

Global Business and the Terrorist Threat

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Dwight Jaffee and Thomas Russell

INTRODUCTION

The costs to the US economy of the terrorist attacks of 11 September 2001 went considerably beyond the horrendous loss of life and property destruction of that day. The event also triggered disruptions in financial markets which threatened adverse effects on the normal operations of a broad set of newly vulnerable industries.

Immediately following the attacks, the insurance industry, recognizing the new magnitude of this risk, began to place terrorism exclusions in standard commercial property loss contracts. At the same time, mortgage providers and other lenders, aware that collateral was now exposed to terrorist action, refused to make loans unless the borrower obtained terrorism insurance coverage.

In the face of this 'catch-22', the pace of mortgage and other lending slowed, leading to a loss of jobs in construction and other industries dependent on loan markets. Reacting to this, and aware of the obligation to maintain full employment, the US Congress passed the Terrorism Risk Insurance Act of 2002 (TRIA), a temporary measure which made Treasury funds available for three years as a backstop to the private insurance market. The purpose of the Act was to buy time to allow the private market to regain its capacity to handle terrorism events. This did not happen, and the Act was extended by a further temporary (two years) measure, the Terrorism Risk Insurance Extension Act (TRIEA), passed in December 2005.¹ This act expired in December 2007 and was in turn replaced by the Terrorism Risk Insurance Program Reauthorization Act of 2007 (TRIPRA). This act maintains a government presence in the terrorism insurance industry through December 2014.

In passing TRIPRA, Congress recognized that current government arrangements do not fully solve the problem of adequate terrorism coverage. In particular, TRIPRA allows private insurers to continue to exclude terrorism losses that arise from attacks using 'unconventional weapons'.

Consequently, losses caused by nuclear, biological, chemical and radiation (NBCR)² attacks remain very difficult to insure.³ Indeed, the need to close this 'NBCR gap' is a major argument used by supporters of an expanded and permanent government presence in the terrorism insurance line. This chapter discusses the policy issues raised by the absence of NBCR coverage, particularly as they relate to the appropriate sharing of this type of risk between the public and private sectors.

TRIPRA AND NBCR RISKS

Nothing in the language of TRIPRA directly prevents insurers from writing coverage against NBCR attacks. Indeed, if they do offer NBCR coverage, any resulting losses would be backstopped by the Treasury in exactly the same way as losses from conventional terrorist acts. It is also important to note that TRIA and now TRIPRA require insurers in the US to offer coverage against conventional (non-NBCR) terrorism losses to their general commercial insurance customers. So, although TRIPRA provides identical benefits to insurers for all forms of terrorist coverage including NBCR risks, it only requires insurers to provide non-NBCR coverage. As a result, few insurers now offer NBCR coverage. What, then, causes the NBCR gap?

That NBCR coverage can be excluded from terrorist insurance under TRIPRA appears to be accidental, and arises as a consequence of a running together of the specific language of the Act, and historical insurance practice in the US. With respect to terrorism risks in general, the 'must offer' clause in the Act states that insurers:⁴

Section 103 (B) shall make available property and casualty insurance coverage for insured losses that does not differ materially from the terms, amounts, and other coverage limitations applicable to losses arising from events other than acts of terrorism.

Since insurers in the US have de facto always excluded NBCR losses from their standard policies, their continued exclusion under TRIA was not a 'material difference' and was therefore permitted.

Still, the question arises as to why insurers would refuse to insure this type of loss, particularly given the access to free Treasury reinsurance of losses at the high end made available by TRIPRA. This question is of central importance to current debates on the appropriate role of government. Since the private market refuses to cover NBCR risks under TRIPRA as it now stands, insuring these risks will require either a different type of

public-private partnership or, possibly, a new wholly public arrangement. In either case, an understanding of the reluctance of the private sector to write NBCR coverage cannot help but improve the design of any alternative arrangement

WHY IS NBCR COVERAGE LIMITED?

The insurance industry has given a number of reasons why NBCR risk is 'uninsurable' – see GAO (2006, pp. 10–11) – but two concerns dominate the discussion:

1. The potential size of a single NBCR loss is too large to be handled by insurance firms which are constrained to remain profitable on a year-by-year basis.
2. The likelihood of an NBCR loss is difficult to quantify and therefore difficult to price.

We examine each of these in turn.

The Potential Losses from an NBCR Attack are too Large to Handle

Two independent studies confirm the view that an NBCR attack has the potential to cause extremely large aggregate insured losses. Table 5.1 provides RMS Inc. estimates of potential insured losses from specific NBCR attacks. These range from a \$28 billion sarin gas attack to a \$450 billion tactical nuclear bomb. Property damage represents the larger part of all

Table 5.1 Potential losses from NBCR attacks, \$ billion

	Property losses	Workers' compensation	Total
Sarin gas attack (1000 kg ground dispersal)	21	7	28
Dirty bomb (15,000 curies of Cesium-137)	62	0.2	62
Anthrax attack (1 kg anthrax slurry)	35	26	61
Anthrax attack (10 kg anthrax slurry)	112	59	171
Anthrax attack (75 kg anthrax slurry)	266	74	340
Sabotage attack on nuclear power plant	202	15	217
Nuclear bomb (battlefield, 1 kt)	140	100	240
Nuclear bomb (tactical, 5 kt)	250	200	450

Source: Risk Management Systems (2005), Table 2.

Table 5.2 Insured loss estimates, large NBCR terrorist attack (\$ billion)

Type of coverage	New York	Washington	San Francisco	Des Moines
Group life	82.0	22.5	21.5	3.4
General liability	14.4	2.9	3.2	0.4
Workers' compensation	483.7	126.7	87.5	31.4
Residential property	38.7	12.7	22.6	2.6
Commercial property	158.3	31.5	35.5	4.1
Auto	1.0	0.6	0.8	0.4
Total	778.1	196.8	171.2	42.3

Source: American Academy of Actuaries (2006), Appendix II.

total losses, although workers' compensation losses are also significant in almost all cases.

Furthermore, these estimates represent only a fraction of total expected losses. First, there would be other forms of insured losses, such as business interruption losses. Second, these are only the direct costs, and do not include any 'multiplier' costs that would arise from economic disruptions across the full economy. For example, estimates put the total losses of the 9/11 attack at more than \$190 billion, versus \$30 billion in insured losses, and put the economic losses of the London bombing at \$4 billion to \$6 billion, even though insured losses were minimal; see RMS (2005).

Table 5.2 provides an alternative set of estimates provided in a study by the American Academy of Actuaries of the insured losses from certain NBCR incidents in four US cities. In New York, a large NBCR event could cost as much as \$778 billion, with insured losses for commercial property at \$158 billion and for workers' compensation at \$483 billion. In addition to New York, three other cities were included in the analysis: Washington, DC, San Francisco, CA and Des Moines, IA (see Table 5.2). To give some sense of the scale of these losses, the industry noted that only some \$163 billion of the estimated \$427 billion policyholder surplus for 2005 was available to cover terrorism risk. Since the surplus in 2006 was in excess of \$600 billion, a more current reference scale would seem to be \$200 billion. Clearly an NBCR attack could cause insured losses on an unprecedented scale.

The Likelihood of an NBCR Attack

The insurance industry refers to the lack of precision in estimates of the likelihood of an NBCR attack as a second reason why these risks are

considered uninsurable. On the one hand, there are commentators who believe that a biological attack in the next ten years is all but certain. In 2005, then US Senate Majority Leader William Frist stated that: 'The greatest existential threat we have in the world today is biological.' He added the prediction that 'an inevitable bio-terror attack' would come 'at some time in the next 10 years'.⁵ Views such as these caused the US to spend over \$33 billion on bioterrorism countermeasures between 2002 and 2006.

On the other hand, there are experts who point out that such extreme estimates have little scientific underpinning. For example, Mueller (2007, p. 1) points out:

Even with the September 11 attacks included in the count, however, the number of Americans killed by international terrorism over the period [1975–2003] is not a great deal more than the number killed by lightning – or by accident-causing deer or by severe allergic reactions to peanuts over the same period. In almost all years the total number of people worldwide who die at the hands of international terrorists is not much more than the number who drown in bathtubs in the United States – some 300–400.

The absence of objective analysis is of particular concern, given the well-known tendency to overestimate the probability of easily imagined events. As Tversky and Kahneman (1973) have noted, although there is no necessary correlation between vividness and likelihood, decision-makers are frequently subject to a judgment bias, the availability heuristic, which causes them to make an association between ease of imagining and judged probability even when vividness and frequency are not correlated; see also Sunstein (2003).

Of their nature, events such as terrorist nuclear bomb attacks are very frightening. As Langewiesche (2007) notes of the Hiroshima Nagasaki bombs: 'But the idea was to terrorize a nation to the maximum extent, and there is nothing like nuking civilians to achieve that effect.' This fear is only increased by the frequent use of such events in works of fiction,⁶ so it is to be expected that judgments of likelihood are biased upwards; see Slovic (1986). To overcome the availability bias, therefore, it is necessary to pay particular attention to 'base rate' data on the objective likelihood of such attacks. It is clear that even committed nation states such as Iran and North Korea find significant challenges in developing nuclear weapons. So no matter how much they may wish to have them,⁷ terrorists on the run from the law face significant – though, as Langewiesche (2007) notes, not insurmountable – obstacles both in developing the weapons and in devising a method of delivery.

With respect to bioterrorism, as Leitenberg (2005, 2006) has noted, a careful analysis of prior bioterrorist attacks raises many questions about the capacity of terrorists to mass deliver the toxic agents. In the Aum Shinrikyo

Tokyo subway gas attack ten terrorists launched five attacks each involving 1 kg of hard-to-get sarin nerve gas. The attack was four years in the planning with an open budget and virtually no monitoring by the Japanese police. Yet the body count was 12 dead total. To be sure this was 12 too many, but in the 2005 London 7/7 backpack-bomb attack, four terrorists with four simple home-made conventional bombs caused 52 deaths.

Again in London, significant international press attention was given to the arrest of a terrorist group in Wood Green accused of a plot to manufacture and distribute ricin gas:

The group was in possession of 22 castor bean seeds. Their equipment was a coffee grinder, 'with a brown residue' (probably of coffee), a mortar and pestle, and a hand-written recipe taken off the Internet at an Internet café and transcribed into Arabic. The recipe was a derivative of the Maxwell Hutchinson recipe in the notorious *The Poisoner's Handbook* sold in thousands of copies at US gun shows, a recipe that would very likely not produce ricin, or extremely little of it.

The first tests for ricin in the London apartment were done by a field test kit and apparently registered positive. Within two days, 20 more specific tests were carried out at the British Defence Science and Technology Laboratory, Porton Down, resulting in 17 negatives and three false positives. However, the task of informing the London Metropolitan Police fell to another Porton Down staffer with public liaison responsibilities, who apparently either did not understand or confused the information that he was to relay, with the result that he phoned the press and police saying that 'traces of ricin' had been found. His actions were later attributed to 'incompetence'. (Leitenberg, 2005, p. 27)

Clearly, as economists, we do not possess the expertise to sort through these various viewpoints. But, then, neither do private insurance companies. Thus this risk is not amenable to precise probability calculation and becomes 'ambiguous' in the sense of Ellsberg (1961). It is well known that insurers are 'ambiguity averse' – see Hogarth and Kunreuther (1989), Kunreuther et al. (1995) – preferring to insure risks with known probabilities which are subject to actuarial calculation, rather than risks where it is difficult to attach likelihoods.

When we add to this the fact that insurance executives may also suffer from availability bias and overestimate the likelihood of attack, and that unlike acts of nature, terrorism risks are man made and so subject to manipulation against the insurer, it is not difficult to understand why insurers maintain that NBCR risks are uninsurable.

UNINSURABILITY REVISITED

These facts make the insurer's case for excluding NBCR risk surface plausible, but at a deeper level it is far from clear what principle of profit-driven

insurance makes this particularly ambiguous and large risk uninsurable. After all, private insurers currently underwrite conventional terrorism risk, and although the federal government does backstop large losses, a for-profit insurance company such as AIG still has current exposure to terrorist loss in excess of \$3 billion.

What is particularly puzzling is why any individual insurance company would ever cite aggregate maximum loss as an argument for not taking at least some part of the risk. Profit-driven insurance companies are free to limit their total exposure on any one class of risk to any amount they wish. In addition (up to state regulatory constraints) they are free to raise the quoted premium to any level which they feel compensates them for the ambiguity in underlying probability.

This would suggest that private insurers should be willing to underwrite at least some amount of NBCR risk. To be sure, the total available from the private sector may then fall short of total demand, but the reaction of the typical private insurer has not been to write limited amounts of insurance, but instead to refuse to write any. In the history of insurance, a pattern of complete withdrawal from a line of insurance following a large loss is well established, and is certainly not unique to NBCR coverage. Private flood insurance, for example, became unavailable after the Mississippi floods of 1927, and private earthquake insurance essentially disappeared in California after the Northridge earthquake of 1994. In both cases it was necessary to develop government programs to support the private insurance market.

THE INSURABILITY OF NUCLEAR REACTORS

The history of private insurance of (non-terrorist) nuclear accidents sheds light on the problem of insuring NBCR risk. At the beginning of nuclear power generation in the US, private insurers refused to insure nuclear plants. Again, doomsday meltdown scenarios were easy to put forward, and since it was a new technology, it was easy to argue that frequency-based probabilities were non-existent. In addition, there can be little doubt that any time the word 'nuclear'⁸ is used, special alarm bells sound. Note that private insurers had no problem providing Union Carbide with insurance to cover fertilizer manufacturing plants in India, though the 1984 Bhopal gas tragedy caused approximately 3800 deaths and several thousand other permanent and partial disabilities and cost private insurers \$200 million of the final \$470 million settlement.

Since the fledgling private nuclear power industry could not expand without insurance, Congress in 1957 passed the Price-Anderson Act to support the private insurance market. Like TRIA, this Act was viewed as

a temporary measure providing enough time (ten years), it was thought, to enable the private insurance markets to assess and price this risk. In actuality, the Act was renewed repeatedly, most recently in 2005, extending the Act to 2025.

When passed in 1957, the original Price-Anderson Act provided a \$560 million limit on liability for nuclear power plant operators. It was decided that the private insurance industry could provide \$60 million of this liability, with the federal government agreeing to cover the next \$500 million. The direct role of the federal government was phased out in 1977, and under the current 2005 extension, private insurers are now required to provide \$300 million in insurance and the nuclear power industry itself provides further coverage up to a total of \$10 billion. Beyond this cover and irrespective of fault, Congress, as insurer of last resort, must decide how compensation is provided in the event of a major accident.

It is interesting that despite the initial cries of uninsurability, private capital now provides \$10 billion of insurance to the nuclear industry. The first \$300 million of this is provided by an insurance pool, American Nuclear Insurers (ANI), with half of this being reinsured with Lloyd's. The remainder is provided through a contractual agreement administered by ANI, in which payments of \$100.6 million per reactor per accident are guaranteed by the operators of nuclear plants, the payments to be collected by an annual assessment of \$15 million (inflation adjusted) per operator per year for ten years. In effect this contractual arrangement is just an old form of insurance known as an 'assessable reciprocal mutual'.

By arranging for *ex post* premium assessments, this scheme overcomes the need to set aside large amounts of capital *ex ante*, one of the major impediments to writing catastrophe insurance; see for example Jaffee and Russell (1997). To be sure, as Heal and Kunreuther (2007, p. 13) point out, \$10 billion in private insurance is well short of the \$100 billion plus in losses which have been estimated to be the cost of a reactor meltdown in a populous state, but an examination of the Price-Anderson Act still establishes a point sufficiently important that we might consider it a general principle of catastrophe insurance. No matter how large the size of aggregate loss, private capital can be induced to flow into any line of insurance so long as the price is right and individual company losses can be limited.

SHOULD TRIPRA BE REWRITTEN TO REQUIRE NBCR COVERAGE?

How can this principle be applied to the problem of the NBCR gap? Clearly the simplest solution would be to rewrite TRIPRA so that the 'must offer'

clause no longer permits the exclusion of NBCR losses.⁹ This solution, however, is strongly resisted by the insurance industry. The following response by the Aon Corporation to the US Treasury and President's Working Group on Terrorism Insurance is typical:

As previously stated, despite the fact that TRIA limits an insurer's maximum loss exposure by providing USD100 billion reinsurance facility excess of carrier retentions, NBCR events implicate loss events, that from an economic loss perspective, exceed USD100 billion and the industry's overall policyholder surplus. Given the substantial aggregate retentions associated with TRIEA 2005 for many large commercial lines carriers and their mandatory workers compensation NBCR aggregate exposures, insurers simply do not want to take on catastrophic NBCR event exposure that threatens both the full loss attributable to their TRIA deductible and coinsurance exposures as well as presenting the potential for insured loss exposure in excess of the TRIA annual aggregate reinsurance capacity of USD100 billion. The inclusion of NBCR coverage would also vastly increase the net aggregate Probable Maximum Loss for insurance carriers and require them to cut aggregate capacity for other natural catastrophe exposures as well as standard commercial lines all other peril exposures. Basically, the (re)insurance industry views NBCR event exposure as a 'company killer' where the potential gross aggregate PML is well in excess of the industry's entire capital base. As such, the insurance industry would likely only offer NBCR coverage if it could cap its exposure at a level far below the current USD100 billion plus exposure that these events present. (Aon Group, 2006)

Because this response is so typical, it is worth examining in more detail. In the first place it is difficult to see why the addition of NBCR losses presents 'a potential for insured loss exposure in excess of the TRIA annual aggregate reinsurance capacity of USD100 billion'. Under current TRIPRA provisions, private insured losses are capped at the company's excess of deductible plus 15 percent of its share of aggregate losses up to \$100 billion. This is true whether the loss is due to conventional or NBCR terrorist attack, so adding NBCR coverage cannot cause insured loss above this limit.

On the other hand, the industry is correct to note that the addition of NBCR liability would affect the probability of loss within the TRIPRA \$100 billion threshold and that this in turn would affect the company's expected loss. In the absence of the \$100 billion cap, by standard probability theory, for any joint distribution the expectation, E , of a sum of two random variables X and Y is given by $E(X + Y) = EX + EY$. So, thinking of X as the random variable 'losses by conventional terrorist attack' and Y as 'losses by NBCR', the addition of NBCR coverage would simply add the expectation of that loss to the current level of expected loss with NBCR losses excluded. Assuming firms were free to price this extra risk, additional premiums should exceed the additional expected losses, so net expected profits should be higher when NBCR coverage is provided.

Again, however, it is necessary to consider the role of the \$100 billion cap. There are scenarios, albeit unlikely, in which the addition of NBCR risks in fact has no effect on an insurance company's expected loss. If the terrorists view conventional and non-conventional attacks as complements, and conduct a large NBCR attack at the same time as a conventional attack with more than \$100 billion in insured loss, the additional NBCR coverage would have no effect on expected loss. In the general case, the additional expected loss from adding NBCR risk will depend on how the joint probability density function of conventional and NBCR loss interacts with the TRIPRA cap.

There are no reliable data with which to make this calculation. Suppose, however, that we accept the industry's view that the addition of NBCR loss would lead to an unacceptable increase in the probability that the deductible will be exceeded together with unacceptable losses in the deductible to \$100 billion range. Clearly it is not difficult to rewrite the law to address this concern.

For example, TRIPRA could recognize two forms of terrorist attack, conventional and NBCR. If the attack is certified to be NBCR, then it could be assigned a zero deductible. In that case there is no marginal impact on the current deductible. At the same time, the level of co-pay for NBCR attacks could be set at a lower level, say 10 percent. Note that with these parameters, the maximum loss to the insurance industry is \$10 billion on a \$100 billion event (less after tax) so that the apportionment of risk as between the public and private sectors is coincidentally of the same order of magnitude as the private-public split for nuclear accidents under the Price-Anderson Act.

Of course, these parameters are just examples. If it is believed that NBCR attacks impose burdens on insurers which require some other special treatment, any combination of deductible and co-pay can be used to reduce the cost of adding this line. This fact was recognized in the failed House Bill, HR 2761. Under this bill, once a loss is certified as being due to an NBCR attack, the industry deductible becomes 7.5 percent (for conventional terrorism it is currently 20 percent) with a step down co-pay to a low of 5 percent for losses above \$60 billion (for conventional terrorism the co-pay is 15 percent). The 'make-available' provision for conventional terrorism is extended to NBCR losses. The reduced deductible and co-pay would have gone some way to soften industry objections to adding NBCR to TRIPRA. In addition, these new terms would render moot the conclusion of the recent RAND study (RAND, 2007), that if NBCR risk were to be added to TRIPRA on the same terms as conventional terrorism risk, premiums would need to be raised to such a level that it would have been the equivalent of letting TRIEA expire.

It remains possible, of course, that even with these special NBCR terms, premiums will be increased and demand for terrorism insurance reduced. There is no obvious reason why this needs to happen. We would recommend that if NBCR risk is added to TRIPRA with a 'make available' proviso, it be made clear that insurance companies are allowed to price these risks separately, so that insured individuals could buy this coverage or not as their circumstances dictated. If NBCR risk is unbundled in this way, its inclusion in the extension of TRIPRA would have no effect on the demand for conventional terrorism insurance.¹⁰

It is also worth noting that since 2001 the financial situation of insurers has improved markedly, and, their protests to the contrary, requiring them to cover NBCR risk with a \$100 billion cap (\$65 billion after tax) is today a far less burdensome task than it was when TRIA was drafted in 2002. As the Consumer Federation of America (2007) has noted:

It is clearly within the financial grasp of property casualty insurers to cover an initial \$100 billion in losses, or \$65 billion after taxes. Insurer retentions under TRIA right now are about \$30 billion, plus an additional 15 percent of losses. The President's Working Group on Financial Markets estimates in their report (PWG 2006, p. 26) that there is presently about \$6–\$8 billion in terrorism reinsurance capacity and \$3–\$4 billion in private capital from sources like hedge funds.

As this demand for reinsurance and private capital will undoubtedly increase if TRIA coverage is reduced, it is quite conservative to assume that at least \$10 billion in reinsurance and \$5 billion in private or securitized capital would be available. Thus, property casualty insurers would only have to fill a 'gap' of about \$20 billion under this program, which is just over 3 percent of the industry's current \$600 billion surplus.

Indeed, with respect to NBCR insurance under workers' compensation, private insurers already provide coverage under the TRIPRA backstop. We turn now to an examination of this problem.

THE SPECIAL PROBLEMS OF WORKERS' COMPENSATION

The workers' compensation line of insurance raises special issues with regard to NBCR attacks. The problems are unrelated to insurance principles, but instead reflect the special history of workers' compensation insurance in the US; see for example Moss (2002, Chapter 6). In order to form the coalition necessary for states to pass workers' compensation insurance legislation, workers and employers made the following deal. Workers would give up the right to sue employers for job-related injury, but workers'

compensation insurance would be mandatory for employers and the contract would not be allowed to contain any exclusions. (The Commonwealth of Pennsylvania allows 'acts of war' to be excluded, but the application of that exclusion to 'certified' acts of terrorism has not been tested.)

This means that for the workers' compensation line, private insurers are already providing NBCR coverage, claims of non-insurability notwithstanding. And, as Table 5.2 shows, the exposure to this line is not insignificant. For the scenarios modeled there, workers' compensation losses in New York City (NYC) amount to \$483 of the total \$778 billion loss, and in all four cities workers' compensation amounts to more than 50 percent of the total loss.

Obviously the breakdown between workers' compensation and other losses depends on the nature of the attack, but unlike conventional terrorism bomb attacks which focus on property, NBCR attacks are particularly hard on any personal insurance line.¹¹

THE RAND STUDY OF ANTHRAX ATTACKS

The RAND Corporation, in conjunction with the risk modeling firm Risk Management Systems, has carried out an extensive analysis of the possible losses that would be created from anthrax attacks; see RAND (2005). The RAND study evaluates two different anthrax attacks: one within a single large building; the other released and widely disbursed outdoors. Table 5.3 summarizes the study's major quantitative results. For the indoor anthrax attack, the estimated total insured losses are just under \$8 billion, including over \$6 billion of workers' compensation claims and

Table 5.3 Allocation of losses by insurance lines from anthrax attacks, (\$ billion)

	Indoor attack	Outdoor attack
Property	1.1	100.4
Workers' compensation	6.1	43.5
Group life	0.3	2.5
Individual life	0.2	2.1
Accidental death/dismemberment	0.2	1.5
Health	0.0	22.4
Total	8.0	172.3

Source: RAND (2005), Table S.2.

over \$1 billion of property damage claims (primarily the estimated costs of decontaminating the building, including the possibility that the building and its contents would need to be replaced). The total insured losses from an outdoor anthrax attack are estimated to be over \$172 billion, more than 25 times as large as the indoor attack. Here the largest component, over \$100 billion, is property damage, reflecting the large number of buildings that would become affected and the large costs of decontaminating them. The next-largest component, \$43 billion, is workers' compensation claims.

The values in Table 5.3 reflect only insured losses, but these cover all expected workers' compensation claims since, as noted, workers' compensation covers NBCR risk in almost all states. Similarly, the estimates include full coverage of the property damage, since it is assumed that the buildings are all fully insured against such an attack. In reality, a relatively small number of buildings are currently actually insured against the property damage that would be created by an anthrax attack.

The RAND study also evaluates who would be responsible for paying these claims under the 2002 TRIA. For the indoor anthrax attack, the firm(s) insuring the building would initially pay all the claims as a result of their deductibles and co-insurance requirements under TRIA. There would be no taxpayer payments, owing to the relatively small total insured losses of \$8 billion. The insured losses would have to reach at least \$20 billion before there would be any US taxpayer liability under TRIA.¹²

For the outdoor anthrax attack, the firms insuring the full set of affected buildings would pay virtually the total amount of the claims. Assuming that most of the affected buildings were relatively small, the individual insurers are not expected to exceed their company-specific deductibles. Thus there would be no ability to recoup from future commercial insurance premiums, and US taxpayers would also have no liability. Thus, even though the losses created by the outdoor anthrax attack are 25 times as great as the indoor attack, because they are assumed to be disbursed across a large number of insurers, individual firms cannot recoup their payments from future premium surcharges and US taxpayers continue to have no liability.

Obviously the size of workers' compensation NBCR exposure is not small. If a company in the District of Columbia (where the death benefit is worth approximately \$1.8 million) were to lose 300 employees as a result of a terrorist attack, the total claim would equal \$500 million (NCCI 2006). However, not all of such claims fall on the private sector. In four states and two territories¹³ workers' compensation insurance is provided by a state-run monopoly, and in 13 other states¹⁴ a not-for-profit

state enterprise competes with the private sector. Still, the exposure of the private sector is significant. In California, for example, the share of the risk taken by the state enterprise, the State Compensation Insurance Fund, fell sharply between 2005 and 2006 (from over 42 percent to 31 percent) and the state is actively campaigning to attract further private capital.

To the extent that private capital willingly exposes itself to NBCR risk in the workers' compensation line, it would appear that the backstop provided by TRIPRA is already adequate.

GLOBAL RESPONSES TO THE NBCR PROBLEM

Terrorism is a global problem. Some form of government support for terrorism insurance therefore exists in many countries. Prior to 9/11, countries such as the UK, Israel, South Africa and Spain had already experienced terrorist attacks, and in these countries, government programs were already in place to support private markets. The attack on 9/11 caused many other countries – for example France, Germany and Australia – to put in place their own government programs. For an overview of all programs see Guy Carpenter & Co. (2007).

NBCR risk is handled in different ways in different countries. Here is a brief list:

- In the UK, the government-supported terrorism reinsurance pool, Pool Re, makes no distinction between conventional and NBCR risk (a nuclear exclusion was deleted in 2002). The UK also has a sizable non-government supported market and in this market NBCR risk is typically excluded.
- In France the government terrorism insurance scheme GAREAT originally excluded nuclear attacks, but in 2006, nuclear attacks were added so that in France NBCR risk is treated no differently from conventional terrorism risk.
- In Germany NBCR risk is excluded from the government terrorism scheme Extremus.
- In Australia the government-run reinsurance pool ARPC includes chemical and biological loss but excludes nuclear.

As this brief list shows, experience with NBCR risk varies from country to country, but in contrast with the current situation in the US, there are existing public programs (UK and France) which include NBCR risk.

CONCLUSION

The failure of TRIA (and its successor TRIPRA) to sustain a private market in NBCR terrorism insurance is widely recognized as a potentially serious problem for the financing of industries vulnerable to terrorism attacks. Weapons of mass destruction are actively sought by many terrorist groups, and there is little doubt that if such weapons were available, they would be used against targets in the United States.

The easiest way to close the NBCR gap would be to amend TRIPRA to expand the 'make available' clause so that it included NBCR losses, and adjust the deductible and co-payments for these losses as necessary to overcome industry resistance. This was the approach adopted in the failed HR 2761.

A more radical approach would be to take this opportunity to examine the question of whether enough time has now passed for a private market in terrorism insurance (including NBCR insurance) to be viable with less government support. Seven years have passed since 9/11 2001, and in these years insurers' reserves have risen to \$600 billion. If the government were simply to cap all terrorism losses at say \$100 billion (\$65 billion after tax) it does not seem unreasonable to require private insurers to bear this risk.

On the other hand, a completely free market in terrorism risk is probably not viable at this time. If all government support was removed and private providers of workers' compensation insurance were to abandon this line, it is quite probable that the burden of any loss would fall on the public sector anyway. Such a crisis can be avoided by recognizing the special problems of NBCR insurance, requiring that both it and conventional terrorism insurance be 'made available', but capping the losses at some sum (say \$100 billion) which is within the capacity of the private market for insurance.

NOTES

1. The pros and cons of permanent government intervention in this industry have been extensively debated; see for example Rand (2007), Wharton (2005) and Jaffee and Russell (2006).
2. A full description of the categories on NBCR loss may be found in GAO (2006), p. 6.
3. Some limited NBCR coverage is available, for example through the Catlin group – see <http://production.investis.com/catlin/news/releases/archive2006/2006-06-12/> – but the conditions are very restrictive.
4. AVAILABILITY – Section 103(B) of the Terrorism Risk Insurance Act of 2002 (15 U.S.C. 6701 note; 116 Stat. 2327).
5. Frist (2005).
6. Recently, for example, an episode of the very successful television show *24* featured the detonation of a terrorist nuclear bomb in Los Angeles.
7. Osama bin Laden's desire for such a device has been noted frequently: see, for example,

the testimony of Jamal Ahmad al-Fadl, a native of Sudan and ex-bin Laden associate, in the trial of the earlier World Trade Center bombing: *United States of America v. Usama bin Laden, et al.* (S(7) 98 Cr. 1023), prosecuted February–July 2001 in the United States District Court (transcripts at <http://cryptome.org/usa-v-ubl-dt.htm>).

8. In his economics Nobel Prize acceptance speech, Schelling (2005) explains the non-use of nuclear weapons after World War II in part by the baggage which the word 'nuclear' brings to strategic war analysis.
9. This is the approach that was taken in HR 2761.
10. 'Background risk' could provide an exception in which the demand for conventional terrorism insurance might decline. Under the current system, with NBCR terrorism coverage generally unavailable, organizations might compensate by purchasing additional conventional terrorism coverage – this is the effect of background risk. When NBCR terrorism coverage becomes available, organizations might eliminate this additional conventional coverage, although we would still expect the sum of conventional and NBCR terrorism insurance coverage to rise.
11. According to the Insurance Information Institute, workers' compensation losses made up only 6 percent of total insured losses in the 9/11 conventional attack. <http://www.iii.org/media/facts/statsbyissue/terrorism/>. This fraction may grow with the growing incidence of respiratory disease associated with the clean-up.
12. The deductible and co-insurance limits have been increased even further under the 2007 extension of TRIA, TRIPRA, and therefore insurers would recoup even less from future premium surcharges, and US taxpayers would become liable only at a threshold even higher than the quoted \$20 billion.
13. North Dakota, Ohio, Puerto Rico, the US Virgin Islands, Washington and Wyoming.
14. Arizona, California, Colorado, Idaho, Maryland, Michigan, Minnesota, Montana, New York, Oklahoma, Oregon, Pennsylvania and Utah.

REFERENCES

- American Academy of Actuaries (2006), Letter to the President's Working Group on Financial Markets; public comment record, US Department of the Treasury, available at http://www.actuary.org/pdf/casualty/tris_042106.pdf.
- Aon Group (2006), Response to the US Treasury and President's Working Group: Terrorism Insurance, available at http://www.aon.com/us/busi/risk_management/risk_transfer/terrorism.
- Congressional Budget Office (2004), 'Homeland security and the private sector', www.mipt.org/pdf/Homeland-Security-Private-Sector-CBO.pdf.
- Consumer Federation of America (2007), 'Testimony before the Senate Committee on Banking, Housing, and Urban Affairs', http://www.consumerfed.org/pdfs/TRIA_Senate_Testimony022807.pdf.
- Ellsberg, D. (1961), 'Risk, ambiguity, and the savage axioms', *Quarterly Journal of Economics*, 75, 643–69.
- Frist, W. (2005), 'US senate leader urges "Manhattan project" against bio-terror threat', Agence France Presse, 27 January.
- Government Accountability Office (GAO) (2006), 'Terrorism insurance: measuring and predicting losses from unconventional weapons is difficult, but some industry exposure exists', GAO-06-1081, www.gao.gov/new.items/d061081.pdf.
- Guy Carpenter & Co. (2007), 'Global terror insurance market', http://gcpportal.guycarp.com/portal/extranet/popup/pdf_2007/GCPub/Terror%20Report%202007.pdf?vid=2.

- Heal, G. and H. Kunreuther (2007), 'Environmental assets and liabilities', available at <http://www.kellogg.northwestern.edu/research/risk/federal/heal-kunreuther.pdf>.
- Heyes, Anthony and Catherine Liston-Heyes (2000), 'Capping environmental liability: the case of American nuclear power', *Geneva Papers on Risk and Insurance*, 25 (2), 196–202.
- Hogarth R. and H. Kunreuther (1989), 'Risk, ambiguity and insurance', *Journal of Risk and Uncertainty*, 2, 5–35.
- Jaffee, Dwight and Thomas Russell (1997), 'Catastrophe insurance, capital markets, and uninsurable risks', *Journal of Risk and Insurance*, 64 (2), 205–30.
- Jaffee, Dwight and Thomas Russell (2006), 'Should governments provide catastrophe insurance', *The Economists' Voice*, 3 (5), 1–8.
- Kunreuther H., J. Meszaros, R. Hogarth and M. Spranca (1995), 'Ambiguity and underwriter decision processes', *Journal of Economic Behavior and Organization*, 26, 337–52.
- Langewiesche, W. (2007), *The Atomic Bazaar: The Rise of the Nuclear Poor*, New York: Farrar, Straus & Giroux.
- Leitenberg, M. (2005), *Assessing the Biological Weapons and Bioterrorism Threat*, <http://www.strategicstudiesinstitute.army.mil/pubs/display.cfm?pubID=639>.
- Leitenberg, M. (2006), 'Bioterrorism, hyped', *Los Angeles Times*, 17 February, <http://www.latimes.com/news/printedition/california/la-oeleitenberg17feb17,0,3489887.story?coll=la-headlines-pe-california>.
- Lyman, Edwin (2004), 'Chernobyl on the Hudson?' a study commission by Riverkeeper, Inc., September.
- Moss, D. (2002), *When All Else Fails*, Cambridge, MA: Harvard University Press.
- Mueller, J. (2007), 'Reacting to terrorism: probabilities, consequences, and the persistence of fear', <http://psweb.sbs.ohio-state.edu/faculty/jmueller/ISA2007T.PDF>.
- NCCI (2006), 'Workers Compensation Terrorism Impact and Education Study Group issues paper', https://www.ncci.com/NCCI/Media/PDF/TRIA_Study_Group_Jan_06.pdf.
- PWG (2006), 'Terrorism risk insurance report of the President's Working Group on Financial Markets', available at <http://www.insureagainstterrorism.org/PWGReport.pdf>.
- RAND Corporation (2005), 'Distribution of losses from large terrorist attacks under the Terrorism Risk Insurance Act', RAND Center for Terrorism Risk Management Policy.
- RAND Corporation (2007), 'Trade-offs among alternative government interventions in the market for terrorism insurance', http://www.rand.org/pubs/DOCUMENTED_briefings/2007/RAND_DB525.pdf.
- Risk Management Systems (RMS) (2005), 'A risk-based rationale for extending the Terrorism Risk Insurance Act', September.
- Schelling, T.C. (2005), 'An astonishing sixty years: the legacy of Hiroshima', Nobel Prize Lecture, http://nobelprize.org/nobel_prizes/economics/laureates/2005/schelling-lecture.html.
- Slovic, P. (1986), 'Informing and educating the public about risk', *Risk Analysis*, 6 (4), 403–15.
- Sunstein, S. (2003), 'Terrorism and probability neglect', *Journal of Risk and Uncertainty*, 26 (2/3), 121–36.

- Tversky, A. and D. Kahneman (1973), 'Availability: an heuristic for judging frequency and probability', *Cognitive Psychology*, 5, 207–32.
- Wharton (2005), 'TRIA and beyond: Terrorism risk and financing in the US', available at <http://knowledge.wharton.upenn.edu/papers/1299.pdf>.