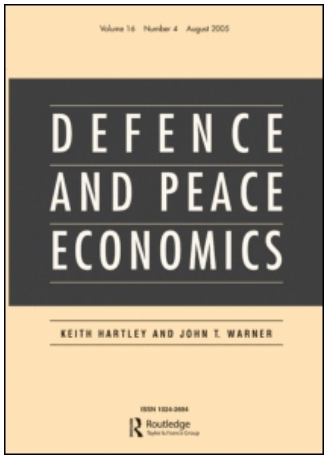
This article was downloaded by:[B-on Consortium - 2007]
On: 8 November 2007
Access Details: [subscription number 778384749]
Publisher: Taylor & Francis
Informa Ltd Registered in England and Wales Registered Number: 1072954
Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



Defence and Peace Economics
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713640174

ARE USA CITIZENS AT RISK OF TERRORISM IN EUROPE?

Carlos Pestana Barros [a]; Isabel Proença [a]; João Ricardo Faria [b]; Luis A. Gil-Alana [c]

[a] ISEG - School of Economics and Management, Technical University of Lisbon, 1249-078 Lisbon, Portugal
[b] Department of Economics and Finance, University of Texas Pan American, Edinburg, TX 78541, USA
[c] Faculty of Economics, Edificio Biblioteca, University of Navarra, E-31080 Pamplona, Spain

Online Publication Date: 01 December 2007
To cite this Article: Barros, Carlos Pestana, Proença, Isabel, Faria, João Ricardo and Gil-Alana, Luis A. (2007) 'ARE USA CITIZENS AT RISK OF TERRORISM IN EUROPE?', Defence and Peace Economics, 18:6, 495 - 507
To link to this article: DOI: 10.1080/10242690701197605
URL: http://dx.doi.org/10.1080/10242690701197605

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: http://www.informaworld.com/terms-and-conditions-of-access.pdf

This article maybe used for research, teaching and private study purposes. Any substantial or systematic reproduction, re-distribution, re-selling, loan or sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

Defence and Peace Economics, 2007
Vol. 18(6), December, pp. 495–507

Downloaded By: [B-on Consortium - 2007] At: 10:36 8 November 2007

ARE USA CITIZENS AT RISK OF TERRORISM IN EUROPE?

CARLOS PESTANA BARROS[a,†], ISABEL PROENÇA[a,‡], JOÃO RICARDO FARIA[b,*] AND LUIS A. GIL-ALANA[c,§]

[a]*ISEG – School of Economics and Management, Technical University of Lisbon, Rua Miguel Lupi, 20, 1249-078 Lisbon, Portugal;* [b]*Department of Economics and Finance, University of Texas Pan American, 1201 W. University Dr.,Edinburg, TX 78541 USA;* [c]*University of Navarra, Faculty of Economics, Edificio Biblioteca, Entrada Este,E-31080 Pamplona Spain*

(Received 1 July 2006; in final form 12 December 2006)

This paper analyzes the determinants of the probability of US citizens being victims of terrorist attacks in European countries, taking into account uncontrolled heterogeneity of the data. The analysis employs ITERATE data from February 1968 to December 2002 to ascertain significant characteristics that influence the probability (e.g. location, type of casualties, type of attack, and type of terrorists). To deal with the unobserved heterogeneity a random-parameter logit model (mixed logit) is used. Some policy implications are presented.

Keywords: Terrorism; Mixed Logit model; Public policy

INTRODUCTION

The objective of this paper is to determine the risk of a US citizen being a victim of terrorism in Europe. In order to deal with the unobserved heterogeneity we use a random-parameter logit model (mixed logit). The model permits the identification of significant statistical variables that explain the variation in the probability of a terrorist attack involving US citizens. Our analysis shows how the risk evolved over the last decades as a result of the type of terrorists, type of attacks and location.

This paper uses the ITERATE database from 1968 to 2002. It takes into account different types of terrorists, namely leftists, nationalists and Islamic terrorist groups and it extends the number of variables as well as the period of study.

In this analysis, terrorism is defined as the premeditated or threatened use of extra-normal violence or force to obtain a political, religious, or ideological objective, through the intimidation of a large audience (Enders and Sandler, 2002). Moreover, we focus on transnational

†Corresponding author. Email: cbarros@iseg.utl.pt
‡Email: isabelp@iseg.utl.pt
*Email: jfaria@utpa.edu
§Email: alana@unav.es

ISSN 1024-2694 print: ISSN 1476-8267 online © 2007 Taylor & Francis
DOI: 10.1080/10242690701197605

Downloaded By: [B-on Consortium - 2007] At: 10:36 8 November 2007

terrorism, i.e. attacks that have implications in two or more countries. By definition, all attacks on US citizens at the European level are international terrorism.

The motivation for the present research is based, first, on the availability of data for terrorist attacks on US citizens. The ITERATE data set has this variable. Another reason is anecdotal evidence that terrorist groups target US citizens more frequently than other nationalities. Since the USA is the leading country in the world, it attracts special acrimony from terrorist groups and this eventually translates into attacks on US citizens. Despite the fact that only 8% of terrorist attacks in Europe result in US victims, we hypothesize that this value is not random. Finally, the economics literature on terrorism is an expanding field of research. A relatively up-to-date survey and a critical, accurate evaluation of the field of research can be found in Enders and Sandler (1995, 2005a). In the applied research, two main types of analyzes are in evidence: time-series models and cross-section or panel data models. The traditional research on international terrorism analyzes terrorism incidents without segmentation, by the type of terrorism groups (Drakos and Kutan, 2003). An exception to this generic approach is Barros and Proença (2005). The present research is innovative in this context.

The paper is organized as follows. The next section presents a descriptive analysis of the terrorist attacks against US citizens. A theoretical framework appears in the third section. The fourth section deals with the empirical model. The fifth section describes the variables used. In the sixth section we present the results, while the seventh section concludes.

DESCRIPTIVE ANALYSIS OF TERRORISM AGAINST US CITIZENS

Figure 1 displays the time-series evolution of the number of US victims of terrorism in Europe. A relative reduction in the number of incidents from 1997 can be observed (Enders and Sandler, 2000). However, there is a small number of US victims in every year analyzed, displaying persistence in the data that justifies the present study.

The dispersion of US victims in different European countries is displayed in Table I. It is observed that the highest number of victims has occurred in the UK, the majority due to the number of Americans killed in the Lockerbie Pan-Am bombing (259 on board and 11 on the ground). For Germany, Greece and Italy, the number of US victims does not exceed 100 and,

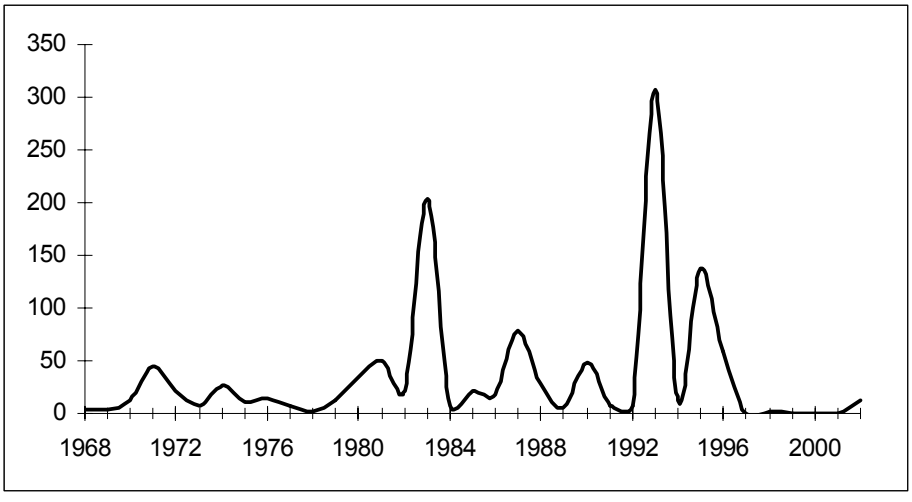


FIGURE 1 Numbers of USA victims in Europe per year.

Downloaded By: [B-on Consortium - 2007] At: 10:36 8 November 2007

TABLE I Number of USA Victims in the European Countries

United Kingdom	538	Denmark	4
Germany	233	Finland	2
Greece	176	Iceland	2
Italy	120	Luxembourg	2
Spain	77	Netherlands	2
France	50	Portugal	2
Austria	6	Vatican City	1
Belgium	5	Sweden	1

in most cases, it is in single digits in those remaining countries where such victims were registered for the entire period (Enders and Sandler, 2005b).

In Table II, we desegregate the number of US victims in Europe according to the type of the terrorist group responsible for the action. We distinguish three main types of terrorist groups that cover the main tendencies that drive terrorist action in general: groups inspired by left-wing political ideas (leftists); groups that are Islamic fundamentalists (Islamic) and groups that fight for independence of a region (nationalists). In the nationalist terrorism group we include two main European groups, the Spanish (Basque) ETA and the Irish IRA. Moreover, we also include in this group, smaller terrorist groups, such as the indeterminate Basques, the Spanish (Catalan) Terra Lliure, Guerrilla Army Galician and the PKK from Kurdistan. In the leftist terrorism we include the German group Baader-Meinhof, the Italian group Red Brigade, the Marxist–Leninist Armed group, the Spanish GRAPO and other leftist groups with minor impact. For a list of the Islamic groups see Barros and Proença (2005).

A terrorist attack may involve more than one victim. In Table II we verify that the Islamic terrorists are those whose attacks involve more US citizens, followed by leftist terrorist groups. Note, however, that the goal of this paper is not to explain the number of US victims but to understand the determinants of the probability that a terrorist attack involves at least one of these victims. Are radical Islamic attacks random? They could be, and we test this hypothesis. This is the aim of the present paper. Evidence of spectacular terrorist attacks on US tourists and embassies in Africa exists (Barros, *et al*., 2006), but such information does not exist at the European level. However, based on this evidence, hate and grievance may exist among radical Islamists at the European level and, when they plan attacks, a bias against US citizens may be present.

THEORETICAL FRAMEWORK

Our framework is based on two strands of literature: a theoretical model that focuses on the behavior of a terrorist group and a set of hypotheses to be tested.

TABLE II Number of USA Victims by Type of Terrorist Group

	No. of Attacks *(1)*	*No. of USA victims* *(2)*	*(2/1)*
Leftists	571	177	0.309
Islamic	590	598	1.013
Nationalists	1080	212	0.196
Others	1531	240	0.156

Downloaded By: [B-on Consortium - 2007] At: 10:36 8 November 2007

The Theoretical Model

In this model we assume one representative terrorist group. The terrorist group targets American citizens more than other nationalities in its attacks. The variable A stands for terrorist attacks aimed at American citizens. The fact that the terrorist organization targets American citizens in its attacks does not necessarily mean that in their successful attacks the victims are Americans; it may happen that in some successful attacks there are no American casualties. We also assume that the terrorist organization has a quadratic instantaneous utility function, with A as the argument:

$$E(U) = E\left[\sum_{t=1}^{T} A_t\left(r - \frac{\gamma}{2}A_t\right)\right] \tag{1}$$

where r and γ are positive constants and the interest rate and the discount rate are zero.

In a given time frame, $t = 1, 2,\ldots, T$, corresponding to the terrorist organization lifetime, terrorist attacks are constrained by the availability of economic resources (Y), personnel (R) and law enforcement (L), as follows:

$$\sum_{t=1}^{T} A_t = \alpha\sum_{t=1}^{T} R_t + \beta\sum_{t=1}^{T} Y_t - \delta\sum_{t=1}^{T} L_t \tag{2}$$

where α, β and δ are the (positive) coefficients associated with each of these variables. Other things being constant, equation (2) indicates that more economic resources and personnel allow for more terrorist attacks, while more law enforcement serves as a deterrence for attacks.

At each point in time, the organization recruits new personnel: $R_t = a + bS_t$, where S stands for popular support of terrorism and the positive parameter a stands for the number of hard-core terrorists (believers) that voluntarily enlist in the terrorist organization. The term bS_t is the number of supporters that are recruited via popular support for terrorist activity, with b capturing the effectiveness of recruitment. Therefore:

$$\sum_{t=1}^{T} R_t = aT + b\sum_{t=1}^{T} S_t \tag{3}$$

Substituting equation (3) into equation (2) yields:

$$\sum_{t=1}^{T} A_t = \alpha\, aT + \alpha\, b\sum_{t=1}^{T} S_t + \beta\sum_{t=1}^{T} Y_t - \delta\sum_{t=1}^{T} L_t \tag{4}$$

Writing $T_0 = \alpha\ aT$ and $\theta = \alpha b$, equation (4) can be expressed as:

$$\sum_{t=1}^{T} A_t = T_0 + \theta\sum_{t=1}^{T} S_t + \beta\sum_{t=1}^{T} Y_t - \delta\sum_{t=1}^{T} L_t \tag{5}$$

The objective of the terrorist organization is to maximize equation (1) subject to equation (5):

$$\max_{A_t} E\left[\sum_{t=1}^{T} A_t\left(r - \frac{\gamma}{2}A_t\right)\right]$$
$$\text{s.t.} \sum_{t=1}^{T} A_t = T_0 + \theta\sum_{t=1}^{T} S_t + \beta\sum_{t=1}^{T} Y_t - \delta\sum_{t=1}^{T} L_t$$

Downloaded By: [B-on Consortium - 2007] At: 10:36 8 November 2007

The Lagrangian for this optimization problem is:

$$L = E\left[\sum_{t=1}^{T} A_t\left(r - \frac{\gamma}{2}A_t\right)\right] + \lambda\left[T_0 + \theta\sum_{t=1}^{T} S_t + \beta\sum_{t=1}^{T} Y_t - \delta\sum_{t=1}^{T} L_t - \sum_{t=1}^{T} A_t\right] \tag{6}$$

The first order conditions regarding A_1 and A_t are respectively:

$$r - \gamma A_1 = \lambda \tag{7}$$

$$E_1[r - \gamma A_t] = \lambda \qquad t = 2, 3, \ldots, T \tag{8}$$

where E_1 [•] denotes expectations conditional on the information available in period 1. Since E_1 $[r - \gamma A_t] = r - \gamma E_1(A_t)$, it follows from equations (7) and (8) that:

$$r - \gamma E_1 A_t = r - \gamma A_1 \Rightarrow A_1 = E_1 A_t, \qquad t = 2, 3, \ldots, T \tag{9}$$

Equation (9) implies that $A_1 = E_1 A_2$. In general, expected next-period terrorist attacks equal current terrorist attacks. As a consequence, changes in the number of terrorist attacks are unpredictable. By the definition of expectations, we have that in each period: $A_t = E_{t-1} A_t + \varepsilon_t$. Since $A_{t-1} = E_{t-1} A_t$ we have that terrorist attacks follow a random walk:

$$A_t = A_{t-1} + \varepsilon_t \tag{10}$$

According to the above specification, the number of terrorist attacks should be a non-stationary variable, which is in sharp contrast with most of the empirical (time-series) models that show that terrorism is stationary, but in line with the results obtained in Barros and Gil Alana (2005).

Applying expectations in equation (5) yields:

$$\sum_{t=1}^{T} E_1 A_t = T_0 + \theta\sum_{t=1}^{T} E_1 S_t + \beta\sum_{t=1}^{T} E_1 Y_t - \delta\sum_{t=1}^{T} E_1 L_t \tag{11}$$

Equation (9) implies that: $\sum_{t=1}^{T} E_1 A_t = TA_1$, and thus, from equation (11), it follows that:

$$A_1 = T^{-1}\left[T_0 + \theta\sum_{t=1}^{T} E_1 S_t + \beta\sum_{t=1}^{T} E_1 Y_t - \delta\sum_{t=1}^{T} E_1 L_t\right] \tag{12}$$

Therefore we can write terrorist attacks in period 2 as:

$$\begin{aligned}
A_2 &= (T-1)^{-1}\left[T_1 + \theta\sum_{t=2}^{T} E_2 S_t + \beta\sum_{t=2}^{T} E_2 Y_t - \delta\sum_{t=2}^{T} E_2 L_t\right] \\
&= (T-1)^{-1}\left[T_0 + \theta S_1 + \beta Y_1 - \delta L_1 - A_1 + \theta\sum_{t=2}^{T} E_2 S_t + \beta\sum_{t=2}^{T} E_2 Y_t - \delta\sum_{t=2}^{T} E_2 L_t\right] \\
&= (T-1)^{-1}\left[\begin{array}{l} T_0 + \theta S_1 + \beta Y_1 - \delta L_1 - A_1 + \theta\sum_{t=2}^{T} E_1 S_t + \theta(\sum_{t=2}^{T} E_2 S_t - \sum_{t=2}^{T} E_1 S_t) + \beta\sum_{t=2}^{T} E_1 Y_t + \\ \qquad \beta(\sum_{t=2}^{T} E_2 Y_t - \sum_{t=2}^{T} E_1 Y_t) - \delta\sum_{t=2}^{T} E_1 L_t - \delta(\sum_{t=2}^{T} E_2 L_t - \sum_{t=2}^{T} E_1 L_t) \end{array}\right]
\end{aligned}$$

Downloaded By: [B-on Consortium - 2007] At: 10:36 8 November 2007

Noting that:

$$TA_1 = \left[T_0 + \theta \sum_{t=1}^{T} E_1 S_t + \beta \sum_{t=1}^{T} E_1 Y_t - \delta \sum_{t=1}^{T} E_1 L_t \right]$$

we have:

$$A_2 = (T-1)^{-1} \left[TA_1 - A_1 + \theta (\sum_{t=2}^{T} E_2 S_t - \sum_{t=2}^{T} E_1 S_t) + \beta (\sum_{t=2}^{T} E_2 Y_t - \sum_{t=2}^{T} E_1 Y_t) - \delta (\sum_{t=2}^{T} E_2 L_t - \sum_{t=2}^{T} E_2 L_t) \right]$$

Consequently we can write the change in terrorist attacks between period 1 and period 2 as the change in the organization's estimate of its lifetime resources divided by the number of periods of life remaining:

$$A_2 - A_1 = (T-1)^{-1} \left[\theta (\sum_{t=2}^{T} E_2 S_t - \sum_{t=2}^{T} E_1 S_t) + \beta (\sum_{t=2}^{T} E_2 Y_t - \sum_{t=2}^{T} E_1 Y_t) - \delta (\sum_{t=2}^{T} E_2 L_t - \sum_{t=2}^{T} E_1 L_t) \right] \tag{13}$$

Equation (13) allows us to characterize changes in the number of terrorist attacks aimed at American citizens as a function of economic (Y) and personnel [support] (S) resources available to the terrorist organization as well as law enforcement (L): $\Delta A_t = F(Y,S,L)$. Also, from equation (13) it is also possible to characterize the level of terrorist attacks in period t+1 as a function of past attacks and economic, personnel and law enforcement variables: $A_{t+1} = G(A_t,Y,S,L)$. Therefore, on the basis of that, one can conjecture that the probability of having a US citizen as a victim in a terrorist attack is also a function of the same economic, personnel and law enforcement variables that affect the level and variation in the number of terrorist attacks.

In the following analysis, the variable A (attacks) will be measured by terrorist attacks performed in Europe; Y (economy) will be proxied by ideological resources and terrorist actions, which are proxies for material resources. S (support) will be proxied by the trend aiming to capture the persistence of the attacks. L (law enforcement) will be proxied by the country dummy variables.

Hypotheses

Consider a hypothesis in which a terrorist group plans a terrorist attack against a US citizen to display the group's grievance, and has chosen a specific location, type of attack and targeted victims. This definition is based on the utility that the terrorist group receives from choosing these components compared with the utility received from alternative ones. The choice underlying the utility defines the following null hypotheses.

Hypothesis 1 (small countries): Terrorists do not target US citizens in small countries because the media impact of such an attack is smaller than in a larger country. This hypothesis is based on the traditional hypothesis that small countries are protected against international terrorist attacks based on their insignificance in world politics. Therefore, terrorist attacks are not perpetuated in small countries. This is a traditional hypothesis in international relations

Downloaded By: [B-on Consortium - 2007] At: 10:36 8 November 2007

models, in which a small size is related to the absence of economies of scale in small countries (Barros, 2002).

Hypothesis 2 (assassination): Terrorist groups in Europe do not prefer to assassinate US citizens in their attack. This hypothesis has not been previously tested.

Hypothesis 3 (Islamic terrorist targeting): Radical Islamic terrorist groups target US citizens in Europe in a non-random way. This hypothesis is based on previous research on terrorism, see Barros *et al*. (2006).

The hypotheses outlined above were tested by means of the adoption of the mixed logit representation that assumes that the probability of a terrorist attack targeting US citizens can be described by a cumulative logit-probability function of exogenous variables with random coefficients.

EMPIRICAL MODEL

Consider the variable y_i, which verifies $y_i = 1$ if the terrorist attack i aimed at US citizens was successful (that is, it resulted in at least one US citizen victim), and $y_i = 0$ otherwise. One may consider that the success of the attack is attained when a latent variable y_i^*, which is not observed and measures the effectiveness of the terrorist action, is greater than a certain threshold, say zero, without loss of generality. Suppose that this variable verifies $y_i^* = \beta' x_i + \varepsilon_i$, where β is a vector of unknown parameters, x_i is a vector with characteristics of the attack and the terrorists identified in the previous section, and ε_i is an unobserved random variable allowing that events with the same characteristics x_i have different results. The risk of having US victims is given by $P(y_i = 1 \,|x_i)$, which, in this framework, is equal to $P(\varepsilon_i > -\beta' x_i)$ and depends on the statistical assumptions on ε_i. When ε_i is independent and identically distributed as in the standard logistic distribution, the above probability is given by the highly popular logit model,

$$P(y_i = 1 \,|\, x_i) = P(\beta, x_i) = \frac{e^{\beta' x_i}}{1 + e^{\beta' x_i}} \tag{14}$$

McFadden (1974), Ben-Akiva and Lerman (1985) and Train (1986) used the logit model to relate the probability of making a choice to a set of variables reflecting decision-maker preferences.

In most applications, a better specification for the latent variable is $y_i^* = \beta' x_i + v_i + \varepsilon_i$, where v_i is a random term that accounts for unobserved heterogeneity among terrorist events, with zero mean and possibly heteroskedasticity, with a distribution that frequently depends on the explanatory variables and underlying parameters. In our case, it represents characteristics that influence the probability that an attack produces US victims and that are not measured or observed, on the one hand; and on the other hand that may result from measurement error in the variables. Unobserved heterogeneity has been subject of concern and has been analyzed in many recent works, such as Chesher (1984), Chesher and Santos Silva (2002), Dubin and Zeng (1991), Gönül and Srinivasan (1993) and McFadden and Train (2000). This type of model seems to be frequent in data concerning the behavior of individuals, and neglecting it is likely to lead to inconsistent parameter estimates or, more importantly, inconsistent fitted choice probabilities.

Downloaded By: [B-on Consortium - 2007] At: 10:36 8 November 2007

To deal with the unobserved heterogeneity we have chosen the random coefficients logit or mixed logit of McFadden and Train (2000), Train (2003), Bhat (1998, 2000), Hensher and Greene (2003). Consequently, the probability that a terrorist attack with given characteristics x_i will result in a US victim is given by,

$$P_i = \int_{-\infty}^{+\infty} \ldots \int_{-\infty}^{+\infty} P(\beta, x_i) N(\beta \mid \mu, \Sigma) \mathrm{d}\beta$$

with $P(\beta,x_i)$ as in equation (14), $N(\beta|\mu,\Sigma)$ the normal density for the coefficient vector β with mean μ and diagonal covariance matrix Σ.

EXPLANATORY VARIABLES

Time-series data on terrorist incidents are found in the ITERATE data base from 1968 to 2002, available from Mickolus (edwardmickolus@hotmail.com). We restricted the data to the main European countries, based on the fact that they are the most visited countries by US tourists and where most terrorist attacks happen. We gathered a total of 3772 observations.

The availability of explanatory variables is limited by the ITERATE data set used, and the variables are essentially attributes of the attacks. They must be interpreted as proxies for the variables listed in the theoretical model. They are proxies for resources (ideological resources, terrorist actions, which are proxies for material resources) and law enforcement (country dummy variables). They are listed in Table III. We have considered the political/religious nature of the terrorist group as a possible determinant on the targeting of US citizens. Therefore, we have classified the terrorist groups into four major types: radical Islamic, Nationalist, radical Leftist and others. Here, *Islamic* is a dummy variable, equal to one whenever the attack was performed by radical Islamic terrorists. ITERATE does not specify radical Islamic attacks, but identifies the first group initiating the action. From ITERATE's list of terrorist organizations, we have chosen the Islamic groups. Some of these Islamic groups may not be radical in nature, but since we are considering terrorism in Europe, we assume that almost all Islamic groups perpetrating terrorist attacks in the Western countries are radical. We have excluded, for instance, the PKK (Kurdish People's Liberation Front), in view of its well-known secular nature. Nationalist terrorist groups are those who fight for the independence of their motherland and leftist groups are those that which fight with an anti-capitalist ideology (Barros and Proença, 2005).

We have also exploited the possibility that each type of terrorist group may have changed the targeting of US citizens during the period. Therefore, we have considered a trend and a square trend and three distinct periods: until the end of 1979, from 1980 to 1989 and from 1990 onwards, and interacted each terrorist type with the dummy variables *D80* (equal to 1 whenever the attack was between 1980 and 1989) and *D90* (equal to 1 whenever the attack was after 1989). For the sake of efficiency we have included only the interactions that were statistically significant at conventional statistical levels.

Assassination, *kidnap*, *letter*, *aerial hijacking*, *bombs*, *arson* and *armed* are dummy variables based on ITERATE's identification of 25 types of incidents, from which we selected the most common ones. We considered various types of terrorism attack, such as assassination (*assassination*); kidnapping (*kidnap*), armed attacks (*armed*) including those employing missiles, armed attacks–other, including mortars, bazookas, and shoot-outs with the police; incendiary bombing, arson and Molotov cocktails (*Arson*); and bombing (*Bomb*), which includes explosive bombing and car bombing.

Downloaded By: [B-on Consortium - 2007] At: 10:36 8 November 2007

TABLE III Explanatory Variables

Variable	*Description*	*Mean*	*Std Dev*	*Minimum*	*Maximum*
Usvic	Equal to one when the attack induced victims that are USA citizens and zero otherwise	0.0798	0.2710	0	1
Totusvics	Total number of victims with USA citizenship	0.3253	5.3379	0	200
Islamic	Equal to one when the event is radical Islamic and zero otherwise	0.1564	0.3633	0	1
Nationalist	Equal to one when the event is of Nationalist type group and zero otherwise	0.2863	0.4521	0	1
Leftists	Equal to one when the event is of Leftist type group and zero otherwise	0.1514	0.3585	0	1
Assassination	Equal to one when the event is an assassination and zero otherwise	0.0774	0.2673	0	1
Kidnapping	Equal to one when the event is a kidnap and zero otherwise	0.0167	0.1282	0	1
Bomb	Equal to one when the type of event is Bombing and zero otherwise	0.3971	0.4894	0	1
Arson	Equal to one when the event is incendiary bombing, arson or Molotov cocktail and zero otherwise	0.1564	0.3633	0	1
Armed	Equal to one when the event is an Armed attack and zero otherwise	0.0533	0.2246	0	1
Wounded	Total number of individuals wounded	1.8211	10.6105	0	231
Killed	Total number of individuals killed	0.3918	5.1151	0	273
France	Equal to one when the event occurs in France and zero otherwise	0.1729	0.3782	0	1
Germany	Equal to one when the event occurs in Germany and zero otherwise	0.1755	0.3805	0	1
Greece	Equal to one when the event occurs in Greece and zero otherwise	0.1084	0.3110	0	1
Italy	Equal to one when the event occurs in Italy and zero otherwise	0.1010	0.3014	0	1
Spain	Equal to one when the event occurs in Spain and zero otherwise	0.0740	0.2618	0	1
Uk	Equal to one when the event occurs in UK and zero otherwise	0.1747	0.3798	0	1
D80	Equal to one when the event occurs between 1980 and 1989. Zero otherwise	0.4077	0.4915	0	1
D90	Equal to one when the event occurs after 1989 and zero otherwise	0.2415	0.4281	0	1
Trend	Time trend measured by year.			1	35

Wounded and *Killed* are continuous variables giving, respectively, the number of individuals wounded and killed in the terrorist attack.

France, *Germany*, *Greece*, *Italy*, *Spain* and *UK* are dummy variables representing the country where the event took place, based on ITERATE's identification of the end location of the terrorist event. The chosen countries are based on their being considered as representative of Western society in terms of dimension and political involvement in international affairs. Furthermore, these are the Western countries, except for Greece, with a higher annual average incidence of terrorist events in the period (Blomberg *et al*., 2003). However, Greece is the fourth country by the total number of attacks for the whole period.

Intervention variables were not taken into account, because it is not clear what the relevant interventions are for preventing victims with US citizenship. However, we assume that

Downloaded By: [B-on Consortium - 2007] At: 10:36 8 November 2007

prevention and deterrence of terrorism are characteristics of the country and therefore these effects are controlled within the country effects.

ESTIMATION RESULTS

To estimate the last we used a simulator for RCL on the Gauss programming language, available in Kenneth Train's home page (http:/elsa.berkeley.edu/~train/Ps.html). Other results were obtained with TSP 4.5. Results can be seen in Table IV.

To estimate the mixed logit we need to identify the variables with random coefficients. Following the suggestion of McFadden and Train (2000) on using the results of the artificial alternative model in their heterogeneity test (identified here as M&T test), we started by considering *Year*, *Year*^{2}, *Bombing*, *Killed*, *Islamic*, *Germany*, *Greece*, *Italy* and *Spain* as

TABLE IV Estimation Results for Mixed Logit

	Mixed Logit (ML)				*Restricted Mixed Logit (RML)*			
			Random effects				*Random effects*	
Parameter	*Estimate*	*t-stat*	*Estimate*	*t-stat*	*Estimate*	*t-stat*	*Estimate*	*t-stat*
C	–2.1023	–4.52			–2.0973	–4.69		
Trend	–0.2287	–3.70	0.0010	0.21	–0.2231	–3.79		
Trend^2	0.0062	3.58	0.0000	–0.25	0.0060	3.70		
Assassination	–0.7934	–1.84			–0.7687	–1.88		
Bomb	0.0161	0.02	1.6275	1.85	0.2277	0.40	1.3137	1.63
Arson	0.7553	3.04			0.7365	2.99		
Armed	0.1862	0.49			0.1509	0.41		
Kidnapping	–1.1759	–1.36			–1.2508	–1.36		
Wounded	0.0370	3.61			0.0360	3.78		
Killed	0.0451	2.11	–0.0014	–0.26	0.0417	2.07		
Islamic	–2.6419	–1.72	3.0679	2.65	–2.3740	–1.65	2.8522	2.47
Nationalists	–3.5666	–2.97			–3.3511	–3.32		
Leftists	1.2385	3.84			1.2502	4.04		
Islamic×D80	1.1786	1.67			1.1476	1.77		
Leftists×D80	1.1826	2.98			1.1596	3.02		
Nationalists×D80	2.5321	1.99			2.3421	2.08		
Nationalists×D90	2.1769	2.17			1.9713	2.14		
Bomb×Leftists	–0.8589	–2.23			–0.8935	–2.47		
Arson×Leftists	–0.9498	–2.17			–0.8780	–2.03		
France	–0.2514	–0.70			–0.2163	–0.66		
Germany	1.1617	3.79	–0.1103	–1.24	1.1164	3.78		
Greece	1.3308	3.91	0.3221	0.43	1.2909	4.26		
Italy	0.3837	0.43	1.6583	1.40	–0.0784	–0.07	2.1699	1.76
Spain	–2.2099	–0.68	4.8266	1.61	–2.2201	–0.76	4.6418	1.80
UK	–1.1453	–1.99			–1.0896	–1.99		
Observations	3772				3772			
LogLikelihood	–857.50				–858.00			
Wald test: H1:ML					9.179			
p-value					0.102			

Observations: Robust standard errors.

Downloaded By: [B-on Consortium - 2007] At: 10:36 8 November 2007

TABLE V Mean, Standard Deviation and Probability of Random Coefficients being Positive

Coefficients	*Mean*	*St. Deviation*	*P(coeff.>0)*
Bombing	0.2277	1.3137	0.5688
Islamic	–2.3740	2.8522	0.2026
Italy	–0.0784	2.1699	0.4856
Spain	–2.2201	4.6418	0.3162

having random coefficients. Such a model was estimated, and Wald tests on the parameters giving the standard deviations of the random coefficients were performed in order to find a restricted model. In Table IV, the estimation for the initial mixed logit and the restricted specification are shown. Covariance matrices were estimated with the robust Eicker–White estimator.

According to the Wald statistic in Table V, the restricted ML model is not rejected at the 10% level, showing evidence that only *Bombing*, *Islamic*, *Italy* and *Spain* have random coefficients, suggesting that unobserved heterogeneity depends on these variables.

Concerning the location of the attack, the probability of a terrorist attack on US victims is lower in the UK, greater in Greece and Germany. Italy and Spain have mixed effects which are positive for 49% of the attacks in Italy and 32% in Spain, according to Table V. In France there is no significant difference relatively to the other European countries. The political/religious nature of the terrorist perpetuating the attack is significant for the probability of the resulting US victims. Nationalist groups lower that probability, although this effect was most attenuated in the 1980s and slightly less after 1989, while leftist groups raise the same probability with attenuation of the positive effect when they choose bombing or arson attacks, but with an increase for attacks maintained in the 1980s. Islamic attacks have heterogeneous effects on the probability of yielding US victims, with around 20% of these attacks having a positive effect in that probability, with this figure rising to 33% in the 1980s. If the terrorist attack consists of assassination, it lowers the probability of having US victims, while attacks that are arson-based increase that probability. Armed attacks have no significant effect. Kidnaps are not significant. The heterogeneous effect of bombing attacks is positive 57% of the time. The greater the number of persons killed in the attack the greater the probability of having US victims. Time is also a significant explanatory variable with a quadratic effect. Both models estimate that the probability of US victims in European terrorist attacks has decreased since 1968 (the initial period in our sample) to 1985 and consequently started to rise after that year.

CONCLUSIONS

In this paper, we have analyzed the determinants of the probability of US citizens being victims of terrorist attacks that occur in European countries, using data referring to terrorist events for the period February 1968 to December 2002.

There is evidence of unobserved heterogeneity in the standard logit model. To deal with this evidence a mixed logit model is used. Related to the hypotheses stated in the third section, we reject the null of Hypothesis 1 based on the result for Greece, the sole small country in the sample showing evidence against it. Additionally, Germany also presents a positive and statistical significant result. Furthermore, the probability of having US victims is significantly lower in the UK, not significantly different in France from the bulk of European countries, while for Italy and Spain the effects are mixed. Based on these results, the first conclusion is

Downloaded By: [B-on Consortium - 2007] At: 10:36 8 November 2007

that it is difficult to make generalizations such as the one established in Hypothesis 1, due to the heterogeneity in the sample analyzed.

We accept the null of Hypothesis 2, since the killings and wounded are positive and statistically significant, and assassination shows a significant negative effect.

Concerning Hypothesis 3, the evidence is not clearly against the null but it is not strongly supported by it either, given that there is targeting of US citizens by Radical Islamic terrorists only in 20% of the attacks, rising to 33% in the 1980s.

The general conclusion is that terrorist groups target USA citizens at the European level, revealing in this behavior hate and grievance against the leading capitalist country. Greece is the country where the effect on the probability of US citizens being victims of terrorists is higher, followed by Germany and Italy, where around 49% of the attacks have a positive effect. On the other hand, the UK is notably the safest country. The differences across countries may be due, on one hand, to the differences in the efficiency of deterrence and prevention of terrorism and, on the other, to the presence of US citizens due to tourism, economic and/or military purposes.

The higher the number of wounded and killed in a terrorist attack, which gives an idea of its dimension and severity, the higher the probability of yielding US victims, as expected. Results on the effect of the political/religious orientation of the terrorist group indicate that nationalists are not targeting US citizens, given the negative effect on the studied probability. This is an intuitive result since nationalism is a motivation driven by internal characteristics of the country. However, after the 1970s, the effect is getting closer to zero. Leftists are clearly the groups whose attacks are more prone to result in US victims, especially in the 1980s, and they are followed closely by Islamic groups.

The year when the attack was performed is also significant and has a quadratic effect on the probability. Consequently, the probability decreases with time until 1985 and increases after that year.

The present paper has limitations, and these limitations should be addressed in future research on this issue. First, it is not clear from the research whether terrorist groups deliberately target US citizens or if the US citizens are victims of the terrorist attack by chance. The different intensity displayed in the data makes the random hypothesis difficult to accept, but it is a hypothesis not discarded by the analysis. Second, we have not taken into account right-wing terrorist groups who had some weight in the past. Finally, we have included leftist groups in our analysis, but over the past decade they have almost vanished.

What is the appropriate anti-terror policy suggested by our results? First, the US government has an interest in protecting its citizens from terrorist attacks. As Germany, Greece and Italy are the places where it is expected that USA citizens will be more exposed, there is room for cooperation between the US and these countries to improve security. Second, the prevention and deterrence policies should take into account the evidence that bombings and arson are dangerous types of attacks concerning US victims, especially attacks that result in wounded and killed, and that the situation is progressively worsening after 1985 (Enders and Sandler, 1993). This prevention should focus more on Islamic terrorist groups since they are, currently, the most representative terrorist groups at the European level and elsewhere (Sandler and Enders, 2005a) and also because of their revealed preference for bombing attacks with many casualties.

ACKNOWLEDGEMENTS

Financial support received from the Fundação para a Ciência e Tecnologia under FCT/POCTI, partially funded by FEDER, is gratefully appreciated by Isabel Proença. The authors thank

Downloaded By: [B-on Consortium - 2007] At: 10:36 8 November 2007

João Santos Silva for his comments on an earlier draft of this paper. Finally, the authors thank the anonymous referees for their helpful comments. The usual disclaimer applies.

References

Barros, C.P. (2002) Small countries and the consolidation of the European Defence Industry. Portugal as a case Study. *Defence and Peace Economics* **13**(4) 311–319.

Barros, C.P. and Gil Alana, L.A. (2005) ETA: a persistence phenomenon. *Defence and Peace Economics* **17**(2) 95–116.

Barros, C.P. and Proença, I. (2005) Mixed logit estimation of radical Islamic terrorism in Europe and North America. *The Journal of Conflict Resolution* **49** 298–314.

Barros, C.P., Gil Alana, L.A. and Faria, J.R. (2006) Terrorism against American citizens in Africa: persistence and poverty. Mimeo.

Ben-Akiva, M. and Lerman, S. (1985) *Discrete Choice Analysis: Theory and Application to Travel Demand.* Cambridge, MA: MIT Press.

Bhat, C. (1998) Accommodating variations in responsiveness to level of service variables in travel mode choice models. *Transportation Research A* **32** 455–507.

Bhat, C. (2000) Incorporating observed and unobserved heterogeneity in urban work model choice modeling. *Transportation Science* **34** 228–238.

Blomberg, S.B., Gregory, D.H. and Weerapana, A. (2003) Economic conditions and terrorism. *European Journal of Political Economy* **20**(2) 463–478.

Chesher, A.D. (1984) Testing for neglected heterogeneity. *Econometrica* **52** 865–872.

Chesher, A.D. and Santos Silva, J.M.C. (2002) Taste variation in discrete choice models. *Review of Economic Studies* **69** 147–68.

Drakos, K. and Kutan, A.M. (2003) Regional effects of terrorism on tourism: Evidence from three Mediterranean countries. *Journal of Conflict Resolution* **47**(5) 621–42.

Dubin, J.A. and Zeng, L. (1991) The heterogeneous logit model. California Institute of Technology, Social Science Working Paper 759.

Enders, W. and Sandler, T. (1993) The effectiveness of anti-terrorism policies: a vector-autoregression-intervention analysis. *American Political Science Review* **87**(4) 829–44.

Enders, W. and Sandler, T. (1995) Terrorism: theory and applications. In *Handbook of Defense Economics,* vol. 1, edited by Keith Hartley and Todd Sandler. Amsterdam: North Holland, 213–49.

Enders, W. and Sandler, T. (2000). Is international terrorism becoming more threatening? A time series investigation. *Journal of Conflict Resolution* **44**(3) 307–22.

Enders, W. and Sandler, T. (2002). Patterns of transnational terrorism, 1970–1999: alternative time-series estimates. *International Studies Quarterly* **46**(2) 145–65.

Enders, W. and Sandler, T. (2005a) *The Political Economy of Terrorism.* New York: Cambridge University Press.

Enders, W. and Sandler, T. (2005b) Distribution of transnational terrorism among countries by income class and geography after 9/11. *International Studies Quarterly* **50**(2) 367–93.

Gönül, F.F. and Srinivasan, K. (1993) Modeling multiple sources of heterogeneity in multinomial logit models: methodological and managerial implications. *Marketing Science* **12** 213–29.

Hensher, D. A. and Greene, W.G. (2003) The mixed logit model: the state of practice. *Transportation* **30** 133–76.

McFadden, D. (1974) Conditional logit analysis of qualitative choice behavior. In *Frontiers in Econometrics,* edited by P. Zarembka. New York: Academic Press, 105–42.

McFadden, D. and Train, K. (2000) Mixed MNL models of discrete response. *Journal of Applied Econometrics* **15** 447–70.

Train, K. (1986) *Qualitative Choice Analysis.* Cambridge, MA: MIT Press.

Train, K. (2003) *Discrete Choice Methods with Simulation.* Cambridge, Cambridge University Press.