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Terrorism Risk Concern in Europe

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Terrorism risk concern in Europe

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Abstract

We explore whether differences of terrorism risk perception across all European countries reflect their underlying differences in terrorism risk, which we decompose into a long term and innovation component. We employ longitudinal country-level data on terrorism risk concern and our modeling approach is motivated by the Bayesian framework. We conclude that the observed risk perception variation is significantly explained by the long term terrorism countries face, while the cyclical part of terrorism activity does not affect risk perception.

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1. Introduction

We conduct the first longitudinal analysis on a pan-European level, investigating whether differences in terrorism risk are reflected on terrorism perception, motivated by the Bayesian framework (Viscusi and O'Connor 1984; Viscusi 1985; Viscusi *et al*. 1987; Rogers 1997). Pinning down the drivers of terrorism concern is important since it is known to affect various economic and non-economic aspects of behavior (Elster 1998; Schuster *et al*. 2001; Becker and Rubinstein 2004; Berrebi and Klor 2006; Frey *et al*. 2007).

2. Data

Data on terrorism concern for 2003-2008 (broken down to six month intervals Spring-Autumn) were obtained from the **Eurobarometer** (ZA: 3904, 3938, 4056, 4229, 4411, 4414, 4506, 4526, 4530, 4565, 4744) which is a harmonized survey of representative samples for Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Turkey, Great Britain and Northern Ireland. We use responses from the question:

"What do you think are the two most important issues facing (OUR COUNTRY) at the moment?"

Terrorism risk concern $trc_{i,t}$ is calculated as the proportion of respondents that mentioned terrorism in the above question:

$$\left(trc_{i,t}\right) = \left(\frac{n_{i,t}}{N_{i,t}}\right) \quad (1)$$

Where (i) denotes country, (t) time period, n number of respondents mentioning terrorism, and N the total number of survey participants.

We proxy terrorism risk by the following metric (Eckstein and Tsiddon 2004):

$$terrindex_{i,t} = \log\left[(1 + deathrate_{i,t} + woundedrate_{i,t} + attackrate_{i,t})\right] \quad \textbf{(2)}$$

Where:

$attackrate_{i,t} = \left(\frac{\text{count of terrorist attacks}}{\text{100 thousand inhabitants}}\right)_{i,t}$, $deathrate_{i,t} = \left(\frac{\text{count of fatal casualties}}{\text{100 thousand inhabitants}}\right)_{i,t}$ and $woundedrate_{i,t} = \left(\frac{\text{count of wounded}}{\text{100 thousand inhabitants}}\right)_{i,t}$.

This metric takes into account, not only the count of attacks, but also the severity of attacks. Data for the period 1994-2007 on terrorist events are obtained from the **Global Terrorism Database** (http://www.start.umd.edu/start/). Data on population were obtained from **Eurostat**.

3. Modeling terrorism risk concern

The Bayesian framework is our departure point where risk perception is a weighted average of the reference risk $trc_{i,t}^{p}$, based on prior beliefs (ex ante perceived risk), and the arrival of new information $r_{i,t}^{s}$, corresponding to the sample risk inferred from the information (Viscusi and O'Connor 1984; Viscusi 1985, 1989; Smith and Michaels 1987; Smith and Johnson 1988; Loewenstein and Mather 1990; Smith *et al.* 1990; Evans and Viscusi 1991; Liu *et al.* 1998; Viscusi and Evans 1998; Smith *et al*. 2001):

$$trc_{i,t} = w_1 \; trc_{i,t}^{p} + w_2 \; r_{i,t}^{s} \quad \textbf{(3)}$$

Where w_1, w_2 are positive constants.

In equation (3) one has to deal with the latent nature of the prior concern and the measurement of sample risk. To this end we assume that the public's prior terrorism concerns reflect a fundamental characteristic, and are shaped by the country's overall past experience with terrorism. Hence the first building block is that priors are a function of a country's long term history of terrorism risk $ltr_{i,t}$:

$$trc_{i,t}^{p} = \beta \; ltr_{i,t} \tag{4}$$

Where $\beta > 0$.

The sample risk is derived as the difference between current terrorism risk and long-term terrorism risk:

$$r_{i,t}^{s} = terrindex_{i,t} - ltr_{i,t} \tag{5}$$

Hence:

$$trc_{i,t} = w_1 \beta \; ltr_{i,t} + w_2 \; terrindex_{i,t} - ltr_{i,t} \tag{6}$$

Now equation (6) is operational provided that long-term terrorism risk and innovations of terrorism risk are available. We derive these quantities by employing a standard time series decomposition of $terrindex_{i,t}$, into a long-run trend $\tau_{i,t}$ and a cyclical component $c_{i,t}$, in an additive manner (see Harvey 1985; Clark 1987):

$$terrindex_{i,t} = \tau_{i,t} + c_{i,t} \tag{7}$$

We decompose the terrorism index employing 3 alternative smoothing specifications: moving averages (using windows of 1.5 or 2.5 years) or exponential smoothing, using a non-linear optimizer to choose the smoothing parameter α which minimizes the sum of squared residuals. Thus, the trend component $\tau_{i,t}$ for each country is:

$$\tau_{i,t}^{ma3} = \frac{terrindex_{i,t-2} + terrindex_{i,t-1} + terrindex_{i,t}}{3},$$

$$\tau_{i,t}^{ma5} = \frac{terrindex_{i,t-4} + terrindex_{i,t-3} + terrindex_{i,t-2} + terrindex_{i,t-1} + terrindex_{i,t}}{5}, \text{ and}$$

$$\tau_{i,t}^{\exp} = \alpha * terrindex_{i,t-1} + \; 1-\alpha \; * terrindex_{i,t-2}.$$

The estimation of the long term terrorism risk $\tau_{i,t}$ permits us to compute the cyclical component $c_{i,t}$, as the deviation of the current terrorism risk from the trend. Thus we explore the Bayesian property of terrorism concern by testing whether prior beliefs and new information have a positive and significant impact (δ's >0):

$$trc_{i,t} = \delta_0 + \delta_1 \; \tau_{i,t-1}^{j} \; + \delta_2 \; c_{i,t-1}^{j} \; + \varepsilon_{i,t} \qquad \textbf{(8)}$$

Where the superscript j denotes each alternative smoothing method and $\varepsilon_{i,t}$ is a random disturbance. The $\delta's$ are parameters estimated by the following alternative techniques: (i) pooled OLS with cluster-robust standard errors, (ii) Fixed-Effects, and (iii) Random-Effects. Also note that the trend and cycle variables are included in the model with a one period lag to ensure that the specification matches agents' available information set at the time of forming their terrorism risk concern.

4. Empirical results

Table 1 presents the empirical results from projecting risk concern on the long-term terrorism risk and its cyclical component, with cluster-robust standard errors. In addition, we conduct a battery of diagnostic tests for the sphericity of the error term $\varepsilon_{i,t}$, with special reference to two types of no-autocorrelation violations. In particular, we explore the possibility that the error terms exhibit time series autocorrelation: $Cov\ \varepsilon_{i,t}, \varepsilon_{i,t-1} \neq 0 \ \forall \ i$. The second considers the possibility for cross-sectional dependence: $Cov\ \varepsilon_{i,t}, \varepsilon_{j,t} \neq 0 \ \forall \ i \neq j$. This type of error dependence would be relevant in the case where terrorism risk concern across European countries was subject to cross-country correlated shocks. Testing for these two types of correlation, we find significant cross-sectional error dependence (using the Pesaran's CD test, Pesaran 2004), but no serial correlation (Wooldridge 2002).

-----Table 1-----

Then we re-estimate model parameters with robust standard errors, accounting for error structures with cross-sectional correlation, applying the Driscoll and Kraay (1998) algorithm. Table 2 reports the relevant estimation results. As a further robustness check we also provide results including time dummies. Controlling for cross-sectional dependence yields qualitatively similar results as the models assuming spherical errors. Irrespectively of the smoothing method, concerns about terrorism are at best marginally affected by the cyclical component. The main driver through all specifications is the trend component of terrorism risk. This implies that terrorism concern cannot be tackled on a short term basis. Rather, people observe the evolution of the terrorism risk and evaluate its long-term trend.

-----Table 2-----

5. Conclusions

We decomposed country terrorism risk into long and short run components, and investigated whether they account for risk perception across European countries. We conclude that risk perception variation is only explained by the long term terrorism countries face. In contrast, the cyclical part of terrorism activity does not affect risk perception. Future research could be directed towards a micro level analysis accounting for respondents' heterogeneity captured by their personal characteristics. Moreover, one could also explore location and timing effects of terrorist incidents as determinants of terrorism risk concern.

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Tables

Table 1. Terrorism risk concern and decomposed terrorism index[a]

Estimation method	Pooled OLS with cluster-robust standard errors			Fixed Effects			Random Effects		
Regressor	**MA3 Filter**[b]	**MA5 Filter**	**EXP. Filter**	**MA3 Filter**	**MA5 Filter**	**EXP. Filter**	**MA3 Filter**	**MA5 Filter**	**EXP. Filter**
trend	0.503*** (0.141)	0.510** (0.187)	0.410*** (0.137)	0.131** (0.056)	0.126 (0.099)	0.426*** (0.118)	0.172* (0.093)	0.194* (0.101)	0.419*** (0.073)
cycle	-0.016 (0.045)	0.013 (0.045)	0.135 (0.084)	-0.005 (0.055)	0.011 (0.054)	0.044 (0.031)	-0.006 (0.045)	0.011 (0.046)	0.050 (0.040)
Intercept	0.070*** (0.015)	0.068*** (0.014)	0.071*** (0.017)	0.086*** (0.002)	0.086*** (0.005)	0.070*** (0.006)	0.080*** (0.017)	0.079*** (0.016)	0.067*** (0.011)
	Diagnostics								
Serial correlation test [c]	0.885	0.821	0.376	0.885	0. 821	0.376	0.885	0. 821	0.376
Cross-sectional independence test [d]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0. 000	0.000
R-squared (within)	-	-	-	0.031	0.018	0.117	0.031	0.018	0.117
R-squared (between)	-	-	-	0.403	0.378	0.199	0.403	0.378	0.201
R-squared (overall)	0.275	0.284	0.200	0.275	0.283	0.184	0.275	0.284	0.186
Observations	288	288	288	288	288	288	288	288	288
Overall significance (p-value)	0.000	0.000	0.000	0.003	0.100	0.001	0.173	0.159	0.000

Notes: (a) *, **, *** denote significance at the 10, 5 and 1 percent level respectively, (b) MA3, MA5 and EXP Filter stand for the moving average smoother with 3 and 5 observations, and the exponential smoother respectively, (c) Wooldridge (2002), (d) Pesaran (2004).

Table 2. Terrorism risk concern and decomposed terrorism index correcting for cross-sectional dependence						
Estimation method	**Pooled OLS with Driscoll-Kraay s. e.**		**FE with Driscoll-Kraay s.e.**	**Pooled OLS with Driscoll-Kraay s. e.**		**FE with Driscoll-Kraay s.e.**
Regressor	**MA3 Filter**	**MA5 Filter**	**EXP. Filter**	**MA3 Filter**	**MA5 Filter**	**EXP. Filter**
trend	0.503*** (0.036)	0.510*** (0.057)	0.426*** (0.085)	0.497*** (0.038)	0.505*** (0.060)	0.418*** (0.077)
cycle	-0.016 (0.068)	0.013 (0.085)	0.044 (0.034)	-0.006 (0.067)	0.023 (0.084)	0.050 (0.031)
Time dummies	-	-	-	Included	Included	Included
Intercept	0.070*** (0.005)	0.068*** (0.005)	0.070*** (0.008)	0.100*** (0.002)	0.093*** (0.005)	0.094*** (0.004)
Diagnostics						
R-squared	0.275	0.284	0.117	0.298	0.307	0.212
Observations	288	288	288	288	288	288
Overall significance (p-value)	0.000	0.000	0.000	0.000	0.000	0.000