to a change in costs in either type of destinations and very small cross cost-elasticities.

Finally, the model can be readily used to carry out normative analyses. For example, a 10% increase in the probability of terror in the risky destinations on the welfare of a representative American household is found to be equivalent to a minute decrease of 0.05% in the household's income. On the other hand, from the point of view of the destination countries suffering from terror, the effect of terror is much bigger. Based on the elasticities calculated in the model a country like Israel, in which tourism contributes about 4% to the GDP, will suffer a decrease of 0.8% in GDP following a 10% increase in the probability of terror. In a tourist oriented country like Spain, where tourism accounts for 10% of the GDP, such an increase can lead to a 2% drop in GDP.

While the model can be extended and improved by adding more years to the data set, and by including more destinations we believe that this study demonstrates the usefulness of structural models in explaining why low-probability terror events have a large impact on tourism.

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Appendix A – Data Used and Its Sources.

The following table summarizes the data used and its source.

Table 1: Data used and its source:

Data used	**Source**
Gross Domestic Product	International Marketing Data and Statistics European Marketing Data and Statistics
Population size	International Marketing Data and Statistics European Marketing Data and Statistics
Number of tourists from country of origin i to destination j	Yearbook of Tourism Statistics
International tourists expenditures (in year 2000 U.S. dollars)	Compendium of Tourism Statistics Tourist Market Trends
Number of tourists in destination	Yearbook of Tourism Statistics
Distance between the countries	Geodesic distance data set
Number of terror events with injuries	Global Terrorism Database
Duration of stay	Compendium of Tourism Statistics http://tinet.ita.doc.gov/outreachpages/inbound.general_information.inbound_overview.html

Appendix B – Five Most Popular Destinations for Each Country of Origin

Country of origin	Destination 1	Destination 2	Destination 3	Destination 4	Destination 5
USA	Mexico	Canada	UK	France	Germany
Germany	Poland	France	Italy	Spain	Austria
UK	France	Spain	USA	Portugal	Italy
Japan	USA	Korea	China	Hong Kong	France
France	Italy	UK	Spain	USA	Germany
Italy	Austria	France	Croatia	Spain	UK
Netherlands	France	Germany	UK	Italy	Spain
Canada	USA	Mexico	France	Cuba	UK
Belgium	Spain	Italy	UK	France	Germany

Sharon Teitler-Regev is a lecturer at the Kinneret College on the Sea of Galilee. She is currently completing her PhD in economics at the University of Haifa, Department of Economics. Her dissertation studies the impact of terror risks on tourism. She holds an M.A. degree in Hotel Administration from the University of Las Vegas Nevada , an M.Sc. in Economics, and B.Sc. (cum laude) in Economics and Management from the Technion.
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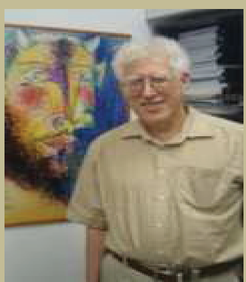

Benjamin Bental, (Ph.D University of Minnesota, 1979), is a professor of economics at the University of Haifa, and the Director of the Center of German and European Culture Studies at that university. Prior to joining the University of Haifa in 1997, Prof. Bental was a faculty member at the Technion, Faculty of Industrial Engineering and Management and served as Visiting Professor in several leading European and U.S. universities. His research interests include macroeconomics, economics of research and development and aggregate implications of contractual frictions. Prof. Bental is serving as the chairman of the Advisory Committee of the Regional Research and Development Program of the Ministry of Science and participates regularly in accreditation committees of the Council of Higher Education in Israel. He has published extensively in leading economic journals.

Samuel Neaman Institute
For Advanced Studies in Science and Technology
Technion - Israel Institute of Technology
Technion city, Haifa 32000, Israel
Tel : 04-8292329, Fax : 04-8231889
www.neaman.org.il