

**Dealing with Extreme Events:
New Challenges for Terrorism Risk Coverage in the U.S.**

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The terrorist attacks on September 11, 2001 (9/11) against the United States revealed that the nature of international terrorism had changed. These attacks raised the fundamental question as to what are the responsibilities of the public and private sectors in reducing the risks of terrorist attacks and who should pay for future losses should the terrorists be successful? This paper focuses on the potential role of insurance in providing future protection against terrorism and the challenges facing the private sector in offering this type of coverage alone. Given the developments since September 11th, we contend that government needs to play an important role in concert with the private sector in providing insurance against losses from this type of extreme event.

Catastrophic events present special challenges for economics and risk management since they can have severe long-term economic and social consequences and are difficult to assess quantitatively. As these events normally have a low probability of occurrence, there are limited historical data on which to base estimates of the risks and there is considerable uncertainty associated with experts' risk assessment estimates. An aversion to ambiguity leads insurers to set premiums much higher than they otherwise would be if there was agreement among experts as to the likelihood and consequences of future events (Kunreuther, Hogarth, and Meszaros, 1993). On the demand side, it is well known that if insurance is voluntary potential purchasers may underestimate the risks and consider the premiums as being too high, thus refusing to purchase coverage (Kunreuther, 1996).

Because these events are capable of inflicting a debilitating impact on the country, providing adequate financial protection to victims of catastrophes often becomes a national issue. Facing

* **Howard Kunreuther** is the Cecilia Yen Koo Professor of Decision Sciences and Public Policy and co-director of the Center for Risk Management and Decision Processes at the Wharton School, University of Pennsylvania, Philadelphia, Pennsylvania. He is also Research Associate, National Bureau of Economic Research, Cambridge, Massachusetts. **Erwann Michel-Kerjan** is Research Fellow at the Center for Risk Management of the Wharton School, University of Pennsylvania, Philadelphia, Pennsylvania and Research Associate at the Laboratoire d'économétrie of the Ecole Polytechnique, Paris. Their email addresses are <kunreuther@Wharton.upenn.edu> and <erwannmk@Wharton.upenn.edu>, respectively.

unprecedented large-scale potential damage, the private sector may severely restrict the insurance supply or even refuse to provide coverage. In such cases, the government is likely to intervene by offering insurance at prices that property owners can afford (Moss, 2002).

Two years after 9/11 and without any new attack on the U.S. soil, there is a burgeoning literature on whether government should intervene in the terrorism insurance market. Those favoring a laissez-faire public policy contend that the private market alone has the capacity to develop a market for covering terrorism risks and any government intervention limits the development of private solutions. (Gron and Sykes, 2002; Jaffee and Russell, 2003). Others argue that if there is any private market failure, it rests with current government policies (e.g., tax, accounting and regulation). Changing these policies so that it would be less costly for insurers to hold surplus capital and freely adjust prices would make private insurers more likely to cover the terrorism risk adequately (Smetters, 2004).

Building on other recent contributions (Michel-Kerjan, 2003-b; Kunreuther, Michel-Kerjan and Porter, 2003; Michel-Kerjan and Pedell, 2004), we argue that large-scale international terrorism today presents a set of very specific characteristics that make it even more important for the public sector to play a role than they do for other extreme events. In particular, we argue that the risk of terrorist attacks is partly in the government's control. These features call for private-public partnerships when developing an insurance program for covering the terrorism risk.

New Frontiers

Evidence on Change in the Nature of the Risk

It is not clear today whether the attacks on September 11, 2001 indicate a new trend toward even larger terrorist attacks. There is empirical evidence, however, that terrorism risk has changed over the past decade. As studied by several authors, there has been a significant rise in casualties from transnational incidents in the 1990s due to terrorism, even though the total number of terrorist attacks worldwide has been decreasing. (U.S. Department of State, 2003; Enders and Sandler, 2000). One possible explanation for this change in the nature of terrorist attacks is the increasing number of religious based terrorist groups, most of whom advocate mass casualties. (Hoffman, 1998; Pillar, 2001; Stern, 2003).¹ In this context, as pointed out by Sandler and Enders (in press), “the events of 11 September with their massive casualties of innocent people of all ages came as no surprise to those of us who study terrorism and warned of an ominous changing nature of transnational terrorism.”

¹ Fundamentalism-based terrorism appears to have started in the fourth quarter of 1979 with the takeover of the U.S. Embassy in Teheran (Enders and Sandler, 2000). In 1980, there were only two religious groups out of the 64 active terrorist organizations. Over the next 15 years, the number increased, so that by 1995 46 percent of the terrorist groups were classified as having religion as a principal motivator for their actions. (Hoffman, 1997).

In this regard, the 9/11 events and the anthrax attacks during the fall of 2001 demonstrated a new kind of vulnerability. Attackers can use the diffusion capacity of our large critical networks and turn them against the target population so that each element of the network (e.g. every aircraft, every piece of mail) now becomes a potential weapon (Michel-Kerjan, 2003-a). Consider the immediate repercussions of 9/11 on airline traffic. As the number of hijacked planes on 9/11 was not known and each flying aircraft was a potential danger, the U.S. Federal Aviation Administration (FAA) ordered all private and commercial flights grounded and suspended less than one hour after the first aircraft crashed against the North WTC Tower. It was on September 12th 2001 aircraft that had been diverted were authorized to resume their flights. It was the first time that the FAA has ever shut down the airline system. With respect to the anthrax episode, the attacks were not turned against a specific postal office. Rather the entire United States Postal Service network was utilized to spread threats throughout the country and abroad. Any envelope could have been contaminated by anthrax, so that the whole postal service was potentially at risk (Boin, Lagadec, Michel-Kerjan and Overdijk, 2003).

These two examples demonstrate that a small but carefully targeted attack can cause large-scale economic consequences because they impact on the operating network. In 1998, U.S. Presidential Decision Directive 63 classified those sectors, among others (e.g. aviation, transportation, water supply, electricity², telecommunications, banking and finance, energy), as “critical infrastructure sectors” for the social and economic continuity of the country. (OECD, 2003; White House, 2003). In that regard, the recent large-scale terrorist attacks in Madrid, Spain on March 11, 2004, show that terrorists could also use trains as a weapon of destruction. These attacks have also been credited with altering the outcome of the Spanish election that occurred three days later, and raises the question as to the potential role of terrorism as a global political weapon.

Insurance: A New Loss Dimension

Prior to September 11, 2001 terrorism coverage in the United States was included in standard commercial insurance policy packages without explicit consideration of the risks associated with these events. It was an unnamed peril on their all-risk commercial and homeowners policies covering damage to property and contents. Even the first attack on the World Trade Center (WTC) in 1993, which killed 6 people and caused \$725 million in insured damages (Swiss Re, 2002-a), was not seen as being threatening enough for insurers to consider revising their view of terrorism as a peril to be explicitly considered when pricing their commercial insurance policy (Kunreuther and Pauly 2004). The private insurance market had functioned effectively in the U.S. because losses from terrorism had historically been small and, to a large

² This is illustrated by the August 14, 2003 power failure in the U.S. and the September 27, 2003 one in Italy.

degree, uncorrelated. Attacks of a domestic origin were isolated, carried out by groups or individuals with disparate agendas neither creating major economic disruption nor many casualties.³

The terrorist attacks of September 11, 2001 killed nearly 3,050 people⁴ from over 90 countries and inflicted damage currently estimated at nearly \$80 billion, about half of which was covered by insurance. (Swiss Re, 2002-a; Liedkte and Courbage, 2002). Commercial property, business interruption, workers' compensation, life, health, disability, aircraft hull, and general liability insurance lines each suffered catastrophic losses. More specifically, insured business interruption losses were estimated at \$11 billion, workers' compensation at \$2 billion, and life insurance at \$2.7 billion⁵. The insured property losses at the WTC were estimated at \$3.5 billion, aviation liability also at \$3.5 billion and other liability costs reimbursed by insurers/reinsurers at \$10 billion (Hartwig, 2002).

The 9/11 terrorist attacks were the most costly event in the history of insurance, inflicting insured losses more than twice that of any prior event. The most costly insured events before 9/11 were from Hurricane Andrew that devastated the Florida coast in 1992 and the Northridge Earthquake in California in 1994--- \$20 billion and \$17 billion in insured losses, respectively (US\$ indexed to 2002).

Figure 1 depicts the trend in world wide insurance losses due to natural catastrophes and man-made disasters from 1970 to 2003 showing how insured losses have increased in recent years. Among the 40 most costly events over this period of time, 75% of them occurred between 1990 and 2003 (in constant prices). In particular, the insured losses from Hurricane Andrew and the Northridge Earthquake led insurers and reinsurers to pay much more attention to the catastrophic potential of natural disasters. Some insurers were forced to declare insolvency due to these events. Those that survived began to rethink how they were doing business by turning to the use of catastrophic models to estimate their risks (Grossi and Kunreuther in press).

The events of September 11th confronted the insurance and reinsurance industries with an entirely new loss dimension. Reinsurers (most of them European) were responsible for most of the \$40 billion in claims. Having their capital base severely hit⁶, most of them decided to drastically reduce their exposure to terrorism, or even stopped covering this risk in the U.S. The few who marketed policies charged extremely high rates for very limited protection. By early 2002, 45 states in the U.S. permitted insurance

³ The Oklahoma City bombing of 1995, which killed 168 people, had been the most damaging terrorist attack on domestic soil; however, the largest losses were to federal property and employees and were covered by the government.

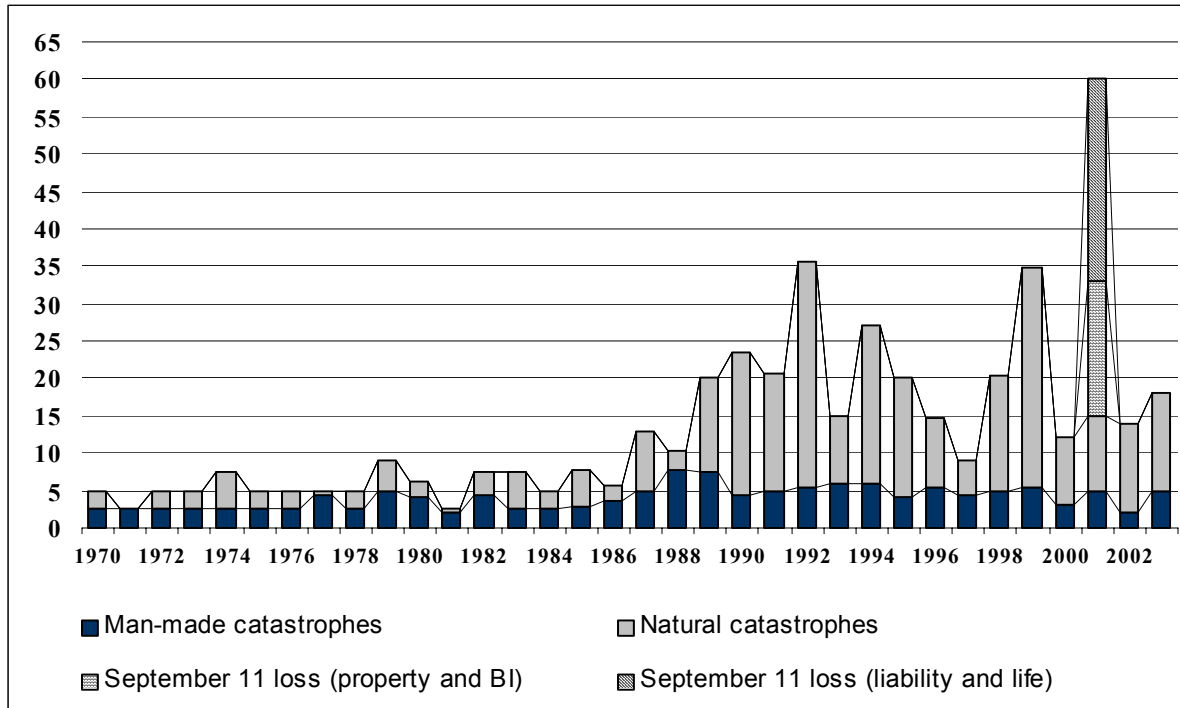
⁴ This number represents victims of the attacks in New York, Washington, DC and Pennsylvania as well as among teams of those providing emergency service.

⁵ The WTC attacks could have been far more costly if the event had taken place later in the day when more people were in the buildings.

⁶ The 9/11 terrorist attacks came on top of a series of catastrophic natural disasters over the past decade and portfolio losses due to stock market declines.

companies to exclude terrorism from their policies⁷, leading to a call for some type of federal intervention (U.S. General Accounting Office, 2002).

Figure 1
Worldwide Evolution of Insured Losses, 1970-2003
(Property and business interruption (BI); in US\$ billion indexed to 2003)



Source: Swiss Re, Economic Research (2002-b; 2003).

Why Is Terrorism Different?

Although terrorist activities and natural disasters can be both characterized as extreme events, there are crucial differences between them. These include: predictability of future events, dynamic uncertainty, shifting attention to unprotected targets, existence of negative externalities and government influencing the risk. In the following sections the implications of such characteristics on insurability and on the need for government partner with the insurance industry are discussed.

⁷ Except for workers' compensation insurance policies that cover occupational injuries without regard to the peril that caused the injury. In particular, terrorism risk and even war cannot be excluded from that coverage. There is only one exception: Pennsylvania law is the only workers' compensation law in the U.S. that does exclude War.

Predictability of Future Events

There are large historical databases on losses from natural hazards in the public domain. These data have been utilized by modeling firms in conjunction with estimates by scientists and engineers to estimate the likelihood and consequences of future disasters in specific locations. In contrast, data on terrorist groups' activities and current threats are normally kept secret for national security reasons.

Moreover, a natural disaster is observable so one can trace the factors that caused the event. In contrast the elements leading to a terrorism attack are generally not readily observed and may be difficult or impossible to determine. We have still no idea today how the anthrax in the U.S. mailings during the autumn of 2001 was manufactured, introduced and by whom.

Some time series data on terrorist acts over the past years are in the public domain, but they may not reflect the changing expectations of planned activities of terrorist groups. As discussed above, the scale and configuration of terrorist attacks of 9/11 represent a new type of vulnerability. The capacity of terrorist groups to adapt their strategy to new security measures makes it challenging to forecast future losses. The firms that have modeled the risks from natural disasters have attempted to develop estimates of terrorist risk, but they are the first to acknowledge that there is considerable uncertainty in their projections. Moreover, their models do not provide distributions of expected loss from terrorism in a pure statistical sense, but rather estimate potential losses associated with specific scenarios. (Kunreuther, Michel-Kerjan and Porter, in press).

Dynamic Uncertainty

Since terrorists are likely to adapt their strategy as a function of their own resources and their knowledge of the vulnerability of the entity they want to attack, the nature of the risk is continuously evolving. The likelihood and consequences of a terrorist attack is determined by a mix of strategies and counterstrategies developed by a range of stakeholders and changing over time. This leads to *dynamic uncertainty* (Michel-Kerjan, 2003-b). In that spirit, while large-scale terrorism risk resembles war risk, it is more complex. When a country is at war, there is an identifiable opponent and a well-specified geographical area for combat. With respect to terrorism, the enemy is comprised of networked groups throughout the world who can attack anywhere in the world and at any time.

More formally, the analyst is confronted with a dynamic game where the actions of the terrorist groups in period t are dependant on the actions taken by those threatened by the terrorists (i.e. the defenders) in period $t-1$. Hence terrorism risk will change depending on at least two complementary strategies by the defenders. The first entails protective measures adopted by those at risk. The second consists of actions taken by governments to enhance general security and reduce the probability that

attacks will occur. In this sense, terrorism is a mixed private-public good. From the terrorists' point of view, they must determine what targets to attack and the commitment of resources to specific activities.

In contrast, actions can be taken to reduce damage from future natural disasters with the knowledge that the probability associated with the hazard will not be affected by the adoption of these protective measures. In other words, the likelihood of an earthquake of a given intensity in a specific location will not change if property owners design more quake-resistant structures. For example, damage due to a future large-scale earthquake in Los Angeles can be reduced through adoption of mitigation measures; however, it is currently not possible to influence the occurrence of the earthquake itself.

Shifting Attention to Unprotected Targets

Terrorists may respond to security measures by shifting their attention to more vulnerable targets. Keohane and Zeckhauser (2003) analyze the relationships between the actions of potential victims and the behavior of terrorists. Establishing publicly observable protective measures for a specific building should reduce the probability of an attack against it because the terrorist group perceives that the marginal benefit of such action (i.e., the likelihood of success) is now lower. However, shielding that building makes an attack on an unprotected structure more likely⁸.

Rather than investing in additional security measures, firms may prefer to move their locations from large cities to less populated areas to reduce the likelihood of an attack. Of course, terrorists may choose these less protected regions as targets if there is heightened security in the urban areas. They also may change the nature of their attack if protective measures in place make the likelihood of success of the original option much lower than another course of action (e.g. switching from hijacking to bombing a plane). This *substitution effect* has to be considered when evaluating the effectiveness of specific policies aimed at curbing terrorism (Enders and Sandler, 1993).

Central Intelligence Agency (CIA) director, George Tenet, suggested this behavior in his prophetic unclassified testimony of February 7, 2001, (prior to 9/11) when he said: "As we have increased security around government and military facilities, terrorists are seeking out 'softer' targets that provide opportunities for mass casualties" (CIA, 2001). Khalid Sheikh Mohammed, the Al Qaeda chief of military operations arrested in March 2003, has since explicitly admitted such a soft target strategy (Woo, 2004-b).

⁸ One exception would be if terrorist groups attack trophy buildings to prove that they can inflict damage to well-protected structures so as to have an immediate psychological impact on the general public. It is also worth noting that risk mitigation can have positive externalities also. For example, an airport that increases its security measures can prevent an aircraft from crashing in an office building hundreds miles away.

Interdependent Security

Another type of negative externality that affects the decision to invest in protective measures relates to problems of *interdependent security*. Kunreuther and Heal (2003) and Heal and Kunreuther (2003) have addressed this issue by asking the following question: What economic incentives do residents, firms or governments have for undertaking protection if they know that others are not taking these measures and that their failure to do so could cause damage to them?

Investing in airline security illustrates the nature of the interdependency problem. Suppose Airline A is considering whether to institute a sophisticated and costly passenger security system knowing that some passengers who transfer from other airlines to their planes may not have gone through a similar screening procedure. The more airlines that do not invest in these measures the less incentive Airline A has to incur this cost. The interdependent risks across firms may lead all of them to decide not to invest in protection.

The crash of Pan America's flight 103 over Lockerbie, Scotland in December 1988 that killed 259 people on board and 11 others on the ground illustrates this point. The explosion was caused by a bomb loaded at Gozo, Malta on Malta Airlines where there were poor security systems, transferred at Frankfurt Airport to a Pan Am feeder and then loaded onto Pan Am 103 at London's Heathrow Airport. The bomb was designed to explode only when the aircraft flew higher than 28,000 feet, which would normally not occur until the plane started crossing the Atlantic to its final destination, New York. There was not a thing that Pan Am could do to prevent this tragedy unless they inspected all transferred bags, which is both a costly and time-consuming process. The terrorists who placed the bomb knew exactly where to check the bag. They put it on Malta Airlines, which had minimum-security measures and Pan Am was helpless. Hence the terrorists took advantage of the weakest link in a chain of interdependencies (Lockerbie, 2001). Similarly, the collapse of the World Trade Center on September 11, 2001 could be attributed in part to the failure of security at Logan airport in Boston where terrorists were able to board planes that flew into the twin towers.

Government Influencing the Risk

International terrorism is a matter of national security as well as foreign policy. It is obvious that the government can influence the level of risk of future attacks through appropriate counter-terrorism policies and international cooperation. Some decisions made by a government as part of their foreign policy can also affect the will of terrorist groups to attack this country or its interest abroad (Lapan and Sandler, 1988; Lee, 1988; Pillar, 2001). Federal and state governments can also devote part of their budget to the development of specific measures on U.S. soil to protect the country. The creation of the new U.S. Department of Homeland Security in 2002 confirms the importance of this role in managing the

terrorist risk. In this regard, government is an actor that can play a key role by not only influencing the risk but also providing relevant information not available to the private sector.

In sum, both terrorist activities and natural disasters have the potential to cause catastrophic losses, thereby posing limitations on the insurability of the risk. Terrorism has additional challenges due to the lack of current data on terrorist activities, the dynamic uncertainty due to the ability of these groups to purposefully adapt their strategy in reaction to new security measures, and the existence of interdependencies that could reduce firms' incentives to adequately invest in security measures. Moreover, the risk of terrorist attacks is partly in the government's control.

Private Market Responses to 9/11

Given the challenges in estimating the likelihood of specific terrorist attacks and their consequences, a question that is being posed today is whether the private insurance market can offer coverage without some public sector involvement. In marketing policies insurers need information in order to establish predictability for at least one year, but preferably over a period of years. That is, even perfect information on the likelihood of an attack during the coming month does little for an insurer that issues one-year policies.

As discussed above, if there are limited data on which to estimate the risk and there is the potential for catastrophic losses, then insurers will want to charge premiums reflecting their aversion to ambiguity and restrict coverage to reduce the possibility of insolvency. If, in addition there are negative externalities associated with the risk, then the private insurer will not be able to encourage risk-reducing measures effectively, as it would be able to do if there were not these interdependencies. The insurer knows that even if Firm A undertakes security measures to reduce its own risk, other firms that have not been as prudent can increase Firm A's risk from what it would otherwise be (Kunreuther and Heal, 2003).

This section examines the demand and supply for terrorism insurance following the terrorist attacks of 9/11. We show that there was and still is a very thin market for protection, and explore why private sector solutions, such as a mutual pool and terrorist catastrophe bonds did not emerge. We conclude that the inability of the insurance industry to satisfy the demand for terrorism coverage at prices acceptable to policyholders during the year following September 11th due to concerns of insurability of the risk, led the Federal government to pass new legislation requiring insurers to provide terrorism coverage.

Market Reactions to 9/11

The response by the insurance industry to the terrorist attacks could have been predicted by the literature on insurance firm behavior following catastrophic events.⁹ In the short run, large losses from a specific disaster reduce surplus and hence the capacity to provide coverage. Given the high transaction costs of raising outside capital to replenish surplus and the relatively high interest rates associated with these funds, firms reduce the amount of coverage they offer and increase the price of insurance for the particular risk that caused the losses. Consider the impact that 9/11 had on the supply of terrorism coverage. Insurers were unable to obtain reinsurance for these events except at very high prices and felt that losses from another terrorist attack of comparable magnitude could do irreparable damage to the industry¹⁰. Others were and still are unable to find reinsurance at any price, particularly if coverage is related to high-risk properties and Nuclear, Biological, Chemical and Radiological (NBCR) risks. As a result, many insurers refused to offer coverage to their clients. The few that did provide insurance charged very high prices so only organizations that were required to have this coverage actually purchased it.¹¹ Unlike reinsurers, primary insurers must obtain approval from state regulatory agencies when implementing new coverage restrictions. As discussed above, the immediate lack of terrorism insurance is in part due to the fact that this exposure was not explicitly priced and then caused large insured losses. On September 12, 2001 insurers found themselves with significant amounts of terrorism exposure from their existing portfolio with limited possibilities of obtaining reinsurance to reduce the losses from a future terrorist attack (Gron and Sykes, 2002). In October 2001, the Insurance Services Office (ISO), on behalf of insurance companies, filed a request in every state for permission to exclude terrorism from all commercial insurance coverage (U.S. General Accounting Office, 2002). As of February 2002, 45 states, the District of Columbia and Puerto Rico had approved the insurance industry's applications for terrorism exclusion language¹². The states that had not approved the new exclusion were California, Florida, Georgia, New York and Texas accounting for about 35 percent of the commercial insurance market (U.S. Congress, Joint Economic Committee, 2002).¹³

⁹ See Winter (1988, 1991), Gron (1994); Doherty and Posey (1997), Cummins and Danzon (1997); Froot and O'Connell (1997, 1999). For an empirical study of market reactions to 9/11, see Doherty, Lamm-Tennant and Starks (2003).

¹⁰ Maurice Greenberg, CEO of AIG made this point by saying "The industry is going to pay its loss in the World Trade Center events. What we're saying is that if terrorist events continue, this is an industry with finite capital", [Hamburger and Oster (2001)].

¹¹ An example illustrating this behavior is the case of insuring Chicago's O'Hare airport. Prior to 9/11, the airport carried \$750 million of terrorism insurance at an annual premium of \$125,000. After the terrorist attacks insurers only offered \$150 million of coverage at an annual premium of \$6.9 million (Jaffee and Russell, 2003).

¹² These exclusions did not apply to workers' compensation insurance policies.

¹³ There is no reliable information, however, on the share of the commercial property and casualty insurance market in the 5 states that did not approve the exclusion (U.S. General Accounting Office, 2002).

Potential Role for Mutual Insurance

One way the private sector might have developed a larger market for terrorism insurance without governmental participation would have been to create mutual insurance, such as risk retention groups. A *risk retention group* (RRG) is an entity that provides liability insurance to its owner-members. Traditionally, it is created when insurance is not available or premiums are so high that few buyers feel they can afford coverage.

The airline industry considered forming such a mutual company when coverage for third party liability for terrorism and war risks was withdrawn within 10 days after 9/11. New policies offered by insurers limited their aggregate third party liability to \$50 million, falling far short of the \$3.5 billion of aviation liability losses from 9/11 (Hartwig, 2002). For airlines, the question of adequate third party liability coverage became vital for the continuity of their activity. As a temporary measure, the federal government provided such coverage for U.S. airlines, as did other governments worldwide.

When first warned that government coverage was going to cease, the U.S. airlines decided to develop their own RRG, *Equitime*, which was created in June 2002. However, this group never became operational. A principal reason may be the continued subsidized financial protection of airlines by federal government, crowding out the emergence of private solutions at a competitive price as well as the creation of broader international insurance programs (ICAO, 2003). Indeed, a temporary FAA terrorism insurance program, which covers approximately 75 U.S. air carriers at significantly discounted rates, had been in effect since September 2001 for a six-month period. It was then extended to the end of 2004 and more recently to December 31 2007 (U.S. House of Representatives, 2003). It provides another example of the phrase often used to characterize government responses to crises that *nothing is more permanent than the temporary*.

In another context, a group of fourteen U.S. workers' compensation insurers that accounts for roughly 40% of the market recently assessed the feasibility of a workers' compensation terrorism reinsurance pool (Towers Perrin, 2004). Workers' compensation represents a specific market in the U.S. because insurance policies cover occupational injuries without regard to the peril that causes the injury. Hence, terrorism risk cannot be excluded from coverage. The feasibility study, released in March 2004, concluded that while the pool could create some additional capacity for each of its members, it would not be enough to matter in the case of a large-scale terrorism attack. Indeed it is conceivable that extreme terrorist attacks would inflict workers' compensation losses of \$90 billion, i.e. three times the capital backing of the private industry's workers' compensation line of business. Moreover, the report concluded that it would be difficult to reach an agreement on a scale of rates that should be charged based on terrorism exposure of pool participants (Towers Perrin, 2004).

Potential Role for Terrorism Catastrophe Bonds

In the aftermath of Hurricane Andrew and the Northridge Earthquake in the early 1990s, property catastrophe reinsurance was in short supply and the price of reinsurance more than doubled in the U.S. For insurers to provide their clients with the same amount of coverage they offered prior to these events they had to find capital from other sources. They collaborated with the investment banking community to develop new classes of financial instruments. Alternative risk transfers, such as options and catastrophe bonds, emerged to cover these losses by transferring part of the risks to the capital markets. Though the market for these risk-linked securities is still in its early stages, insurers and reinsurers have over \$9.5 billion in catastrophe bond since its inception in 1997 and 2003 (Swiss Re, 2004). However, this market is still considerably below the expectations of insurers, reinsurers and investment bankers accounting for less than 3% of worldwide catastrophe reinsurance coverage (U.S. General Accounting Office, 2003).

A market for catastrophe bonds to cover losses from terrorist attacks has *not* emerged since 9/11. Bantwal and Kunreuther (2000) specified a set of factors that might account for the relatively thin market in catastrophe bonds for natural hazard risks that may partially explain the lack of interest in terrorist catastrophe bonds. In their paper the authors conjecture that the reluctance of institutional investors to enter this market is due to a combination of ambiguity aversion, myopic loss aversion, and fixed costs of education on a new type of asset.

Four additional elements may help explain the lack of interest in terrorist catastrophe bonds. There may be a moral hazard problem associated with terrorism-related financial assets if terrorist groups are connected with financial institutions having an interest in the U.S. Terrorism risk is likely to be more highly correlated to the equity markets suggesting that a terrorism cat bond would not offer the same diversification as a natural disaster catastrophe bond.

Second, investment managers may fear the repercussions on their reputation of losing money by investing in an unusual and newly developed asset. Unlike investments in traditional high yield debt, money invested in a terrorist catastrophe bond can disappear instantly and with no warning.¹⁴ Those marketing these new financial instruments may be concerned that if they suffer a large loss on the catastrophe bond, they will receive a lower annual bonus from their firm and have a harder time generating business in the future. The short-term incentives facing investment managers differ from the long-term incentives facing their employers. If this is a major problem in marketing catastrophe bonds, then there is a need to develop strategies for bringing the principal (employer and its shareholders) and its agents (investment managers) into alignment (Kunreuther, 2002).

¹⁴ This same problem can occur with cat bonds for natural hazards but the risks are more familiar than terrorist attacks and the cat bonds have been marketed since 1997 without any major losses so that investors are less concerned with the reputational effects of suffering a large loss.

A third reason is that cat bonds only work for short tail exposures. That is, the investors need to know that any losses will be finalized within a relatively short period after the termination of the bond (e.g. one year later). Workers compensation and liability claims, and even property losses from biological or radiological attacks can take several years even decades to fully develop.

A fourth reason why there has been no market for terrorist catastrophe bonds has been the reluctance of reinsurers to provide protection against this risk following the World Trade Center attacks of September 11th. Financial investors perceive reinsurers as experts in this market. Upon learning that the reinsurance industry required high premiums to provide protection against terrorism, investors were only willing to provide funds to cover losses from terrorism if they received a sufficiently high interest rate.

Finally, and related to the last point, most investors and rating agencies consider terrorism models to be too new and untested to be used in conjunction with a catastrophe bond covering risks in the United States.¹⁵ The models are viewed as providing useful information on the potential severity of the attacks but not on their frequency. Without the acceptance of these models by major rating agencies, the development of a large market for catastrophe bonds exclusively issued for terrorism risk losses is unlikely in the United States (U.S. General Accounting Office, 2003)¹⁶.

Need for Government Intervention

When the private insurance market fails there is normally a response from the public sector. Insurers were prepared to cancel windstorm coverage in hurricane-prone areas of Florida following Hurricane Andrew in 1992 and the state legislature passed a law the next year that individual insurers could not cancel more than 10 percent of their homeowners' policies in any county in any one year and that they could not cancel more than 5 percent of their property owners' policies statewide.

At the same time the Florida Hurricane Catastrophe Fund was created to relieve pressure on insurers should there be a catastrophic loss from a future disaster (Lecomte and Gahagan, 1998). In California insurers refused to renew homeowners' earthquake policies after the 1994 Northridge

¹⁵ It is worth noting that the process of rating natural disaster catastrophe bonds has been streamlined in recent years as rating agencies have become more familiar and experienced with the catastrophe models used to estimate the risks from these events.

¹⁶ The first terrorism catastrophe bond was issued in Europe in August 2003. The world governing organization of association football (soccer), the FIFA, which organizes the 2006 World Cup in Germany, developed a bond to protect its investment. Under very specific conditions, the catastrophe bond covers against *both* natural and terrorist extreme events that would result in the cancellation of the final World Cup game without the possibility of it being re-scheduled to 2007 (U.S. General Accounting Office, 2003). The second terrorist-related bond is a securitization of catastrophe mortality risk that was undertaken in 2003 by Swiss Re, the world largest life reinsurer. Mortality is measured with respect to a mortality risk index, weighted according to Swiss Re's exposure in several countries. The trigger threshold for the mortality index is 30% higher than expected up to the end of 2006, based on 2002 mortality in these countries. This may represent 750,000 deaths. According to Woo (2004-a), this huge number could be attainable only if very pessimistic lethality estimates are made for two simultaneous events: a large pandemic *and* a terrorist attack using weapons of mass destruction that would kill several hundred thousand people.

earthquake and the California Earthquake Authority was formed in 1996 with funds from insurers and reinsurers (Roth, Jr., 1998).

In the case of terrorism, no state or federal insurance legislation was enacted during the year following 9/11. As a result many firms remained largely uncovered at the time of the first anniversary of the 9/11 attacks (Hale, 2002). The lack of available terrorist coverage delayed or prevented certain projects from going forward due to concerns by lenders or investors¹⁷. For example, the U.S. General Accounting Office noted several cases of deals that could not be completed and a construction project that could not be started because the firms could not find terrorism coverage at prices they could afford (U.S. General Accounting Office, 2002 pp.11-14).

As discussed above, government actions can influence the risk of an attack. The public sector also has the capacity to diversify the risks over the entire population and to spread past losses to future generations of taxpayers, a form of cross-time diversification that the private market cannot achieve because of the incompleteness of inter-generational private markets (Gollier, 2002; Smetters, 2004).¹⁸ This is particularly important for extreme losses that pose severe problems of liquidity and possible insolvency to insurers and reinsurers.

A Temporary Answer: Terrorism Risk Insurance Act of 2002 (TRIA)

The lack of private insurance coverage after the terrorist attacks of 9/11 led to a number of proposals for private-public partnerships to provide insurance against terrorism¹⁹ and to the passage of the Terrorism Risk Insurance Act of 2002 (TRIA) on November 26, 2002. As we indicate in this section, TRIA is neither a complete answer nor a definitive one for dealing with terrorism protection.

Risk Sharing under the TRIA Program

While the passage of TRIA may have been welcome news for commercial enterprises,²⁰ it appears to have been a mixed blessing for insurers. They were obligated to offer an insurance policy against terrorism to all their clients, who then had the option of refusing the coverage except for workers' compensation coverage where terrorism protection can not be excluded from policies.

¹⁷ Although it is difficult to measure at a micro-level how important the real impacts were, see Russell (2003).

¹⁸ It is worth noting that there may be a cost associated with that federal intergenerational diversification too. Such diversification would be done through the tax system, and then imposes additional cost as well as imposes risk on people who may not be willing to bear it.

¹⁹ For a review of these proposals, see Smetters (2004).

²⁰ According to a study by the U.S. Council of Insurance Agents and Brokers (CIAB), 85% of insurance brokers who responded, estimated that terrorism was more available in the market in June 2003 than it was in January 2003 (CIAB, July 2003).

Under TRIA's three-year term²¹, insured losses from commercial lines of insurance as well as business interruption are covered only if the U.S. Treasury Secretary certifies the event as an "act of terrorism" carried out by foreign persons or interests²² and only for losses higher than \$5 million. There is a specific risk-sharing arrangement between the federal government and insurers that operates in the following manner. First, the federal government is responsible for paying 90% of each insurer's primary property-casualty losses during a given year above the applicable *insurer deductible*, up to a maximum of \$100 billion; the insurance company pays the remaining 10% in addition to the deductible. This deductible is determined as a percentage of the direct commercial property and casualty earned premiums of each insurer the preceding year. The percentage varies over the three-year operation of TRIA: 7% in 2003, 10% in 2004 and 15% in 2005.²³

Second, if the insurance industry suffers terrorist losses that require the government to cover part of the claim payments, then these outlays can be partially recouped *ex post* by the U.S. Treasury through a mandatory policy surcharge. In other words, eventually the federal government will pay only for insured losses above specific insurance marketplace retention amounts. That amount is specified as \$10 billion in 2003, \$12.5 billion for 2004 and \$15 billion for 2005. The recouping of funds by the government from insurers applies only with respect to insured losses that are higher than the total market deductible threshold level and below the market retention level. This financial obligation is imposed on insurers writing lines of coverage that are included in TRIA. Insurers can then impose a surcharge applied to all property and casualty insurance policies whether or not the insured has purchased terrorist coverage.

An important element of this program is that the federal government does not receive any premium for providing this coverage. With respect to catastrophic losses, while the overall effect on the crowding-out of private solutions is not clear a priori, there is no way reinsurers can compete with a zero cost federal terrorism reinsurance program. This limits the role of reinsurance companies to covering the deductible portion of the insurer's potential liability from a terrorist attack.

²¹ The act expires on December 31, 2005. The "make available" requirement of the act is scheduled to expire on December 31, 2004, but the Secretary of Treasury has the authority to extend this requirement by one additional year to December 31, 2005.

²² A domestic terrorist event like the Oklahoma City bombings would not be covered under TRIA. TRIA does not cover life insurance, so that standard policies for this coverage will continue to cover these losses. The law also excluded punitive damages from coverage.

²³ The deductible level under TRIA can be large for most US insurers. A recent study estimates that AIG's 2004 deductible would be \$2.7 billion, Others like Travelers, ACE, Chubb or Berkshire would have lower 2004 deductibles: \$928 million, \$743 million, \$600 million and \$200 million, respectively (Morgan Stanley, 2004).

Insurance supply

Under TRIA, insurers are required to offer all their policyholders terrorist coverage for commercial property, commercial casualty, and workers' compensation.²⁴ Companies were given 90 days after TRIA was enacted to develop and disclose to policyholders new premiums and coverage terms. Many insurance companies found themselves in the situation of having to set a price for a risk they would have preferred not to write. Although their exposure to losses from terrorism has been reduced through the private-public partnership created by TRIA, it is still significant.

Catastrophe modelers, leveraging their considerable experience and expertise in modeling natural hazard events, released the first generation of terrorism models in 2002. Insurers and reinsurers can use these models to obtain estimates of future losses from terrorist attacks across multiple lines and thereby make more informed pricing decisions. Loss estimates for individual addresses can be of significant interest when the location, type of activity conducted at the address and/or the prominence of the tenant may make that property a particularly attractive target. Kunreuther, Michel-Kerjan and Porter (in press) discuss the strengths and limitations of these new models.

Since these terrorism models have been applied to thousands of potential targets, they can provide a picture of the relative risk by state, city, zip code and even by individual location. The Insurance Services Office (ISO) used the estimates provided by one of its subsidiaries, Applied Insurance Research, to file advisory loss costs with the insurance commissioner for each state at the beginning of 2002.²⁵ ISO defined three tiers for the country, listing Washington, DC, New York, Chicago and San Francisco in the highest tier with recommended loss costs in those cities of \$0.10 per \$100 of property value. A second tier consisted of Boston, Houston, Los Angeles, Philadelphia and Seattle; the rest of the country fell into the third tier.

ISO's recommendations were not, however, well received by cities in the first tier who felt they were being treated unfairly. There were complaints that such premiums would lead businesses to relocate to other areas (Hsu, 2003). Negotiations ensued and compromises were made. ISO filed revised loss costs for first-tier cities based on zip code level model results, which differentiated between the higher risk of downtown city centers and the lower risk of properties on the outskirts. But nowhere did the new loss

²⁴ Since fire is covered by standard all risk policies, an insured that decided not to purchase terrorism coverage per se would be covered against losses due to a fire consequential to a terrorist attack unless she happens to be the direct target of the attack.

²⁵ A *loss cost* is defined by ISO as the long-term average annual expected loss (as generated by the Applied Insurance Research model) per \$100 of insured property value. It is used to set insurance rates, or premiums, after the addition of an expense-loading factor to cover administrative fees and a profit margin. Once an ISO advisory loss cost has been approved by a state, any insurance company can adopt it without having to undertake its own often lengthy and expensive rate filing process.

costs exceed \$0.03 per \$100 of property value.²⁶ Thus, while the new official advisory loss costs no longer adequately reflected the risk in the eyes of the modelers, they became more palatable to other stakeholders. The Departments of Insurance in all 50 states eventually approved these ISO advisory loss costs that covered the years 2003, 2004, and 2005.

Is TRIA Failing?

TRIA was designed to provide adequate reimbursements and indemnification to victims of major terrorist attacks and to assure social and economic continuity of the country should terrorist attacks occur. The existence of a viable terrorism insurance market is a cornerstone for a system of national preparedness, since it impacts on a variety of economic activities. These range from real estate transactions, where insurance is normally a condition for a mortgage, to investment in cost-effective loss reduction measures that are rewarded by lower premiums or higher coverage limits.

Congress passed TRIA partly for these reasons and also because there was a large unsatisfied demand for coverage by firms during the year following 9/11 due to limited available coverage at prices that businesses felt they could afford. The expectation was that TRIA would ease insurers concerns about suffering large losses from future disaster and hence they would offer terrorism coverage at premiums that would be attractive to firms at risk.

Short-Term Market Reactions to TRIA To examine the immediate impact of TRIA, one can observe the stock price responses of firms in industries most likely to be affected by TRIA, such as construction, banking, property and casualty insurance, real estate investment trusts and transportation firms. Brown, Cummins, Lewis and Wei (2003) analyze these reactions for a sample of firms ranging from 28 in the construction industry to more than 200 in banking. According to their study, there was a decline in stock prices for banks, transportation firms and real estate and a statistically significant negative response in stock prices for the property and casualty (P&C) insurance companies. The analysis conducted for the five trading days prior to the passage of TRIA and the five trading days immediately thereafter, indicates that P&C insurers stocks on average lost nearly 3% of their value during this period.

The most credible explanation of that negative reaction is that insurers now had an obligation to offer coverage for a risk they would not have provided otherwise. It is worth noting, however, that insurers now recognize the need for having a federal backstop program that requires them to offer terrorism insurance. According to a survey undertaken by the Council of Insurance Agents and Brokers

²⁶ The second tier (third tier) settled at \$0.018 (\$0.001, respectively) per \$100 of property value.

(CIAB)²⁷ and released end of March 2004, 80% of brokers indicated that their commercial customers were in favor of TRIA renewal after 2005 (CIAB, 2004).

Empirical Evidence on Market Penetration TRIA has been operating for a relatively short time so it is too early to obtain extensive and precise data on the market penetration of terrorism insurance. Although TRIA requires insurers to offer terrorism coverage, the few studies that have been undertaken suggest that, there have been few takers.

The CIAB undertook the first national survey in March 2003 on the level of demand for terrorist coverage (CIAB, March 2003). Almost half of the brokers who responded to the survey indicated that fewer than 20% of their largest commercial P&C accounts (customers who pay more than \$100,000 annually in commission and fees to the broker) had purchased terrorism coverage. The low demand was even more pronounced for smaller companies (less than \$25,000 in commission and fees to the broker): 65% of the brokers indicated that less than 1 in 5 customers were purchasing insurance against terrorism.

According to another national survey by the CIAB undertaken in Spring 2003, 72% of the brokers indicated that their commercial customers were still not purchasing terrorism insurance coverage (CIAB, July 2003). Even in locations like New York City, the level of demand remained low two years after the attacks. During the autumn of 2003, the New York-based insurance brokerage firm Kaye Insurance Associates surveyed 100 of its clients at middle market real estate, retail and manufacturing in the New York area on a series of insurance-related issues, including terrorism insurance. Only 36% of companies indicated that they had purchased terrorism insurance (Kaye, 2003). If the low level of demand continues this means that an attack similar to the one on the World Trade Center, would very likely have a much more devastating effect on the business continuity today than after 9/11 because losses would be much less diversified.

Large firms that buy terrorism coverage are now typically paying an additional 20% of the standard commercial property/casualty premium for this protection. Most small and medium firms pay 10% of the standard premium for this type of coverage. For large accounts located in high-risk areas such as Manhattan, the cost was assessed up to 100% or more of the standard commercial insurance premium at the beginning of 2003 (CIAB, March 2003). While prices have fallen since the start of 2003, Manhattan properties are still paying 20% of standard premiums to included terrorism, according to the Kaye survey.

Although TRIA limits the potential losses to the insurance industry, some insurers are still concerned about the impact of a large terrorist attack on the solvency of their firms and their ability to pay (credit risk). Some firms at risk are concerned not only with acts of terrorism certified by the federal

²⁷ The CIAB represents the top tier of the nation's insurance brokers who collectively write 80 percent of the commercial property/casualty premiums annually.

government but also by the prospect of domestic terrorism, such as an attack similar to the Oklahoma City bombings in 1995, which would not be covered by TRIA. The market for domestic terrorism is still mixed, with some insurers offering coverage (sometimes at no cost if the risk is perceived to be low) while others exclude it (CIAB, March 2003). In the latter case, businesses may prefer not to buy any terrorism coverage than having just partial protection.

Heuristics and Behavioral Biases Since most businesses have little or no information on terrorism risk and no new attack has occurred on U.S. soil since 9/11, firms may perceive the chances of another event to be extremely low. This behavior has been well documented for natural hazards where many individuals buy insurance after a disaster occurs and cancel their policies several years later if they have not suffered a loss. It is hard to convince them that the best return on an insurance policy is no return at all. In other words, there is a tendency for most people to view insurance as an investment rather than as a form of protection (Kunreuther, 1996).

A few years after 9/11, concern with damage from terrorism appears to have taken a back seat. In 2003, most firms believed that if a terrorist attack occurred, it would not affect them, whereas in the first few months after 9/11, they had the opposite belief. The aforementioned CIAB study indicated that more than 90% of the brokers said that their customers eschew terrorism insurance because they think they do not need it (CIAB, July 2003). These firms consider insurance, even at relatively low premiums, to be a bad investment, or even a questionable expense. The expectation that government may financially aid affected businesses whether or not they are covered by insurance, as illustrated by the airline industry following 9/11, may also contribute to the unwillingness of firms to purchase a policy. On the other hand, suppliers of terrorism insurance are likely to charge higher premiums than normal because of the large uncertainty surrounding this risk and the possibility of a concentrated loss in a metropolitan area that could lead to insolvency.

Concluding comments

There seems to be a large difference in the perception of the seriousness of the terrorist threat by those who are potential buyers of insurance and those who are supplying coverage under the mandatory offer provision. In these circumstances, TRIA will not solve the problem alone. If one wants to create a market for terrorism insurance, both buyers and sellers need to do a more systematic analysis of the relationship between the price of protection and the implied risk. There is no guarantee that in revising their beliefs firms will be willing to pay more for coverage or that insurers will greatly reduce their premiums. But there is a much better chance that a larger market for terrorism coverage will emerge than if the status quo is maintained.

The U.S. Treasury Department is required by Congress to undertake studies of the supply and demand for terrorism coverage as inputs to the process of determining whether TRIA should be renewed in 2005 may be made. Those studies, launched in December 2003, are expected to provide a better understanding of the types of terrorism coverage offered by insurers and the current level of demand.

A Proposed Program for the United States

Currently it is unclear what type of terrorism insurance program will emerge in the United States after 2005. One possibility is that TRIA will be renewed with the same or a new risk-sharing arrangement between the insurance industry and the federal government. However, if the program is terminated on December 31, 2005, alternative solutions will need to be found. The challenge is to develop a program that will satisfy the different interested parties, each of whom has their own set of values and concerns. In addition to insurance coverage, there are ways of providing protection before an event, so as to reduce the need for the public sector to provide financial aid following a disaster.

A look abroad

It is instructive to consider the private-public partnerships that other countries have established after 9/11 for providing terrorism coverage. Below we provide some features of programs operating in three European countries: the United Kingdom, France, and Germany²⁸.

United Kingdom In the wake of the two terrorist bomb explosions in the City of London in April 1992 and an announcement seven months later by British insurers that they would exclude terrorism coverage from their commercial policies, the UK established a mutual insurance organization (Pool Re) to accommodate claims following terrorist activities. Pool Re charges a separate, optional premium for terrorism coverage that can be calculated as a percentage of the total sum insured under a fire and accident policy and mainly depends on the location of the property. The four different rates established by Pool Re are based on the risks, with the highest rate in Central London and the second highest in the rest of the city. The Treasury backs Pool Re as the reinsurer of last resort

Until September 11, 2001 terrorism exclusions within insurance policies in the UK were limited to property coverage. They were based on the Terrorism Act of 1993 and designed to deal with the IRA bombing campaign on mainland Britain. Fire and explosion were excluded by insurance companies, but were covered under Pool Re. The scale of the 9/11 attacks led to the need for extending protection under

²⁸ Michel-Kerjan and Pedell (2004) provide a comparative analysis relative to each country's market of the current terrorism insurance programs developed after 9/11 in France, Germany and the U.S.

Pool Re to “all risks” (including damage caused by chemical and biological as well as nuclear contamination), which was done on January 1, 2003. The Pool Re policy covers now all these risks, which has resulted in doubling of the pre September 11th 2001 premiums. Moreover, insurers are now free to set the premiums for underlying terrorism policies, thereby introducing competition into the terrorist insurance market²⁹.

France After suffering several terrorist attacks during the 1980’s, a law enacted in September 1986 requires the French insurers to provide terrorism coverage up to the overall limits of a standard commercial property insurance policy. To avoid problems of adverse selection and low demand for insurance that may result in large uncovered losses, terrorism insurance is mandatory in France. After 9/11 French insurers were required to renew terrorist coverage and retain most of the risk, as most reinsurers refused to cover acts of terrorism in their policies. Discussions between FFSA, GEMA³⁰ and the French government led to the creation of the first post 9/11 country-backed reinsurance pool for terrorism worldwide, the GAREAT (for Group of Insurance and Reinsurance Against Terrorism), on January 1, 2002.

A scale of premiums charged by the pool is established nationwide. Those premiums only depend on the sum insured³¹ and not on the location at risk. All insurers must be members of the pool (Godard et al., 2002). As of 2004, the current partnership between the government and the insurance industry is a four-layer scheme. Private insurers retain the first portion of losses up to 400 million euros; the next layer is placed in the international insurance and reinsurance market up to 1.65 billion euros (a 1.25 billion euros trench). A third layer is comprised of reinsurance covering losses between 1.65 and 2.0 billion euros. Losses greater than 2.0 billion euros are covered by the government (unlimited guarantee for which the pool pays an annual premium), and managed by the Caisse Centrale de Réassurance, a public-owned reinsurer.

²⁹ There was also an intention to set the *maximum* insurance retention for the next four years, with individual insurers’ retentions being based on market share. It is now set at £30 million (43 million euros) per event and £60 million (86 million euros) per annum for 2003; it will increase up to £100 million (144 million euros) per event and £200 million (288 million euros) per annum for 2006.

³⁰ The French Federation of Insurance Companies and the French Group of Mutual Insurance Firms, respectively; the two major representative institutions from the French insurance market.

³¹ For sums insured higher than €6 million and lower than €20 million, the insurer pays to the pool a premium equal to 6% of the commercial property and business insurance premium paid by the insured. The insurers continue to cover lower risks without the possibility for them to be reinsured by the pool. In particular, the insurance contracts of individuals are not modified. For sum insured higher than €20 million but lower than 50, the applied percentage is 12%. When sum insured is higher than €50 million, the insurer pays a premium equal to 18% of her basic insurance premium. The French decree dated December 31, 2002 allows policyholders with sum insured higher than €20 million to limit their cover for acts of terrorism to 20% of the property damage guarantee. Finally, for “special risks” (nuclear, captives or property over 750 million euros, nuclear or captives) the rate is quoted individually (25 policies entered into this category in 2003).

Germany Discussions between the German federal government and the insurance industry led to the creation of a special insurer for terrorism risks, Extremus AG. The company has been operating since November 2002. *Extremus*, a corporation whose shareholders are essentially private insurers and reinsurers operating in Germany, directly insures terrorism risk through the participating companies. As in France, a premium scale is established nationwide that depends on the sum insured and not on the location at risk. Coverage by Extremus is non-compulsory and is only offered if the total insured value per policy is at least 25 million euros. As of 2004, the annual reinsurance capacity is limited to 10 billion euros and is provided in three layers. The shareholders of Extremus provide the first layer of 1.5 billion euros. International reinsurers led by Berkshire Hathaway provide the second layer of 0.5 billion euros. The Federal Government of Germany would provide an additional capacity of 8 billion euros if needed. It is interesting to note that the second layer was reduced from 1.5 billion euros in 2003 to 0.5 billion euros at the beginning of 2004 in order to enable Extremus to cover its operating costs. The third layer was reduced from 10 billion euros to 8 billion euros at the beginning of 2004.

These three countries have created private-public partnerships based upon an insurance pool covered by government reinsurance. Terrorism insurance is required for every business in France, while there is voluntary participation in the U.K. and in Germany³². Several features of these European programs could be instituted in developing a sustainable terrorist insurance program in the U.S. after 2005 that involves shared responsibilities between the public and the private sectors.

Role of Different Stakeholders in the U.S.

Since U.S. state governments can also influence the risk, they could become active players in a national terrorism insurance program. If so, criteria for their participation would have to be discussed further. For example a State government could pay a share of the loss if the attack occurred somewhere within its boundaries. Alternatively all 50 States would financially contribute to governmental reimbursements wherever the location of the attack.

TRIA could be modified as a private-public partnership that shared responsibility between the insured parties, the private sector and the government(s). The insured would be responsible for the initial level of losses through a deductible on their policy. The size of the deductible could depend on mitigation measures in which the insured would have invested. For losses above the deductible, we propose that

³² While no national survey has been published yet, available data from personal communication with Extremus state as follows. By the end of November 2003, Extremus managed 1,100 contracts of 40,000 firms exposed to risks over 25 million euros in Germany, yielding an estimate of only 2.75% of market penetration. Although this estimate has to be dealt with carefully as the size of the contracts is not accounted for, level of demand for terrorism coverage remains very low. When focusing on the largest companies operating in Germany, the percentage is much higher, in a range of 30% purchasing insurance coverage (Michel-Kerjan, and Pedell, 2004).

insurers and reinsurers cover middle-sized losses up to a specific threshold (market retention). Above that threshold, state and federal reinsurance could cover 100% of losses for extreme events rather than just 90% covered under TRIA. The question as to whether such government reinsurance protection should be provided gratis as is currently done under TRIA remains open³³.

One option for the private sector would be the creation of a pool arrangement that could link insurance with global mitigation measures more systematically as well as internalizing some of the externalities and interdependencies associated with terrorism risk. For example, insurers may want to require specific risk reduction measures and/or security measures as a condition for coverage. If a pool arrangement emerges as a possible program, then national associations of insurers and reinsurers, in partnership with the Treasury, will play a key role in its implementation. There are a set of challenges associated with the creation and operation of a pool arrangement. Should it be pre or post-funded? Should participation in the pool be voluntary or mandatory? To what extent could the pool diversify the risk and create additional capacity for each of its members? What rate scale should be charged by the pool and how could one reach a consensus among all potential members? In that regard, the terrorism models developed since September 11th could be used to establish a national scale of rates charged by the pool based on terrorism exposure.

Should coverage be mandatory?

Existing institutions, such as banks and financial institutions, could require coverage as a condition for loans and mortgages to protect their own investments. Property owners would assume the cost of their risk through their insurance premiums and would be aided financially in their recovery process should a terrorist attack occur by being able to file a claim to cover their direct losses as well as business interruption. Rents to tenants in commercial buildings may increase to reflect the cost of terrorist insurance coverage. Mandatory coverage for these and other risks would guarantee a much larger market for terrorism insurance and enable the insurance pool to diversify its risks across structures and geographical areas. By increasing the premiums contributed to the pool, the likelihood of a catastrophic loss that would exceed the pool's resources would be reduced.

The question as to whether insurance should be mandatory has not been explicitly raised in discussions of the future of terrorism insurance in the United States.³⁴ It would likely take center stage if other terrorist attacks, even small-sized ones, occurred on U.S. soil. It is much easier to defend a voluntary private market approach for providing terrorism insurance when no losses have been incurred.

³³ In France and Germany, the government receives nearly 10% of direct terrorism insurance premiums levied against the insured in 2004 for providing reinsurance. (Michel-Kerjan and Pedell, 2004).

³⁴ That question was raised in the aftermath of World War II in the context of war damage insurance to provide coverage against losses from nuclear weapons attacks (Hirshleifer, 1953).

The lessons of September 11th indicate that there will be strong pressure for public sector involvement following any large-scale disaster. Considering some type of required insurance before such an event occurs should alleviate the political pressure for federal relief and facilitate the recovery process through insurance claims dispersed rapidly to those suffering losses.

There are lessons to be learned from abroad in this regard. In Israel that has been suffering terror attacks for years, the government administers two mandatory programs for dealing with terrorism risk. The Israeli Income and Property Tax Commission levies a national property tax predominantly on Israeli business. The Commission pays for claims on property damages from a terrorist attack, while indirect damages (including business interruption) must be covered by private insurance. The second government program, administered by the National Insurance Institute, provides for medical care, lost wages, payments to the families of attack victims and personal injury (General Accounting Office, 2001).

Conclusion and Challenges

The events of 9/11, as well as more recent terrorist attacks worldwide have changed insurers views of terrorism. They do not consider it insurable by the private sector alone. We also believe there is a need for private-public partnership but question whether TRIA is the appropriate form for this to take. As of today the demand for insurance remains quite low. This means that another mega-attack such as the one on 9/11` could have a much greater financial impact on the US economy because much the loss would not be diversified through insurance and reinsurance. The government because of its responsibilities to protect the country should partner with the private sector to create a large and sustainable insurance market for terrorism risk to help assure the social and economic continuity of the country should another large-scale attack occur.

The terrorist attacks of 9/11 as well as those in other parts of the globe have raised not only the question as to what one should do to aid the recovery process should another disaster occur but also how to prevent an attack and mitigate the consequences of future catastrophes. There could be an opportunity to use insurance for encouraging investment in risk-reducing measures through premium reductions and purchase requirements, especially if such mitigation programs integrate dynamic uncertainty and the externalities associated with interdependencies. The questions as to how to do that and who should decide are open ones and call for future research.

In order to develop a coherent strategy, one needs also to incorporate the growing knowledge of how individuals and firms process information on extreme events and then make choices. As illustrated by behavior related to natural disasters, most residents in hazard-prone areas are *not* concerned about the possibility of catastrophe events before they occur, assuming “they will not happen to me”. Only after the disaster do they want to take protective action. Hence immediately after an extreme event the door springs

open for implementing well-understood disaster reduction policies, but closes rapidly as the memories of the impacts of the disaster fade. These mitigation programs are well defined for natural disasters where safer structures can be built and/or people can move out of harm's way. In the case of chemical accidents, the inventory level and/or production of specific toxins can be reduced to lower the risk of another mishap occurring.

When it comes to developing a strategy to reduce the risks of future terrorist activities, considerable uncertainty exists with respect to who are the perpetrators, what are their motivations, what is the nature of their next attack and where will it be delivered. Terrorist groups can attack anything, anywhere, at any time, and one cannot protect everything. Hence, as discussed above, it is extraordinarily difficult to know what priority to assign to risk-reducing measures.

Although this paper makes the case for private-public partnerships for dealing with terrorism, one should recognize that creating and developing such arrangements might be challenging, as there are problems associated with sharing information. Government agencies are often reluctant to share knowledge of terrorist plans and activities due to national security concerns. In the same spirit, approximately 85% of U.S. critical infrastructure is owned or operated by private firms who understand their operation, interdependencies, investments in security and their clients (e.g. airlines). They may not want to share such sensitive data with government agencies without compromising business competition or privacy issues.

To deal with all these issues there is a need to examine the role of regulations, standards, third party inspections and other policy tools. By defining economic criteria to measure their efficiency as well as taking distributional issues into account, one should be able to provide substantial benefits to the affected individuals and firms as well as improving social welfare.

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