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The Impact on Workers' Compensation Insurance Markets of Allowing the Terrorism Risk Insurance Act to Expire

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Key findings

- Compared with other insurance lines covered by the Terrorism Risk Insurance Act (TRIA), workers' compensation (WC) offers insurers less flexibility to control terrorism exposure through modifications in coverage: WC policies cannot exclude terrorism, impose policy limits, or exclude losses from nuclear, biological, chemical, or radiological (NBCR) attacks.
- If reinsurers are unwilling to provide much more coverage for both conventional and NBCR attacks, insurers might respond to TRIA's expiration in December 2014 by declining to provide WC coverage to employers who present a high geographic concentration of potential losses.
- Without TRIA in place, employers perceived to be at high risk for terrorism might have to obtain coverage in residual markets, which could charge higher premiums.
- The higher cost of coverage would tend to reduce labor incomes and economic growth even if there is never another attack, though these effects are likely to be small.
- Expiration of TRIA and growth in the residual market might also mean that WC losses from a catastrophic terror attack would largely be financed by businesses and taxpayers throughout the state in which the attack occurs, adding to the challenge of rebuilding in that state. TRIA, in contrast, spreads such risk across the country.

SUMMARY ■ Policy debates over the Terrorism Risk Insurance Act (TRIA) have focused primarily on property insurance, yet certain institutional features of workers' compensation (WC) markets could cause TRIA's expiration to have very different consequences in WC than in property and other TRIA lines. This policy brief examines how insurers who sell WC might respond to the expiration of TRIA, how these market responses could affect the cost and availability of WC coverage, and who would bear the financial burden of catastrophic WC losses from a terrorist attack without TRIA in place. A primary motivation for this policy brief is to help policymakers considering TRIA reauthorization better understand the potential impacts of TRIA expiration on the full range of insurance markets currently covered by the law by broadening the reauthorization debate to include WC.

The fundamental reason why TRIA expiration is likely to affect WC markets differently from other TRIA lines is that state WC statutes rigidly define the terms of coverage. In contrast to other TRIA lines, policy limits and terrorism exclusions are not an option in WC. Insurers facing limited risk-management options in WC might be forced to decline WC coverage for all risks to avoid catastrophe exposure, whereas insurers could limit terrorism risk in property insurance and other TRIA lines while continuing to sell the underlying policy.

A dramatic expansion of private reinsurance capacity covering terrorism losses would help reduce the impact of TRIA's expiration at the end of 2014. However, additional reinsurance capacity for WC would need to cover nuclear,

biological, chemical, or radiological (NBCR) attacks in addition to conventional losses to adequately replace the capacity currently available in TRIA, and the willingness of the reinsurance industry to assume large-scale NBCR risk remains uncertain. Predicting the response of the reinsurance industry to TRIA's expiration is beyond the scope of this policy brief. Instead, we describe possible WC market impacts in the plausible event that private reinsurance capacity does not increase enough to replace the capacity provided under TRIA.

If sufficient expansion of terrorism reinsurance for both conventional and NBCR risks does not materialize, private insurers might reduce the availability of WC coverage by refusing to sell policies to businesses perceived to face high terrorism risk. Because WC coverage is mandatory for nearly all U.S. employers, businesses that are shut out of private WC markets would then be forced to obtain coverage in markets of last resort known as residual markets. Residual market policies are often more expensive than ordinary WC policies. TRIA expiration could thus have adverse impacts on labor incomes and employment even in the absence of another terror attack, though the magnitude of these effects may be limited.

Migration of terrorism risk to residual markets following TRIA expiration would give residual markets and other state institutions a larger role in the allocation of catastrophic losses covered by WC in a future large terror attack. Whereas TRIA serves to spread catastrophe risk broadly over the entire U.S. commercial property and casualty (P&C) insurance industry and its policyholders, TRIA expiration could lead to a large share of catastrophic losses being borne within the state in which the attack occurs. Within most states in which an attack occurs, losses would be shared broadly by all P&C policyholders (i.e., businesses) in the state; in a minority of states, losses would instead be borne by state budgets, and thus by taxpayers and state residents at large. For states that never suffer an attack, TRIA expiration may reduce their role in financing very large terrorism losses.

Thus, TRIA expiration could have the effect of redistributing risk such that the burden of catastrophic losses is confined within the state that is attacked, which would add to the challenge of rebuilding in the affected state. It is important that policymakers be aware of this plausible scenario when debating how to proceed with TRIA.

INTRODUCTION

The terrorist attacks of September 11, 2001, caused more than \$40 billion of insured losses in 2014 dollars, making 9/11 the most expensive manmade catastrophe in insurance history.¹ The reinsurers who absorbed most of the losses from 9/11 moved quickly to exclude terrorism from their policies, and the ensuing scarcity of terrorism reinsurance led to availability and affordability problems in many lines of commercial property and casualty (P&C) insurance.² The Terrorism Risk Insurance Act of 2002 (TRIA) sought to guarantee the availability of commercial P&C insurance covering terrorism using two related policy levers. TRIA requires commercial P&C insurers to offer their policyholders coverage that includes losses due to terrorism on the same terms as the underlying (nonterrorism) coverage. Meanwhile, TRIA established the Terrorism Insurance Program (TRIA program), a risk-spreading mechanism designed to protect commercial P&C insurers from catastrophic losses due to terrorism. Since TRIA was enacted in 2002, terrorism insurance has become widely available, and a majority of businesses (62 percent in 2013) purchase property insurance that covers losses due to terrorist attacks that use conventional weapons.³ With TRIA facing expiration at the end of 2014, however, the ability of the private insurance industry to cover terrorism risk in the absence of TRIA has again become a pressing policy question.

Workers' compensation (WC) insurance, which provides medical and indemnity benefits to victims of on-the-job injuries and illnesses, is the largest single P&C line covered by TRIA on the basis of net premium written.⁴ Despite many similarities to the other TRIA lines, WC is unique among TRIA lines in several respects: Coverage is mandatory for almost all businesses,⁵ losses due to terrorism cannot be excluded, and there are a number of important regulatory and statutory restrictions on the form of coverage. Past reauthorization debates have focused heavily on property insurance, yet the distinctive institutional features of WC systems raise the possibility that TRIA expiration would lead to very different reactions in the WC insurance market.

In this policy brief, we seek to broaden the TRIA reauthorization debate by examining the possible impact of TRIA expiration on WC markets. We answer several questions about how TRIA's expiration might affect WC markets.

First, how would insurers who sell WC policies respond to TRIA's expiration? We explain the nature of terrorism risk in WC and identify a range of statutory and regulatory limita-

tions on insurer behavior in WC that may produce different post-expiration market dynamics in WC than in other TRIA lines. As will be discussed, the expiration of TRIA may cause employers to seek coverage in the market of last resort, known as the *residual market*, for the state in which the employees are located.

Second, what are the potential consequences of growth in the residual market, both before and after a future terrorist attack? We examine implications of residual market growth for the employer cost of workers compensation coverage, which may affect employers even in the absence of future attacks. Because the employers with the highest perceived terrorism risk would face the greatest pressure to move to residual markets, we also describe how catastrophic losses from a terrorist attack covered by a residual market policy would be distributed across employers, insurers, and taxpayers in the absence of TRIA.

Before turning to these questions, we provide some background on WC markets and TRIA.

BACKGROUND ON WORKERS' COMPENSATION AND TRIA

Even though each state has its own WC laws, the basic structure of WC is common across states: Employers must provide no-fault compensation for lost earnings and medical costs to victims of work-related injury and illness. Employers typically purchase WC insurance coverage to meet their obligations to injured workers, although some self-funding mechanisms are observed.⁶

Coverage for Losses Due to Terrorism Events

The impact of TRIA expiration on WC markets depends at the most basic level on the extent to which on-the-job terrorism casualties are covered by WC policies. Injuries and illnesses generally are compensable if they are determined to be work-related or to "arise out of the employment," but the causal connection between employment and injury may seem more tenuous for terrorism than for more ordinary types of workplace injuries. To better understand the extent to which terrorism is a source of risk in WC, we examined the legal doctrines that would justify compensability of terrorism casualties.

Even though WC is financed and provided by the private sector, the nature of this coverage is defined by each state's WC

statute and its application by the courts. Whether on-the-job casualties from a particular terrorist attack are legally compensable under WC may thus depend on state law and the nature of the attack. The clearest and broadest ground for compensability is the *positional risk* doctrine. This doctrine covers cases where employment put the worker in harm's way even though the cause of the injury was not related to employment. This principle seems to encompass most terrorism scenarios in which workers are harmed at their place of employment. The leading WC law practice guide suggests that related doctrines well established in New York WC law are practically equivalent to the positional risk doctrine, and that there were therefore no court challenges to WC claims filed by or on behalf of 9/11 victims who were on the job at the World Trade Center on 9/11.⁷

The majority of states have not affirmed the positional risk doctrine, however, leaving the compensability of on-the-job terror victims theoretically contestable in some attack scenarios. In these states, the older and more stringent doctrine of *increased risk* may provide the relevant legal test. The question here is not whether the worker would have been in harm's way "but for" his employment (as in positional risk), but whether the employment placed the worker at greater risk than the general public. The leading WC law practice guide argues that 9/11 casualties would not have been clearly compensable had the same style of attack happened in Chicago, rather than New York, since Illinois rejects the positional risk doctrine.⁸ The legal distinction between these two doctrines may be greatest for the most indiscriminate and potentially catastrophic attack modes, such as nuclear, biological, chemical, or radiological (NBCR) attacks.⁹

While the applicability of WC coverage to large-scale terrorism may be legally ambiguous in many jurisdictions, many interviewees expressed concern that wholesale denial of terrorism victim claims would be damaging to insurer brands, and most anticipated that politicians and state insurance commissioners would exert considerable public pressure on insurers to pay. Even if terrorism claims are sometimes contestable, the insurers we interviewed say they treat on-the-job terrorism as a catastrophe risk without regard to each jurisdiction's affirma-

tion of the positional versus increased risk doctrine.¹⁰ This view may be prudent, given that the issues at stake have never been litigated in the context of a mass terrorism event. In keeping with the stated perception of our interviewees, we will treat terrorism casualties as being compensable in all jurisdictions for the remainder of this policy brief.

Terrorism Represents an Important Form of Catastrophe Risk in Workers' Compensation

Perhaps the fundamental requirement of a well-functioning insurance system is that it maintain solvency in order to fulfill its obligations to policyholders. Ideally, the statistical independence of losses across covered individuals leads to the applicability of the law of large numbers: The total loss on a large risk pool can be predicted with sufficient precision that an insurer selling actuarially fair coverage (i.e., setting the premium equal to the expected loss per policy) will face an acceptably low risk of insolvency. Catastrophe risk arises when statistical independence across policies or across covered lives fails—and a low-probability but high-consequence event causes a large number of claims to be filed at the same time. When extraordinarily large losses exceed the premium an insurer has collected, the insurer's policyholder surplus must be used to pay out claims. Insolvency occurs when the excess of losses over premiums exceeds policyholder surplus.

Terrorism does present the potential for extremely large WC losses. Attack simulations performed by Risk Management Solutions (RMS) for previous RAND work suggest that losses in WC could be more than \$10 billion from a large conventional attack (10-ton truck bomb) and more than \$300 billion from a nuclear attack.¹¹ In comparison, the 9/11 attacks caused approximately \$2.6 billion (in 2013 dollars) of WC losses.¹² What is more, the probabilities of these catastrophic events are highly uncertain. As discussed in a previous RAND policy brief on TRIA, terrorism risk models are limited in their ability to predict the frequency of events.¹³

Losses in workers' compensation could be more than \$10 billion from a large conventional attack (10-ton truck bomb) and more than \$300 billion from a nuclear attack.

Insurers can, in principle, increase premiums to account for catastrophic losses, but two important factors may limit the effectiveness of this strategy in the case of terrorism. First, because there is so much uncertainty about the probability of a large terrorist attack, it is hard to know how big an increase is enough. Second, even with a higher rate, insurers will still have to hold a large amount of capital to limit the probability of insolvency. In other words, setting the premium at expected loss, or even a multiple of it, is not enough because an extremely large loss could still wipe out the company. Holding such capital is expensive, and whether WC insurers are willing or able to do so is an open question.¹⁴

The reluctance of property insurers to cover terrorism in the wake of 9/11 illustrates the influence that catastrophe risk can have on insurers if ample reinsurance is not available.¹⁵

TRIA Provides an Important Backstop for Workers' Compensation Insurance Markets

TRIA mitigates the impact of terrorism on insurance markets by transferring catastrophe risk to the federal government and then spreading losses broadly across the entire P&C policyholder base in order to reduce the solvency impact a large attack would have on any particular insurance company. In order for there to be any possibility of federal reimbursement under the TRIA program, a single terrorist act must cause industry-wide insured losses greater than \$100 million in the lines covered by TRIA.¹⁶ This provision, which is known as the program trigger, guarantees that the TRIA program is involved only with large-scale attacks. In addition to the program trigger, each insurer faces a deductible of 20 percent of direct earned premium in the TRIA lines.¹⁷ For losses above the deductible, the federal government reimburses insurers for 85 percent of insured losses. Payouts under the TRIA program stop when total insured losses in all TRIA lines reach \$100 billion for the insurance industry as a whole, and the law also exempts insurers from paying out claims above this cap.¹⁸ The risk-spreading function of the TRIA program therefore applies to the tranche of risk between individual insurers' deductibles (on the order of \$1 billion to \$2 billion for large insurance groups) and \$100 billion of industry-wide losses.

The financing provisions of TRIA are critical to understanding how TRIA spreads terrorism risk. TRIA payouts on insured losses up to \$27.5 billion must be recouped via assessments on all P&C policies sold in the United States. Recoupment above this amount is at the discretion of the Secretary of

the Treasury. The recoupment provision means that TRIA does not allocate this lowest tranche of terrorism risk below \$27.5 billion to taxpayers. Rather, terrorism risk is spread across the nationwide population of commercial P&C policyholders over multiple years of recoupment.

THE RESPONSE OF WORKERS' COMPENSATION INSURERS TO THE EXPIRATION OF TRIA

The TRIA program significantly limits the risk of very large terrorist attacks to the commercial P&C industry, and so insurers are likely to take steps to control the additional risk exposure they would face on their current books of business without TRIA in place. In most TRIA lines, insurers would generally have flexibility to choose some mix of the following responses:

1. Impose tighter policy limits.
2. Exclude terrorism.
3. Purchase additional reinsurance.
4. Raise premiums for high-risk accounts.
5. Decline policies for high-risk accounts.
6. Withdraw from markets.

Broadly speaking, the first four responses in this list are compatible with insurers continuing to cover nonterrorism risks while either limiting their catastrophe exposure or demanding greater financial rewards for bearing terrorism risk. The last two options, in contrast, would limit terrorism exposure while simultaneously reducing provision of nonterrorism coverage. We find that the first two options are generally unavailable in WC, and that the adequacy of the third and fourth options is questionable, raising the possibility that insurers will manage their terrorism risk exposure following TRIA expiration in ways that would make it more difficult for businesses to purchase WC coverage. The following two subsections explain the reasons for these constraints.

State Workers' Compensation Laws Limit the Ability of Insurers to Impose Policy Limits or Terrorism Exclusions

WC coverage is defined by each state's WC statute, so strategies that involve changing the insurance contract are generally not an option. The statutory nature of WC coverage rules out both policy limits and terrorism exclusions. Reflecting the roots of WC as an alternative to tort liability, WC laws

make the employer (and so its insurer) fully responsible for all lifetime medical expenses arising from a workplace injury; our interviewees frequently referred to medical liability as being “unlimited.”

Similarly, no occupational hazards can be excluded from a WC policy. While our discussion of WC law above raised the possibility that some terrorism casualties might be judged not to be compensable, an insurer would never be able to introduce a terrorism exclusion into a WC policy. This distinction between WC and other P&C lines is most stark in the case of NBCR attacks. While all the TRIA lines must offer terrorism coverage on the same terms as the underlying policy in order to access the reinsurance program, many P&C policies had general NBCR exclusions prior to 9/11. Where state regulators have continued to affirm these exclusions on the underlying policy, NBCR availability and take-up have remained extremely limited compared with conventional terrorism coverage.¹⁹ The unavoidable financial risk posed by NBCR attacks sharply distinguishes WC from other P&C lines: Offer and take-up rates for WC NBCR coverage are effectively 100 percent, and would remain so following TRIA expiration. In an NBCR event, a disproportionate share of insured losses (as opposed to damages, which may not be insured) may derive from WC losses.

Insurers may also be more reliant on TRIA’s \$100 billion cap on industry-wide payouts in WC than in other lines as a result of their inability to limit NBCR exposure through exclusions or policy limits. Extreme scenarios, such as the \$300 billion WC loss from a nuclear attack mentioned above, could therefore become more salient to insurers in the absence of this cap. Insofar as exposure to tail risk drives insurer decisions about terrorism coverage, the possibility of NBCR losses may be an important influence on WC market reactions to TRIA expiration.

Much Greater Reinsurance Capacity, Including for NBCR Attacks, Would Be Necessary to Replace TRIA in Workers’ Compensation

Reinsurance could help insurers manage additional terror risk exposure in WC. However, we found cause for concern that increased reinsurance capacity following TRIA expiration may not be fully adequate for WC insurers to manage the increase in risk resulting from TRIA expiration. The response of reinsurance markets to TRIA expiration is far beyond the scope of

Demand for reinsurance would likely increase if TRIA expired, yet it is not clear that sufficient reinsurance capacity would become available.

this policy brief, so we want to be clear that we are asserting the possibility of an inadequate increase in reinsurance capacity rather than arguing that this is a certain outcome.

Today, with TRIA in place, insurers generally reinsure a portion of the terrorism exposure on their WC books. Many of the insurers we spoke with who have large TRIA deductibles prefer to transfer some of their catastrophe exposure below the deductible to a reinsurer; smaller insurers may also reinsure their losses “up the side” of the TRIA program, eliminating the already-reduced tail risk associated with the program’s 15 percent cost-sharing provision. Typical per-occurrence policy limits might be on the order of \$1 billion to \$2 billion for a large insurer, whereas we saw above that realistic terrorism losses in WC alone might be orders of magnitude larger.

The fact that insurers factor TRIA coverage into their reinsurance purchases underscores that demand for reinsurance would likely increase if TRIA expired, yet it is not clear that sufficient reinsurance capacity would become available to fully replace the coverage available through TRIA.²⁰ Current estimates of per-risk terrorism reinsurance capacity across all lines range from \$2 billion to \$8 billion.²¹ Fully replacing TRIA would require at least an order-of-magnitude increase over these estimates. Some reinsurers are pessimistic about such an expansion, although others believe that improvements in terrorism modeling and the appetites of sophisticated investors for insurance-linked securities would lead to adequate capacity growth, at least for conventional attacks.²²

The response of reinsurance markets to TRIA expiration is a vital question in all TRIA lines, but the unique features of WC raise some additional concerns. WC coverage is defined by statute, whereas reinsurance markets are generally unregulated, creating the potential for a mismatch in scope between available reinsurance coverage and the underlying terrorism

risk assumed by primary insurers writing WC. The issue of greatest concern to our interviewees was the tail risk created by NBCR exposure: Reinsurers are free to choose whether to include NBCR coverage, while primary insurers cannot exclude any occupational hazards from a WC policy. Even reinsurance industry leaders who predict a substantial increase in reinsurance capacity for conventional terror risks point out that reinsurers are likely to have a limited appetite for NBCR risk in light of the much greater uncertainty surrounding these attack modes.²³ We accordingly view the availability of reinsurance adequate to control WC tail risk—particularly NBCR risk—as uncertain enough to warrant serious consideration of how WC markets would function without a substantial increase in reinsurance capacity.

Premium Increases in Workers' Compensation Insurance May Be Insufficient to Offset Terrorism Exposure

Neither policy limits nor terrorism exclusions are viable strategies for managing terrorism risk in WC, so insurers writing WC coverage may retain much greater catastrophe risk exposure on their books if the availability of terrorism reinsurance for both conventional and NBCR exposure does not increase substantially. We might expect insurers to seek higher premiums in response to this increase in tail risk. Higher WC premiums could provide an incentive for insurers to write WC policies even in the face of increased catastrophe exposure, especially to the extent that insurers can set risk-based premiums that vary from employer to employer within a state.²⁴

It is unclear whether insurers will be able to hike WC premiums enough to compensate for increased catastrophe risk, however. The extent to which insurers are able to raise premiums will depend in large part on state premium regulation. The insurers that we spoke with view WC as facing more stringent premium regulation than other TRIA lines. This view finds some support in the National Association of Insurance Commissioner's (NAIC's) classification of state insurance rate filing requirements: Among the 47 states with competitive WC markets, NAIC classifies 27 states as requiring prior approval for WC rates but only 11 states as requiring prior approval for commercial property insurance.²⁵ Our interviewees also stated that some WC markets restrict insurers' ability to use geography as a factor in setting prices. Several interviewees who operate in the New York WC market stated that a single insurance company would not be allowed to charge dramatically higher premiums

for a business in Manhattan than for a similar business in a small upstate city. However, limits on geographic pricing may differ substantially across states. California, for instance, allows insurers to develop rating plans that draw very fine geographical distinctions.²⁶

There are other reasons to think that insurers may have more pricing flexibility than one might conclude from looking at rate filing regimes. The effective stringency of rate regulation depends both on the system that is in place and the behavior of state insurance regulators in implementing that regulation. Rate regulation that explicitly promotes insurance affordability may come into conflict with solvency regulation, and we do not have sufficient evidence to predict how regulators would balance these objectives in a post-TRIA world.²⁷ Moreover, there may be substantial pricing flexibility even under prior approval. Insurers may have a reasonable amount of discretion in applying their scheduled rating factors, and some states carve out exceptions to WC rate regulation for large employers. Most importantly, large insurance groups with multiple licensed carriers in a state can generally refer businesses with different perceived risk to different companies within the group that have relatively high or low multipliers.

We conclude that even though WC does appear to face stricter regulation than other TRIA lines, the mediating factors of regulatory behavior and differences across states in detailed rules make it inadvisable to generalize about the extent to which state regulation would constrain post-TRIA premium increases. The pricing flexibility that is known to exist even under premium regulation suggests that industry observers who have highlighted the potential for higher WC premiums following TRIA expiration are well justified.²⁸

Premium increases and withdrawal of WC capacity are not mutually exclusive outcomes, however. Premium increases even several times greater than the actuarially fair cost of terrorism coverage are unlikely to cover losses from a large terrorist attack.²⁹ Although higher premiums could theoretically allow primary insurers to build up adequate capital over a number of years without a catastrophic loss, the U.S. tax system and other corporate finance considerations strongly discourage primary insurers from accumulating reserves against future losses.³⁰ Our interviewees generally reported that the increased threat to solvency that would result from TRIA expiration would far outweigh any offsetting revenue gains from realistic premium increases, and that there is “no price” at which insurers would consider it prudent to write a book of business that exposed them to the risk of insolvency from realistic (if unlikely) terrorist events.

Options for Managing Terrorism Risk in the Absence of TRIA

What might insurers do to manage terrorism risk in WC if reinsurance capacity for both conventional and NBCR terrorism fails to expand sufficiently? Without the ability to control risk exposure by changing the terms of coverage, insurers seeking to limit their catastrophe exposure are left with a binary decision of whether or not to write a policy. The impact of TRIA expiration on WC availability is thus likely to operate through changes in insurer underwriting decisions. Absent a dramatic increase in the provision of affordable reinsurance, insurers may tighten underwriting standards against terror risk and decline coverage to high-risk accounts.

Given the deep uncertainty surrounding both the frequency of attacks and the probabilities of different attack modes in different locations, insurers manage terrorism exposure differently from natural catastrophes. Whereas an insurer might manage property risk to withstand a hurricane with a 1 percent chance of occurring in any given year, our interviewees felt that the abundance of unknown unknowns in terrorism modeling invalidates attempts to manage the probability of ruin from terrorism in WC. Instead, insurers choose a deterministic attack mode and manage their books of business to limit the probable maximum loss that would result from a single instance of that attack.³¹

To develop underwriting rules, an insurer must choose a tolerance for the probable maximum loss from the chosen attack mode. This loss tolerance will define a *concentration limit*, or a maximum amount of exposure the insurer is willing to assume within the blast radius of a single attack. Our interviewees emphasized that this tolerance should be chosen as part of a larger enterprise risk management exercise, and that there is no straightforward formula linking capital strength to a concentration limit. However, rules of thumb used by ratings agencies and other analysts suggest that an insurer would not want to risk more than 20 to 30 percent of its policyholder surplus in the single selected event.³²

Once concentration limits are defined for an insurer, adherence to those limits requires tight control over the underwriting and sales processes. Insurers seek to collect any information that would allow the insurer to measure the size and location of an employer's exposure more precisely. Geocoding of establishments down to the street address, exact counts of employees and dependents,³³ and even work shift patterns and absenteeism levels were mentioned as critical underwriting data by many of our interviewees. Underwriters can then evaluate

We expect that TRIA expiration would tend to reduce the amount of WC capacity provided by the insurance industry.

a policy jointly with the rest of the insurer's book—including all lines and not just WC—to ensure that policy issue will not violate the concentration limit.

Concentration limits matter more for some employers than for others. Employers of any size in dense urban areas may be affected by concentration limits: The greater the density of employees within a blast radius, the greater the odds that an insurer will already have reached its concentration limit for that location. Some large employers, especially those in landmark buildings, may be large enough to exceed some insurers' concentration limits on their own.³⁴ While investment banks and media companies housed in skyscrapers clearly fall into this group, some of our interviewees noted that hospitals, universities, or corporate campuses could raise similar concerns even in suburban or rural settings.³⁵

Although we do not have sufficient evidence to quantify the market impact of TRIA expiration, we expect that TRIA expiration would tend to reduce the amount of WC capacity provided by the insurance industry. All the insurers with whom we spoke said that they would have to revisit their guidelines for terrorism underwriting in the event of TRIA expiration, and this would make it harder for businesses to obtain coverage. Reductions in the availability of coverage would be most pronounced for large employers, landmark buildings, and businesses in dense urban areas.

A more radical option available to an insurer seeking to limit its terrorism exposure would be to withdraw from WC markets altogether, either nationwide or in particular states perceived to be at high risk of terrorism. The insurers we interviewed described WC as being a relatively unprofitable line of commercial insurance and suggested that some insurers might exit markets following TRIA expiration. Actuarial data provide modest support for the view that this response is credible, as WC has offered unfavorable financial performance in recent years compared with other commercial P&C lines. Over the

past ten years, WC combined ratios in the 37 markets where the National Council on Compensation Insurance (NCCI; an organization that calculates advisory loss costs for WC in many states) calculates advisory rates have been 5.5 percent higher than the nationwide combined ratio for all P&C lines (including WC) reported by NAIC; WC combined ratios have been above 100 percent in nine of the past ten years.³⁶ The fact that national multiline insurers operate in WC markets in spite of these unfavorable combined ratios points to the existence of more indirect business justifications for selling WC, however. Insurers may value the cash flow provided by WC premiums as a source of “float” for investment,³⁷ or there may be marketing value for a single insurer willing to write all P&C policies—including WC—for a given customer. Given the presence of these countervailing reasons for selling WC, we cannot say whether increased terrorism risk exposure due to TRIA expiration would actually lead any insurers to exit WC markets—especially if (as some insurers speculated) state insurance commissioners are savvy about threatening to bar companies exiting WC from other, more profitable P&C lines.

The readiness of the market to provide sufficient reinsurance capacity to replace TRIA is beyond the scope of this policy brief, and we should note that large increases in reinsurance capacity would mitigate these impacts. Even so, it behooves policymakers to assess market impacts if the hoped-for expansion of reinsurance markets fails to materialize. If that indeed turns out to be the case, then it is reasonable to expect insurers to reduce the amount of WC coverage that they write. We now turn to the consequences should that outcome occur.

CONSEQUENCES FOR RESIDUAL MARKETS, EMPLOYERS, AND TAXPAYERS

WC coverage is mandatory, so terror losses will generally be insured losses in WC even if private insurers reduce the availability of WC coverage and premiums rise. Fully understanding the impact of TRIA expiration on market functioning and the distribution of terror risk requires understanding how businesses obtain WC coverage when they are shut out of the private market. We find that the effects of TRIA expiration on market functioning and the distribution of catastrophe risk will depend critically on the institutional details of markets of last resort, which are known in WC as *residual markets*.

Reduction in Workers’ Compensation Capacity by Insurers Will Force Residual Markets to Grow

In most state WC systems, coverage is available in a competitive or voluntary market.³⁸ In the voluntary market, employers choose freely among a number of competitive insurers, and insurers can engage in underwriting to decline coverage to high-risk employers. Because it is possible for an employer not to find a willing insurer in the voluntary market, enforcement of the WC coverage mandate demands the presence of a residual market comprising at least one insurance provider that cannot turn business away. Employers who are forced to seek WC coverage in a residual market lose the freedom of choice between insurers, and, as we discuss below, residual markets can have other drawbacks for employers.

In the 46 states (and the District of Columbia) with competitive WC markets, there are two very different residual market mechanisms in place. Thirty-two states and the District of Columbia use an assigned-risk mechanism: An employer seeking residual market coverage is assigned to one of several servicing carriers, which are typically reinsured by an insurance pool consisting of all the insurers who participate in the voluntary market.³⁹ Fourteen states, meanwhile, direct all residual market business to a competitive state fund, which is a quasi-governmental insurer set up to guarantee the availability of WC coverage. Among states with cities judged to be in the highest tier of terrorism risk by A.M. Best, Illinois and the District of Columbia use assigned-risk pools, while New York and California rely on state funds.⁴⁰

Employers who are forced to seek WC coverage in a residual market lose the freedom of choice between insurers, and residual markets can have other drawbacks.

Residual markets are typically relatively small: NCCI, which operates assigned-risk mechanisms in 20 states, reports nationwide residual market share between 3.5 percent and 11.5 percent since 2000. Residual markets can grow dramatically when there are disruptions in the voluntary market, however. For example, market share of the California State Compensation Insurance Fund grew to over 53 percent in 2003 following a wave of insolvencies and dramatic cost increases.⁴¹ Should TRIA expire and WC insurers reduce the availability of voluntary market coverage, then residual markets will have to grow.⁴²

Residual Market Growth Can Increase Employer Costs, Reduce Service Quality

There are immediate drawbacks to having a larger residual market. The most important consequence is higher prices for WC coverage. In states with assigned risk pools, premiums tend to be considerably higher in the residual market.⁴³ This is largely because the residual market functions as a high-risk pool. Underwriting in the voluntary market means that the highest-cost employers are likely to be covered in the residual market, and the loss experience of these employers can have an influence on the premiums paid by all employers who are on the residual market. As a result, premiums for the same establishment may be substantially higher in an assigned risk pool.⁴⁴

Because premiums are paid entirely by employers, it may seem plausible that employers would respond to higher WC costs by reducing hiring, in which case residual market growth would reduce employment and, potentially, economic growth. However, the public finance literature suggests that workers, not employers, may bear the economic costs of WC premiums in the form of reduced wages.⁴⁵ To the extent that premiums are passed on to workers, higher residual market premiums may actually serve to reduce wages, reducing the deterrent effect of higher premiums on hiring. Of course, this does not mean residual market growth is harmless: To the extent that workers bear the costs of residual market growth with reduced wages, TRIA expiration would reduce labor incomes and may discourage labor supply.⁴⁶ The economic effects of these market disruptions may be limited by the fact that WC is a small share of total compensation—WC employer costs averaged 1.4 percent of total compensation in March 2014.

Who Pays If Terrorists Strike an Employer with a Residual Market Policy?

Reductions in the availability of voluntary market coverage following TRIA's expiration would make it more likely that WC losses from a future terrorist attack would be covered by a residual market policy. Who would finance WC payouts if terrorists struck an employer with a residual market policy? The allocation of WC catastrophe risk depends on the design of the residual market mechanism in the state where the attack takes place. The details of WC systems vary from state to state, so it is difficult to make accurate generalizations. Instead, we present detailed discussions of three states perceived to face high terror risk: Illinois, California, and New York. We chose these three states because each exemplifies a different set of residual market mechanisms. Illinois has an assigned-risk pool operated by NCCI, California has a state fund that participates in the state's guaranty association, and New York has a state fund backed by the state government. We will then discuss the applicability of these case studies to other states.

Illinois: Large Terrorism Losses in Assigned Risk Mechanisms Are Borne by Insurers Participating in the Voluntary Workers' Compensation Market, and May Eventually Be Passed on to Policyholders

Illinois is one of the 20 states with an NCCI-operated assigned risk mechanism as of 2012. In 2012, the Illinois residual market comprised four servicing carriers and no direct assignment carriers. All residual market policies in Illinois were therefore reinsured through NCCI's National Workers' Compensation Reinsurance Association.⁴⁷ The pool allocates all risk to all the insurers operating in the state's voluntary market in proportion to their share of voluntary market premium.⁴⁸ Servicing carriers bear no direct financial risk on their residual market policies, though they do bear risk through their participation in the reinsurance pool.

The financial responsibility for a catastrophic loss on a residual market policy would be allocated to the insurers operating in the Illinois voluntary market in proportion to their WC market share. Although NCCI operates pools in many states, the residual market reinsurance pool is segmented by state and policy year: Losses on an Illinois policy in 2012 are not shared with insurers that do not operate in that market in that year.

In the short run, terrorism losses in Illinois would be borne by insurers operating in the voluntary market. Since

many national insurers participate in WC markets (including the Illinois market), the financial burden of this catastrophe risk would be geographically dispersed to the extent that these losses are ultimately borne by insurance company shareholders outside the state (i.e., capital markets).⁴⁹

It is possible that insurers may attempt to replenish their capital following a large residual market loss by raising premiums. This would serve to transfer the long-run financial burden of catastrophic terrorism losses to future policyholders. The feasibility of premium hikes after a terror attack will depend on the stringency of state premium regulations, both in Illinois and in other states where the affected insurers operate. Because WC premiums must typically be justified on the basis of projected loss costs in the market at hand, insurers may have a difficult time convincing regulators in other states to approve rate increases occasioned by a capital loss due to terrorism. Some interviewees suggested that insurers may have some ability to justify post-attack rate increases through changes to more subjective elements of a rate filing, such as underwriting and contingency factors, but there is generally no provision for recoupment of pool losses. Illinois has a use and file system of rate regulation, which generally means that the state relies on competitive pressure rather than price regulation to maintain insurance affordability.⁵⁰ It seems plausible that insurers would attempt to replenish capital by hiking rates in Illinois, especially to the extent that pool losses due to a high-visibility catastrophe allow all insurers participating in the Illinois market to justify rate hikes to their customers without damaging their competitiveness.⁵¹

To sum up, the burden of catastrophic terror losses on a residual market policy in Illinois would be borne by all the insurers participating in the Illinois WC market in the short run. Some of these capital losses may lead to higher premiums in the Illinois WC market in the longer run, transferring the burden to future policyholders within the state.

California: Large Terrorism Losses May Be Financed by Future Workers' Compensation Policyholders Throughout the State

In California, the insurer of last resort is the State Compensation Insurance Fund (SCIF). While SCIF competes for business on the voluntary market, SCIF's primary function is to guarantee the availability of WC coverage for all businesses by refusing to provide coverage only under extreme circumstances.⁵² If TRIA expiration leads to stricter voluntary market

underwriting in California, high-risk employers would likely obtain coverage from SCIF.

Should SCIF suffer a major terrorism-related loss, the lowest tranche of catastrophic losses would be absorbed by SCIF's capital base and any applicable terrorism reinsurance. Although SCIF is a single-state, monoline insurer, it is not by any means a small company: SCIF had about \$900 million of direct written premium in 2012 and a 10 percent market share, making it the largest WC insurer in California.⁵³ Between TRIA and private reinsurance arrangements, SCIF had a reasonable degree of terrorism reinsurance above its 2012 TRIA deductible of \$203 million; in addition to TRIA, SCIF reinsured up to \$100 million of terrorism losses (including NBCR) over its deductible in 2012.⁵⁴ SCIF's \$6 billion of policyholder surplus should enable it to withstand extensive terrorism losses even in the event of TRIA expiration.⁵⁵ Even so, these figures also make it clear that an unprecedentedly large terror attack (e.g., \$10 billion in WC losses) could threaten the solvency of SCIF under TRIA expiration unless it is able to increase the policy limits on its reinsurance by at least an order of magnitude.⁵⁶ To understand which parties would bear the cost of outstanding WC claims in such an event, we need to examine the resolution mechanism that would apply if SCIF exhausted its policyholder surplus.

Although SCIF is publicly chartered, it is legally classified as a public enterprise fund and cannot draw on the credit of the state budget. Resolution of a SCIF insolvency might instead be handled by the California Insurance Guarantee Association (CIGA), which is the body set up to pay out P&C insurance claims on behalf of an insolvent insurer. SCIF is a member of CIGA, and while there is substantial political uncertainty built into SCIF's resolution process, CIGA involvement may be attractive as an already-established mechanism for paying out claims.⁵⁷

Guaranty funds such as CIGA exist in every state and have similar procedures for financing claims owed by an insolvent insurer. First, the guaranty fund would have a high-priority claim on recoveries from the liquidation of the insurer's estate, including any reinsurance payouts triggered by the terrorism event. Estate recoveries often are not sufficient to finance all outstanding claims in the event of a large insolvency: The average share of guaranty fund expenses recovered from estates in the five largest P&C insolvencies was 60 percent.⁵⁸ All state guaranty funds accordingly have assessment mechanisms to finance their claims payouts. In California, deficits incurred by CIGA are financed through assessments billed to insurance companies that operate in the state's WC market.⁵⁹ In most

states, these assessments are capped at 2 percent of written premium in the insurance lines included in the guaranty fund account.⁶⁰ As in most states, CIGA accounts for WC liabilities separately from other P&C liabilities generated by insolvencies.⁶¹ This means that the base for assessment to finance WC claims includes only WC premiums in California.

As we saw above in the context of residual market reinsurance pools, the ultimate incidence of losses paid by the guaranty fund depends on the affected insurers' ability to pass assessments on to policyholders or other parties. In sharp contrast to the lack of explicit recoupment provisions for residual market pool losses, all state guaranty funds specify a way for insurers to recoup their assessments. The details of the recoupment mechanism provided to insurers would determine who bears the long-run burden of terrorism losses in excess of policyholder surplus, reinsurance payouts, and estate recoveries.

Although guaranty fund assessments in California are initially billed to insurers, state law requires insurers to recover these assessments directly from policyholders by surcharging their insurance premiums. As a consequence, the financial burden of catastrophic WC losses is confined to WC policyholders in California in the years following the attack. Seven states use policyholder surcharges to finance WC guaranty fund expenses.

Two different models for recoupment of guaranty fund expenses are in use in other states. In some states, guaranty fund assessments may be recouped through rates and premiums. The distributional effects of this arrangement are similar to the effects of surcharges, since the costs are borne by future WC policyholders. The third model, however, has very different distributional consequences. Rather than assessing policyholders, five state fund states allow insurers to deduct their guaranty fund expenses against their premium taxes over several years (typically five years) in equal increments. The burden of catastrophic risk in these states would not be borne by insurers or policyholders, but rather by state budgets in the form of reduced tax revenues. Ultimately, these costs would require higher taxes or reduced government services in the state where the attack happens.⁶²

New York: Large Terrorism Losses May Be Financed by State Taxpayers

Like California, New York relies on a competitive state fund to guarantee the availability of WC coverage. This entity is the Workers' Compensation Fund of the New York State Insurance Fund (NYSIF). NYSIF wrote \$1.94 billion of net WC

premium in 2012, amounting to a 38 percent market share.⁶³ As with SCIF, NYSIF's capacity to bear catastrophic losses is determined by its policyholder surplus and reinsurance arrangements. NYSIF held \$3.1 billion of policyholder surplus in 2012.⁶⁴ Unlike SCIF, which reinsures terror losses above its deductible, NYSIF did not purchase any reinsurance for terrorism or other risks in recent years.⁶⁵

A large terrorism loss could exhaust NYSIF's policyholder surplus. Unlike SCIF, which is legally independent of the California state government, NYSIF is an agency of the New York state government.⁶⁶ NYSIF's annual report explicitly states that "as an agency of the State, all liabilities of the Workers' Compensation Fund are guaranteed by the State should the Workers' Compensation Fund become insolvent."⁶⁷ This suggests that the financial burden of paying WC claims in excess of NYSIF's policyholder surplus would fall on the New York state budget—and ultimately on taxpayers and recipients of state government services.

Without TRIA, Catastrophic Terrorism Losses May Have a Deeper Financial Impact on the State That Is Attacked

Rigorous analysis of how TRIA expiration would change the allocation of tail risk associated with WC losses from terrorism would require detailed state-by-state investigations that are beyond the scope of this study. With that caveat in mind, however, we can offer a tentative classification of states into three categories of risk-bearing structures based on summary descriptions of residual market institutions and guaranty fund rules.⁶⁸ The table summarizes this classification and compares these risk-bearing structures to the allocation of catastrophe risk under TRIA. In each case, we distinguish between the short-run and long-run incidence of tail risk. Also, for simplicity we do not discuss losses that are covered by private reinsurance or below the TRIA deductible.⁶⁹ Based on extreme event predictions from the RMS terrorism model used in previous RAND work, this operationalizes the notion of "tail risk" for purposes of the table as WC losses from a successful attack larger than a 2-ton truck bomb.

The first row of the table lists the 32 states and the District of Columbia that use an assigned risk mechanism backed by a reinsurance pool. Our case study of Illinois suggests that these states would allocate catastrophic losses on residual market accounts to the primary insurers participating in the state's voluntary market, at least in the short run. These losses may

Classification of State Residual Markets by Risk-Sharing Structure

TRIA Status	Residual Market Type	Guaranty Fund Recoupment Type	States (and the District of Columbia)	Incidence of Short-Run Tail Risk ^a	Incidence of Long-Run Tail Risk ^a
Expired	Assigned risk mechanism with reinsurance pool	Any	Alabama, Alaska, Arizona, Arkansas, Connecticut, Delaware, District of Columbia, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, North Carolina, Oregon, South Carolina, South Dakota, Tennessee, Vermont, Virginia, West Virginia, Wisconsin (33)	Primary insurers	State WC policyholders, capital markets
Expired	State fund	Premium tax offset	Louisiana, New York, ^b Oklahoma, ^c Pennsylvania, ^c Texas, Utah (6)	State fund, guaranty fund	State taxpayers
Expired	State fund	Surcharge or rates and premiums	California, Colorado, Hawaii, Kentucky, Maine, Maryland, Montana, Rhode Island (8)	State fund, guaranty fund	State WC policyholders
Reauthorized	Any	Any	All	Federal government	Nationwide P&C policyholders

NOTE: The four monopolistic systems (North Dakota, Ohio, Washington, Wyoming) are excluded from this table.

^a "Tail risk" refers to catastrophic losses above current TRIA deductibles and WC catastrophe reinsurance policy limits, but below the TRIA program cap.

^b New York has a unique mechanism for its WC guaranty fund; we include it here because the state fund is backed by the state government, so the long-run allocation of tail risk is similar to states with premium tax offsets.

^c Oklahoma and Pennsylvania also allow insurers to choose between recoupment between premium tax offset or rates and premiums. It is unclear to us why an insurer would choose to recoup through rates and premiums rather than premium tax offset unless the insurer collected insufficient premium to claim the full allowable deduction, since higher premiums would generally place the insurer at a competitive disadvantage and depend on the decisions of state regulators.

be shared with future WC policyholders in the state that is attacked to the extent that capital depletion for insurers operating in the state leads to higher premiums.

Classification of the risk-bearing structure in the state-fund states is more complicated because it generally requires careful investigation of what resolution mechanism is available in the event that the state fund becomes insolvent. For instance, the information used in the table would not have revealed that NYSIF is backed by the New York state government. Even so, we can conservatively classify six states as allocating tail risk to state budgets. Assuming that a state fund is either backed directly by the state government or included in that state's guaranty fund for WC insurers, the availability of premium tax offsets as a recoupment mechanism ensures that tail risk will be borne by state budgets. The second row of the table thus includes the five state fund states that allow premium tax offsets in addition to New York, where the state fund is backed directly by the state government.

The third row of the table lists the eight state fund states that do not allow premium tax offsets as a method of guaranty fund recoupment. Without detailed research into each state's resolution mechanism, we cannot rule out the possibility that some of these state funds are backed directly by state budgets. Even in California, the actual resolution mechanism chosen will depend on choices by elected officials. With that caveat in mind, it is likely that if one of these eight state funds is rendered insolvent by a large terror attack in the absence of TRIA, the tail risk will be borne by commercial insurance policyholders in that state.⁷⁰

In all three cases, we can conclude that TRIA expiration will lead to more of the tail risk being borne within the state where the attack takes place. For comparison, the final row of the table describes risk-bearing with TRIA in place, assuming that catastrophic WC losses from a future attack are covered by a voluntary market policy or a state fund.⁷¹ Because the nationwide population of commercial P&C policyholders is much

larger than the population of policyholders in any given state, TRIA serves to reduce the magnitude of the financial burden on any particular state by distributing a given loss over a much larger risk pool. We therefore conclude that the financial impact of catastrophic WC losses on a state that experiences an attack will be larger if TRIA expires.

TRIA expiration will lead to less sharing of tail risk across states. It is also worth noting how tail risk will be distributed *within* a state under the risk-bearing structures we have identified. The mechanisms that would be applicable in state-fund states spread the burden throughout the state that is attacked without regard to differences in terrorism risk.⁷² Within-state distribution is less clear in assigned-risk states because within-state recoupment will be mediated by the behavior of insurance markets. To the extent that insurers replenish capital with statewide rate increases, the tail risk will also be spread broadly throughout the state that is attacked. Even though perceived terror risk is higher in central business districts than in suburban or rural areas, TRIA expiration would not eliminate risk-sharing across regions within states: It could actually make within-state risk-sharing (instead of nationwide risk-sharing) the primary mechanism for bearing catastrophe risk associated with terrorism. Businesses in rural upstate New York, for instance, might end up financing a much greater share of the WC losses from a nuclear bomb in Manhattan if TRIA expires than if it is reauthorized.

The financial impact of catastrophic WC losses on a state that experiences an attack will be larger if TRIA expires.

SUMMARY AND IMPLICATIONS FOR POLICY

The institutional features that distinguish WC from other TRIA lines may result in very different market dynamics in the event that TRIA expires. In property insurance and other TRIA lines, market observers anticipate that insurers would be less likely to offer terrorism coverage on terms comparable to the underlying policies, and that this market response would lead to substantially lower take-up among policyholders. Fewer businesses would have terrorism coverage as a result, which may be to the detriment of post-attack resiliency and increase the need for federal disaster assistance.⁷³ Markets for ordinary insurance policies covering nonterrorism risks, however, should not experience severe disruptions.

Matters are likely to be very different for WC. Coverage mandates ensure that employers will continue to be covered even in the event that TRIA expires, but adherence to the mandate may require the highest-risk employers to obtain coverage in residual markets. High-risk businesses may have to pay more for their WC coverage, and some of this cost may be passed on to workers in the form of reduced wages. This market reaction could thereby reduce labor incomes and economic growth even if there is never another terror attack, though these effects are likely to be small since WC is a small share of compensation for most businesses.

Residual market growth resulting from TRIA expiration would also change the allocation of catastrophic losses following a large terror attack. TRIA serves to spread losses broadly across all P&C policyholders in the United States. If TRIA expires, the distribution of losses would be governed by a very different set of state-level institutions: assigned risk pools, state funds, and guaranty associations. Unlike TRIA, none of these risk-bearing arrangements is explicitly designed to spread risk across state borders. For states that never suffer an attack, TRIA expiration may reduce their role in financing terrorism losses.

Thus, TRIA expiration could have the effect of redistributing risk such that the burden of catastrophic losses is confined within the state that is attacked to a greater extent, adding to the challenge of rebuilding in the affected state. It is important that policymakers be aware of these consequences and tradeoffs when debating how to proceed with the program.

NOTES

¹ Insurance Information Institute, “Terrorism Risk and Insurance,” web page, 2014. As of April 22, 2014: http://www.iii.org/issues_updates/terrorism-risk-and-insurance.html.

² Richard J. Hillman, *Terrorism Insurance: Rising Uninsured Exposure to Attacks Heightens Potential Economic Vulnerabilities*, Washington, D.C.: U.S. Government Accountability Office, GAO-02-472T, 2002.

³ As opposed to attacks using NBCR weapons (Marsh Risk Management Research, *2013 Terrorism Risk Management Report*, 2013).

⁴ National Association of Insurance Commissioners, *2012 Property/Casualty & Title Industry Report*, 2013.

⁵ WC coverage (or certified self-insurance arrangements that provide equivalent benefits to injured workers) is mandatory in every state except Texas.

⁶ In 2011, the 50 state and the District of Columbia’s WC systems collectively paid an estimated \$56 billion of wage replacement and medical benefits to injured workers. 74 percent of these benefits were paid by either private insurers (57 percent) or state funds (17 percent), which are the types of insurance providers we focus on in this report. The remaining 26 percent of benefits was paid by “self-insured” employers who did not purchase a WC policy (National Academy of Social Insurance, *Workers’ Compensation: Benefits, Coverage and Costs, 2011*, Washington, D.C., 2013).

Self-insured employers may use one of several insurance arrangements in place of a WC policy, and the applicability of TRIA to catastrophic WC losses for a self-insured employer may vary with the precise arrangement chosen. Catastrophic terror losses on the more common arrangements (self-insurance with excess coverage and captive insurers) would generally be eligible for TRIA reimbursement, and some of our interviewees suggested that self-insurance would become less attractive to employers in the event of TRIA expiration. Rigorous analysis of how TRIA expiration would affect these arrangements is beyond the scope of this policy brief, however.

⁷ Lex K. Larson and Arthur Larson, *Workers’ Compensation Law: Cases, Materials, and Text*, LexisNexis, 2008.

⁸ See Larson and Larson, 2008; Matt Hlinak, “In Defense of the Increased-Risk Doctrine in Workers’ Compensation,” *Journal of Business and Economics Research*, Vol. 7, No. 4, 2009, pp. 57–68.

⁹ A third principle is generally affirmed, but is less broadly applicable. A terrorist attack known to be targeted toward a particular employer—or toward particular employees for work-related reasons—would be compensable under the doctrines that cover employment-related assaults (Larson and Larson, 2008). This basis for compensability is clearly narrower than positional risk, and the indiscriminate character of many terrorism scenarios (especially NBCR attacks) that might result in catastrophic losses and TRIA involvement would seem to limit its relevance to large-scale terrorist attacks.

¹⁰ In the event that TRIA expiration leads to significant WC market disruption, one option for state policymakers would be to amend WC statutes to affirm the increased risk doctrine with respect to terrorism, in effect excluding casualties due to indiscriminate attacks from WC policies. Such an exclusion could serve to shift catastrophe risk to lines of insurance currently excluded from TRIA (most likely group health and disability), conceivably disrupting these markets as well. The potentially important interactions between WC and these other lines of insurance would be an important consideration for state policymakers evaluating such a change in WC statutes, but they are beyond the scope of this policy brief.

¹¹ For reference, nationwide employer costs for WC in 2011 were \$77 billion, \$47 billion of which were collected as insurance premiums by private insurers or state funds (National Academy of Social Insurance, 2013). If we allocate policyholder surplus across the entire P&C insurance industry and across lines of insurance in proportion to net premium written, we assign about \$60 billion of policyholder surplus to WC (National Association of Insurance Commissioners, 2013). Policyholder surplus is defined at the level of the insurance company and not at the level of the specific line, so there is not a rigorous way to estimate the policyholder surplus available for WC losses.

For a detailed description of the RMS model, see Appendix A of Lloyd Dixon, Robert J. Lempert, Tom LaTourrette, and Robert T. Reville, *The Federal Role in Terrorism Insurance: Evaluating Alternatives in an Uncertain World*, Santa Monica, Calif.: RAND Corporation, MG-679-CTRMP, 2007. As of April 22, 2014: www.rand.org/t/MG679.

¹² The ratio of WC losses to property damages from a terrorist event can vary substantially with scale and attack mode. In the RMS simulations described in Dixon et al. (2007), the ratio of WC losses to the total of WC losses and property damages ranged from 0 percent to 45 percent for almost all attack modes and were spread broadly throughout this range. RMS also examined a \$15 billion event (hazardous materials transportation sabotage in Chicago) in which WC losses accounted for over 80 percent of total losses. WC was about 6 percent of total insured losses in the 9/11 attacks, but this proportion need not hold in future attacks (Insurance Information Institute, 2014).

¹³ Henry H. Willis and Omar Al-Shahery, *National Security Perspectives on Terrorism Risk Insurance in the United States*, Santa Monica, Calif.: RAND Corporation, RR-573-CCRMC, 2014, pp. 10–12. As of April 22, 2014: www.rand.org/t/RR573.

¹⁴ Natural catastrophes seldom lead to mass casualties in the workplace, since weather hazards such as hurricanes and tornadoes arrive with sufficient advance warning that workers can shelter to minimize exposure. The National Council on Compensation Insurance (NCCI), an organization that calculates advisory loss costs for WC in many states, had not included an explicit provision for catastrophe risk since the 1970s (Thomas V. Daley, “Catastrophes and Workers Compensation Ratemaking,” *Casualty Actuarial Society Forum*, Winter 2007, pp. 1–42). After 9/11, NCCI calculated terrorism provisions ranging from \$0.01 to \$0.03 per \$100 of payroll in the states and \$0.05 per \$100 of payroll in the District of Columbia (personal communication with NCCI, November 21, 2013).

¹⁵ Hillman, 2002.

¹⁶ An attack must cause insured losses of \$5 million or more to be eligible for certification as a terrorism event, but an event may be certified without reaching the program trigger. The certification decision is made jointly by the Secretary of the Treasury, the Secretary of State, and the Attorney General.

¹⁷ For insurers who write WC, our interviewees reported that TRIA deductibles might range from as little as \$10 million for a small monoline WC insurer to as high as \$2 billion for a national multiline insurer.

¹⁸ Baird Webel, *Terrorism Risk Insurance: Issue Analysis and Overview of Current Program*, Washington, D.C.: Congressional Research Service, 2013; Robert J. Rhee, “Insurance for Acts of Terrorism,” in John Alan Appleman, ed., *Appleman on Insurance*, Matthew Bender & Co., 2008; Public Law 110-160, Terrorism Risk Insurance Program Reauthorization Act of 2007, December 26, 2007.

¹⁹ U.S. Government Accountability Office, *Terrorism Insurance: Status of Coverage Availability for Attacks Involving Nuclear, Biological, Chemical, or Radiological Weapons*, Washington, D.C., GAO-09-39, 2008.

²⁰ For a large insurance group, TRIA could, in principle, pay 85 percent of the losses above a \$1 billion deductible up to \$100 billion. Then TRIA would in effect exempt the carrier from additional payments. The value of TRIA to the insurer in terms of reduced claim payments could thus conceivably exceed \$100 billion.

²¹ For the \$2 billion figure, see Aon, *Response to U.S. Treasury and President’s Working Group: Terrorism (Re)insurance*, September 2013. As of April 22, 2014: <http://www.aon.com/attachments/risk-services/2013-Aon-Response-to-Presidents-Working-Group.pdf>. For the \$8 billion figure, see Kean Driscoll, testimony before the U.S. House of Representatives Financial Services Committee Subcommittee on Housing and Insurance, November 13, 2013.

²² For a reinsurer arguing that TRIA is necessary, see J. E. Smith, testimony before the U.S. House of Representatives Committee on Financial Services, September 19, 2013. For testimony on modeling improvements, see Driscoll, 2013. For testimony on insurance-linked securities, see John Seo, testimony of before the U.S. House of Representatives Committee on Financial Services Subcommittee on Housing and Insurance, Washington, D.C., November 13, 2013. A recent report based on stakeholder comments by the President’s Working Group on Financial Markets found that “the private market does not have the capacity to provide reinsurance for terrorism risk to the extent currently provided by TRIA” (President’s Working Group on Financial Markets, *The Long-Term Availability and Affordability of Insurance for Terrorism Risk*, Washington, D.C., 2014).

²³ See Driscoll, 2013; Seo, 2013.

²⁴ Economic theory also suggests that stock insurance companies facing an increase in solvency risk would need to compensate their investors with a higher rate of return to offset increased capital risk.

²⁵ National Association of Insurance Commissioners, Commercial Lines (EX) Working Group, “Attachment A: Review Results of State Survey on Commercial Lines Regulation,” March 28, 2014. Insurance regulation has moved away from older “prior approval” systems to less restrictive approaches such as “file and use.” NAIC notes elsewhere that “The movement of states away from prior approval of rates has been more pronounced in connection with commercial lines than personal lines. It has occurred less rapidly in connection with workers’ compensation insurance than with most other commercial lines” (National Association of Insurance Commissioners, *Property and Casualty Model Rate and Policy Form Law Guideline*, 2010). For an overview of alternative approaches to rate regulation, see Sharon L. Tennyson, *Efficiency Consequences of Rate Regulation in Insurance Markets*, Networks Financial Institute Policy Brief No. 2007-PB-03, 2007.

²⁶ One insurer, for example, currently uses a modifier of 0.95 for three zip codes in Pasadena and Beverly Hills but a modifier of 1.20 for the rest of Los Angeles. See California Department of Insurance, “Consumers: CA Workers’ Compensation Rate Comparison,” web page, no date. As of April 22, 2014: <http://www.insurance.ca.gov/0100-consumers/0010-buying-insurance/0080-compare-premiums/0010-workers-comp-rate-comp>.

²⁷ One industry observer we spoke with argued that regulators tend to focus on affordability when approving expected loss costs but tend to focus on solvency when approving “deviations” (company-specific rate multipliers), suggesting that insurers could offset insufficient loss cost increases with higher deviations.

²⁸ See Aon, 2013; Marsh Risk Management Research, 2013.

²⁹ A rough calculation extrapolating the NCCI surcharges to non-NCCI states on the basis of A.M. Best’s classification of cities into tiers of terrorism risk yields roughly \$1 billion of additional premium per year across all states. (This calculation uses the surcharges to data on covered wages by state reported in National Academy of Social Insurance, 2013.)

³⁰ Dwight M. Jaffee and Thomas Russell, “Catastrophe Insurance, Capital Markets, and Uninsurable Risks,” *Journal of Risk and Insurance*, Vol. 64, No. 2, 1997, pp. 205–230. For an application of this argument to terrorism, see R. Glenn Hubbard and Bruce Deal, *The Economic Effects of Federal Participation in Terrorism Risk*, Analysis Group, 2004.

³¹ We found a striking degree of uniformity across insurers in the scenario chosen. Nearly all of our interviewees reported calculating probable maximum loss from a 5–6-ton truck bomb—roughly a dump truck full of TNT. One justification for this choice of scenarios is that this attack mode is large enough to cause a building collapse. Another likely reason for the uniformity of practices across insurers is that this is the scenario used by credit rating agency A.M. Best to conduct its terror stress tests; the threat of negative ratings action from A.M. Best can immediately affect stock market performance and access to credit and is thus highly salient to insurers (A.M. Best, “Draft: The Treatment of Terrorism Risk in the Rating Evaluation,” Oldwick, N.J., 2013).

³² Previous RAND research on the solvency impacts of terrorism focused on events that would use more than 30 percent of policyholder surplus (Dixon et al., 2007). A.M. Best’s rating methodology focuses on how a 5–6-ton truck bomb would affect a more sophisticated measure of risk-adjusted capital strength, but they also warn that a given post-attack decline in capital strength will be weighted more heavily for an insurer with a greater number of locations where an attack would cause probable maximum loss greater than 20 percent of policyholder surplus (A.M. Best, 2013).

³³ WC statutes typically do not pay death benefits unless the decedent has survivors.

³⁴ In theory, a large employer could insure with multiple companies to avoid concentration limits, an option which seems to be available in property and other TRIA lines (Marsh Risk Management Research, 2013). Several of our interviewees reported that WC statutes generally did not allow employers to spread their coverage across multiple insurers, however.

³⁵ One interviewee noted that detailed geocoding could exempt dispersed workplaces such as multibuilding corporate campuses from policy rejections.

³⁶ For WC results, see Dennis Mealy, *2013 State of the Line: Analysis of Workers Compensation Results*, 2013. For all-lines P&C results, see *NAIC Industry Overview: State of the Insurance Industry*, 2013. The combined ratio is the ratio of underwriting losses and administrative expenses to premium collected. It is a commonly used measure of the operating profit of an insurance company before investment returns. Even though a combined ratio above 100 percent means that an insurer is spending more on losses and expenses than it collects in premium, it does not imply that the company is unprofitable after investment returns are accounted for.

³⁷ For an expression of this view, see Warren Buffett, “Berkshire Hathaway Shareholder Letter,” February 25, 2012.

³⁸ Four states (North Dakota, Ohio, Washington, and Wyoming) provide all WC coverage through a single monopoly provider. Our discussion of WC market impacts in the absence of an attack is not applicable to these states. As we discuss below in the context of states with competitive state funds, the distribution of terrorism risk in these monopoly states would depend on whether the state fund is backed by an insurance guaranty association or by the state government.

³⁹ In some states, residual market policies may also be placed on a direct assignment basis, in which case the policy is not reinsured by the insurance pool and the insurer instead keeps the underwriting gain or loss on the policy. In calendar year 2011, 13 of the 25 states for which NCCI reported residual market data had at least some direct assignment business in the residual market, and direct assignment business was 31 percent of calendar year written premium (National Council on Compensation Insurance, *Residual Market Management Summary 2012*, Boca Raton, Fl., 2012).

Catastrophe risk on a direct assignment policy would be covered by the same reinsurance arrangements that apply to the insurer’s voluntary market business. If TRIA expiration makes voluntary market participation less attractive to insurers, it should also make direct assignment less attractive.

⁴⁰ A.M. Best’s classification of U.S. cities into three categories, or “tiers,” of terrorism risk is based on discussions with risk modeling specialists.

⁴¹ California Department of Insurance, *2003 California P&C Market Share Report*, 2004. A competitive state fund’s market share will overstate the size of the residual market since competitive state funds also sell policies on the voluntary market.

⁴² Self-insurance will also become more attractive to large employers that can bear the ordinary risk of WC, so not all employers that are forced out of the voluntary market will enter the residual market. However, self-insurance is generally not an option for small and medium-sized employers. In addition, many self-funded employers either use high-deductible plans or self-insure but rely on excess coverage to ensure that they do not bear WC catastrophe risk. To the extent that TRIA expiration reduces insurers' willingness to provide these alternatives to traditional WC coverage, self-insurance may become more difficult.

We used data on residual market size from NCCI to examine whether residual markets in high-risk states grew faster than those in low-risk states during the year between 9/11 and when TRIA was passed in 2002. We found that growth was slightly higher in markets containing cities with high perceived terrorism risk than in markets without high perceived terrorism risk. However, this evidence is not robust, and the preexisting trends in the WC market make it inadvisable to attribute all policy year 2002 changes to the effect of 9/11. The value of the immediate post-9/11 experience for predicting what would happen if TRIA expires at the end of 2014 is sharply limited both by the short time frame of the period between 9/11 and the enactment of TRIA and the fact that the insurance and reinsurance industries have greater experience managing terrorism risk today than they did in 2002.

⁴³ While state funds that serve residual markets also serve as high-risk pools, it is not necessarily the case that an employer would pay higher premiums for a state fund policy than it would have paid for a policy with a private insurer. Some of our interviewees voiced concern that both the California and New York state funds have sometimes "underpriced" in recent years.

⁴⁴ We were unable to find published nationwide estimates of how much higher premiums are in residual markets. The Illinois Workers' Compensation Commission advises employers that "premiums cost about 45 percent more than the open market" on the residual market (Illinois Workers' Compensation Commission, "Workers' Compensation Insurance: It's the LAW," web page, 2002. As of April 22, 2014: <http://www.iwcc.il.gov/insurance.htm#new>). An interviewee familiar with residual markets in a number of states stated that premiums are typically 15 percent to 80 percent higher.

Some interviewees argued that the additional risk posed by participation in reinsurance pools that contain substantial terrorism risk could also discourage insurers from selling WC coverage throughout a state with high perceived terror risk: Risk in the pool is allocated in proportion to voluntary market share, so it seems plausible that an insurer with high market share in a given state might worry about catastrophe exposure through the assigned risk pool. However, we could not find any conclusive evidence that these considerations are large enough to have a material impact on business decisions in WC markets.

⁴⁵ For evidence on the incidence of WC premiums, see Jonathan Gruber and Alan B. Krueger, "The Incidence of Mandated Employer-Provided Insurance: Lessons from Workers' Compensation," *Tax Policy and the Economy*, Vol. 5, 1991, pp. 111–143. For a competing view, see Timothy Besley and Anne Case, "Unnatural Experiments? Estimating the Incidence of Endogenous Policies," *Economic Journal*, Vol. 110, No. 467, 2000, pp. 672–694.

⁴⁶ More subtle disadvantages of residual market growth may derive from the loss of efficiencies that can be achieved when employers match with insurers: Some small WC insurers have expertise in particular industries, which can help limit WC costs through specialized safety programs and claims management practices. Any benefits from this type of industry specialization are generally less likely when employers cannot choose between insurers. Examples mentioned in our interviews included insurers who specialize in health care facilities or long-distance trucking. Another form of potential mismatch could arise because residual markets are overwhelmingly populated by the smallest businesses, and our interviewees asserted that large employers who might wish to reduce their premiums by choosing a high-deductible plan would not be well served by state funds.

However, the economic impact of both these types of mismatch is unclear. According to an expert with whom we communicated during the project, the trend in the industry has been for specialized WC companies to merge with large multiline insurance groups. Similarly, some of our interviewees contested the idea that state funds were not appropriate for large employers. The state funds we examine in our case studies below both offer retrospective rating plans, which have similar risk-retention characteristics to a high-deductible plan.

⁴⁷ NCCI, 2012.

⁴⁸ The National Workers' Compensation Reinsurance Association is a quota-share reinsurance treaty between the servicing carrier and all the insurers operating in the voluntary WC market. The entire premium collected on a residual market account is paid to the pool as the reinsurance premium, and the pool assumes all the risk associated with residual-market policies.

⁴⁹ Losses on pool policies are eligible for TRIA reimbursement. In principle, insurers participating in the residual market pool could cede some of this assumed risk to reinsurers, but our interviewees stated that such arrangements are rare in practice.

⁵⁰ National Council on Compensation Insurance, *NCCI Filing Guide*, 2014.

⁵¹ Insolvencies among small, WC-only insurers may also result in higher premiums if these companies are an important source of competitive pressure on larger insurers. To the extent that small insurers' exposure to catastrophic losses is limited by their small market share, this may turn out not to be an important effect.

⁵² SCIF can reject applications for coverage in only two circumstances: if an employer is judged to be in violation of workplace safety standards or if an employer is judged to be beyond the “safe carrying of the fund” (California Insurance Code, Sec. 11784(c), as of April 22, 2014: <http://www.leginfo.ca.gov/cgi-bin/calawquery?codesection=ins>). An interviewee who is knowledgeable about California’s WC market said he was not aware of any occasion when coverage had been declined for the latter reason.

⁵³ California Department of Insurance, *2012 California Property and Casualty Market Share Report*, 2012.

⁵⁴ SCIF’s TRIA deductible was calculated on the basis of its 2011 direct earned premium (KPMG, *State Compensation Insurance Fund: Statutory Basis Financial Statements*, 2012).

⁵⁵ State Compensation Insurance Fund, 2012.

⁵⁶ The impact of an attack causing \$10 billion in WC losses on SCIF’s solvency would depend on both on SCIF’s market share and the geographic concentration of its business. This discussion considers a hypothetical scenario in which SCIF has enough exposure to a single attack to threaten its solvency, since we believe a scenario in which SCIF faces substantial exposure from a single attack is possible if TRIA expiration leads to reduced private insurance capacity in high-risk areas of California.

⁵⁷ The political ambiguity surrounding SCIF has to do with the fact that depletion of SCIF’s policyholder surplus is not legally sufficient to render SCIF insolvent. In general, CIGA involvement is triggered by a finding of insolvency issued by a court of competent jurisdiction at the request of the California Department of Insurance (DOI). While depletion of policyholder surplus would generally lead the DOI to pursue a finding of insolvency, the California insurance code excludes SCIF from the article establishing procedures for the liquidation of insurance companies. That is, the insurance commissioner lacks the legal authority to find SCIF insolvent. Instead, the law instructs the insurance commissioner to file a report with the governor and the leaders of the assembly recommending a remedy. Resolution through the usual guaranty fund mechanism would be an option because SCIF is a member of CIGA. See sections 1010(a) and 1063 of the California Insurance Code, as of April 22, 2014: <http://www.leginfo.ca.gov/cgi-bin/calawquery?codesection=ins>.

⁵⁸ Personal communication with the National Conference of Insurance Guaranty Funds (NCIGF), February 20, 2014.

⁵⁹ In California, assessments are based on net direct written premium in the year that the assessment is levied. This means that insurers could avoid assessments by withdrawing from a market post-attack. Our interviewees argued that guaranty fund assessments are unlikely to determine an insurer’s decision to enter or exit a market, which is plausible since assessments are passed on to policyholders (in California) or, in some states, to taxpayers.

⁶⁰ At least 35 states use a 2 percent cap, and both the NAIC and NCIGF model guaranty fund laws recommend 2 percent as the assessment cap; other states use 1 percent or 1.5 percent as a cap for WC (personal communication with NCIGF, February 20, 2014). CIGA’s WC assessment is currently split between a minimum 1 percent assessment to pay off bonds and an ordinary assessment capped at 1 percent. Currently, the bond assessment and the ordinary assessment are both 1 percent, resulting in a combined 2 percent assessment.

⁶¹ NCIGF reports that 29 of the 47 non-monopolistic states (and 7 of the 14 state fund states) have a separate guaranty fund account for WC (personal communication with NCIGF, February 20, 2014).

⁶² The cost of capital associated with delayed recoupment of the guaranty fund assessment would be borne by insurers.

⁶³ New York State Insurance Fund, *2012 Annual Report*, 2012.

⁶⁴ New York’s Department of Financial Services, which regulates insurance business in the state, allows NYSIF to designate a portion of its policyholder surplus for specific catastrophic events, and NYSIF assigned a combined \$374 million for foreign and domestic terrorism in 2012.

⁶⁵ New York State Insurance Fund, 2012.

⁶⁶ New York State Insurance Fund, 2012.

⁶⁷ New York State Insurance Fund, 2012.

⁶⁸ We use the listing of state residual market institutions on the NCCI website (as of April 22, 2014: https://www.ncci.com/nccimain/residualmarkets/administratorsassignedcarriers/pages/admin_table.aspx) and check our initial coding against information in NCCI (2012) and, in some cases, state fund websites. Our listing of guaranty fund recoupment rules was obtained in personal communication with NCIGF, February 20, 2014.

⁶⁹ Based on our interviewees’ descriptions of typical TRIA deductibles and WC reinsurance programs, the risk-bearing structures described in the table would be accurate for losses above \$4 billion and below the \$100 billion program cap. To the extent that the Secretary of the Treasury chooses not to pursue optional recoupment for the 85 percent of losses between the industry retention amount of \$27.5 billion and \$100 billion that would be reimbursed by the TRIA program, the cost of reimbursement for this tranche of losses would be borne by future taxpayers rather than future P&C policyholders.

⁷⁰ Five of these eight states have a separate guaranty fund account for WC, so in these states, the tail risk will be borne entirely by future WC policyholders in the state. The other three (Hawaii, Kentucky, and Montana) would assess all commercial P&C policies in the state.

⁷¹ With TRIA in place, terror losses on an assigned-risk policy reinsured by the pool would be allocated to the carriers participating in the reinsurance pool rather than the servicing carrier for purposes of TRIA program reimbursement (personal communication with NCCI, March 14, 2014). The distribution of this risk prior to calculating TRIA reimbursement would most likely increase the size of the attack necessary to trigger TRIA reimbursement, though tail risk would continue to be borne by the TRIA program.

⁷² For simplicity, we are assuming that state budgets are financed by a lump-sum tax on all state residents. In reality, the distribution of losses recouped through premium tax offsets depend on a combination of the state's tax system and what specific public spending is cut as a result of reduced revenues.

⁷³ See companion studies for arguments to this effect: Willis and Al-Shahery, 2014; Tom LaTourrette and Noreen Clancy, *The Impact on Federal Spending of Allowing the Terrorism Risk Insurance Act to Expire*, Santa Monica, Calif: RAND Corporation, RR-611-CCRM, 2014. As of April 22, 2014: www.rand.org/t/RR611.

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About This Document

This document is part of a series of three policy briefs examining the potential ramifications of allowing TRIA to expire. The other two documents in the series examine

- the national security implications of terrorism risk insurance, including the evolution of terrorism risk and risk modeling since 2001 and whether access to terrorism risk insurance makes the nation more safe and secure
- the impact of TRIA on federal spending, considering the costs to taxpayers of payment made through the program as well as taxpayer-funded compensation and assistance for uninsured losses following an attack.

These three policy briefs build on previous RAND research for the 2005 and 2007 authorizations of TRIA. For more information on the background and effects of TRIA than allowed in the focused analysis of national security issues here, please see

- *The Federal Role in Terrorism Insurance: Evaluating Alternatives in an Uncertain World*, 2007 (www.rand.org/t/MG679)
- *Distribution of Losses from Large Terrorist Attacks Under the Terrorism Risk Insurance Act*, 2005 (www.rand.org/t/MG427)
- *Trends in Terrorism: Threats to the United States and the Future of the Terrorism Risk Insurance Act*, 2005 (www.rand.org/t/MG393)
- *Issues and Options for Government Intervention in the Market for Terrorism Insurance*, 2004 (www.rand.org/t/OP135).

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This work was conducted within the RAND Center for Catastrophic Risk Management and Compensation. The center conducts research and seeks to identify policies, strategies, and other measures that have the potential to reduce the adverse social and economic effects of natural and manmade catastrophes by

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