

Modeling the Solvency Impact of TRIA on the Workers Compensation Insurance Industry

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Abstract

The enterprise in a rating bureau risk model is the insurance industry. This paper describes how statewide or national loss exceedance curve output from a catastrophe model for workers compensation losses from terrorist attacks can be combined with insurance industry financial data in a basic model to estimate the financial impact on the United States workers compensation insurance industry. Many different metrics of impact on the industry are calculated for different percentile levels for the loss size of a single terrorist attack. The model is run with and without consideration of recoveries to insurers from the Terrorism Risk Insurance Act (TRIA) in order to assess the impact of this law on industry solvency. Qualitative results that indicate that TRIA does provide a very high level of protection to the industry are discussed.

Keywords. Catastrophe, Terrorism, TRIA, Solvency

1. INTRODUCTION

The enterprise in a rating bureau risk model is the insurance industry. This paper describes how statewide or national loss exceedance curve output from a catastrophe model¹ for workers compensation losses from terrorist attacks can be combined with insurance industry financial data in a basic model to estimate the financial impact on the United States workers compensation insurance industry. Many different metrics of impact on the industry are calculated for different percentile levels for the loss size of a single terrorist attack. The model is run with and without consideration of recoveries to insurers from the Terrorism Risk Insurance Act (TRIA) in order to assess the impact of this law on industry solvency. Qualitative results that indicate that TRIA does provide a very high level of protection to the insurance industry are discussed.

1.1 Research Context

This paper falls primarily into the CAS Research Taxonomy categories of III.H.I.3, II.U, and I.D.5. Very little has been written in CAS literature about terrorism (Maher, et. al. [2]).

¹ Provided to NCCI by EQECAT.

2. BACKGROUND AND METHODS

In 2002 the National Council on Compensation Insurance (NCCI) contracted the experienced catastrophe modeling firm EQECAT to formulate a catastrophe model, similar to existing earthquake and hurricane property insurance models, for workers compensation losses resulting from terrorist attacks in the United States. EQECAT modelers utilized a list of likely sites –“landmark” buildings, etc. - for a terrorist attack. A game theoretic approach was used to incorporate information about the likely behavior of terrorist groups in terms of what types of attacks would be carried out against which sites and to generate probabilities of events and associated numbers of worker casualties by injury type. These injury numbers were combined with NCCI data on the distribution of per claim costs by injury type to estimate dollars of workers compensation loss associated with each event (NCCI [3]).

Output was delivered to NCCI for 16 individual states and nationwide in the form of loss exceedance curves, a standard output for catastrophe models. Loss exceedance curves match an amount of dollars of total loss with the probability that one or more events, each of which causes at least that much loss, will occur in a single year. For example, a point on the loss exceedance curve may indicate that there is a 3% probability that one or more events, each of which causes at least \$10 billion of loss, will occur in a single year.

In 2002 the TRIA became law. This act provides very significant reinsurance recoveries and limits on total liability to the property and liability insurance industry in the event of a large terrorist attack of foreign origin. TRIA expires at the end of 2005 and there is significant concern about how expiration will affect the insurance market and there is much discussion of possible extension. So assessing TRIA’s impact on the industry is of great interest.

2.1 An Industry Financial Model For Terrorist Attacks

Translating the output of the catastrophe model into estimated financial impact on the industry requires a financial profile of the industry by insurance group. Thompson Financial compiles various financial data such as surplus and premium by state by line of business for United States insurers. The process of how a terrorist attack might distribute losses to various insurers and what recoveries would be provided by TRIA is intrinsically complicated. Several reasonable simplifying assumptions result in a model that is tractable, practically simple, and yet maintains qualitatively meaningful results relative to the uncertainty intrinsic

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to the catastrophe model itself. These assumptions include:

1. Exactly one terrorist attack, as defined by TRIA, occurs in a single year.
2. Losses are reduced by 28% to account for such factors as vacations, absenteeism, etc. The EQECAT modeled assumed total workforce by location to be present.
3. Workers compensation losses from an attack are 25% of all commercial property and liability losses from the attack.²
4. Insurers incur workers compensation losses from an attack in proportion to their direct written premium market share statewide (or nationally). Similarly, losses for non-WC commercial losses are incurred in proportion to market share in these other lines (see discussion in Section 2.3).
5. Insurers are considered on a total national group basis surplus and commercial lines premium for purposes of capacity, impairment, and solvency impact.
6. Insurer group surplus is reduced by the group's total losses from the terrorist attack (see discussion in Section 2.3).
7. An insurer group is considered impaired if after the attack its surplus drops below 1/3 of its net written premium and is considered insolvent if its surplus drops below 0.
8. TRIA recoveries have an effective deductible that is a certain percentage (typically selected at 10% but in TRIA it actually varies by year from 7% to 15%) of insurer group direct written commercial lines premium, require a 10% co-payment, and are proportionately reduced to the extent that total industry commercial lines losses from the event exceed \$100 billion. Total insurer liability to policyholders is limited to \$100 billion.

Loss exceedance probabilities consolidate information about both the frequency and the

² Workers compensation losses from September 11, 2001 are on the order of 10% of all commercial insurance losses from the event, but many catastrophe modelers have judged this percentage to be uncharacteristically low.

severity probabilities for catastrophic events. It is possible to formulaically convert the exceedance probability for each event loss amount into the percentile for that loss amount on the event severity probability distribution, thus removing the frequency assumptions. The output metrics can be paired with the associated event severity percentiles, forming the distribution of the metric given a single event happens in a single year.

2.2 Specific Financial Metrics Estimated by the Model

The analysis examined the financial impact of terrorism events from both a nationwide and a state-specific perspective. The nationwide approach would be appropriate if, for example, several events in multiple states were classified as a “single event” for the purposes of TRIA. The financial impact would be spread over a larger number of carriers but the potential magnitude typically would be greater than would be expected in a single, state specific event. Specific metrics included:

- Workers compensation nationwide capacity insolvent from a nationwide event
- Workers compensation nationwide capacity impaired from a nationwide event
- Workers compensation small mid-western state capacity insolvent from a state event
- Workers compensation small mid-western state capacity impairment from a state event
- Property liability policyholder deficit³ from a nationwide event
- Property liability 2% assessment payback years from a nationwide event

2.3 Some Limitations of Model Assumptions

Strict proportional market share allocation of losses will tend to underestimate the rate of insolvency, impairment, and TRIA recovery. In reality allocations would be somewhat uneven and more concentrated with certain insurers. Using the national loss exceedance curve also produces this kind of underestimation relative to state exceedance curves, since an

³ The policyholder deficit is the amount of losses that is unfunded due to a carrier’s insolvency.

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actual event will tend to be geographically localized and have disproportionate impact on insurers with market shares concentrations in the affected area. However, premium collected specifically for terrorism and associated reinsurance are also not modeled. The exclusion of these two effects somewhat offsets the proportional allocation assumption.

The assumption of a single TRIA covered event in a single year does not account for the annual nature of insurer financial results and TRIA recoveries, nor the possibility of a terrorist attack of domestic origin not covered by TRIA. However, this assumption eliminates the controversial topic of average annual frequency, a parameter for which there is tremendous uncertainty in estimation and is subject to dramatic changes over time. The range of reasonable average annual frequency assumptions is narrow and low, with 5 probably being an upper bound. This means that there is little room for the qualitative result of using an aggregate annual loss distribution to vary dramatically from using the event severity distribution as was done in the model.

2.4 Model Output

The model outputs are quite varied. For a specific event, a single point on a loss exceedance curve, an example of the model output is shown in Table 1.

Table 1

| <u>Metric</u> | <u>Example Value</u> |
|---------------------------------|----------------------|
| TRIA Recovery | 72,977,501,790 |
| TRIA Deductible and Copayment | 27,022,498,210 |
| Blowover TRIA Liability | 21,184,481,906 |
| Net Industry Loss | 27,022,498,210 |
| Total Loss | 121,184,481,906 |
| Net WC Loss | 6,468,510,211 |
| Net Statewide WC Loss Ratio | 17.2% |
| Net Commercial Lines Loss Ratio | 14.3% |
| Groups Writing WC in State | 337 |
| Insolvencies | 8 |
| Impairments | 24 |
| Groups Writing PL in State | 1058 |
| Insolvencies | 21 |
| Impairments | 47 |
| Policyholder Deficit | (153,492,930) |
| Recapitalization Cost | (1,349,819,849) |
| PD Payback in Years at 2% | 0.04 |
| State WC Capacity Impaired | 21% |
| National WC Capacity Impaired | 21% |
| State WC Capacity Insolvent | 1% |
| National WC Capacity Insolvent | 1% |

2.5 Flexibility and Further Directions

The model is quite flexible and allows for many assumptions and parameters to be adapted for specific analyses. Examples of input parameters that can be changed without redesigning the existing model algorithm are shown in Table 2.

Table 2

| <u>Parameter</u> | <u>Typical Value</u> |
|---|----------------------|
| WC Exceedance Curve | US |
| Deductible by Group as Percentage of National DWP | 10% |
| Limit of Total Liability | 100,000,000,000 |
| Copayment Percentage | 10% |
| TRIA Recoveries | TRUE |
| Losses Above Liability Limit Retained | FALSE |
| Ratio of WC Loss / All Commercial Loss | 25% |

Although the model has been applied to workers compensation terrorism loss exceedance curves from EQECAT, the loss exceedance curve is a standard output format in the catastrophe modeling world. The TRIA impact model could easily be adapted to output from other modeling firms, output for other lines of business, or even output for other catastrophic perils (with TRIA recoveries turned off).

The model would be enhanced if insurer premiums and event losses were available at a higher geographical resolution, such as zip code level. This refinement would accurately account for the unevenness, relative to statewide (or national) market share, that will actually occur. This information would be difficult and costly to assemble. Assembling the information and adapting the model would increase the model cost by orders of magnitude.

An alternative that would tend to capture much of the allocation unevenness effect on the final industry statistics would be to add a random factor in the distribution of losses relative to market share. This would require adding either a simulation or numerical integration component to the model.

3. RESULTS AND DISCUSSION

The model output supports conventional wisdom about the intent of the structure of TRIA. TRIA generally responds only to the very largest events or to somewhat smaller events that affect a concentrated regional insurer. In doing so TRIA greatly moderates the insolvency and financial impairment consequences of these rare events. With TRIA in place, immediately after a giant event the US property and liability insurance industry would remain solvent with unimpaired surplus and would continue to be able to access credit and capital markets.

In the absence of TRIA, a major catastrophic terrorism event would effectively bankrupt the industry. Due to the impact of guarantee fund assessments, an event of this magnitude is projected to adversely affect even those carriers that do not suffer direct underwriting losses. It also appears that TRIA is relatively more important in protecting the financial viability of state funds and smaller regional insurers than major national carriers with much greater financial resources. The model results indicate that these single state and regional insurers are likely to experience a large proportion of losses when a terrorist attack happens in their market; moreover their share of the loss in the state will typically be quite large relative to their nationwide premium and total surplus.

3.1 TRIA Protection of Workers Compensation Industry Solvency

Industry insolvency poses a great threat to the economy. Chart 1 indicates that because it is spread broadly throughout the industry a nationwide event would not begin to impact industry solvency until it approaches a 1 in 100 chance event. Above this level TRIA insulates the industry from serious exposure to insolvency. Without TRIA a highly extreme event (say, 1 in 200) would bankrupt carriers with more than half the industry's surplus.

In the case of a single, state specific terrorist event the adverse impact on solvency begins near the 1 in 50 event range (Chart 2). Because of the greater concentration of exposure in smaller regional companies, the risk of insolvency rises more rapidly. Even with the protection of TRIA in the case of the most extreme events as much as 10% to 20% of capacity is projected to be lost due to insolvencies.

Chart 1

**Workers Compensation
National Capacity Insolvent After a Terrorist Event
Nationwide Event**

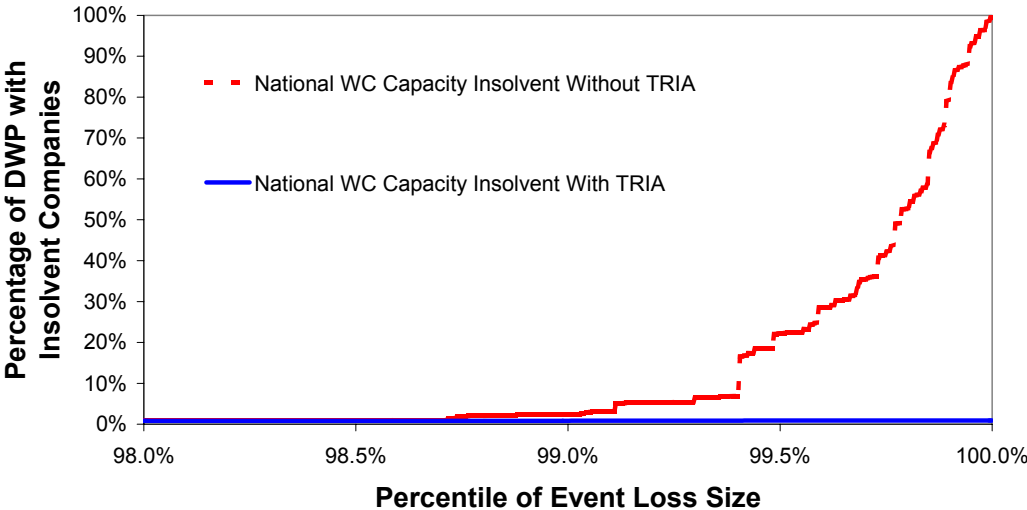
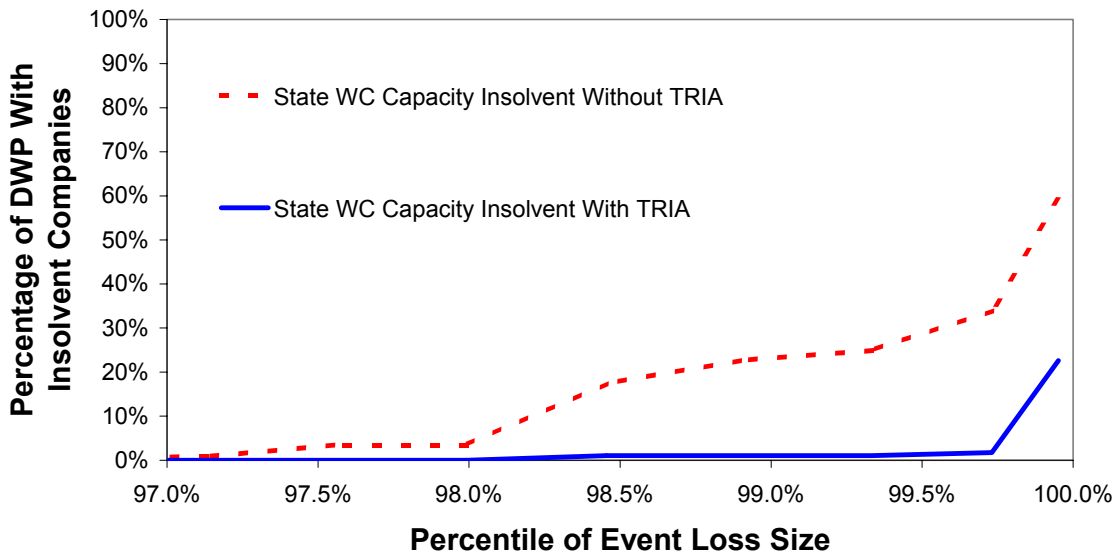


Chart 2

**Workers Compensation
State Capacity Insolvent After a Terrorist Event
Small Midwestern State Event**

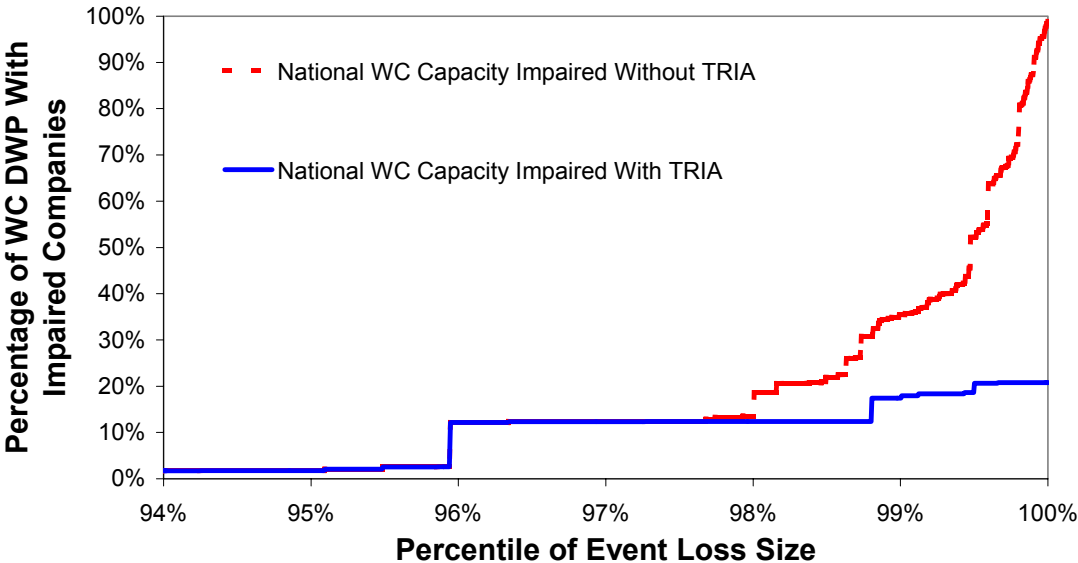


3.2 TRIA and Impairment of Workers Compensation Industry Capital

If underwriting losses erode a carrier's capital, its ability to continue as an active competitor in the marketplace will be impaired. The model projections indicate that TRIA will protect market competition in the case of extreme events by limiting the extent of capital deterioration in the face of extreme terrorist events. As illustrated in Chart 3, starting near the 1 in 25 countrywide event range, even with TRIA it is estimated that from 10% to 20% of underwriting capacity could be impaired. While this is material, it is significantly better than the drastic decline in underwriting capacity without TRIA.

Chart 3

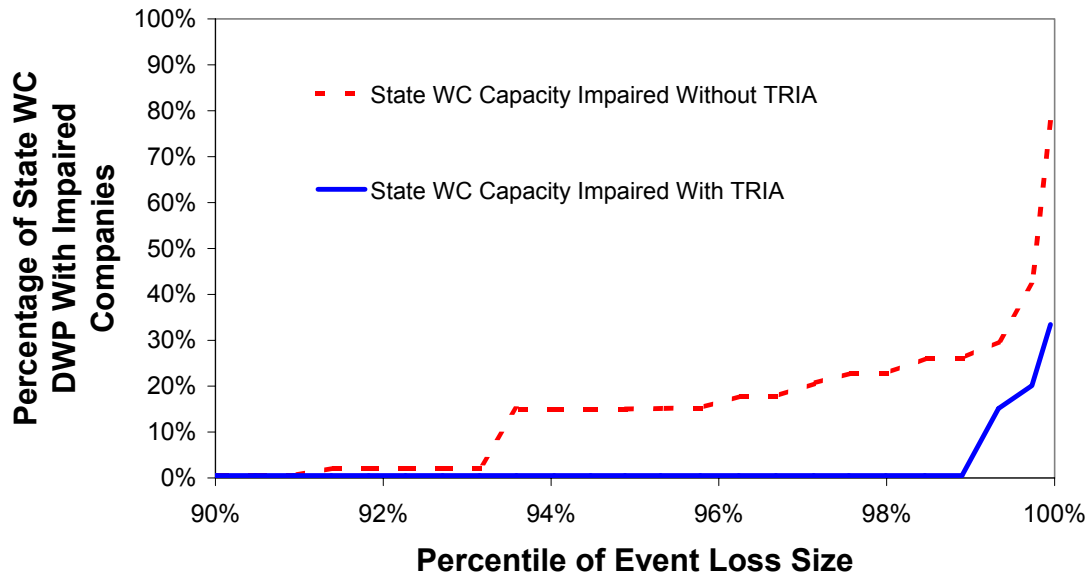
**Workers Compensation
National Capacity Impaired After a Terrorist Event
Nationwide Event**



Arguably it appears that TRIA may be even more important to the continued competitiveness of state level competition. Chart 4 indicates that, without the TRIA backstop, underwriting capacity begins to deteriorate just above the 1 in 10 event level and begins to accelerate around the 1 in 25 event range. With the financial backing of TRIA underwriting competitiveness is not adversely impacted until the 1 in 100 event is reached.

Chart 4

**Workers Compensation
State Capacity Impaired After a Terrorist Event
Small Midwestern State Event**

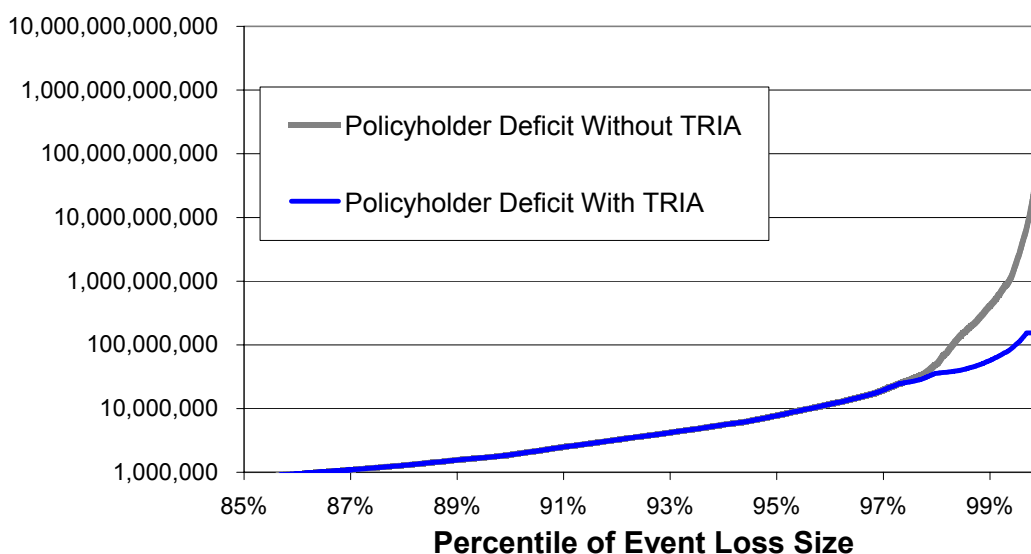


3.3 Making Up the Underwriting Deficit

Not only underwriting capacity is lost when carriers become insolvent. The underwriting loss can be considerably greater than the carrier's surplus. This means that policyholders face unfunded insured claims. This under funding is referred to as the policyholder deficit (Butsic [1]). Chart 5 depicts the model's estimates of this deficit under a countrywide event scenario. The deficit begins to appear before the 1 in 10 event level; TRIA relief begins near the 1 in 25 range. This makes clear that TRIA is not expected to protect the industry from any chance of insolvencies; rather TRIA protects the industry from massive insolvencies in the case of a highly extreme event.

Chart 5

Property/Liability Policyholder Deficit After a Terrorist Event Nationwide Event



3.3 TRIA and State Guarantee Funds

State guarantee funds are intended to provide policyholders with financial protection in the event of an insurer insolvency. In most states these are funded on an “as needed” basis by an assessment on the remaining insurers in the state. Typically the assessments are based on a carrier’s premium volume and are limited in any year to a modest percent of written premium⁴.

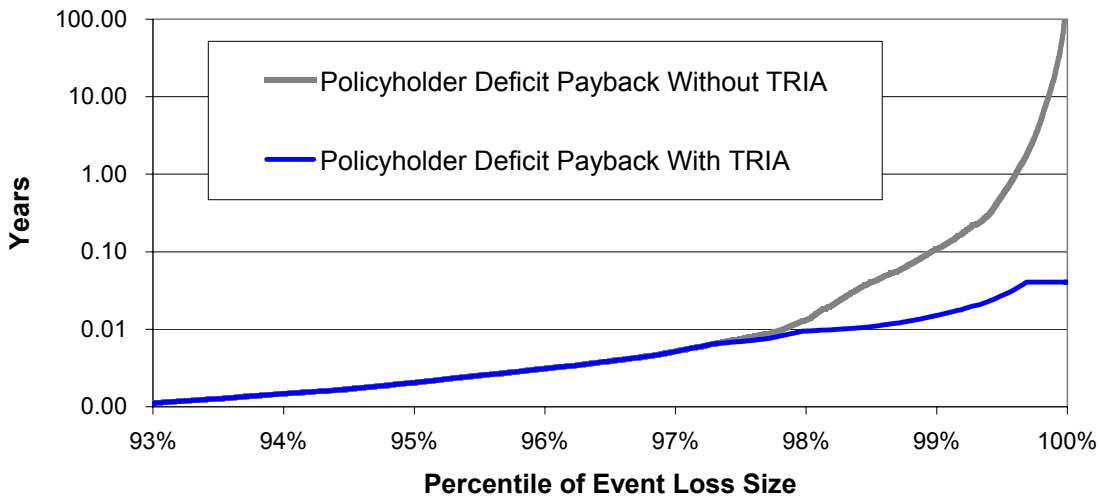
Chart 6 depicts the number of years required at a 2% assessment rate for the guarantee funds to cover the policyholder deficits in Chart 5. If it is possible to assess the industry on a countrywide basis, it appears that the payback period to cover policyholder claims is

⁴ The maximum is often equal to the state’s premium tax rate. The assessments may be used to offset premium taxes.

manageable⁵ except in the most extreme event scenarios. In the more likely case of an event in a single state, the impact on the market is likely to be considerably longer because only the premium in the affected state would be subject to assessments.

Chart 6

**Property/Liability
Years for Payback of Policyholder Deficit with
2% Assessment After a Terrorist Event
Nationwide Event**



4. CONCLUSIONS

TRIA will provide dramatic solvency support for the workers compensation insurance industry if the country experiences an extreme terrorist event. Without TRIA such an extreme event would likely bankrupt not just most of the capacity of the workers

⁵ This might be the case if the “single-event” were actually several events resulting in insolvencies in several states.

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compensation, but also most of the capacity of the entire property and liability insurance industry. TRIA does not provide significant financial relief to the industry under the broad range of likely terrorist attacks. TRIA provides greater protection to regional carriers and state funds with concentrated exposures than to the large national carriers with greater resources and most diverse exposures.

Acknowledgment

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5. REFERENCES

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Abbreviations and notations

TRIA, Terrorism Risk Insurance Act
NCCI, The National Council on Compensation Insurance

Biographies of Authors

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