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AN EMPIRICAL ANALYSIS OF THE U.S. MARKET FOR CATASTROPHE AND NON-CATASTROPHE RISKS

Erwann Michel-Kerjan
Paul Raschky
Howard Kunreuther

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ABSTRACT

Using a unique dataset of insurance decisions by over 1,800 large U.S. corporations, this study provides the first empirical analysis of firm behavior that compares corporate demand for property and catastrophe insurance (here, terrorism). We combine demand and supply data and apply a simultaneous-equation approach to address the problem of endogenous premium decisions. The main finding is that demand for property and catastrophe insurance are not very different and that the demand for catastrophe coverage is actually more price inelastic. We also show that a corporation's ability to self-insure affects the demand for catastrophe insurance but not for property insurance.

Erwann Michel-Kerjan
The Wharton School
University of Pennsylvania
Center for Risk Management
3730 Walnut Street, 556 JMHH
Philadelphia, PA 19104-6340
erwannmk@wharton.upenn.edu

Paul Raschky
University of Innsbruck
paul.raschky@buseco.monash.edu.au

Howard Kunreuther
Operations and Information Management
The Wharton School
University of Pennsylvania
3730 Walnut Street, 500 JMHH
Philadelphia, PA 19104-6366
and NBER
kunreuther@wharton.upenn.edu

I. Introduction

Classical economic theory considers firms to be risk-neutral agents; firms should thus have no interest in purchasing insurance if the premiums are priced above actuarially fair rates. In practice, however, we observe that many corporations actually purchase for example property coverage against fire, natural disaster or terrorism risks. Consumers, on the other hand, obtain insurance coverage against some property risks (e.g. fire) but are often reluctant to purchase insurance coverage against certain other risks (e.g. natural disasters, terrorism) even though premiums are actuarially fair, or even subsidized.

While there are already some empirical studies comparing the demand for catastrophic and non-catastrophic insurance on the market for homeowners (e.g. Grace, Klein, and Kleindorfer 2004), no comparable analysis of the market for corporate property insurance exists. The major impediment to such an analysis was the lack of data. Existing empirical studies (e.g. Aunon-Nerin and Ehling 2008, Hoyt and Khang 2000) only have information on the corporate insurance policies for standard property insurance.

The present article benefits from a unique set of insurance purchase decisions for non-catastrophic and catastrophic risks by over 1,800 large corporations headquartered in the United States (provided by Marsh & McLennan) (demand side). We combine this data with pricing decisions by insurance companies (provided by the rating agency A.M. Best) (supply side) to construct a new cross-sectional dataset on the U.S. corporate insurance market. The dataset allows us to determine decisions by corporations to buy catastrophe and non-catastrophe insurance. Using terrorism risk as the catastrophe type, we apply a simultaneous-equation approach to estimate and compare price elasticities of corporate demand for standard property insurance and for catastrophe risk coverage.[1] In comparison to the existing empirical studies on corporate demand for insurance (e.g. Aunon-Nerin and Ehling 2008, Hoyt and Khang 2000), the combination of demand and supply data helps us to address the endogeneity inherent in the relationship between degree of coverage and insurance premium. As such, this paper also presents the first consistent estimates of premium elasticities for the corporate demand for insurance.

Our empirical findings can be summarized with three important conclusions. First, we find that corporate demand for insurance for catastrophe and non-catastrophe risks does not differ greatly. Second, the corporate demand for catastrophe coverage is actually more price inelastic than the demand for non-catastrophe coverage. Specifically, we find that a 10% increase in price will reduce quantity of terrorism coverage by only 2.42% whereas it will reduce the quantity of property coverage by 2.91%. This result is in contrast to the findings with respect to individual insurance choices in laboratory experiments (e.g. Ganderton, Brookshire, McKee, Stewart, and Thurston 2000) and empirical studies on homeowners insurance (Grace, Klein, and Kleindorfer 2004). These studies show that the majority of homeowners do not purchase catastrophic coverage voluntarily and those cases that do obtain some coverage, exhibit a very elastic demand. Managers acting on behalf of a firm do exhibit a different behavior than homeowners making choices for protecting (or not protecting) their residence. Third, we find that the firm's ability to self-insure (higher solvency ratio) only decreases the demand for catastrophe insurance but has no significant impact on the demand for property insurance.

Our paper contributes to the literature that examines why firms purchase insurance. One strand discusses how the behavior of (risk-averse) managers within the firm can actually explain corporate demand for insurance. Greenwald and Stiglitz (1990) and Greenwald and Stiglitz (1993) show how the risk of bankruptcy and the existence of incentive systems within the firm could lead managers to act in a risk-averse manner on behalf of the company. In this spirit, Mayers and Smith (1982) and Han (1996) argue that risk-averse managers have an incentive to purchase property insurance to protect their interests and reputation. More recent literature supports this view and suggests that some of the variance in corporate performance can be attributed to discretionary behavior of individual managers (e.g. Adams, Almeida, and Ferreira 2005, Bloom and Van Reenen 2010).[2] Bertrand and Schoar (2003) provide compelling evidence that investment and financing decisions of firms depend on executives' fixed effects, such as how age and level of education affect risk-taking behavior, and that the extent of this influence is economically large.

A more complete understanding as to how managers make decisions about purchasing insurance coverage on behalf of the firms they work for should then help explain corporate demand for insurance. Managers have to estimate unknown future outcomes to evaluate whether - and at what price - insurance is efficient. Contributions from behavioral economics and psychology suggest that decision making under uncertainty is not always consistent with the standard rational choice model, but rather, can be subject to choice heuristics and biases (e.g. Tversky and Kahneman 1973, Tversky and Kahneman 1974, Kahneman, Daniel and Tversky, Amos 2000, Gennaioli and Shleifer 2010). According to these studies, how individuals perceive the risk could be a much more important factor influencing decisions than estimates of the risk provided by experts (Van den Steen 2004). This aspect is particularly relevant for insurance decisions on very low-probability but high-consequence events on which this paper focuses. Camerer and Kunreuther (1989) propose a useful dichotomy in risk perception of such catastrophic events: typically, individuals either ignore those low-probability risks (optimism) or over-estimate them by focusing on possible outcomes without paying much attention to the likelihood of them happening (availability bias). Such bimodal distributions of behavior were also shown experimentally by McClelland, Schulze, and Coursey (1987) and Finkelstein and McGarry (2007) analyzing actual long-term care insurance decisions by individuals. Gennaioli and Shleifer (2010) combine aspects of these representative heuristics in a more formal framework. Their model suggests that individuals tend to largely neglect risks with a very low probability. However, once a low-probability event takes place, the risk is back in their attention and individuals tend to overinsure against this risk. Kaplanski and Levy (2010) show media coverage of aviation disasters leads to more pessimistic behaviour on the stock market and a short-term decrease in demand for risky assets.

In the context of homeowners' insurance against catastrophic risks, many homeowners appear downplay the risk. They exhibit over-optimism about the likelihood of a disaster and are thus willing to pay for coverage only when it costs less than the actuarially fair price. One reason for this behavior is because their perceived likelihood of the event is below their threshold of concern. In this case individuals assume that "It won't happen to me" - a form of probability neglect (Tversky and Kahneman 1992, Kunreuther, Novemsky, and Kahneman 2001, Sunstein 2002).

Even when the cost of insurance is subsidized, many people located in high risk areas still do not purchase coverage; this has been shown to be the case for flood risk in the United States (Kunreuther, Ginsberg, Miller, Sagi, Slovic, Borkan, and Katz 1978, Michel-Kerjan and Pedell 2010). In the same spirit, Grace, Klein, and Kleindorfer (2004) analyzed insurance purchase decisions of homeowners living in hurricane-prone areas of the U.S., finding that even those homeowners who purchased insurance against catastrophe risks (hurricane) exhibited a more price elastic demand for catastrophic risks than for non-catastrophe risks (fire). A related finding is that many individuals are willing to pay significantly more for non-catastrophe insurance than for catastrophe insurance (Ganderton, Brookshire, McKee, Stewart, and Thurston 2000).

Turning to firm behavior, there is already some empirical evidence that managers' decisions are also affected by over-optimism (e.g. Camerer and Lovallo 1999, Malmendier and Tate 2005, Ben-David, Graham, and Harvey 2007). The question we want to study in this article is whether we will thus observe a similar pattern in the corporate context as the one characterizing individuals' insurance decisions. More specifically, do individual managers of a firm treat low-probability, high-consequence risks (e.g., natural disasters, terrorism) very differently than non-catastrophe risks (e.g., fire) when they purchase insurance against those respective risks, and if so how? Given the series of catastrophes that occurred worldwide in the past decade, a better understanding of these financial decisions has become even more important. Our analysis reveals that a majority of firms does not only purchase catastrophe insurance, but also that exhibits a significantly price inelastic demand for such protection.

The remaining sections of the paper are structured as follows. In Section 1, we provide some background information on terrorism insurance in the United States and describe our data. In Section 2, we present our empirical strategy. The results of our analysis are discussed in Section 3 with robustness checks provided in Section 4. Section 5 concludes.

II. Data

Before discussing our dataset and empirical strategy, we provide some background information about the nature of the terrorism insurance market in the United States. Prior to the terrorist attacks of September 11, 2001, insurance losses from terrorism were viewed as so improbable that the risk was not explicitly mentioned in any standard policy and hence the rate for providing such coverage to firms was never calculated. Terrorism was covered *de facto* in most commercial insurance contracts. Things changed radically in 2001. The September 11, 2001 (9/11) attacks killed over 3,000 people and injured more than 2,250 others. The attacks also inflicted damage estimated at nearly $80 billion, about $32.5 billion of which (2001 prices) was covered by insurance (U.S. President's Working Group on Financial Markets 2006). In response to 9/11, the Terrorism Risk Insurance Act of 2002 (TRIA) was passed by Congress and signed into law by the President on November 26, 2002. [3]The Act has been renewed several times and is now extended to the end of 2014.

The operation of this new terrorism insurance market is somewhat complex and it is not the purpose of this paper to analyze it (see Brown, Cummins, Lewis, and Wei 2004, Kunreuther and Michel-Kerjan 2004). Still, there are features of TRIA that will be important for our analysis and also for the policy implications of our findings. First, with TRIA, insurers are required to offer terrorism coverage to all their commercial clients (a legal "make available" requirement). These firms have the right to refuse this coverage.[4] Second, the federal government provides insurers with no-cost up-front reinsurance above a predefined deductible for each insurer.[5] More specifically, the federal government is responsible for paying 85% of the insurer's loss above the insurers' deductible; the insurer covers the remaining 15%. This joint federal-private insurance responsibility is capped at $100 billion. No-cost up-front reinsurance would provide insurers with liquidity in the post-attack period. TRIA stipulates that the federal government can recoup part of its payment over time against the entire insurance industry not just those insurers whose losses were partially covered by the public sector.

Let us now turn to the presentation of the data set. Data on the demand side (i.e., corporations purchasing insurance) was obtained from Marsh, one of the world largest insurance brokers. Marsh provided us with company-level insurance contract data on their clients headquartered in the U.S. in 2007. Data was reported through an intranet form completed by brokers of the different Marsh offices in the United States. Company identities were kept anonymous through the use of random ID numbers designed specifically for this study. We assume that idiosyncrasies among brokers or offices were randomly distributed across the dataset. The original dataset included 1,884 companies. We have removed companies with total insured value lower than $1 million. Of the remaining 1,808 companies, 1,064 had purchased terrorism insurance in conjunction with their normal property insurance. This implied a market penetration of 59%[6]. Of these 1,064 companies we have observations for 628 on all relevant dependent and explanatory variables. The data does not include exact information on the physical location of the companies' assets, so we used the location of the Marsh office which brokered their policy (typically in the same location as the headquarters of the company) as the proxy for location. Given that each individual contract covered multiple locations for a single company, we assume that the number of locations per company is randomly distributed across our dataset. (Marsh divides their offices into the nine major regions, each combining a number of states.[7]) Firms in the dataset were divided into 20 industry sectors. Table I shows the distribution of companies within the full sample across these different industry sectors. It also shows the number of companies which had purchased terrorism insurance.

[INSERT TABLE I ABOUT HERE]

The average size of the companies in our sample is measured by assets that are covered under property insurance; that is the total insured value (TIV hereafter). This measure only contains tangible assets but no values associated with business interruptions or workers' compensation. The mean for the TIV variable in our sample is \$1.75 billion (median of \$2.95 billion) (see Table II)[8].

[INSERT TABLE II ABOUT HERE]

The focus of the empirical analysis is our full subsample of 628 companies that have terrorism coverage. Our dependent variable is the degree of coverage, $Cover_{Terror}$, defined as the ratio of the limit on the terrorism insurance policy the firm purchased (i.e., the maximum terrorism claim payment it can receive from its insurers minus the deductible) to TIV. We construct the variable for property insurance, $Cover_{Property}$, in a similar way. It is defined as the ratio of the limit on the property insurance policy the firm purchased (i.e., the maximum property claim payment they can receive from their insurers) to TIV. We find that the mean degree of coverage against catastrophe risks, $Cover_{Terror}$, is 0.480, and the mean degree of coverage against non-catastrophe risks $Cover_{Property}$, is 0.548. The premiums paid by the company for terrorism insurance and for property insurance are labeled $Premium_{Terror}$ and $Premium_{Property}$, respectively. A better measure of the cost of insurance is the premium paid by these companies per \$1,000 of coverage (limit of the policy) and we calculate this figure for both terrorism and property insurance ($Premium_{Terror}/Limit_{Terror}$ and $Premium_{Property}/Limit_{Property}$); we use these two variables in our demand treatment (see equations (1) and (2) below). We find that on average, firms pay eight times more for property than they do for terrorism (\$4.848 versus \$0.592 per \$1,000 of coverage). Statistics on all these demand side variables are reported in Table III.

[INSERT TABLE III ABOUT HERE]

To account for the demand-supply interaction that determines insurance purchase decisions, we gathered supply-side data on the insurance companies providing property and terrorism coverage to all the firms in our sample in 2007 using annual A.M. Best Insurance Reports-P/C US & Canada (Version 2008.1). In addition, the rating agency A.M. Best provided us with the premiums collected by these insurance companies for all non-life insurance lines and for terrorism lines from 2002 to 2008 (so we could determine that there were no peculiarities in 2007). The choice of the supply variables is based on Kleffner and A. (1996) who identify a number of factors that determine insurers' ability to write corporate coverage. It typically depends on the characteristics of their portfolio of corporate clients and on financial indicators that have an impact on the cost of risk bearing. We thus use the following variables for the empirical analysis: (a) total assets; (b) overall liquidity, and (b) A.M. Best rating (proxy for financial strength).

Two other variables were created to analyze the supply side. We determined for 2006 the exposure share that each company in our Marsh sample had in the portfolio of its insurer. We could then create a diversification proxy: considering the portfolio of a given insurer, the lower the share each one of its clients represents, the more diversified its exposure is. So for each firm i insured by insurer j, we calculate the ratio between the limit of the terrorism insurance policy i (i.e., maximum possible payment the insurers will have to make for its client i) over the total insurance premiums collected for all lines of business exposed to terrorism risk from all the client firms of insurer j. This ratio can be interpreted as a measure of exposure for insurer j: the higher the ratio, the less client-diversified the insurer's portfolio is. We call this variable $Frac\ Limit_{Terror}$. We construct a similar variable for property coverage, $Frac\ Limit_{Property}$. These two variables will be compared so we can better measure whether the no-cost up-front federal reinsurance had an impact on how insurers manage their concentration of terrorism exposure. We expect that insurers will take on more concentrated risks with terrorism than they do for the standard property because they can transfer part of their exposure to the government free of charge. The descriptive statistics of the supply side data are presented in Table IV.

[INSERT TABLE IV ABOUT HERE]

The supply and demand datasets were then merged using the unique insurance company identifier, j. Based on available information for all these variables, it was possible to identify the full information on insurance supplier for 421 of the 628 large companies in the subsample; our demand-supply analysis thus focuses on these 421 firms. The final sample consists of 15 different large insurance suppliers.

III. Empirical Approach

To investigate the effects of heuristics on the corporate demand for insurance, we proceed as follows. We first construct a demand/supply system of equations for each type of risk, terrorism (catastrophic risk) and property (non-catastrophic risk). We then compare the price elasticities of the demand for insurance for the two different types of risk to identify whether there is an over-optimism bias. If over-optimism plays an important role, the demand for catastrophe risk insurance should be much more price elastic (as Grace, Klein, and Kleindorfer (2004) have shown to be the case for homeowners) to reflect a lower willingness to pay for catastrophe insurance coverage than for non-catastrophe. Moreover, to identify if there is a possible "New York effect" we also undertake a series of analyses specific to the New York area which has been the target of the last two Al Qaeda attacks, in 1993 and 2001. Here we estimate the demand/supply system of equations for a New York sub-sample and compare our results with those obtained for the rest of the country.

On the demand side, we first identify the drivers of the corporate decision to purchase coverage against terrorism and property. We use only the subsample of companies that have bought both types of coverage. We analyze the determinants of the quantity of terrorism coverage purchased and compare these results with the quantity of property insurance purchased. To determine the key drivers of the corporate insurance demand, we construct the following equation:

$$Cover_{cij} = \beta_0 + \beta_1 \ln(TIV_i) + \beta_2 \ln\left(\frac{Premium_{cij}}{Limit_{cij}}\right) + I_i + R_i + \epsilon^1_{cij} \tag{1}$$

where $Cover_{cij}$ denotes, for company i, its degree of coverage for risk type c, (terrorism or property). TIV is the total insured value of company i and $Premium/Limit$ is the cost of insurance (premium per \$1,000 of coverage limit for the respective type of insurance). I and R are industry and region specific dummies; ϵ^1_{cij} is the error term and β are coefficients to be estimated. We are primarily interested in the coefficient β_2, that exhibits the price elasticity of demand. We expect β_2 to be negative and significant for both types of risk. Under the assumptions that premiums for both risks are actuarially fair and that individual insurance decision on catastrophic risk is biased by some heuristic, β_2 should be larger in the case of terrorism insurance compared to standard property insurance.

We now turn to the supply side and analyze some key factors that can impact insurance pricing (e.g., concentration of exposure, assets, liquidity, and rating). Once again, we construct the supply side equation for terrorism and for property insurance:

$$\begin{aligned} \ln\left(\frac{Premium_{cij}}{Limit_{cij}}\right) &= \gamma_0 + \gamma_1 Frac\ Limit_{cij} + \gamma_2 \ln(Limit_{cij}) + \gamma_3 Cover_{cij} \\ &\quad + \gamma_4 \ln(Assets_j) + \gamma_5 Liquidity_j + I_i + R_i + \epsilon^2_{cij} \end{aligned} \tag{2}$$

where $Frac\ Limit_{cij}$ is, the share of company i's property or terror limit in insurer j's portfolio. $\ln(Limit_{cij})$ reflects the policy limit of the respective type of insurance c. $Cover_{cij}$ is the degree of coverage of each policy. $Assets_j$ are the total assets of insurer j and $Liquidity$ denotes its overall liquidity. As in (1), I and R are industry and region specific dummies, γ are parameters to be estimated and ϵ^2_{cij} is the error term.

We apply a simultaneous equations model that accounts for the interaction between the corporation's choice on the degree of coverage and the insurance company's choice on the amount of premium to charge. We therefore combine the above equations and construct a system of equations. However, OLS would render inconsistent results because the endogenous variables are used as regressors in the respective other equation. Simultaneity and correlation of the error terms in equations (1) and (2) are likely to bias the results and estimating equations (1) and (2) separately would yield inconsistent parameter estimates. We decided to use three-stage least squares (3SLS) to estimate the parameters of interest. 3SLS combines the advantages of 2SLS (two-stage least squares) and SUR (seemingly unrelated regressions) models and allows us to correct for the potential simultaneity bias and the presence of error term correlation. The estimates are performed for property and for terrorism insurance coverage separately.

IV. Results

The results of our estimates are presented in Table V. The first four columns show the coefficients of the supply and the demand side estimates for terrorism and property insurance for the full sample. Comparing the coefficients of our variable of key interest (Premium/Limit), we find that price elasticities for catastrophe (terrorism) and non-catastrophe risk (property) are actually very similar: -0.242 and -0.293, respectively. As predicted, these coefficient are negative and significant. In fact, corporate demand for terrorism insurance is actually more price inelastic than for property insurance, even though the difference is small. A price increase of 10% will decrease the quantity of property insurance purchased by 2.93% and the quantity of terrorism insurance by only 2.42%. Our estimates stand in contrast to existing studies that insurance demand for catastrophic risk is much more price-elastic than for non-catastrophic risk (Grace, Klein, and Kleindorfer 2004) found a -1.9 coefficient for catastrophe risk and -0.4 for non-catastrophe risk). We also analyze the possible existence of a New York effect, but the results are very similar those using the entire sample (Table V).

[INSERT TABLE V ABOUT HERE]

From the analysis we also see that the coefficient of TIV (-0.060) is negative and highly significant, indicating that larger companies have, on average, a lower degree of coverage than smaller firms (ratio limit over TIV is lower). This might be due to higher geographical diversification of their assets. It could also be that smaller firms purchase insurance to access risk-management expertise of the insurers (Doherty 2000). Larger companies are more likely to have some form of in-house risk-management and therefore require less of these "real services" from the insurer. In addition, larger companies also have better access to short-term capital and might substitute market insurance with self-insurance (Hau 2004). Comparing the coefficients of the TIV shows that this effect (larger companies have a lower degree of coverage than smaller firms) is smaller in the case of terrorism insurance, though (coefficient of -0.060 versus -0.103 in the case of property). Terrorism risk can be considered more complex than standard risk and it is more costly to generate information about the risk in-house. As a result, companies might have an additional incentive to take advantage of insurers' risk-management expertise in that case.

We now turn to the supply side and the determinants of insurers' pricing decisions (Table V). Contract-specific variables such as the policy limit and the degree of coverage are important determinants of premiums charged by the insurer. As shown in Table V (full sample) both variables, ln(*Limit*) (-0.206 and -0.331, for terrorism and property respectively) and *Cover* (-3.229 and -2.348), have a negative sign and are highly significant. This indicates the insurance companies give discounts for larger limits in general, as well as for a higher degree of coverage. Both can be explained by decrease of some administrative costs (i.e., transaction costs related to evaluate the customer's exposure to a certain risk) with higher limits and degrees of coverage. Another interesting result is the different effects of the share of policy limit in the insurer's portfolio, *Frac Limit*. This is our empirical proxy for the insurer's diversification effort. We find a positive and significant (at least at the 10% level) effect for property insurance (0.150) but not a significant effect in the case of terrorism.

This finding has two important policy implications of the effect of federal intervention in the market for terrorism insurance. First, in contrast to the insurer's property portfolio, the terrorism portfolio benefits from free up-front reinsurance by the federal government. This has certainly led insurers to provide much more capacity than they would have otherwise since they are not responsible for all the potential losses they cover. These same insurers might be less careful about concentration of risks for terrorism than they are for property insurance (hence a 0.053 coefficient which is very close to zero). Second, the obligation of insurers to offer terrorism insurance to every corporate customer with a property insurance policy reduces the insurer's options to make appropriate decisions regarding diversification in its portfolio (unless they terminate the contract for property coverage too, which they are unlikely to do). The coefficients for Assets and Liquidity - which are proxies for the insurers' financial strength and capacity to meet their obligations - do not appear to be significantly different from zero, indicating that these two variables do not have a significant impact on insurers' behavior.

V. Robustness Analysis

In a first robustness check, we include in our estimates several additional control variables identified in the literature (see Table VI). The theoretical model developed by Hau (2004) and the empirical results by Aunon-Nerin and Ehling (2008) suggest that companies with better access to the capital market have lower insurance coverage. We therefore include the solvency ratio (a measure of how a company meets its long-term debt) and the current ratio (a measure of how well a company meets its short-term debt) as additional regressors in our demand side estimates. Data on solvency ratio and current ratio are available for only 137 and 129 companies, respectively. The results presented in Table VI indicate that estimates are robust to the inclusion of these ratios (demand is more inelastic for terrorism coverage than it is for property coverage). Solvency ratio appears to have a substitution effect: a higher solvency ratio will decrease the demand for insurance coverage. The coefficient is significant only in the case of terrorism insurance (-0.076). This result suggests that corporations use their ability to self-insure (higher solvency ratio) as a substitute for catastrophe insurance but not for property insurance. Current ratio, which measures how well a company meets its short-term debt, appears to have no impact on the demand for neither property nor catastrophe insurance. The insurer's financial strength, proxied by A.M. Best's financial rating, appears to have no significant effect on pricing either. Our results stay robust if these variables are included.

[INSERT TABLE VI ABOUT HERE]

We did a second robustness check to overcome a challenge inherent to the fact that our sample might not be random. The dataset we received from Marsh contains a portfolio of 1,884 companies, where only 1,064 companies decided to purchase terrorism coverage. The quantity of insurance a company purchases from its insurer is a decision made by each company and might be driven by unobserved characteristics for which we cannot control. For instance, in the 620 companies that did not purchase insurance there could be, as discussed in the introduction, managers who simply undervalue the probability. Therefore, the subsample of those companies that do have terrorism insurance might be a self-selected sample.

The solution to this problem is to extend the sample-separation case generally characterized by two simultaneous equations systems corresponding to the two different regimes (a company has catastrophe insurance or not) and a selectivity criterion that determines the regime to which the observations belong. This procedure was suggested by Lee, Maddala, and Trost (1980), who overcome this limitation by reflecting the self-selection process in the first stage. We also assume that the probability of a company buying terrorism insurance has an influence on the degree of coverage in the second stage. To our knowledge, this approach is the only consistent estimator given the distribution of our company sample.

In the first stage we estimate a probit model where the dependent variable is a dichotomous indicator equal to 1 for companies that have catastrophe coverage and equal to 0 otherwise. We use the natural logarithm of the total insured value of company, TIV (an empirical proxy for the size of the company). The expectations on the sign of this size variable are not clear a priori. On the one hand, as discussed in the previous section, larger companies are supposedly more able to diversify their risks. As a result, they should be less likely to buy catastrophe coverage than small firms. This suggests a negative sign. On the other hand, larger companies are a more visible (and arguably, a more attractive) target for terrorist groups who seek to inflict major economic disruption and impose fear on a large number of people. Larger companies might thus be more likely to buy terrorism coverage and more likely to accept a higher cost of coverage as well. This suggests a positive sign. It is not clear which one will be the most important effect.

The first stage specification also demands a variable that fulfills the exclusion criterion. Finkelstein and McGarry (2006) show that individuals not only differ in their exposure to risk but also in their preferences for insurance coverage. They provide evidence that individuals who behave more cautiously in their day-to-day life are also more likely to purchase a large quantity of insurance. We thus use information on a company's insurance decision against flood risks as a proxy for its preference for insurance coverage against catastrophic risks. We construct a dummy variable that switches to 1 if the company has purchased some flood insurance and equals 0 otherwise as our selection variable. We expect the flood variable to yield a positive coefficient.

The predicted value from the first stage is then used to calculate the inverse Mills ratio,[9] which measures the likelihood that a company has purchased some terrorism coverage. Following the methodology developed in Lee, Maddala, and Trost (1980), we estimate a reduced form equation of the pricing model and integrate the inverse Mills ratio. We then use the predicted values of this estimate to construct an instrument for premium/limit to be used in the final demand side estimate of the coverage. This demand side equation thus includes the exogenous regressors, the instrument and the inverse Mills ratio.

The results in Table VII reveal that our estimates are again robust. The selection variable Flood has a strong positive coefficient (0.307) in the first stage estimates. The coefficient of the inverse Mills ratio, λ, is not significantly different from 0. This result suggests that the selection bias is quantitatively not important in our case.

[INSERT TABLE VII ABOUT HERE]

The price elasticity of the demand for insurance can be driven by other time invariant company specific effects that we do not observe. Omitting these factors could result in biased estimates. For example, we do not observe a company's past experience with terrorist attacks or its overall risk-management strategy. Although our dataset does not contain multiple observations per company over time, we have two observations per company; one for each type of insurance. We can use these two observations, pool the data, and construct a panel dataset that allows us to control for company specific fixed effects. Given that each company purchases both types of insurance from the same supplier, this setting is used to control for company-insurer-dyad fixed effects.

We construct the following demand function:

$$Cover_{cij} = \alpha_i + \zeta_1 \ln\left(\frac{Premium_{cij}}{Limit_{cij}}\right) + \zeta_2 TRIA_c + \zeta_3 \left[\ln\left(\frac{Premium_{cij}}{Limit_{cij}}\right) \times TRIA_c\right] + u_{cij} \tag{3}$$

where $Cover_{cij}$ and $\left(\frac{Premium_{cij}}{Limit_{cij}}\right)$ denote for the degree of coverage and the cost of insurance for company i's insurance policy of risk type c with insurer j. $TRIA$ is a dummy variable that switches to 1 if policy c covers terrorism risk and 0 if it covers property risk. $\left[\ln\left(\frac{Premium_{cij}}{Limit_{cij}}\right) \times TRIA_c\right]$ is an interaction term between premium and the $TRIA$ dummy. ζ_3 presents the difference in the price elasticity of demand for the terrorism risk. α_i captures company fixed effects.

We expect ζ_1 to be negative and ζ_3 to be not significantly different from zero. As done before to account for the potential endogeneity in the relationship between degree of coverage and insurance premium, we apply a standard IV approach and use $Frac\ Limit$ and an interaction term between $TRIA$ and insurer j's expense ratio as exogenous instruments for insurance premium. The results of the panel-estimates are presented in Table VIII. Column 1 shows the estimated coefficients from the standard fixed effects model. The coefficient for insurance premium (-0.179) is negative and smaller than the ones presented in Tables VI and VII. $TRIA$ depicts a significant positive sign, indicating that the firms choose a higher degree of coverage for the catastrophic risk. The interaction term between the $TRIA$ dummy and the premium variable is positive and significant. This suggests that the demand for terrorism insurance is more price-inelastic ($\zeta_1+\zeta_3$). However, once we account for endogeneity (column 2), the coefficient of the interaction term renders insignificant, while the coefficient of the premium elasticity stays significant. This supports our cross-section results in Tables VI and VII and shows once again no important difference in the premium elasticity of corporate demand for insurance against standard risk and catastrophic risk.

[INSERT TABLE VIII ABOUT HERE]

VI. Concluding Remarks

There have been important theoretical contributions during the past two decades that help explain decisions made by corporations as to how they should protect their assets against all sorts of risks they face, and the role that insurance can play in that regard. A principal reason for the absence of empirical studies to test these theories has been the inability to obtain data on insurance decisions by large number of firms. Proprietary issues, regulatory systems and anti-trust law make it often difficult for the research community to access a data sample large enough to undertake substantial empirical analysis of corporate insurance decisions.

This paper provides the first analysis of U.S. corporate demand for insurance, and compares firms' behavior for catastrophe and non-catastrophe risks. We looked specifically at 1,808 large companies across regions and industry sectors that are headquartered in the United States. We used terrorism threat as our catastrophic risk and property insurance as the non-catastrophic risk. We found that a large portion of these companies did not purchase terrorism insurance, maybe because their managers are over-optimistic and do not believe another major terrorist attack could seriously impact the operation of the firm.

For those companies with terrorism coverage, however, the demand functions for catastrophe and non-catastrophe insurance do not exhibit major differences in price elasticity. Furthermore, we find that corporate demand for catastrophe insurance is slightly more inelastic than demand for property insurance. This empirical result differs from other studies conducted in the context of homeowners' decision making where demand for catastrophe risk insurance was shown to be much more price elastic than for standard property insurance. Our analysis reveals that managers who purchased terrorism insurance are highly risk averse with respect to catastrophic losses.

One reason for the difference between how individuals behave as homeowners and as managers of a firm is that, in the latter case, they do not have to personally pay for that insurance; the company does. Moreover, should a disaster occur, managers can have their bonuses reduced or even be fired for not having purchased catastrophe coverage but they do not personally bear the financial cost associated with purchasing it.

Finally, these findings should be regarded as a starting point for future research in the emerging field of catastrophe economics. It would be useful to access more detailed corporate information on liquidity, short-term credit or decision structures within the company (including incentive systems in place) to provide a comparative analysis of how these other characteristics affect corporate decisions for catastrophe and non-catastrophe risk insurance. It would also be useful to extend the analysis provided here to extreme events other than terrorism (e.g., technological accidents of large magnitude, natural disasters), and also to countries with different institutional settings and different degrees of government involvement in commercial insurance markets to determine how these factors influence managerial behavior with respect to catastrophes.

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Notes

[1]Analyzing how corporations consider terrorism risk, our analysis also contributes to a growing literature on economics of national security which looks at the effects of terrorism on a variety of indicators such as companies' stock value (Abadie and Gardeazabal 2003, Brown, Cummins, Lewis, and Wei 2004), vacancy rate in business offices of large cities (Abadie and Dermisi 2008) or GDP (Tavares 2004).

[2]Corporate demand for property insurance can be also explained by contractual obligations (Garven and MacMinn 1993), tax incentives (Main 1983, Nance, Smith, and Smithson 1993), the need to increase liquidity and avoid the costs of bankruptcy (Mayers and Smith 1982, MacMinn 1987, Hau 2004) or access to the risk-management expertise of the insurers (Doherty 2000).

[3]The complete version of the original Act can be downloaded at: http://www.treas.gov/offices/domestic-finance/financial-institution/terrorism-insurance/claims-process/program.shtml

[4]Note that attacks using weapons of mass destruction (so-called CBRN; chemical, biological, radiological and nuclear) are typically excluded from terrorism coverage. To the contrary, workers' compensation laws do not permit employers or insurers to exclude coverage for worker injuries caused by terrorism. It is thus covered by the insurers whether or not its clients has purchased specific terrorism coverage or not.

[5]The deductible is defined as a percentage (20% in 2007, the year of our data) of all premiums earned by the insurer in the preceding year in all the lines of business covered under TRIA.

[6]Market penetration/take-up rate is defined here as the percentage of companies that have a terrorism insurance policy, and not the amount of assets insured against terrorism over the total amount of assets.

[7]**Central Midwest** - Illinois, Indiana, Minnesota, Missouri, Wisconsin; **Mid-Atlantic** - District of Columbia, Maryland, Pennsylvania (Harrisburg, Philadelphia), Virginia; **New York Metro** - New Jersey (Morristown), New York (New York), Connecticut (Norwalk); **Northeast** - Connecticut, Massachusetts, Maine, New York (Rochester, Syracuse), Rhode Island; **South Central** - Louisiana, Oklahoma, Texas; **Southeast** - Alabama, Florida, Georgia, North Carolina, South Carolina, Tennessee, Virginia; **Southwest** - Arizona, California (Los Angeles, Newport Beach, and San Diego); **Upper Midwest** - Kentucky, Michigan, Ohio, Pennsylvania (Pittsburgh); **West** - Alaska, California (San Francisco, San Jose), Colorado, Hawaii, Oregon, Utah, Washington. (Note that California, New York, and Pennsylvania include offices that are in multiple regions. The specific locations are included in parentheses.)

[8]We also have information for the full sample as to whether a company has some form of flood insurance, but do not have complete information on the flood contract. We converted this information into a binary yes/no variable, which we will use when undertaking robustness checks.

[9] The inverse Mills ratio is calculated by dividing the probability density function by the cumulative distribution function.

Table I
Distribution of Companies and Terrorism Insurance Across Industries - Full Sample

Distribution of companies for the full sample of 1,808 large clients and companies with terrorism insurance (1,064). Data stems from Marsh & McLennan and is a cross-section of corporations headquartered in the U.S. for 2007. Table contains absolute number of firms and fraction per industry.

Industry	**Firms**	**in %**	**With terror insurance**	**in %**
Agriculture	11	0.61%	3	27.27%
Construction & Design	46	2.54%	23	50.00%
Distribution	35	1.94%	19	54.29%
Education	75	4.15%	55	73.33%
Financial Institutions	78	4.31%	56	71.79%
Food & Beverages	79	4.37%	40	50.63%
Healthcare	156	8.63%	115	73.72%
Hospitality & Gaming	84	4.65%	56	66.67%
Manufacturing	452	25.00%	199	44.03%
Media	46	2.54%	29	63.04%
Mining	18	1.00%	3	16.67%
Pharmaceutical	36	1.99%	20	55.56%
Power & Utilities	105	5.81%	69	65.71%
Public Entities	59	3.26%	35	59.32%
Real Estate	124	6.86%	97	78.23%
Retail & Wholesale	125	6.91%	70	56.00%
Services	120	6.64%	76	63.33%
Technology	68	3.76%	41	60.29%
Telecomm	27	1.49%	17	62.96%
Transportation	64	3.54%	41	64.06%
Total	**1,808**		**1,064**	

Table II

Descriptive Statistics - Full sample

Summary statistics for the full sample of 1,808 large clients of Marsh & McLennan. Cross-section data for corporations headquartered in the U.S. for 2007. Data definitions: $Terrorism$, a dummy variable that switches to one if the company has purchased some coverage against terrorism risk and zero otherwise. TIV, the total insured value hereafter). This measure only contains tangible assets but no values associated with business interruptions or workers' compensation. $Flood\ Insurance$, a dummy variable that switches to one if the company has purchased some flood coverage and zero otherwise.

Obs.	**Variable**	**Mean**	**Std. Dev.**	**Min.**	**Max.**
Terrorism (Yes/No)	1,808	0.589	0.492	0.000	1.000
TIV ($ million)	1,808	1,750	5,780	1.000	93,221
Flood Insurance (Yes/No)	1,808	0.740	0.439	0.00	1.000

Table III

Descriptive Statistics - Companies with Terror Coverage

Summary statistics for the full sample of 628 large clients of Marsh & McLennan that have purchased terrorism coverage. Cross-section data for corporations headquartered in the U.S. for 2007. Data definitions: $Cover_{Terror}$, the ratio of the limit on the terrorism insurance policy the firm purchased (i.e., the maximum terrorism claim payment it can receive from its insurers minus the deductible) to TIV. $Cover_{Property}$, the ratio of the limit on the property insurance policy the firm purchased to TIV. $Premium_{Terror}$, premiums paid by the company for terrorism insurance per $1,000 of coverage (limit of the policy). $Premium_{Property}$, premiums paid by the company for property insurance per $1,000 of coverage (limit of the policy). We calculate this figure for both terrorism and property insurance ($Premium_{Terror}/Limit_{Terror}$ and $Premium_{Property}/Limit_{Property}$)

Obs.	**Variable**	**Mean**	**Std. Dev.**	**Min.**	**Max.**
$Cover_{Terror}$	628	0.480	0.376	0.002	1.000
$Cover_{Property}$	628	0.548	0.365	0.008	1.000
TIV ($ million)	628	1,970	5,970	1.000	93,221
$Premium_{Terror}$ ($)	628	111,963	400,815	21.000	5,877,503
$Premium_{Property}$ ($)	628	1,238,668	2,503,894	2,106	29,731,212
$Premium_{Terror}/Limit_{Terror}$ ($)	628	0.592	1.645	0.001	22.195
$Premium_{Property}/Limit_{Property}$ ($)	628	4.848	7.973	0.290	99.948

Table IV

Descriptive Statistics - Supply Side - Insurance Companies

Summary statistics for supply-side data on the insurance companies providing property and terrorism coverage to all the firms in our sample in 2007 using annual A.M. Best Insurance Reports-P/C US & Canada (Version 2008.1). Full information on insurance supplier for 421 of the 628 large companies.The final sample consists of supply side data from 15 different insurance suppliers. Data definitions: $Frac\ Limit_{Terror}$, the ratio between the limit of the terrorism insurance policy i (i.e., maximum possible payment the insurers will have to make for its client i) over the total insurance premiums collected for all lines of business exposed to terrorism risk from all the client firms of insurer j. $Frac\ Limit_{Property}$, the ratio between the limit of the property insurance policy i (i.e., maximum possible payment the insurers will have to make for its client i) over the total insurance premiums collected for all property lines of business from all the client firms of insurer j. Total assets and overall liquidity.

Obs.	Variable	Mean	Std. Dev.	Min.	Max.
$Frac\ Limit_{Terror}$	421	0.104	0.174	5.29E-07	0.991
$Frac\ Limit_{Property}$	421	0.075	0.127	4.26E-07	0.934
Total Assets ($ million)	421	48,114	45,154	771.911	124,644.300
Liquidity	421	165.782	36.013	127.200	240.800

Table V

Insurance Demand and Pricing for Terrorism & Property Insurance - System of Equations

Three-stage least squares (3SLS) estimates for premium (*Supply*) and insurance coverage (*Demand*) for terrorism and property insurance. The explanatory variables in the supply side equation are $Frac\ Limit_{cij}$, the share of company i's property or terror limit in insurer j's portfolio, $\ln(Limit_{cij})$, the policy limit of the respective type of insurance c, $Cover_{cij}$, the degree of coverage of each policy, $Assets_j$, the total assets of insurer j and *Liquidity*, the insurer's overall liquidity. The explanatory variables in the demand side equation are TIV, the total insured value of company i and $Premium/Limit$, the cost of insurance (premium per $1,000 of coverage limit for the respective type of insurance). The first 4 columns present estimates for the full sample, followed by 4 columns with estimates for a New York subsample and 4 columns with estimates for a subsample containing all other regions. All specification include industry and region specific dummies except for the New York subsample, which only includes industry dummies. R^2 indicates the overall fit of the model.

	Full sample				New York				Other regions			
	Terror		Property		Terror		Property		Terror		Property	
	Supply[c]	Demand[d]	Supply[c]	Demand[d]	Supply[c]	Demand[d]	Supply[c]	Demand[d]	Supply[c]	Demand[d]	Supply[c]	Demand[d]
$ln(TIV)$		−0.060***		−0.103***		−0.031		−0.096***		−0.070***		−0.107***
		(0.010)		(0.006)		(0.051)		(0.022)		(0.010)		(0.007)
$ln\left(\frac{Premium}{Limit}\right)$		−0.242***		−0.293***		−0.243***		−0.254***		−0.248***		−0.295***
		(0.015)		(0.013)		(0.071)		(0.046)		(0.015)		(0.013)
$Frac\ Limit$	0.053		0.150**		−0.083		0.163		0.047		0.155*	
	(0.099)		(0.071)		(0.841)		(0.427)		(0.113)		(0.083)	
$ln(Limit)$	−0.206***		−0.331***		−0.100		−0.330***		−0.233***		−0.340***	
	(0.040)		(0.025)		(0.166)		(0.097)		(0.039)		(0.026)	
$Cover$	−3.229***		−2.348***		−3.648***		−2.594***		−3.024***		−2.330***	
	(0.160)		(0.089)		(0.490)		(0.314)		(0.161)		(0.092)	
$ln(Assets)$	0.001		0.012		0.010		0.018		−0.002		0.008	
	(0.010)		(0.011)		(0.056)		(0.035)		(0.013)		(0.013)	
$Liquidity$	−0.035		−0.038		0.024		−0.054		−0.035		−0.048	
	(0.032)		(0.033)		(0.024)		(0.162)		(0.039)		(0.040)	
Industry FE[a]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region FE[b]	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes
No. of obs.	421	421	421	421	61	61	61	61	360	360	360	360
R^2	0.581	0.492	0.603	0.711	0.629	0.418	0.585	0.732	0.590	0.529	0.689	0.721

Notes: [a]Agriculture is the omitted industry dummy. [b]Central Midwest is the omitted region dummy. [c]Dependent variable is $ln\left(\frac{Premium}{Limit}\right)$. [d]Dependent variable is *Cover*. ***, **, * denote significance at the 1%, 5% and 10% level, respectively.

Table VI

Insurance Demand and Pricing for Terrorism & Property Insurance - Self-insurance and Rating - System of Equations

Three-stage least squares (3SLS) estimates for premium (*Supply*) and insurance coverage (*Demand*) for terrorism and property insurance (full sample). The explanatory variables in the supply side equation are $Frac\ Limit_{cij}$, the share of company i's property or terror limit in insurer j's portfolio, $\ln(Limit_{cij})$, the policy limit of the respective type of insurance c, $Cover_{cij}$, the degree of coverage of each policy, $Assets_j$, the total assets of insurer j and *Liquidity*, the insurer's overall liquidity and dummy variables for the insurer's credit rating. The explanatory variables in the demand side equation are TIV , the total insured value of company i and $Premium/Limit$, the cost of insurance (premium per $1,000 of coverage limit for the respective type of insurance), the solvency and the current ratio. All specification include industry and region specific dummies.

	Terror		**Property**		**Terror**		**Property**		**Terror**		**Property**	
	Supply[c]	Demand[d]	Supply[c]	Demand[d]	Supply[c]	Demand[d]	Supply[c]	Demand[d]	Supply[c]	Demand[d]	Supply[c]	Demand[d]
$ln(TIV)$		−0.061***		−0.094***		−0.063***		−0.092***		−0.061***		−0.103***
		(0.017)		(0.012)		(0.019)		(0.013)		(0.010)		(0.006)
$ln\left(\frac{Premium}{Limit}\right)$		−0.252***		−0.272***		−0.238***		−0.266***		−0.239***		−0.292***
		(0.025)		(0.022)		(0.028)		(0.024)		(0.015)		(0.013)
Solvency ratio		−0.076*		−0.042								
		(0.044)		(0.038)								
Current ratio						−0.004		−0.009				
						(0.005)		(0.006)				
Frac Limit	−0.034		0.142		0.008		0.180		0.036		0.152*	
	(0.367)		(0.196)		(0.271)		(0.190)		(0.123)		(0.081)	
$ln(Limit)$	−0.168***		−0.298***		−0.187***		−0.295***		−0.212***		−0.334***	
	(0.064)		(0.044)		(0.063)		(0.044)		(0.039)		(0.025)	
Cover	−3.000***		−2.471***		−3.148***		−2.528***		−3.242***		−2.349***	
	(0.267)		(0.147)		(0.280)		(0.153)		(0.161)		(0.088)	
$ln(Assets)$	−0.065		0.061*		−0.056		0.087**		−0.002		0.013	
	(0.048)		(0.036)		(0.038)		(0.036)		(0.018)		(0.014)	
Liquidity	−0.035		0.053		−0.240		0.0776		−0.047		−0.046	
	(0.032)		(0.123)		(0.148)		(0.120)		(0.055)		(0.048)	
Rating A+[e]									0.011		0.008	
									(0.039)		(0.032)	
Rating A++[e]									−0.038		−0.042	
									(0.052)		(0.045)	
Industry FE[a]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region FE[b]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs.	137	137	137	137	129	129	129	129	421	421	421	421
R^2	0.639	0.524	0.738	0.734	0.643	0.544	0.741	0.737	0.581	0.500	0.672	0.714

Notes: [a]Agriculture is the omitted industry dummy. [b]Central Midwest is the omitted region dummy. [c]Dependent variable is $ln\left(\frac{Premium}{Limit}\right)$. [d]Dependent variable is *Cover*. [e]Rating A is the omitted rating dummy. ***, **, * denote significance at the 1%, 5% and 10% level, respectively.

Table VII
Insurance Demand and Pricing for Terrorism & Property Insurance - Sample Selection

Lee, Maddala, and Trost (1980) estimates for premium (*Supply*) and insurance coverage ((*Demand*) for terrorism and property insurance (full sample). The 1^{st} estimates regress a dummy variable *sample* on TIV , the total insured value of company i and the selection variable flood insurance. *Sample* switches to one if the company has bought terrorism insurance and zero otherwise. The explanatory variables in the supply side equation are $Frac\ Limit_{cij}$, the share of company i's property or terror limit in insurer j's portfolio, $\ln(Limit_{cij})$, the policy limit of the respective type of insurance c, $Cover_{cij}$, the degree of coverage of each policy, $Assets_j$, the total assets of insurer j and *Liquidity*, the insurer's overall liquidity. The explanatory variables in the demand side equation are TIV , the total insured value of company i and $Premium/Limit$, the cost of insurance (premium per $1,000 of coverage limit for the respective type of insurance). The first 4 columns present estimates for the full sample, followed by 4 columns with estimates for a New York subsample and 4 columns with estimates for a subsample containing all other regions. All specification include industry and region specific.

	1^{st} stage^e	Terror		Property	
		Supply^c	Demand^d	Supply^c	Demand^d
$ln(TIV)$	0.051**	0.632***	−0.059***	0.574***	−0.101***
	(0.020)	(0.095)	(0.013)	(0.072)	(0.009)
$ln\left(\frac{Premium}{Limit}\right)$			−0.262***		−0.308***
			(0.016)		(0.013)
$Frac\ Limit$		−0.605		0.453*	
		(0.591)		(0.253)	
$ln(Limit)$		−0.738***		−0.867***	
		(0.089)		(0.073)	
$Cover$		−0.825***		−0.567***	
		(0.298)		(0.194)	
$ln(Assets)$		−0.024		0.111***	
		(0.066)		(0.035)	
$Liquidity$		0.000		0.000	
		(0.002)		(0.000)	
$Flood$	0.307***				
$Insurance$	(0.083)				
λ		−0.616	−0.124	−0.125	0.005
		(0.575)	(0.168)	(0.317)	(0.119)
Industry FE^a	Yes	Yes	Yes	Yes	Yes
Region FE^b	Yes	Yes	Yes	Yes	Yes
No. of obs.	1,808	441	441	441	441
R^2		0.606		0.672	
Log Likelihood	-957.790				

Notes: [a]Agriculture is the omitted industry dummy. [b]Central Midwest is the omitted region dummy. [c]Dependent variable is $ln\left(\frac{Premium}{Limit}\right)$. [d]Dependent variable is $Cover$. [e]Dependent variable is *sample*, a dummy that switches to one if the company is in the sample of companies that have terrorism coverage and 0 otherwise (Probit). ***, **, * denote significance at the 1%, 5% and 10% level, respectively.

Table VIII
Insurance Demand FE-Estimates

Fixed Effects (FE) and Instrumental Variable Fixed Effects (IV-FE) estimates for insurance coverage. Panel dataset constructed by pooling the sample and generating one observation per type of insurance. $Cover_{cij}$, the degree of coverage, is regressed on $\left(\frac{Premium_{cij}}{Limit_{cij}}\right)$, the cost of insurance for company i's insurance policy of risk type c with insurer j, $TRIA$, a dummy variable that switches to one if policy c covers terrorism risk and zero if it covers property risk and $\left[\ln\left(\frac{Premium_{cij}}{Limit_{cij}}\right) \times TRIA_c\right]$, an interaction term between premium and the $TRIA$ dummy. Estimates control for company as well as company-insurer-dyad fixed effects. Frac limit and an interaction term between insurer j's expense ratio and TRIA are used as instruments in the IV-FE model. Robust standard errors in parenthesis.

	FE	**IV-FE**
$ln\left(\frac{Premium}{Limit}\right)$	-0.179***	-0.189***
	(0.020)	(0.057)
$TRIA$	0.431***	0.487
	(0.111)	(0.579)
$\left[\ln\left(\frac{Premium}{Limit}\right) \times TRIA\right]$	0.139***	0.124
	(0.017)	(0.079)
No. of obs.	1,184	966
R^2	0.456	0.594
1^{st} stage F-stat ln(Premium/Limit)		12.40***
1^{st} stage F-stat ln(Premium/Limit) X TRIA		7.60***
Underid. Test		0.025

Notes: ***, **, * denote significance at the 1%, 5% and 10% level, respectively.