MPRA

Munich Personal RePEc Archive

Corporate Management of Highly Dynamic Risks: The Case of Terrorism Insurance in Germany

Thomann, Christian; Pascalau, Razvan; Schulenburg, J.-Matthias Graf von der and Gas, Bruno

13. December 2007

Corporate Management of Highly Dynamic Risks: The Case of Terrorism Insurance in Germany [*]

Christian Thomann[†]

University of Alabama and Leibniz University Hannover, Germany

Razvan Pascalau[‡]

Department of Economics, Finance & Legal Studies

University of Alabama, USA

Bruno Gas

CEO Extremus, AG

J.-Matthias Graf von der Schulenburg [§]

Leibniz University Hannover, Germany

December 13, 2007

[†]University of Alabama and Leibniz University Hannover, Germany

[‡]Razvan Pascalau, Department of Economics, Finance & Legal Studies, Culverhouse College of Commerce and Business Administration, University of Alabama, 200 Alston Hall Box 87-0224, Tuscaloosa, AL, 35487, USA; Tel.:+1-205-348-7592; E-Mail: rpascala@cba.ua.edu.

[§]Contact Author: J.-Matthias Graf von der Schulenburg, Institute for Insurance Economics, Leibniz Universitaet Hannover, Königsworther Platz 1, 30167 Hannover, Germany. E-Mail: jms@ivbl.uni-hannover.de

Abstract

This article extends the theory of corporate risk management to encompass highly dynamic risks. Taking Viscusi's (1989) prospective reference from the context of individual decision making and applying it to a corporate context we propose a theory of how corporations process new information. Using unique data on all terrorism insurance policies sold in Germany we find support for this concept of risk-updating by showing that the demand for terrorism insurance is strongly determined by the recent occurrence of terrorist attacks.

1 Introduction

The terrorist attacks of September 11th, 2001 (henceforth, 9-11) have created an unprecedented level of destruction. Using civilian aircraft against buildings, the terrorists killed 2,871[1] people, destroyed or severely damaged 31.1 million sq. ft. of office space (Fuerst, 2005) and caused one of the most expensive insured losses in history. The bombings in Madrid, 2004, and London, 2005, and a number of attempted attacks have since then served as reminders that the struggle against terrorism is going to last a long time. Governments have responded to the terrorism threat by passing legislation aimed at protecting citizens, engaging in military operations, increasing defense spending and by intervening on terrorism insurance markets. Yet, terrorism does not only affect governments. It is also a major challenge for corporate risk managers.

Terrorism's highly dynamic[2] nature sets terrorism apart from most other risks that corporations face. Terrorist organizations can change their aims, form coalitions with other groups and embrace innovations. They are able to allocate their resources to maximize damage and alternate between targets. The scarcity of reliable information further complicates the task of corporate risk managers. Contrasting with the extent of public attention, there have not been many large scale attacks conducted by globally organized groups in either the United States or the European Union. Yet, the number of terrorist attacks constitutes one of the main sources of information on the risk potential of terrorist groups. Information in the media or provided by governments is likely to be biased and aimed at reaching political goals in the war on terror.[3] The emergence of terrorism as a global security problem calls for an understanding of corporations' management of terrorism risk. In order to gain this understanding it is necessary to inquire into the more general question of how corporations weigh new information on rapidly evolving risks and how this information translates into corporate policy.

Unexpectedly, this question has not yet been discussed in the literature on corporate risk management. It is therefore our goal to first close this gap by proposing a theory of how corporations process new information on dynamic risks and then to provide insights into corporations management of terrorism risk[4]. Our analysis is divided into

---

[1] National Obituary Archive-Honor Roll (2007).

[2] Kunreuther et al. (2003) use the term "dynamic uncertainty".

[3] See Wilkinson (1986) for a discussion on a number of instances during which the media's coverage of terrorists events was subject to censorship.

[4] See Michel-Kerjan and Pedell (2005) for a description of the Public-Private Partnerships in France,

four sections. First, we review the theory of corporate risk management. We then propose a theory of how corporations process new information on dynamic risks. We do this by adapting Viscusi's (1989) prospective reference theory which was developed for individual decision making to a corporate context. Prospective reference theory generalizes the expected utility model. It suggests that decision makers treat their information on probabilities as imperfect and that in the face of new information they update their risk assessment.

Second, we provide a definition of terrorism risk and discuss the difficulty of accurately assessing this risk. We argue that the dynamic properties of terrorism and the lack of reliable information lead corporations to place a great weight on single and statistically insignificant events. We further describe the terrorism insurance market in Germany. Third, we introduce our unique dataset on all terrorism insurance purchases through the German government sponsored terrorism insurer. The dataset spans the period from November 2002 until March 2007. During this time period corporations in Germany were confronted with contradicting evidence. Until March 2004, Western Europe and North America were spared from large terrorist attacks. Since then terrorists have successfully targeted Spain and Great Britain. They have also attempted to attack targets in Germany and a number of other European countries. Fourth, we formulate our model that accounts for the particularities of the German terrorism insurance market. We test if recent terrorist activity has a non-declining importance for the demand for terrorism insurance. We further analyze whether corporations' reactions differ with firm characteristics and check the robustness of our model.

Our analysis leads to three main results: First, corporations assess their probability of falling victim to a rapidly evolving risk using a mechanism that allows for dynamic updating and which leads them to overvalue new information. Second, we observe that corporations' risk management activities react strongly to the level of terrorist activity observed during the previous 12 months. Third, corporations consider the characteristics of terrorist attacks, and they use this information to adjust their demand for terrorism insurance accordingly.

The paper is organized as follows: Section 2 develops and extends the theory of corporate risk management. Section 3 discusses the dynamic nature of terrorism risk and describes the institutional arrangement for insuring against this risk. Section 4 focuses on the dataset and presents the regression models. Section 5 concludes the

Germany, and the US.

article.

2 Theory of Risk Management and its Extension to Dynamic Risks

There are good reasons that corporate risk management differs from that of risk averse individuals because corporations cannot be genuinely risk averse (Jensen and Meckling 1976). Modiglani and Miller (1958) show that under the assumptions of a symmetric distribution of information and perfect capital markets the marginal cost of capital is not affected by the firm's financing decision. Since shareholders can manage risk by diversifying their assets they prefer that corporations do not reduce revenue by purchasing costly insurance coverage. Thus, managing risks should not matter to corporations.

Yet, there is a lot of evidence to the contrary. For instance, large diversified corporations are buying insurance and even insurers are reinsuring themselves[5]. Regarding the theoretical assumptions, Mayers and Smith (1982), Stulz (1984), MacMinn (1987) and Froot et al. (1993) show how managing even idiosyncratic risk can be in the interest of a corporation's diversified shareholders. The motives identified for managing risks include among others a reduction in the expected costs of financial distress and the optimization of tax burden. Assuming costly financing and decreasing marginal returns on investments, Froot et al. (1993) demonstrate that risk management can help increase a corporation's value. Variation in a corporation's internal cash flows may lead either to a reduction of its investments or pressure to raise capital externally. Both adversely affect profits. The expected costs of either giving up positive net present value projects or raising funds externally can be reduced through managing risks. Managing risk can also lower transaction costs connected with bankruptcy (MacMinn, 1987)[6]. Further, a company facing a convex tax function can benefit from risk management as it helps to smooth its profits. The expected tax liabilities on profits will be higher than the tax liabilities on expected profits.

Summing up, due to different kinds of transaction costs corporations try maximize a concave function. Thus, corporations behave as if they were risk averse, even if their

---

[5]See Cole and McCullough (2006) for a recent study on insurers demand for (international) reinsurance.

[6]See Altman (1984) and Warner (1977) for an empirical investigation into bankruptcy costs.

3

shareholders can diversify risks on financial markets. This implies that the results derived from the expected utility model might also hold in a corporate environment. Yet, there is evidence that corporations' behaviour exhibits even closer similarities to that of individuals. Ellsberg (1961) shows that individuals' welfare is affected by uncertainty over probabilities. Thus, individuals prefer a lottery with known probabilities over another lottery with unknown, ambiguous probabilities. This result contrasts with the expected utility theory that assumes that individuals are indifferent to ambiguity over probabilities. Yet, ambiguity aversion can also be observed in a corporate context. While analyzing the prices charged by insurance underwriters, Kunreuther et al. (1995) find that ambiguity over size and probability of losses leads to significantly increased price quotes. Higher prices for ambiguous risks imply that insurance corporations act as if they are averse to ambiguity.

The standard theory of corporate risk management and its extension to ambiguous risks assumes that risks are stable over time. This simplification appropriately captures a corporation's exposure for most risks. The risks associated with natural catastrophes, fires and accidents are predominantly stable and risk managers can rely on statistical information based upon a large number of historical events. On the other hand, terrorism risk is a highly dynamic risk. Thus, past assessments may not appropriately capture a corporation's exposure. To reflect the dynamics and the difficulties of properly assessing a corporation's exposure to a highly dynamic risk we propose a new extension to the theory of corporate risk management. We suggest applying Viscusi's (1989) prospective reference theory which was originally developed for individual decision making.

Prospective reference theory assumes that decision makers use a dynamic Bayesian process to determine the probability of uncertain events. In the bivariate model of Viscusi's (1989) prospective reference theory, the decision maker has a prior belief of an event's probability (q). This prior belief is weighted with a parameter γ. This parameter corresponds to the individual's confidence in its prior belief. In the periods after this prior belief has been formed, the decision maker views ξ additional trials. In these trials he observes the outcome in question with a probability p. As a result of his prior knowledge, the number of additional trials, and their outcomes the decision maker then forms a posterior probability p^*. One obtains this posterior probability by combining the prior information q weighted with γ, with the p outcomes from the ξ trials:

$$p^* = \frac{\gamma q + p\xi}{\gamma + \xi} \tag{1}$$

4

The posterior probability p^* is well behaved and can be used to generalize the expected utility model. It can explain the overweighing of low probabilities, premiums for the elimination of certain risks, and the Allais paradox[7].

Prospective Reference Theory has been empirically tested in a number of studies. Viscusi and Connor (1984) analyze the risk assessment of workers in the chemical industry. In their study they provide workers, who had previous experience with handling chemicals, with additional information (hazard warnings) on new chemicals that were to be used on their job. In their study they find that even very experienced workers place a great weight on the new information about dangerous chemicals. The posterior probability is greatly influenced by the new information (ξ/γ is very large). Viscusi and Evans (2006) extend the analysis of worker decision processes to reflect the significantly different probabilities reported by workers and those implied by their behavior. Jakus and Shaw (2003) find that hazard warnings influence anglers' choices by investigating the impact of fish consumption advisories on recreational fishing. More specifically, they observe that an increasing severity of hazard warnings leads to increased perceived risk.

3   Terrorism

3.1   Terrorism

Terrorism, defined as the "premeditated, politically motivated violence perpetrated against noncombatant targets by subnational groups or clandestine agents, usually intended to influence an audience" (United States Department of State, 2000, xii), imposes a very particular risk. Although terrorism itself is not new, its nature has changed drastically. Over the last twenty years terrorists' motivations, organizational structures and goals have evolved. From the 1960s to the 1980s terrorism was predominately inspired by separation, racism, Marxist ideology, nationalism, and economic inequality (Wilkinson, 1986). The respective groups, among them the German "Rote Armee Fraktion", were characterized by well-defined command and control structure. They had distinct objectives and their trained members were full-time planning, preparing, and executing attacks (Hoffman, 1997). Due to these characteristics terrorism was considered to be a mainly domestic and regional risk. With the exception of countries like Great Britain, Spain, and South Africa with a history of regional conflicts, terrorism was even included

---

[7]See Viscusi (1989) for an in-depth discussion of the predictive power of prospective reference theory.

in standard fire insurance contracts.

Today terrorism is no longer seen as mainly a domestic risk. During the last decades additional motives for terrorism have appeared, different kinds of organizational structures have emerged, and terrorists' actions have gained lethality (Enders and Sandler, 2000). The 1979 takeover of the American embassy in Teheran marked the rise of a new kind of terrorism that aims at establishing an Islamic state. The shift towards religiously inspired terrorism has significant implications for potential attacks because religious groups might even view civilians to be legitimate targets. Post-cold war terrorist groups have also become more amorphous: their members are often times living "regular" lives and international networks, i.e. Al-Qaeda, have gained importance.

The events of 9-11 have placed terrorism among other catastrophe risks like hurricane and earthquake risk. Yet, the dynamics of terrorism pose challenges for the accurate risk assessment. These dynamics are illustrated by the American Department of Homeland Security's (DHS) "Security Advisory System" (DHS, 2007). The system uses five color-coded steps to give a broad indication of the likelihood of a terrorist attack. Red illustrates a severe risk of terrorist attacks, orange stands for a high risk, yellow for significant risk and blue for a general risk of terrorist attack. The threat levels are based on the assessment of a range of factors including current intelligence, recent events, and what is known about terrorist intentions and capabilities. It takes both the probability and the gravity of a potential attack into account. The system was introduced on March 12th, 2002 at the threat level "yellow". Until January 2004 the national threat level was changed 10 times between "yellow" and "orange". Since January 2004 the nationwide threat level has remained at "yellow". Instead of adjusting the nationwide threat level the DHS has only placed certain regions (New York and New Jersey), air travel, and mass transit under a higher alert status. Higher alerts are binding for the executive branch and result in a number of measures to increase protection against acts of terrorism.

[Insert Table 1 here]

Table 1 presents the chronology of the changes to the Homeland Security Advisory System. Yet it is not only the frequent adjustments to the Homeland Security Advisory System that demonstrate the difficulties even government entities face when assessing terrorism risk. In a study conducted by the General Accounting Office (GAO, 2004) the DHS acknowledged that there were no explicit criteria or quantifiable factors used

to determine the threat level and that these threat levels included a certain amount of subjectivity. This subjectivity should not be underestimated.

Behavioural Economists have shown that individuals use a number of heuristics when assessing the probability of rare occurrences. Among them is the well-known availability heuristic (Kahneman and Tversky, 1973). This heuristic leads individuals to attribute a greater probability to events that are easily retrieved from memory. This may result in an overestimation of the probability of recent events. In an article based upon data from November 2001, Fischhoff et al. (2003) provide evidence that individuals significantly overestimate their exposure to terrorism risk. They find that 43% (19%) of their respondents living within (outside) a 100 miles of the World Trade Center attribute a 50% or higher chance of themselves being hurt in a terrorist attack. Sunstein (2003) suggests that individuals' perception of terrorism risk might be even further exaggerated. Thus, subjects may be prone to probability neglect leading them to focus solely on the bad outcome and not on its likelihood[8]. Yet, there exists evidence that terrorists' activities follow a cycle that is characterized by periods of high and low activity (Enders and Sandler, 2005). A severe attack might thus signal a regime of an increased danger of terrorist attacks.

3.2 Institutional Arrangements for Terrorism Insurance in Germany

9-11 has also resulted in one of the most expensive insured losses in history. The inflation adjusted insured damage of 9-11 is only surpassed by the losses from the hurricanes Katrina, 2005, and Andrew, 1992 (Swiss Re, 2006). In fact, the 9-11 events led to important changes on terrorism insurance markets in a number of countries including Germany. Before that date terrorism claims were regularly included in standard fire insurance contracts in Germany[9]. Although discussions about excluding terrorism risk from regular insurance contracts can be found in the German insurance literature from the 1970s and 1980s, during which the country experienced a number of terrorist attacks (i.e. the attacks on the Olympic Games in Munich, 1972, and the various attacks conducted by the leftist Red Army Faction), the insurance industry saw no need to exclude these risks

---

[8]Contrasting evidence is presented by Viscusi and Zeckhauser (2005). A large part of the subjects in their analysis did not acknowledge that 9-11 changed their terrorism risk assessment.

[9]Exclusions for terrorism risk were only regularly in countries (i.e. Great Britain, Northern Ireland, Israel, Spain and South Africa) with a history of regional conflicts.

from fire insurance contracts[10]. Since terrorism risk was covered by a corporation's fire insurance contract, risk managers were able to treat terrorism risk separately. However, 9-11 heavily affected Munich Re and Allianz (Hartwig 2002). As a consequence, terrorism risk was excluded from commercial fire insurance contracts in Germany and the German government intervened by offering reinsurance coverage for terrorism insurance.

Although Germany is not the only country where the government reinsures terrorism risk, there are some particularities that distinguish the country's terrorism insurance scheme. Due to the regulation in Germany, government sponsored terrorism insurance is only available from one insurer, Extremus AG. The terrorism insurance contracts are highly standardized. Thus, they allow us to compare purchasing patterns over time. Extremus AG, a public-private partnership, was founded in 2002, and is owned by 16 private insurance companies. Extremus is 100 % reinsured for claims up to 10 billions €. The layer between 0 and 2 billion € is provided by the private insurance market. The layer between 2 and 10 billion € is reinsured by the German government. Corporations interested in government backed terrorism insurance must purchase their (standardized) coverage through Extremus.

The primary insurance contracts offer compensation for property losses (buildings and content), direct business interruption losses, and clean-up costs that were caused by an act of terrorism. The contracts are designed as upper limit policies. For this type of contract the policyholder's payout is the minimum of the loss due to a terrorist attack, and the upper limit (UL) selected when purchasing the contract. Another particularity of the German terrorism insurance scheme is that only very few risk characteristics are used to determine the terrorism insurance premium. The premium is calculated mainly by accounting for the policyholder's maximum possible loss (MPL), a number that is obtained from the fire insurance contract, and the upper limit (UL) selected by the policyholder. It should be noted that during the time period studied Extremus did not adjust its premiums.

---

[10]The articles include Schmidt and Gerathewohl (1973) and Hübner (1981).

4   Empirical Analysis

4.1   The Data

The dataset includes all contracts sold by the government sponsored insurer from the company's foundation in the 4th quarter of 2002 through the 1st quarter of 2007. There are more than 1000 observations per year in the dataset. It provides detailed information on the policyholders and the policies purchased. It names the policyholder, his address and the nature of the business. In addition, the dataset contains the inception and expiration date of the policy, *MPL* and *UL*. There is data on 5614 terrorism insurance contracts[11]. Figure 1 depicts the number of all policies sold by Extremus since its inception. The policyholders come from 18 industries. Most contracts, 2424, are sold to real estate corporations. Many contacts are also bought by businesses from the financial sector. 513 contracts are purchased by banks, 665 by insurance companies and 530 by real estate investment funds. Table 2 presents the number of policyholders by industry and year.

[INSERT TABLE 2 HERE]

The data is highly skewed due to a small number of very large insurance contracts and a large number of smaller contracts. Thus, there are significant differences between the mean and the median of the variables reported in Table 3. The median of *MPL* is € 55 million. The mean of *MPL* is nearly seven times larger (€ 419 million) than its median. There are 1322 (105) insurance contracts with a *MPL* of € 100 million (€ 1 billion) or more. A corporation's size is denoted by *MPL* which is recorded in the regular fire insurance contract and marks the sum of the insured tangible assets and the corporation's business interruption limit. Of the 5620 insurance contracts sold, 2974 are property insurance contracts (median *MPL*: € 50 million). An additional 211 include coverage against interruption of business operations (median *MPL*: € 55 million) and 2646 cover both property and losses due to business interruption (median *MPL* € 67 million). The distribution of the upper limits (*UL*) is less skewed[12]. The mean of *UL* is € 77.2 million. The median of *UL* amounts to € 47.8 million. Consequently, Extremus' premium income depends greatly on its largest policyholders. The largest 10 contracts

---

[11]Due to the fact that terrorism insurance for policyholders with a MPL of less than € 25 million is available from regular insurance companies our dataset is censored at this point.

[12]Extremus limits these to € 1.5 billion annually .

9

contribute to 19 % of total premium income. The largest 100 contracts (1.7 percentile) paid 66% of the total premium the company collected. The mean (median) terrorism insurance premium is € 67,095 (€ 11,201).

Comparing the numbers from our dataset with the overall market level data reported by the Association of German Insurers it becomes clear that terrorism insurance is not equally attractive for all of the 40,000 corporations in Germany that are eligible to purchase a separate terrorism insurance policy. Of these 40,000 corporations only 2.9% decide that the benefits of a terrorism insurance policy offers outweigh its costs. The market penetration increases significantly with the size of the company: 21% (2003) and 15% (2004) of the 60 largest corporations ($MPL > €$ 5 bn) purchase terrorism insurance. A comparison of the low overall market penetration of Extremus and the (high) relative limits chosen by its clients reveals that the terrorism insurance contracts offered appeal only to a limited number of corporations. The mean relative amount of coverage purchased (quotient of MPL and UL) is 86%. A large part of the policyholders, 2357 of 5620, even purchases full insurance.

[INSERT TABLE 3 HERE]

4.2   Regression Analysis

The test and analysis of our proposed extension to the theory of risk management are conducted in three steps. After accounting for the particularities of our data we formulate our estimation equations. Using the whole dataset we first test if recent terrorist activity has led to changes in the demand for terrorism insurance in Germany. The analysis focuses on the influence of the attacks on Madrid (March 11th, 2004), London (July 7th, 2005), and the attempts to bomb two trains in Germany (June 31st, 2006). Table 4 gives an overview of the events studied. Since terrorism risk has changed drastically over the last few years, one can assume that the knowledge about terrorism risk at any given time is equally distributed among different corporations. Second, we analyze whether the reaction to terrorism differs according to company specific factors. Third, we examine how well our models predict the developments of the German insurance market by conducting two out of sample forecasts. We further apply the proposed extension to analyze the terrorism insurer's own premium projections.

[INSERT TABLE 4 HERE]

10

The general attrition problem, where companies reenter the sample after leaving, complicates a panel approach to analyzing our data. Thus, we limit to a time series approach that in this case suffices to describe the patterns of demand for terrorism insurance in Germany. We use monthly data on *(A)* the change in the number of policies insured with Extremus and *(B)* the change of premium income generated. Both dependent variables reflect the terms and conditions used in the terrorism insurance contracts. The fact that the insurance contracts expire at the end of the calendar year results in 96.9% of all contracts expiring in December. The same rule leads to a great number of contracts incepting in January (82.3%) (see Figure 1 for details). Nearly all contracts (97.7%) sold in January end in December. Of the total net premium income of 377 million €, 82% was generated by contracts starting in January, 99% can be attributed to contracts ending in December. Since contracts tend to be purchased for the whole year we also see most of the change in premium income occurring in January. Table 5 shows monthly data on both the number of policies sold and the change in premium income.

[INSERT TABLE 5 HERE]

Standard unit root tests (ie., Dickey-Fuller) suggest that the two series are stationary at the standard significance levels. Further, our series do not appear to be serially dependent. Those results have not been reported to economize on space, but they are available upon request from the authors. In a first step we estimate two regression models for the whole dataset. The models explain the change in the number of policies (ΔPol_t) and the change in premium income in a given month ($\Delta PINC_t$) with the help of dummy variables denoting January (*January*), the months following an attack ($Attack_i$), and interaction variables ($Inter_i$). The interaction term captures the effect of a terrorist attack on the policyholders' tendency to renew their contract following an attack.

We formulate the following two simple models:

$$\Delta Pol_t = \beta_{a0} + \beta_{a1} January + \sum_{i=1}^{3} \alpha_{ai} Attack_i + \sum_{i=1}^{3} \varphi_{ai} Inter_i + \varepsilon_a \qquad (A)$$

$$\Delta PInc_t = \beta_{b0} + \beta_{b1} January + \sum_{i=1}^{3} \alpha_{bi} Attack_i + \sum_{i=1}^{3} \varphi_{bi} Inter_i + \varepsilon_b \qquad (B)$$

where $i=1$, 2, 3 and denote the Madrid, London, and the attempted attacks on the German trains, respectively.

While we have data on 53 months ($t=1,\ldots, 53$) we are only able to use information from t=7 to t=53. This is due to the fact that it took Extremus some time to establish its customer base. As a result it is only after March 2003 that the number of policies sold stabilized. We conduct a Breusch-Pagan/Cook-Weisberg test to test for potential problems arising from heteroskedasticity. This test (*H0:Constant Variance*) shows no indication of heteroskedasticity (Regression A: $\aleph^2_{(1)}=2.53$, Regression B: $\aleph^2_{(1)}=1.65$). The Bartlett's periodogram-based test for white noise indicates no problems for both regressions. The regression results provide evidence that the inflow of new information leads to significant changes in the demand for terrorism insurance (see Table 6).

[INSERT TABLE 6 HERE]

Although the coefficients for the dummy variables ($Attack_i$, $i=1$, 2, 3), which denote the month of an attack, and the two months following are not significant, we find that the terrorist attacks have a significant influence on the demand for terrorism insurance. The interaction terms ($Inter_i$, $i=1$, 2, 3), marking a January following an attack are positive and significantly different from zero. Our estimates suggest that the terrorists' activity level observed during the previous 12 months has a strong and apparently not declining importance for a company's insurance decision. The latter is not usually reversed until the end of the year. The negative coefficient for the JANUARY variable (-144 for Regression A and -3.18 million € for Regression B) captures the drop in the demand for terrorism insurance that resulted from the absence of major terrorist attacks on western targets between the foundation of the terrorism insurer in November 2002 and January 2004.

The interaction variables represent the effects of the attacks on Madrid and London and the attempted train bombings in Germany on the demand for terrorism insurance. Due to these attacks the demand for terrorism insurance in Germany did not decline as expected during January of 2005, 06 and 07 but proved to be rather stable. Thus, due to the Madrid and London attacks demand for insurance increased by 62 and 82 contracts, respectively. These numbers account for an increase in total premiums of around 14.4% and 38.8%, respectively. The coefficients of the interaction variables are not declining. The relation between the prior probability and the recent experience thus appears to be stable. Hence, corporations do not seem to get more familiar with

terrorism risk or at least do not perceive their past assessments to appropriately reflect their present exposure. The significant weight that corporations place on recent terrorist activities makes it necessary to model their risk management decisions using a concept that integrates these dynamics.

In the second step we investigate whether a corporation's reactions differ with respect to its characteristics (location, financial sector/non-financial sector, and size). To do this we first divide our dataset into two groups: Subgroup 1 (Large Cities) includes corporations with headquarters located in cities with more than 500,000 inhabitants, while subgroup 2 (Small Towns) concerns those from smaller towns. We estimate two multivariate regression models (C: Dependent Variable: ΔPol_t; D: Dependent Variable ΔPINC_t) to gain insights into the differences between these groups (Table 7). While multivariate regression models produce the same coefficients and standard errors as separate OLS, they also provide an estimate of the covariances of the residuals across the two equations.

[INSERT TABLE 7 HERE]

Regressions C and D confirm our prior findings. Yet, we observe that there are significant differences in how corporations interpret the information on terrorist attacks. The post 9-11 attacks, all of which targeted large cities, have reminded corporations located in those cities how acute the terrorism threat is. Thus, corporations located in bigger cities purchased more insurance contracts after each of the three attacks. This higher demand in turn translated into premium income increases of 51.2%, 64.1%, and 55.2%, respectively. The results appear ambiguous in the case of corporations located in smaller cities. Hence, it appears that only after the London attacks did both the number of insurance contracts and the premium income actually increase. In contrast, it appears that after the Madrid and attempted attacks on the German trains the premium income actually decreased. Using the Breusch-Pagan test of independence, the two models appear statistically independent. We further perform Wald tests to confirm that the individual interaction coefficients are significantly different from each other (Table 7). The test shows that the three coefficients across the two subgroups are different from each other at the 10% and 5% significance level, respectively.

We further examine whether corporations respond differently to terrorist attacks according to their size (measured as MPL)[13]. Regression E of Table 8 displays that on

---

[13]We divide our dataset into to subgroups (small policyholder:$MPL \leq$ mean(MPL) and large policy-

average larger policy holders are more sensitive to both an absence of terrorist attacks and an increased terrorist activity. For the larger corporations the higher number of policies bought reflects an increase in premiums of around 24%[14], 30%, and 20% due to the Madrid, London and attempted German train attacks, respectively. For smaller policy holders, the Madrid, London, and attempted German train attacks led to premium increases of only 6%, 8% and 0.5%, respectively. Again, these results are significantly different across the two types of policy holders. Finally, regression F (Table 8) shows that in response to the terrorist attacks the financial corporations bought on average more insurance contracts than the financial corporations. The interaction terms appear significantly different across the two equations at the 5% significance level.

[INSERT TABLE 8 HERE]

Next, in the third step we investigate the accuracy of the estimated equations by inspecting the out-of-sample forecasting performance of our models. Table 9 reports the results. Thus, we trim the last 10% of the observations from the sample (i.e. roughly 5 observations) and re-estimate the equations on the shorter sample. Using the newly estimated coefficients we obtain predictions of the previously trimmed data. To save space, we limit this forecasting exercise to equations *(A)* and *(B)*. For equation *(A)*, three of the actual observations fall within the 95% confidence interval formed around the forecasts. For equation *(B)*, the number of observations predicted correctly with 95% confidence increases to four.

[INSERT TABLE 9 HERE]

In the final step of our analysis we apply our findings to the terrorism insurer's premium projections. We find that, just like its clients, Extremus places a great weight on recent terrorist activities. When founding Extremus in 2002, its shareholders expected to sell policies worth € 500 million annually. This number was later adjusted to € 250 million (Extremus, 2003). However, even this adjusted figure proved to be exaggerated (see Table 10). During the first 14 months of operation, from November 2002 until December 2003, 1080 insurance contracts generated € 105 million of premiums income. For 2004 the company sold 1071 insurance contracts and received € 78 million in premiums. In 2005 the number of contracts increased to 1176 while the premium income decreased to € 66 million. The following year Extremus underwrote 1195 insurance contracts worth

---

holder: $MPL \geq \text{mean}(MPL)$.

[14]The precise magnitude of the coefficient is obtained as $e^{\alpha_{bi}} - 1$.

14

€ 68 million. From January until March 2007 Extremus sold 1050 insurance contracts that are expected to bring the company a premium income of € 59 million.

Corporation's renewal rates, which denote the percentage of corporations that have purchased terrorism insurance in the year *t-1* and buy another terrorism insurance contract in *t*, provide further support of the influence of terrorist attacks on the demand for terrorism insurance. Only 62% of the policyholders that bought terrorism in 2003 insurance renewed their coverage the following year. After the attacks in Madrid this number increased to 78 %. It climbed to 86% for policies renewed in the year 2006. For 2007 the renewal rate came to 80%.

[INSERT TABLE 10 HERE]

To sum up, according to the prospective reference theory, had there been more terrorism attacks then corporations would have bought more terrorist insurance. The discrepancies between the expected and the actual premium income appear significant. Yet, due to the great weight that corporations place on their recent experience, they are not entirely unexpected. In 2002 it was impossible to know that Europe would not see any major terrorist attacks before March 2004. Thus, the projected premium income of € 250 million or even € 500 million may actually have been the best possible estimate.

5 Conclusion

In this article we study corporations' management of terrorism risk. We extend the theory of corporate risk management by applying a concept developed for individual decision making to a corporate context. This concept, named prospective reference theory, allows corporations to update their probability assessment based upon recent observations. Using this framework we show that corporations risk management decisions for terrorism risk are governed by a process that permits for a dynamic updating of probabilities.

Looking at three major terrorist events in Europe after 9-11 we find that corporations tend to overweigh recent information when making their risk management decisions. We show that the attacks on London, Madrid and to a lesser extend the attempted attacks on German trains in 2006 led to significant increases in the demand for terrorism insurance in Germany. This result indicates that it is necessary to model corporations

risk management decisions for highly dynamic risks using a mechanism that allows for dynamic updating and overweighs new information.

We further find evidence that corporations also consider specific characteristics of recent terrorist attacks when making their risk management decisions. We observe that corporations located in densely populated areas, larger corporations, and corporations from the financial sector showed stronger reactions to the terrorist attacks studied in this article. Applying the proposed extension to the terrorism insurer's premium own forecast we see that these are also largely determined by recent terrorist activities.

6   References

Altman, Edward I. (1984). "A Further Empirical Investigation of the Bankruptcy Cost Question," Journal of Finance 39, 1067-1089.

Arrow, Kenneth, and Robert Lind. (1970). "Uncertainty and the Evaluation of Public Investment Decisions," The American Economic Review 60, 364-378.

Cole, Cassandra R., and Kathleen A. McCullough. (2006). "A Reexamination of the Corporate Demand for Reinsurance," Journal of Risk and Insurance 73(1), 169-192.

DHS. (2007). "Homeland Security Advisory System". Washington, DC.

Einhorn, Hillel, and Robin Hogarth. (1986). "Decision Making under Amiguity," Journal of Business 59, 225-250.

Ellsberg, Daniel. (1961). "Risk, Ambiguity and the Savage Axioms," Quarterly Journal of Economics 75, 643-669.

Enders, Walter, and Todd Sandler. (2000). "Is Transnational Terrorism Becoming More Threatening? A Time Series Investigation," The Journal of Conflict Resolution 44, 307-332.

Enders, Walter, and Todd Sandler (2005). "Transnational Terrorism 1968-2000: Thresholds, Persistence, and Forecasts" Southern Economic Journal, 467-483.

Extremus. (2003). Geschäftsbericht. 2002.

Fischhoff, Baruch et al. (2003). "Judged Terror Risk and Proximity to the World Trade Center," The Journal of Risk and Uncertainty 26, 137-151.

Froot, Kenneth A., David S. Scharfstein, and Jeremy Stein. (1993). "Risk Management: Coordinating Corporate Investments and Financing Policies," Journal of Finance 48, 1629-1658.

Fuerst, Franz, "Exogenous Shocks and Real Estate Rental Markets: An Event Study of the 9/11 Attacks and their Impact on the New York Office Market". In: Chernick, H. (Ed.): Resilient City, Russell Sage Foundation Publications, New York

GAO. (2004). Homeland Security Advisory System: Preliminary Observations Regarding Threat Level Increases from Yellow to Orange.

Hartwig, Robert. (2002). "11 September 2001: One Hundred Minutes of Terror that Changed the Global Insurance Industry Forever." In Geneva Association (ed.), Etudes et Dossiers No. 251, Special Issue on the Economic Consequences of the September 11 Attacks on National Insurance Markets. Geneva.

Hoffman, Bruce. (1997). "The Confluence of International and Domestic Terrorism," Terrorism and Political Violence 9, 1-15.

Hübner, Ulrich. (1981). "Rechtsprobleme bei der Deckung politischer Risiken," Zeitschrift für die gesamte Versicherungswirtschaft 70, 1-48.

Jakus, Paul, and Douglass Shaw. (2003). "Perceived Hazard and Product Choice: An Application to Recreational Site Choice," Journal of Risk and Uncertainty 26, 77-92.

Jensen, Michael C., and William H. Meckling. (1976). "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure," Journal of Financial Economics 3, 305-360.

Kunreuther, Howard, Erwann Michel-Kerjan and Beverly Porter. (2003). "Assessing, managing and financing extreme events: dealing with terrorism," Working Paper vol. 10179, National Bureau of Economic Research: Cambridge.

Kunreuther, Howard et al. (1995). "Ambiguity and underwriter decision processes," Journal of Economic Behavoir and Organisation 26, 337-352.

MacMinn, Richard. (1987). "Insurance and Corporate Risk Management," Journal of Risk and Insurance 55, 658-677.

Mayers, David, and Clifford W. Smith. (1982). "On the Corporate Demand for Insurance," Journal of Business 55, 281-296.

Michel-Kerjan, Erwann, and Burkhard Pedell. (2005). "Terrorism Risk Coverage in the Post-9/11 Era: A Comparison of New Public-Private Partnerships in France, Germany and the U.S.," Geneva Papers on Risk and Insurance-Issues and Practice 30, 144-170.

Modigliani, Franco, and Merton H. Miller. (1958). "The Cost of Capital, Corporation Finance and the Theory of Investment," The American Economic Review 48, 261-297.

National Obituary Archive-Honor Roll (2007), Death Toll from 9/11 http://www.arrangeonline.com/ Obituary/memorials.asp?ObituaryID=64163480, accessed September 20, 2007.

Schmidt, R., and K. Gerathewohl (1973). "Die Versicherung bei Gewalttätigkeiten gegen eine Gemeinschaft, wobei Personen oder Sachschäden entstehen," Zeitschrift für die gesamte Versicherungswirtschaft 62, 277-317.

Stulz, René M. (1984). "Optimal Hedging Policies," Journal of Financial and Quantitative Analysis 19, 127-140.

Sunstein, Cass R. (2003). "Terrorism and Probability Neglect," Journal of Risk and Uncertainty 26, 121-136.

Swiss Re. (2006). Natural catastrophes and man-made disasters 2005: high earthquake casualties, new dimension in windstorm losses.

Tversky, Amos, and Daniel Kahneman. (1981). "The Framing of Decisions and the Psychology of Choice," Science 211, 453-458.

Tversky, Amos, and Daniel Kahneman. (1974). "Judgement under Uncertainty: Heuristics and Biases," Science 185, 1124-1131.

United States Department of State. (2004). "Patterns of Global Terrorism 2003"

(Washington, DC, US Department of State).

Viscusi, W. Kip. (1989). "Prospective Reference Theory: Toward an Explanation of the Paradoxes," Journal of Risk and Uncertainty 2, 235-264.

Viscusi, W. Kip, and Charles O'Connor. (1984). "Adaptive Responses to Chemical Labelling: Are Workers Bayesian Decision Makers?," American Economic Review 74, 942-956.

Viscusi, W. Kip, and William Evans. (2006). "Behavioral Probabilities," Journal of Risk and Uncertainty 32, 5-15.

Viscusi, W. Kip, and Richard Zeckhauser. (2005). "Recollection Bias and the Combat of Terrorism," Journal of Legal Studies 34, 27-55.

Warner, Jerold B. (1977). "Bankruptcy Costs: Some Evidence", Journal of Finance 32, 337-347.

Wilkinson, Paul. (1986). "The Media and Terrorism: A Reassessment," Terrorism and Political Violence 9, 51-64.

Appendix

Table 1: Chronology of the Changes to the Homeland Security Advisory System: March 2002-June 2007 (DHS, 2007) .

Date	Threat Level
March 12, 2002	Introduction of Homeland Security Advisory System At Yellow
September 10, 2002	Raised from Yellow to Orange
September 24, 2002	Lowered from Orange to Yellow
February 7, 2003	Raised from Yellow to Orange
February 27, 2003	Lowered from Orange to Yellow
March 17, 2003	Raised from Yellow to Orange
April 16, 2003	Lowered from Orange to Yellow
May 20, 2003	Raised from Yellow to Orange
May 30, 2003	Lowered from Orange to Yellow
December 21, 2003	Raised from Yellow to Orange
January 9, 2004	Lowered from Orange to Yellow
August 1, 2004	Raised from Yellow to Orange, specifically for the financial services sectors in NY City, Northern New Jersey, and Washington, DC
November 10, 2004	Lowered from Orange to Yellow, for the financial services sectors in New York City, Northern New Jersey, and Washington, DC
July 7, 2005	Raised from Yellow to Orange for mass transit
August 12, 2005	Lowered from Orange to Yellow for mass transit
August 10, 2006	Raised from Yellow to Red for flights originating in the UK bound for the US; raised to Orange for all commercial aviation operating in or destined for the US
August 13, 2006	Lowered from Red to Orange for flights originating in the UK bound for the US; remains at Orange for all domestic and international flights

Table 2: Policyholders by Industry 2002-2007

	2002/3	2004	2005	2006	2007	2002-2007
Banks, Asset Managers	99	111	106	105	92	513
Construction	19	19	31	23	13	105
Utilities	19	16	16	14	13	78
Airports	26	22	20	22	17	107
Stores	36	37	42	46	42	203
Real Estate	490	452	460	530	492	2424
Real Estate Inv Funds	96	100	107	120	107	530
Churches, Foundations	21	20	19	21	17	98
Hospitals	9	5	7	7	7	35
Art, Fairs	12	10	11	10	9	52
Logistics	11	15	14	15	12	67
Media, IT	34	33	31	31	24	153
Other	18	22	21	23	18	102
Local Authorities	32	18	18	18	15	101
Tourism	26	31	38	43	32	170
Heavy Industry	28	31	36	35	23	153
Transportation	10	11	12	11	12	56
Insurance	194	118	127	121	105	665
Total	1180	1072	1117	1195	1050	5614

Number of Policies Sold by Extremus (2002 - 2007)
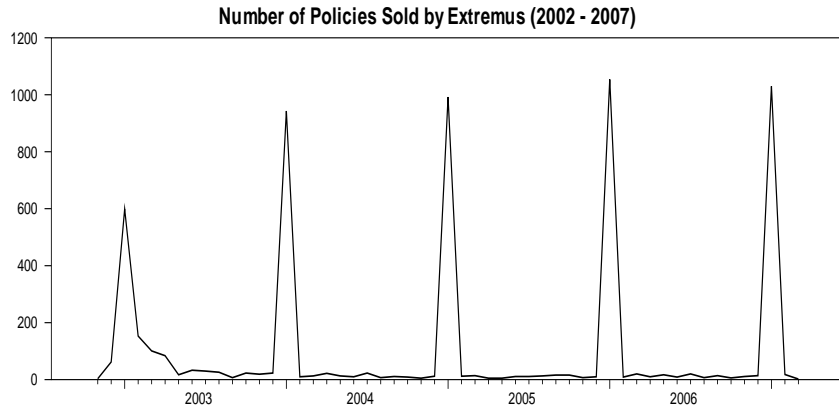
Table 3: Descriptive Statistics Terrorism Insurance Contracts 2002-2007

		2002/3	2004	2005	2006	2007	2002-2007
Degree of	Mean	0.85	0.86	0.85	0.86	0.87	0.86
Coverage	Median	1.00	1.00	1.00	1.00	1.00	1.00
Net premium	Mean	89,014	73,207	59,934	57,151	56,220	67,095
(€)	Median	9,558	11,246	11,389	11,654	12,858	11,201
MPL (€)	Mean	5.54E+08	3.77E+08	3.78E+08	3.65E+08	4.15E+08	4.19E+08
	Median	4.83E+07	5.42E+07	5.58E+07	5.86E+07	6.11E+07	5.50E+07
MPL* (€)	Mean	1.80E+08	2.02E+08	1.78E+08	1.00E+08	1.17E+08	1.48E+08
Property	Median	4,601,627	6,758,664	5,569,052	4,959,100	4,778,776	5,27E+06
MPL (€)	Mean	5.16E+08	2.92E+08	2.85E+08	2.73E+08	2.91E+08	3.33E+08
Business Inter.	Median	4.31E+07	4.63E+07	4.73E+07	4.83E+07	5.02E+07	4.72E+07
UL (€)	Mean	7.12E+07	7.30E+07	7.56E+07	8.07E+07	8.58E+07	7.72E+07
	Median	4.33E+07	4.64E+07	4.76E+07	5.00E+07	5.03E+07	4.78E+07

* Includes only contracts, where MPL Property, respectively MPL Business Interruption >0

MPL - maximum possible loss, UL -upper limit of compensation

Table 4: Events Studied

Event Window	Event
3/2004 (-0;+3)	On March 11th 2004 Madrid was struck by a terrorist attack on commuter trains that took the lives of 190 people and wounded approximately 1500 travellers. The attack took place three days before the Spanish election and led to a defeat of the conservative government in these elections. The bombing wa the first major religiously inspired terrorist attack on a European city.
7/2005 (-0;+3)	On July 7th 2005, one day after London had won the qualification for the 2012 Olympic Games, three bombs exploded in the British capital killing 52 people and leaving approximately 700 injured. The attack was conducted by four suicide bombers. The attacks underscored that suicide bombings might be conducted by attackers that are born in the European Union: Three of the four bombers were born in Britain. The July incidents were the first suicide attacks in Europe.
7/2006 (-0:+2)	On July 31st and August 1st, 2006 two bombs were found on trains in Germany. It was only by coincidence that they did not explode. These bombs marked the first major religiously inspired terrorism incident in Germany.

Table 5: Descriptive Statistics: Demand for Terrorism Insurance by Month

	△Number of policies sold				Δ Premium Income (€ thousands)			
Month	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
1	923.6	186.24	599	1054	-329.31	2431.88	-3083.16	3513.16
2	40.4	63.04	9	153	126.33	273.99	-6.34	616.16
3	30.0	40.22	2	101	306.08	840.70	-283.92	1792.69
4	30.3	36.54	5	84	272.63	499.71	4.28	1021.90
5	13.0	5.65	5	17	31.50	17.03	16.69	51.81
6	15.8	11.53	9	33	25.88	10.15	19.11	40.90
7	21.0	7.87	11	30	12.18	88.69	-107.21	106.73
8	13.3	8.96	7	26	17.94	27.49	-21.63	41.78
9	12.0	3.92	7	16	23.34	14.96	3.54	39.48
10	13.5	7.60	6	23	42.94	43.26	13.61	106.78
11	9.0	6.32	3	19	22.47	10.03	14.10	37.03
12	24.2	21.70	10	62	386.45	777.95	21.05	1777.74
Total	105.9	272.61	2	1054	81.60	789.58	-3083.16	3513.16

Table 6: Ordinary Least Square Estimates

	Regression A	Regression B
	ΔNumber of policies sold	Δ Premium Income (€ thousands)
January	-144.65***	-38,145***
	(21.43)	(332,573)
Attack_1	-5.66	-95,672
	(11.19)	(173,681)
Attack_2	-7.99	-85,429
	(12.74)	(197,744)
Attack_3	-3.66	-43,305
	(12.74)	(197,744)
Inter_1	62.00**	1,656,964***
	(29.84)	(463,1480
Inter_1	82.00***	2,986,772***
	(29.84)	(463,148)
Inter_1	1.00	2,529,191***
	(29.84)	(463,148)
cons	14.66***	98,790*
	(3.73)	(57,894)
N	46	46
R^2	0.74	0.75

Standard errors in parentheses;

*Significant at 10 %; **Significant at 5 %; ***Significant at 1 %

Table 7: Multivariate OLS Estimates by Location

	Regression C (Multivariate)		Regression D (Multivariate)	
	ΔNumber of policies sold		ΔLog Premium Income	
	(a)	(b)	(a)	(b)
	Small Towns	Large Cities	Small Towns	Large Cities
January	-46.88***	-92.53***	-0.060***	-0.641***
	(3.69)	(10.52)	(0.009)	(0.019)
$Attack_1$	1.63	1.22	-0.002	0.002
	(1.93)	(5.49)	(0.004)	(0.010)
$Attack_2$	-0.88	4.47	-0.002	0.006
	(2.20)	(6.26)	(0.005)	(0.011)
$Attack_3$	0.13	-1.86	-0.001	0.001
	(2.20)	(6.25)	(0.005)	(0.011)
$Inter_1$	17.00***	45.00***	-0.309***	0.512***
	(5.14)	(14.65)	(0.012)	(0.026)
$Inter_2$	18.00***	54.00***	0.013***	0.641***
	(5.14)	(14.65)	(0.012)	(0.026)
$Inter_3$	-12.00**	15.00	-0.070***	0.552***
	(5.14)	(14.65)	(0.012)	(0.026)
cons.	4.86***	4.53**	0.006	-0.000
	(0.64)	(1.83)	(0.001)	(0.003)
N	46	46	46	46
R^2	0.90	0.74	0.98	0.97
Breusch-Pagan	$\aleph^2_{(1)}=0$		$\aleph^2_{(1)}=0.011$	
Indep. Test	Pr. = 0.984		Pr. = 0.916	
H(0): $Inter_{ia}$ =$Inter_{ib}$	Wald Stat.	P-value	Wald Stat.	P-value
i=1	F(1,38) = 2.90	0.097	F(1,38) = 827.62	0.000
i=2	F(1,38) = 4.79	0.035	F(1,38) = 483.59	0.000
i=3	F(1,38) = 2.69	0.109	F(1,38) = 475.22	0.000

Standard errors in parentheses;

*Significant at 10 %; **Significant at 5 %; ***Significant at 1 %;

Large Cities include all cities with more than 500,000 inhabitants. Small Towns include all other.

Table 8: Multivariate OLS Estimates by Sector and Size

	Regression E (Multivariate)		Regression F (Multivariate)	
	ΔLog Premium Income		ΔNumber of policies sold	
	(a)	(b)	(a)	(b)
	Large Corp.	Small Corp.	Non-Financial Corp.	Financial Corp.
January	-0.202***	-0.139***	-56.25***	-90.156***
	(0.018)	(0.010)	(10.651)	(2.709)
$Attack_1$	-0.006	0.003	1.25	1.343
	(0.009)	(0.005)	(5.562)	(1.415)
$Attack_2$	0.001	0.003	4.083	-0.489
	(0.011)	(0.006)	(6.333)	(1.611)
$Attack_3$	-0.006	-0.002	0.083	-1.822
	(0.010)	(0.006)	(6.333)	(1.611)
$Inter_1$	0.245***	0.063***	2	68***
	(0.024)	(0.014)	(14.832)	(3.773)
$Inter_2$	0.303***	0.008***	17	68***
	(0.024)	(0.014)	(14.832)	(3.773)
$Inter_3$	0.196***	0.005***	-44***	48***
	(0.024)	(0.014)	(14.832)	(3.773)
cons.	0.006	0.009***	6.25***	3.156
	(0.003)	(0.002)	(1.854)	(0.471)
N	46	46	46	46
R^2	0.82	0.92	0.78	0.97
Breusch-Pagan	$\aleph^2_{(1)}=0.412$		$\aleph^2_{(1)}=2.679$	
Indep. Test	Pr. = 0.521		Pr. = 0.1017	
H(0): $Inter_{ia}$ =$Inter_{ib}$	Wald Stat.	P-value	Wald Stat.	P-value
i=1	$F(1,38) = 43.19$	0.000	$F(1,38) = 16.73$	0.000
i=2	$F(1,38) = 66.71$	0.000	$F(1,38) = 9.99$	0.000
i=3	$F(1,38) = 47.70$	0.000	$F(1,38) = 32.51$	0.000

Standard errors in parentheses;

*Significant at 10%; **Significant at 5%; ***Significant at 1%; Financial Corporations are defined as
Asset Management Corporations, Banks, Insurers and Real Estate Investment Funds. Non Financial
Corporations comprise of all other corporations. Large Corporations have a MPL > mean (MPL). Small
Corporations are all others.

Table 9: Out of Sample Predictions for Regressions A and B

	ΔNumber of policies sold				ΔPremium Income			
Month	Prediction	Actual	t-stat	p-value	Prediction	Actual	t-stat	p-value
11/2006	16	4	2.73	0.01	112,130	-21,631	2.03	0.05
	(4.24)				(660,040)			
12/2006	16	13	0.70	0.49	112,130	39,475	1.10	0.28
	(4.24)				(660,040)			
1/2007	-130	-129	-0.05	0.96	-3,083,156	-553,966	-7.24	0.00
	(22.44)				(349,450)			
2/2007	16	14	0.37	0.71	112,130	-4,953	1.77	0.09
	(4.24)				(660,040)			
3/2007	16	2	3.20	0.00	112,130	8,759	1.57	0.13
	(4.24)				(660,040)			

Table 10: Aggregate Demand for Terrorism Insurance

	2002/3	2004	2005	2006	2007	2002-2007
Number of Contracts Sold	1180	1071	1116	1195	1050	5612
Net Premium Income (€ million)	105	78.4	65.8	68.3	59	377
Sum of Max Possible Losses (€ bn.)	653	407	422	436	436	2350
Sum of Upper Limits (€ bn.)	84	78.7	84.5	96.5	90.1	434
% of Contracts renewed until t+1	62%	78%	86%	80%	-	76%*
% of Contracts renewed until 2007	39%	58%	71%	80%	-	-

* of contracts written between 2002/3 and 2006