The Impact of Offshore Affiliate Reinsurance Tax Proposals on the U.S. Insurance Market

An Updated Economic Analysis

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Executive Summary

Tax legislation proposed in the last decade targeted reinsurance that a foreign-owned U.S. insurance firm buys from an offshore affiliate. These proposals arose from pressure from some U.S.-owned insurance groups that portray offshore affiliate reinsurance as a tax-avoidance strategy. These groups argue that the proposed tax is necessary to level the playing field and will not harm U.S. consumers. Two of the co-authors of this report wrote prior reports in 2009 and 2010 to evaluate the economic impact of the tax.

The previously proposed legislation would have denied the deduction of reinsurance premiums ceded to offshore affiliates in excess of certain industry averages. The latest proposal, the Warner/Neal proposal, would still disallow foreign-owned insurers from deducting premiums that they cede to their offshore affiliate reinsurers. However, when the risks materialize and reinsurance recoveries come back to the U.S. insurers, these recoveries would be excluded from taxable income. If implemented, the new proposal will negatively impact insurance consumers (purchasers of insurance), especially those who rely on natural disaster coverage. We were asked by a coalition of insurance firms and insurance consumers opposed to the legislation to update our previous analyses to explain the industry and consumer effects, and estimate the economic impact of the Warner/Neal proposal. We summarize our conclusions below.

Reinsurance is critical to risk management in the property and casualty (P&C) insurance industry, particularly for natural catastrophes and other infrequent but high-loss events.

- Approximately half of the global use of reinsurance comes from the U.S., which has the world's largest insurance market. These reinsurers face unique risks from natural disasters and the U.S. legal liability system. In 2015, the U.S. accounted for 60 percent of worldwide insured losses for natural catastrophes.
- The key function of reinsurance is risk-pooling to lower insurance company risk through global diversification. An insurer can reduce the impact of large losses by sharing (*i.e.* ceding) its exposure to particular risks. A reinsurer can bear these risks more efficiently because it assumes them from a variety of sources and many of the risks (*e.g.*, hurricanes in Florida and earthquakes in Japan) are uncorrelated. Global reinsurance allows an insurer to provide more local insurance, or provide a higher limit of protection, than its capital assets would otherwise allow. This increases insurance availability and makes it more affordable, particularly for infrequent but high-impact risks.
- The reinsurance market is global because insurers need diversification across the widest possible geographic area. For example, almost 60 percent of the $68 billion in payments for the 2005 hurricane trio (Katrina, Rita, and Wilma) came from foreign insurers and

reinsurers, and the distribution of payments for the attack on the World Trade Center is similar.

Affiliate reinsurance is more prevalent than non-affiliate reinsurance because it addresses the problems of adverse selection and moral hazard, and also allows for efficient intragroup capital management.

- Affiliate reinsurance is a response to problems which plague all insurance markets—adverse selection and moral hazard. The insurer often knows more than the reinsurer about the risks it insures, and this information asymmetry creates an incentive for the insurer to transfer the worst risks (adverse selection) and/or to be lax in its underwriting (moral hazard). If the insurer and reinsurer are part of the same corporate group, their incentives are better aligned: vertical integration "internalizes" the costs of adverse selection and moral hazard. This is especially important with respect to infrequent, high-loss events such as natural catastrophes, where the information asymmetry is most pronounced.
- Moreover, as a tool for inter-company risk transfer and efficient intragroup capital management, affiliate reinsurance is central to the group structure of the insurance industry. Relative to non-affiliate reinsurance, affiliate reinsurance allows risk and capital to be moved more quickly and easily in response to changing market conditions.

The proposed tax would reduce the ability of offshore reinsurers to reinsure infrequent, high-loss risks such as earthquakes, hurricanes, and terrorism risk.

- The legislation would increase the cost of providing insurance for lines in which there can be a significant time lag between the initial reinsurance transaction and when the reinsurance recoverable is received ("long-return" risks). In addition to natural disasters, the long-return risks also include lines of insurance with a long payout period such as product liability and workers' compensation.

U.S. homeowners and businesses would feel the effect of the tax in the form of reduced availability of, and higher prices for, P&C insurance.

- We analyze financial data collected by the National Association of Insurance Commissioners ("NAIC") on more than 3,000 large U.S. P&C firms over a twenty-year period (1996–2015). Such information on past industry behavior is the best basis for predicting future industry behavior.
- We first estimate the rate at which U.S. subsidiaries would replace their offshore affiliate reinsurance with capital and/or non-affiliate reinsurance, neither of which is a good substitute. Our key finding is that the net supply of reinsurance (non-affiliate and affiliate combined) would drop by one-eighth or $18.3 billion as a result of the proposed tax.
- We then analyze how the industry as a whole would adjust to this new market environment in terms of the amount of insurance it would be willing to write. We

estimate that the supply of insurance, as measured by insurance premiums, would drop by $9.3 billion, which represents a 1.4 percent drop on average, a 1.8 percent drop in the long-return lines, and a far larger drop in certain insurance lines such as Earthquake (4.6 percent), Ocean Marine (5.6 percent), and Product Liability (5.2 percent).

- We analyze the change in the price of insurance as a function of supply in the historical data. We estimate that U.S. consumers would have to pay $5 billion more per year to obtain the same coverage. In percentage terms, the proposed tax would increase the price of insurance by 0.8 percent, on average, and as much as 6 percent in some insurance lines.
- Corresponding to the reduction in insurance supply and the increase in insurance price, insurance coverage (for future losses and expenses) would drop by 2.2 percent, on average, and as much as 17 percent in some lines of business. Certain states like Texas and Florida where low frequency, high impact risks are concentrated would see prices rise as much as 3 percent.

House Republicans also proposed a comprehensive Blueprint tax reform platform ("Blueprint") in June 2016. One provision in the Blueprint, known as border adjustability, has the potential to subject reinsurance ceded and other forms of offshore risk transfer to a 20 percent import tax. (The Blueprint tax reform platform acknowledges that financial transactions may not be subject to the same taxation provisions.) Assuming that this provision is applied to payments by offshore reinsurers, regardless of whether the reinsurers are affiliated or non-affiliated with the U.S. insurers and whether the reinsurance is long-return or not, it would adversely affect the U.S. reinsurance market more significantly than the Warner/Neal Bill.

The impact of the border adjustment proposal is uncertain, because it would place the industry in uncharted territory and the proposal lacks specific details. Thus, we provide a range of potential impacts of border adjustability, viewed independently from other components of the Blueprint.

- At the low end, for example, a 20 percent reduction in reinsurance would lead to a $15.6 billion drop in the supply of U.S. insurance, which is 67 percent greater than the impact we calculated under the Warner/Neal Bill, and U.S. consumers would pay $8.4 billion more to obtain the same coverage.
- At the high end, an 80 percent reduction in reinsurance would lead to a $69.3 billion drop in the supply of U.S. insurance, which is 7.5 times the impact we calculated under the Warner/Neal Bill, and U.S. consumers would pay $37.4 billion more to obtain the same coverage.
- If we apply our analysis of the Warner/Neal Bill and assume the 39 percent reduction in reinsurance ceded by foreign firms in long-return lines similarly applied to all firms and

all lines, the impact would be a $31.2 billion drop in the supply of U.S. insurance, and U.S. consumers would pay $16.9 billion more to obtain the same coverage.

We note that our estimates above do not capture all of the adverse consequences of the border adjustment tax for several reasons. First, under the border adjustment proposal, the diversification benefits obtained by U.S. insurance companies exporting risks to foreign reinsurers would be materially diminished. This dramatic change in the diversification benefits to the U.S. insurance and reinsurance industry would cause larger price increases than predicted by our quantitative analysis, which is based on the observed behavior of insurers and reinsurers between 1995 and 2015. Second, after nearly a decade of low reinsurance rates in the U.S., reinsurers' ability to absorb any tax impact is limited. The ability to replace lost insurance coverage is further limited given the regulatory hurdles in setting up U.S. insurance operations and difficulties in raising external equity capital quickly. Thus, reinsurers and insurers would have to pass on the price impact onto insurance consumers. Third, our simulation model ignores some practical constraints such as mandatory requirements for insurance (for home mortgage, commercial real estate, other commercial financing, *etc.*) which limit the extent to which insurance can drop. Inelastic demand in these circumstances would cause larger increases in price of insurance.

Last but not least important, both the Warner/Neal Bill and border adjustability tax proposals would widen the protection gap between insured and uninsured economic losses. The increasing prevalence of natural and man-made catastrophes, such as aviation and maritime disasters and large fires, makes closing this gap even more important. If not properly managed, part of this gap will fall on the governments at the state and Federal levels as a safety net.

I. Introduction

In the past decade, Congress has considered and rejected a number of proposed bills targeting reinsurance that a foreign-owned U.S.-based insurance company purchases from an affiliate located outside of the U.S.[1] In September 2016, Senator Mark Warner (D-VA) and Representative Richard Neal (D-MA) introduced the latest version, which proposes that the deduction for reinsurance premiums paid by a U.S. insurer to its offshore affiliate should be disallowed, but that the recoverable under the reinsurance contract should be tax exempt when paid—this has come to be referred to by many as a "deferral," as un-taxed recovery in the future effectively allows deduction of the reinsurance premium on a deferred basis.[2]

Reinsurance – insurance for insurance companies – is a key tool for managing risk. Approximately half of the global demand for reinsurance comes from the U.S. The U.S. has been involved in seven of the top ten most costly insurance losses worldwide between 1970 and 2015, including Hurricane Katrina ($49 billion), Hurricane Sandy ($20 billion), Hurricane Andrew ($24 billion), the 9/11 Terror attacks ($44 billion), and the Northridge earthquake ($25 billion).[3] More importantly, the risk of a large insurance loss has been increasing over time, as all but two of the top ten insurance losses occurred after 2000.

Proponents of the proposed tax legislation claim that the purchase of reinsurance from foreign affiliates is largely a tax-avoidance strategy by U.S. subsidiaries, and that the legislation is necessary to level the playing field.[4] They further claim that the legislation

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1 For example, H.R. 3424, legislation introduced by Rep. Richard E. Neal (D-MA) in 2009, and proposed legislation introduced by Sen. Robert Menendez (D-NJ) and Rep. Neal in 2015. A similar but slightly different version was also included in the tax reform legislation introduced by former House Ways and Means Committee Chairman Dave Camp (R-MI) in 2014.

2 Press Release, "Sen. Warner, Rep. Neal Introduce Legislation to Close Foreign Reinsurance Tax Loophole — Legislation would remove incentives for foreign insurance groups to move capital to tax havens abroad," September 28, 2016, available at: http://www.warner.senate.gov/public/index.cfm/pressreleases?ContentRecord_id=03D45963-9516-48EE-841A-142049D8FA4A.

3 Insurance Information Institute, "Catastrophes: Global," available at: http://www.iii.org/fact-statistic/catastrophes-global. Insurance Information Institute, "Terrorism," available at: http://www.iii.org/fact-statistic/terrorism. Insurance Information Institute, "Hurricanes," available at: http://www.iii.org/fact-statistic/hurricanes. Insurance Information Institute, "Earthquakes: Risk and Insurance Issues," October 2016, available at: http://www.iii.org/issue-update/earthquakes-risk-and-insurance-issues.

4 Technical Explanation of Bill to Amend the Internal Revenue Code of 1986 to Prevent Avoidance of U.S. Tax Through Reinsurance with Nontaxed Affiliates ("Technical Explanation"), pp. 3–4 and 11–12. In addition, the OECD's initiatives at combating abusive transfer pricing practices by multinational

Continued on next page

would have no adverse effect on U.S. consumers because, in their words, the affected transactions "add no additional capacity to the market, but rather require a mere bookkeeping entry to move premium from the U.S. company's pocket to the foreign parent's pocket…"[5]

Opponents of the legislation counter that reinsurance represents a genuine transfer of risk and the associated losses from an insurer to a reinsurer, even if the two entities belong to the same corporate group. As evidence that affiliate reinsurance serves a valid non-tax business purpose, they note that U.S.-based insurance groups themselves make extensive use of it.[6] Opponents also dispute the claim that consumers would not be harmed, predicting that the legislation would make property and casualty (P&C) insurance less available and affordable in the U.S.

To help inform the debate, a coalition of insurance firms and insurance consumers opposed to the legislation previously asked two of the co-authors of this current report to examine the economic impact H.R. 3424 would have on U.S. consumers. We wrote two reports in 2009 and 2010 that concluded that the proposed legislation would lead to a decrease in the supply of reinsurance of 20 percent, a decrease in the supply of primary insurance of 2.1 to 2.4 percent, and simultaneously a 2.1 to 2.4 percent increase in insurance price.

The Coalition asked us to update the analyses to assess the impact of the new proposal, the Warner/Neal Bill. Toward that end, we analyze comprehensive financial data collected by the NAIC on more than 3,000 large U.S. P&C firms over a twenty-year period (1996–2015). We use a three-step approach to estimate the direct effect of the proposed tax on the supply of reinsurance and the indirect effect on the supply and price of primary insurance. We estimate that the legislation would have the following economic impact:

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companies since 2013 have also raised concerns that reinsurance with affiliates of foreign insurance groups may amount to profit shifting to foreign low or no tax jurisdictions, shielding U.S. profits from taxation under the higher tax rate in the U.S. See OECD, "Action Plan on Base Erosion and Profit Shifting," available at: https://www.oecd.org/ctp/BEPSActionPlan.pdf. Since that publication the OECD's intent has been clarified as a focus on the use of captive insurance by industrial groups.

5 "Testimony of William R. Berkley," September 26, 2007, p. 9, available at: http://www.coalitionfordomesticinsurance.com/cms/upload/resources/Berkley_Testimony_Final.pdf.

6 For instance, W.R. Berkley Group, one of the strongest advocates of H.R. 3424, makes extensive use of affiliate reinsurance: 17 of the 22 companies in the Berkley group reinsure most of their business with affiliates. Missie Tessier, "Neal Bill Opponents Respond to Inaccurate and Misleading Berkley Statements," Coalition for Competitive Insurance Rates, July 15, 2009, available at: http://www.keepinsurancecompetitive.com/press-releases/2009/7/15/neal-bill-opponents-respond-to-inaccurate-and-misleading-ber.html.

- Reduce the supply of reinsurance, as measured by the insurance premiums, in the U.S. by $18 billion, which represents 13 percent of *all* reinsurance and nearly 30 percent of reinsurance ceded by foreign insurers (non-affiliated as well as affiliated). All of the reductions come from the long-return lines of insurance. Among these lines, the reduction represents 39 percent of all reinsurance ceded by foreign insurers;[7]
- Reduce the supply of primary insurance in the U.S. by 1.4 percent, and by 1.8 percent of all long-return lines;
- Increase the price of primary insurance by 0.8 percent overall, and by 6 percent in some lines of business;
- Reduce the insurance coverage by 2.2 percent overall, and by 17 percent in some lines of business; and
- As a result of higher prices, require U.S. consumers to pay $5 billion more per year to obtain the same insurance coverage.

We extend our analysis to measure the variation in the effects of the tax across states. First, we apply the estimated nationwide impact to individual states, based on the value of premiums written in each state. We present these results for all 50 states and 15 lines of business in the report (impacts for all 50 states and District of Columbia are contained in Appendix B). Second, we rely on the distribution of hurricane risks among several coastal states to allocate the nationwide impact. We illustrate the impact for 7 states and 2 lines of business in the report.

This paper also explores the impact of the border adjustment tax, contained in House Republican's Blueprint tax reform platform. Viewed independently from the Blueprint's other components, we predict that the border adjustment tax is likely to have a far larger adverse impact on the U.S. insurance market and insurance consumers than that of the Warner/Neal Bill.

We conclude that the new proposals would lead to a degradation of the ability of firms to manage risk, both inside and outside of the P&C industry, and widen the protection gap between insured and uninsured losses. The financial burden of excess catastrophe risk, in particular, would likely fall more heavily on the government.

The report is organized as follows. In the next section (Section II), we discuss the P&C industry and the important role of reinsurance in the U.S. Section III explains the economic rationale for affiliate reinsurance, and summarizes the current tax treatment of offshore affiliate reinsurance transactions and the new proposals. In Section IV, we present our

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[7] We limit reductions in reinsurance to those lines of business that have a long-return period, which include natural disaster lines and other long-tail lines.

analysis of the economic impact of the proposed Warner/Neal Bill and the border adjustment provision of the Blueprint. (We provide a more technical description of our methodology in Appendix A.) In Section V, we look at the state-level impact of the proposed tax. Finally, in Section VI, we offer a brief conclusion.

II. P&C Insurance and the Role of Reinsurance

Property and casualty insurance protects businesses, homeowners and others against a wide range of risks, including earthquakes and hurricanes, crop failure, workers' compensation claims, and general liability including class action lawsuits. In 2015, U.S. P&C insurers wrote $591 billion in direct premiums and incurred $297 billion in claims and $146 billion in underwriting expenses.[8]

This section begins with a historical review of the U.S.'s significant exposure to natural and man-made disasters (Section II.A).[9] We then describe the critical role played by reinsurance, in particular foreign reinsurers, in alleviating the U.S. losses from natural and man-made catastrophes (Section II.B). Section II.C provides systematic information about the role played by foreign insurers and reinsurers in the U.S. P&C insurance market.

A. The U.S. Exposure to High-Severity Low-Frequency Risks

Insurance companies attempt to manage risks so that, on average, the premiums they collect minus their expenses equal or exceed the present value of their losses (*i.e.*, their claims payments). Some risks such as automobile insurance can be measured relatively easily. For instance, millions of automobile drivers are insured every year and insurance companies can predict the annual rate of accidents and injuries and the magnitude of losses with a great deal of accuracy. Other risks, such as earthquakes and class action lawsuit awards which occur infrequently but impose catastrophic losses, are harder to predict and manage.

The U.S. P&C insurance market is broken down into 33 direct lines of business (see Figure 1 for the top 10 lines and Table 2 for all lines). Many of these lines, such as homeowner multiple peril (HMP) and commercial multiple peril (CMP), are at risk for catastrophic losses.

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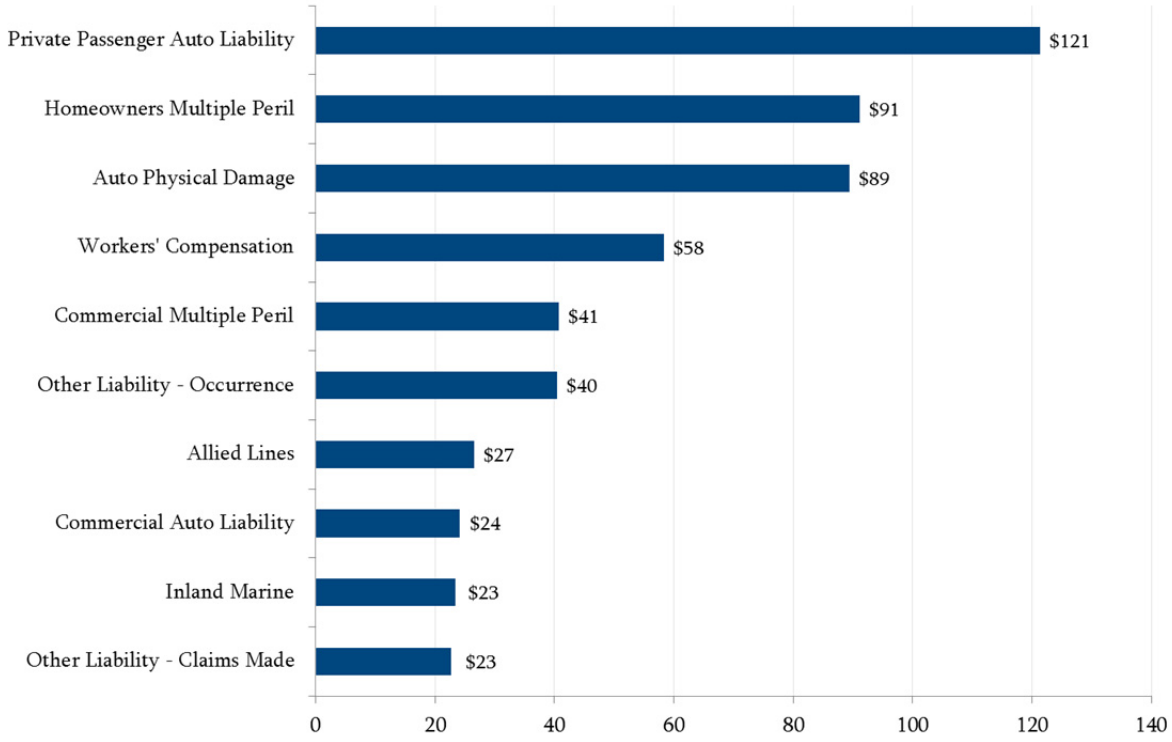
[8] A.M. Best, Best's Aggregates & Averages-Property/Casualty-United States & Canada, 2016 Edition, p. 3.

[9] See FIO, Report Providing an Assessment of the Current State of the Market for Natural Catastrophe Insurance in the United States, September 2015, for definitions of natural catastrophes.

Figure 1. Top 10 Insurance Lines in 2015 (by Direct Premiums Written, $ Billions)



Source: NAIC.

Compared to the rest of the world, the U.S. incurs the most insured losses associated with natural disasters, as well as other liability-related claims such as medical malpractice and product liabilities. As we later discuss, these lines will be most affected by the Warner/Neal Bill.

1. Natural Catastrophes

Natural disasters such as hurricanes and earthquakes have two unique features compared to other lines of insurance:[10]

1. Fat-tailed distribution: Natural disasters occur infrequently, but the resulting losses are often devastating. Therefore, the insurer has to either maintain significant capital to cover potential catastrophic losses or use extensive reinsurance.
2. Correlated losses: Natural catastrophe causes widespread losses with many policyholders simultaneously suffering losses. This makes geographic diversification

[10] Tristan Nguyen, Insurability of Catastrophe Risks and Government Participation in Insurance Solutions, Background Paper prepared for the Global Assessment Report on Disaster Risk Reduction 2013, The United Nations Office for Disaster Risk Reduction, p. 3, available at: http://www.preventionweb.net/english/hyogo/gar/2013/en/bgdocs/Nguyen,%202012.pdf.

across countries through reinsurance even more critical, so that premiums in one area of the world can be used to cover losses in another. The U.S. experiences many different types of natural disasters each year spread across much of the nation. According to a recent report by the Federal Insurance Office of the U.S. Treasury Department ("FIO"), ten different states accounted for a third of major disaster declarations between 1953 and 2014.[11]

Prior to 1989, the U.S. insurance industry had never suffered a loss of more than $1 billion from a single disaster.[12] That year, Hurricane Hugo caused insurance losses of $7 billion,[13] and numerous catastrophes since then, most of them natural disasters, have surpassed Hugo, as shown in Figure 2. In 1992, Hurricane Andrew caused $24 billion in insured losses in Florida and Louisiana, and State Farm's losses alone ($4.6 billion) were equal to the entire capital of State Farm P&C at the time.[14] In 1994, insured residential losses from the Northridge earthquake in southern California totaled $14 billion, exceeding the cumulative dollars ever collected for earthquake insurance in the state.[15] In 2005, the trio of hurricanes that hit Florida and the Gulf Coast (Wilma, Rita, and Katrina) totaled $68 billion in insured losses.[16] In 2012, Hurricane Sandy caused $20 billion in insured losses, a majority of which were incurred in New York and New Jersey, states that had not incurred hurricane damage in several decades.[17] 2012 was the third costliest year for insured disaster losses in U.S. history.

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[11] These states are Alabama, Arkansas, California, Florida, Kentucky, Louisiana, Missouri, New York, Oklahoma, and Texas. Natural catastrophes in these states include severe storms, flooding, hurricanes/tropical storms, tornadoes, wildfires, and earthquakes. FIO, Report Providing an Assessment of the Current State of the Market for Natural Catastrophe Insurance in the United States, September 2015, p. 8.

[12] Paul R. Kleindorfer and Howard C. Kunreuther, "Challenges Facing the Insurance Industry in Managing Catastrophic Risks" in "The Financing of Catastrophe Risk," January 1999, p. 149.

[13] Insurance Information Institute, "Hurricanes," available at http://www.iii.org/fact-statistic/hurricanes. Reported in 2015 dollars.

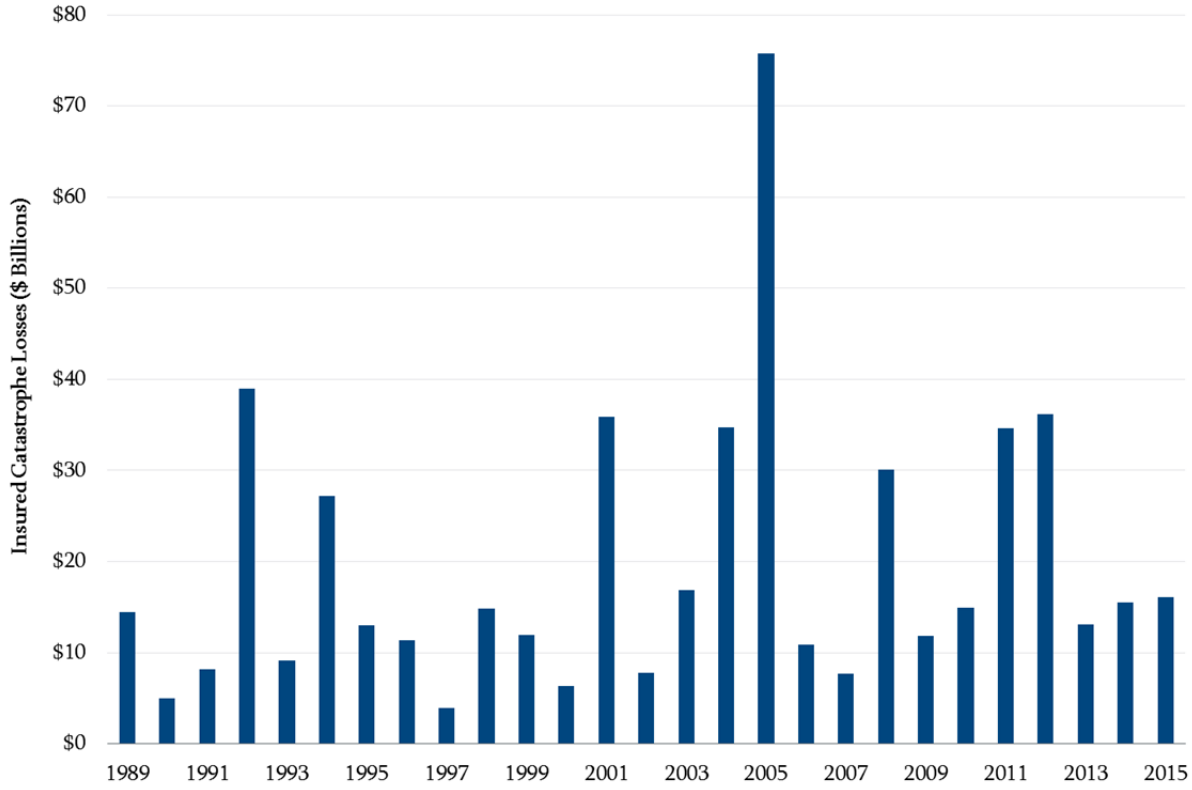
[14] Insurance Information Institute, "Hurricanes," available at http://www.iii.org/fact-statistic/hurricanes. Reported in 2015 dollars. Raymond James, "Florida Hurricane Catastrophe Fund: Financing Observations and Perspective," presented to Florida Insurance Council, 2009 Summer Insurance Symposium, June 2, 2009, p. 11.

[15] Raymond James, "Florida Hurricane Catastrophe Fund: Financing Observations and Perspective," presented to Florida Insurance Council, 2009 Summer Insurance Symposium, June 2, 2009, p. 11.

[16] Insurance Information Institute, "Hurricanes," available at http://www.iii.org/fact-statistic/hurricanes. Reported in 2015 dollars.

[17] Insurance Information Institute, "Catastrophes: U.S.," available at http://www.iii.org/fact-statistic/catastrophes-us.

Figure 2. U.S. Insured Catastrophe Losses ($ Billions, 2015 Dollars)



Source: Insurance Information Institute.

In fact, 5 of the 10 most expensive events in U.S. history occurred over the past decade.[18] According to Insurance Information Institute, catastrophe losses in the U.S. between 1994 and 2013 are attributable largely to weather-related events such as hurricanes and tropical storms (41.1 percent), tornados (36.0 percent), and winter storms (6.4 percent).[19] Moreover, losses have risen due to rising wealth and increased population concentration in exposed areas such as coastal and earthquake-prone states (Figure 3). In 2012, New York and Florida ranked as the two states most exposed to hurricane losses, each with about $2.9 trillion in insured coastal exposure. Texas is ranked third with $1.175 trillion. The insured value of all coastal property was $10.6 trillion in 2012, up 20 percent from $8.9 trillion in 2007 and up 48 percent from $7.2 trillion in 2004.[20] The losses from natural disasters will almost certainly continue to grow because of the residential and commercial development that has occurred

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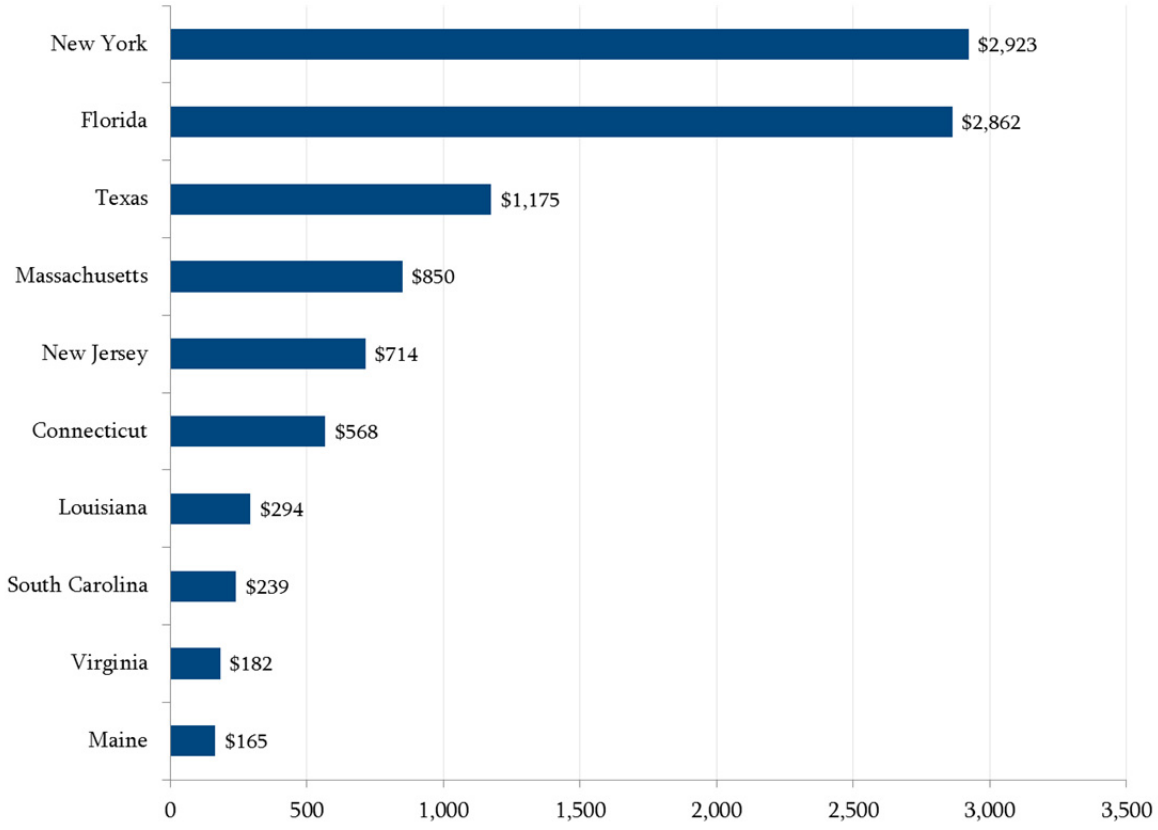
[18] Insurance Information Institute, "Briefing on the Property/Casualty Insurance Industry: Function and Financial Overview," January 29, 2015, p. 25.

[19] Insurance Information Institute, "Briefing on the Property/Casualty Insurance Industry: Function and Financial Overview," January 29, 2015, p. 24.

[20] Insurance Information Institute, "Briefing on the Property/Casualty Insurance Industry: Function and Financial Overview," January 29, 2015, p. 26.

along coastlines. According to U.S. Census Bureau forecasts, the population in hurricane-exposed states will increase by 36.3 percent between 2000 and 2030, which is faster than other areas of the U.S.[21] As the FIO stated in 2014, "several studies have shown, for example, that many natural disasters which occurred in the past (and which are capable of repetition) would be far more costly were they to occur today, and that in general loss severity from natural catastrophes will continue to grow."[22] For instance, RMS projected that the 1-in-100 loss for Florida is over $110 billion, with a projected annual catastrophe loss of nearly $9 billion.[23]

Figure 3. U.S. Insured Coastal Exposure in 2012 ($ Billions)



Source: AIR Worldwide.

[21] Robert P. Hartwig and Claire Wilkinson, "Residual Market Property Plans: From Markets of Last Resort to Markets of First Choice," Insurance Information Institute, September 2009, p. 12.

[22] FIO, "The Breadth and Scope of the Global Reinsurance Market and the Critical Role Such Market Plays in Supporting Insurance in the United States," December 2014, p. 17.

[23] Dowling & Partners, IBNR Weekly, October 6, 2016, p. 2.

2. Commercial Liability

In addition to catastrophe losses, the U.S. is by far the largest commercial liability insurance market in the world (Table 1), accounting for 52 percent of the worldwide market in 2014 ($86.6 out of $165 billion). Premiums spent on commercial liability coverage in the U.S. represent 0.52 percent of GDP, more than any other country.

Table 1. Top 10 Largest World Commercial Liability Markets (2014)

Rank	Country	Direct Premiums Written ($ billions)	GDP ($ billions)	Premiums/GDP
1	**United States**	**86.6**	**16,805**	**0.52%**
2	United Kingdom	10.6	2,714	0.39%
3	Germany	8.6	3,752	0.23%
4	France	6.7	2,813	0.24%
5	Japan	6.3	4,913	0.13%
6	Canada	5.0	1,831	0.27%
7	Italy	5.0	2,134	0.23%
8	Australia	4.9	1,501	0.33%
9	China	4.2	9,603	0.04%
10	Spain	2.1	1,370	0.15%
	Top 10	**140**	**47,435**	**0.30%**
	World	**165**	**77,400**	**0.21%**

Source: Swiss Re. Available at http://www.iii.org/fact-statistic/product-liability. The ranking is based on the direct premiums written on commercial liability in each country.

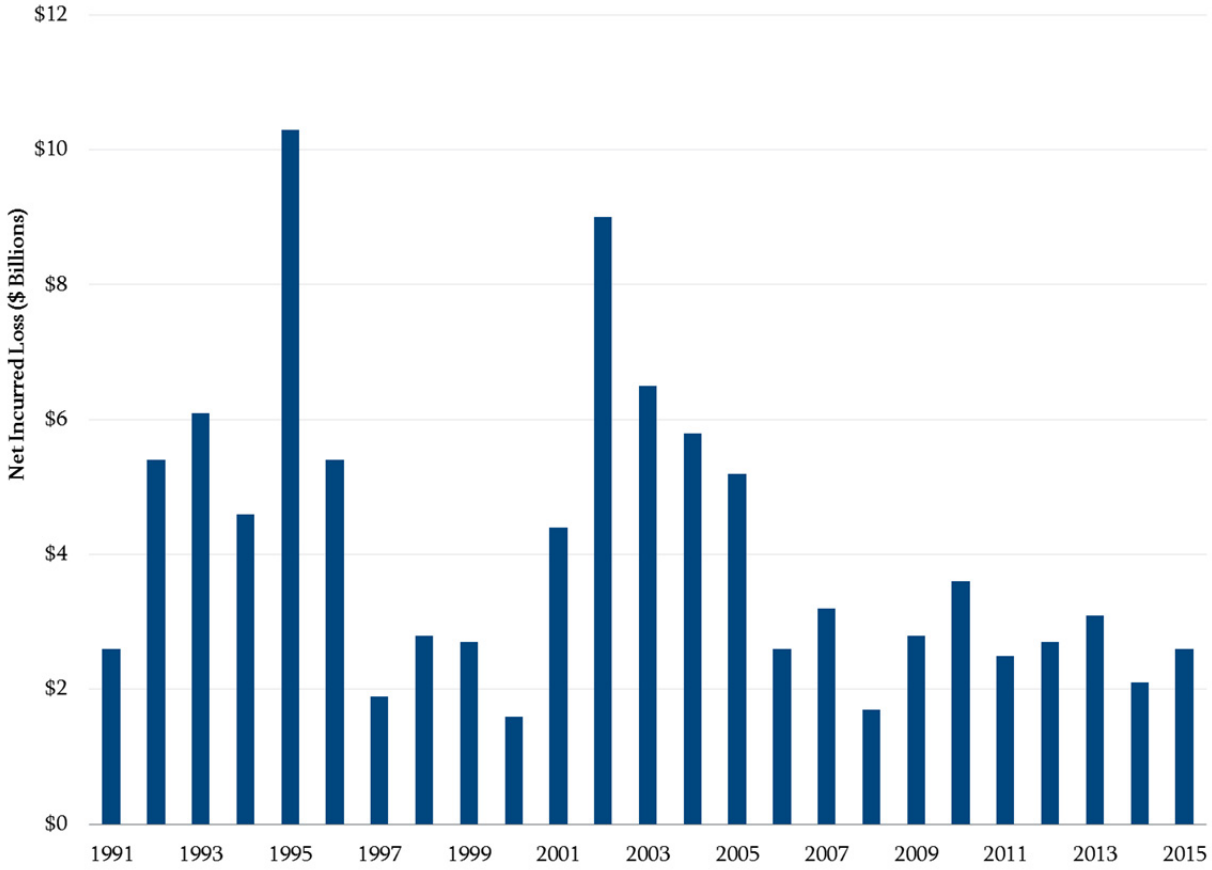
The U.S. P&C industry has experienced several liability crises in recent decades, for example due to asbestos and environmental (A&E) litigation.[24] U.S. businesses continue to face significant commercial liability exposure from perils including professional errors and omissions, directors and officers liability, general liability, products liability, and many others.

Like natural catastrophes, many commercial liability risks in the U.S. are characterized by high severity and low frequency. For example, since 1991 when insurers first separately disclosed their A&E exposures, the U.S. P&C industry has incurred $122 billion of losses, and paid out $96 billion, leaving $26 billion of reserves remaining. (Out of the total, asbestos accounted for $82 billion of the losses.) This $122 billion of incurred losses was about twice the total industry surplus in 1984 when the A&E risk was first recognized ($147 billion in

[24] See, *e.g.*, Swiss Re, "Commercial liability: a challenge for businesses and their insurers," Sigma No. 5/2009, pp. 23-24.

today's dollars).[25] Moreover, A&E exposure is more volatile than any other legal liability (Figure 4) and hard to predict. A.M. Best has recently increased its loss estimate for asbestos claims by approximately 18 percent to $100 billion.[26] Furthermore, the payout period after the insured event occurs can take more than 10 years.[27]

Figure 4. U.S. Industry A&E Net Incurred Loss



Source: Dowling & Partners, IBNR Weekly, September 15, 2016, p. 9.

Insurance for cyber risk is becoming more prevalent, but like A&E insurance, future risk exposure faced by insurers is highly uncertain. According to one industry insider, "the cyber market now is where the natural catastrophe market was in the early 2000s." While previously in the natural catastrophe market, reinsurers knew there would be a certain number of storms over the course of the year, the information for cyber was more anecdotal

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25 Dowling & Partners, IBNR Weekly, September 15, 2016, p. 9.

26 Press release for A.M. Best Special Report: A.M. Best Increases Estimate for Net Ultimate U.S. Asbestos Losses to $100 Billion, November 28, 2016.

27 IRS Revenue Procedure 2015-52, Loss Development, available at https://www.irs.gov/pub/irs-drop/rp-15-52.pdf.

than data-led.[28] Further, many reinsurers are not adequately prepared for, or even aware of so-called "silent" cyber risks, which refer to cyber risks that many existing insurance policies do not explicitly exclude.[29]

B. Reinsurance For U.S. P&C Risks

Given the unique characteristics of natural catastrophes, insurers use a number of methods to manage their risk exposures. Some avoid certain risks, some use capital and reinsurance, and others use alternative methods such as catastrophe bonds to transfer risk.[30] In this paper we focus on the role of reinsurance in managing insurance risks. There are two types of reinsurance: proportional and non-proportional. With proportional (or quota share) reinsurance, the reinsurer provides insurance for a fixed percentage of the primary insurer's losses. With non-proportional reinsurance, the reinsurer agrees to cover losses above a pre-determined threshold up to a pre-determined cap.

Reinsurance helps support the availability and affordability of natural catastrophe insurance in the U.S. A major earthquake, for example, is likely to affect the entire portfolio of a primary insurer, leading to thousands of claims in different lines of business, such as motor, business interruption and private property insurance. Without reinsurance, an insurance company may not be able to cover all correlated claims from such a concentrated event.

The extent to which U.S. P&C insurers rely on reinsurance as of year-end 2015 is illustrated in Table 2 on a line-by-line basis. Reinsurance (both affiliate and non-affiliate) is approximately 21 percent of total premiums written. For property lines of insurance, the average utilization is 18 percent for unaffiliated reinsurers, and is as high as 43 percent for allied lines.

Because the U.S. represents roughly half of the insured risk worldwide,[31] U.S. insurers rely on foreign reinsurance to more effectively diversify their U.S. risks and to provide greater amounts of coverage to U.S. consumers at more affordable prices. Reinsurance is a global industry, consisting of approximately 50 large, professional reinsurers and reinsurance groups such as Berkshire Hathaway, Swiss Re, Munich Re, XL Catlin, and several Lloyd's of London

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28 Dowling & Partners, IBNR Weekly, September 15, 2016, p. 6.

29 The Bank of England (BoE) Prudential Regulation Authority (PRA), Cyber Insurance Underwriting Risk, Consultation Paper, CP39/16, November 2016, p. 12.

30 As noted in FIO (2014), p. 6, the alternative risk insurance market gain popularity during the 2000s as additional ways to protect against increasing losses from catastrophes. In the first half of 2014, it contributed to 6 percent of total capitalization of the reinsurance industry. However, the long-term commitment of non-traditional capital sources has not yet been tested: few cat bonds to date have experienced major losses (*ibid.*, p. 42).

31 See Table 1 and Figure 5.

syndicates, as well as many smaller reinsurers.[32] Since the core business of global reinsurers is "the reinsurance of peak risks originally assumed by primary insurers—*i.e.*, risks with low probabilities of occurrence, but high severities,"[33] foreign reinsurance is critical to provide protection for U.S. natural catastrophes.

Table 2. 2015 P&C Reinsurance Utilization by Line of Insurance ($ Millions)

	Lines	Direct Business	Reinsurance Assumed		Reinsurance Ceded		Net Premiums Written	Reins Utilization	Unaffiliated Rein Utilization
			From Affiliates	From Non-Affiliates	To Affiliates	To Non-Affiliates			
		[1]	[2]	[3]	[4]	[5]	[6] = [1]+[2]+[3]	([4]+[5])/ ([1]+[2]+[3])	[5]/ ([1]+[2]+[3])
1	Fire	13,210	1,792	2,674	2,592	3,435	11,649	34.1%	19.4%
2	Allied lines	26,590	792	3,236	3,356	13,152	14,110	53.9%	43.0%
3	Farmowners multiple peril	4,078	206	121	265	373	3,766	14.5%	8.5%
4	Homeowners multiple peril	91,184	1,210	3,034	3,369	9,927	82,133	13.9%	10.4%
5	Commercial multiple peril	40,757	1,799	1,785	2,597	5,209	36,534	17.6%	11.7%
6	Mortgage guaranty	4,871	17	117	139	185	4,682	6.5%	3.7%
8	Ocean marine	3,793	658	517	740	1,281	2,947	40.7%	25.8%
9	Inland marine	23,424	392	700	1,616	11,354	11,546	52.9%	46.3%
10	Financial guaranty	543	(1)	16	94	45	419	24.9%	8.1%
11.1	Medical professional liability - occurrence	2,400	219	146	143	134	2,489	10.0%	4.9%
11.2	Medical professional liability - claims-made	7,425	184	384	740	842	6,411	19.8%	10.5%
12	Earthquake	2,351	22	326	498	538	1,663	38.4%	19.9%
13	Group accident and health	4,591	869	768	909	527	4,792	23.1%	8.5%
14	Credit accident and health (group and individual)	171	23	1	26	130	39	80.2%	66.7%
15	Other accident and health	1,924	722	1,392	272	205	3,561	11.8%	5.1%
16	Workers' compensation	58,381	2,811	2,614	7,605	6,868	49,333	22.7%	10.8%
17.1	Other liability - occurrence	40,459	2,580	4,009	6,928	10,288	29,832	36.6%	21.9%
17.2	Other liability - claims-made	22,638	876	2,128	3,923	3,451	18,268	28.8%	13.5%
17.3	Excess workers' compensation	1,182	1	171	258	167	928	31.4%	12.3%
18.1	Products liability - occurrence	3,163	614	128	1,079	291	2,535	35.1%	7.4%
18.2	Products liability - claims-made	514	72	11	133	104	360	39.8%	17.5%
19.1	Private passenger auto liability	121,315	1,399	3,359	2,506	5,290	118,277	6.2%	4.2%
19.3	Commercial auto liability	24,172	741	1,155	2,160	2,382	21,527	17.4%	9.1%
21	Auto physical damage	89,429	1,642	1,547	4,735	2,940	84,943	8.3%	3.2%
22	Aircraft (all perils)	1,612	128	299	432	674	933	54.2%	33.1%
23	Fidelity	1,266	96	59	87	123	1,212	14.7%	8.6%
24	Surety	5,726	337	498	753	486	5,321	18.9%	7.4%
26	Burglary and theft	287	13	17	52	25	240	24.3%	8.0%
27	Boiler and machinery	1,846	191	1,384	887	795	1,739	49.2%	23.2%
28	Credit	1,878	114	206	624	504	1,069	51.4%	22.9%
29	International	70	11	69	38	30	82	45.3%	20.3%
30	Warranty	3,217	389	51	1,042	1,341	1,273	65.2%	36.7%
31	Reinsurance - Nonproportional Assumed Property	XXXX	1,948	10,149	3,298	802	7,998		
32	Reinsurance - Nonproportional Assumed Liability	XXXX	299	5,489	1,313	191	4,285		
33	Reinsurance - Nonproportional Assumed Financial Lines	XXXX	6	201	50	2	156		
34	Aggregate write-ins for other lines of business	1,429	5	51	259	153	1,072	27.8%	10.3%
35	**Totals**	**605,896**	**23,176**	**48,809**	**55,517**	**84,245**	**538,119**	**20.6%**	**12.4%**

Source: NAIC data.

The critical reliance on foreign reinsurance for natural catastrophes and costly legal liabilities can be seen in several ways. First, the U.S. accounted for more than half of worldwide insured losses from natural catastrophes between 2005 and 2015 (Figure 5). Its annual share

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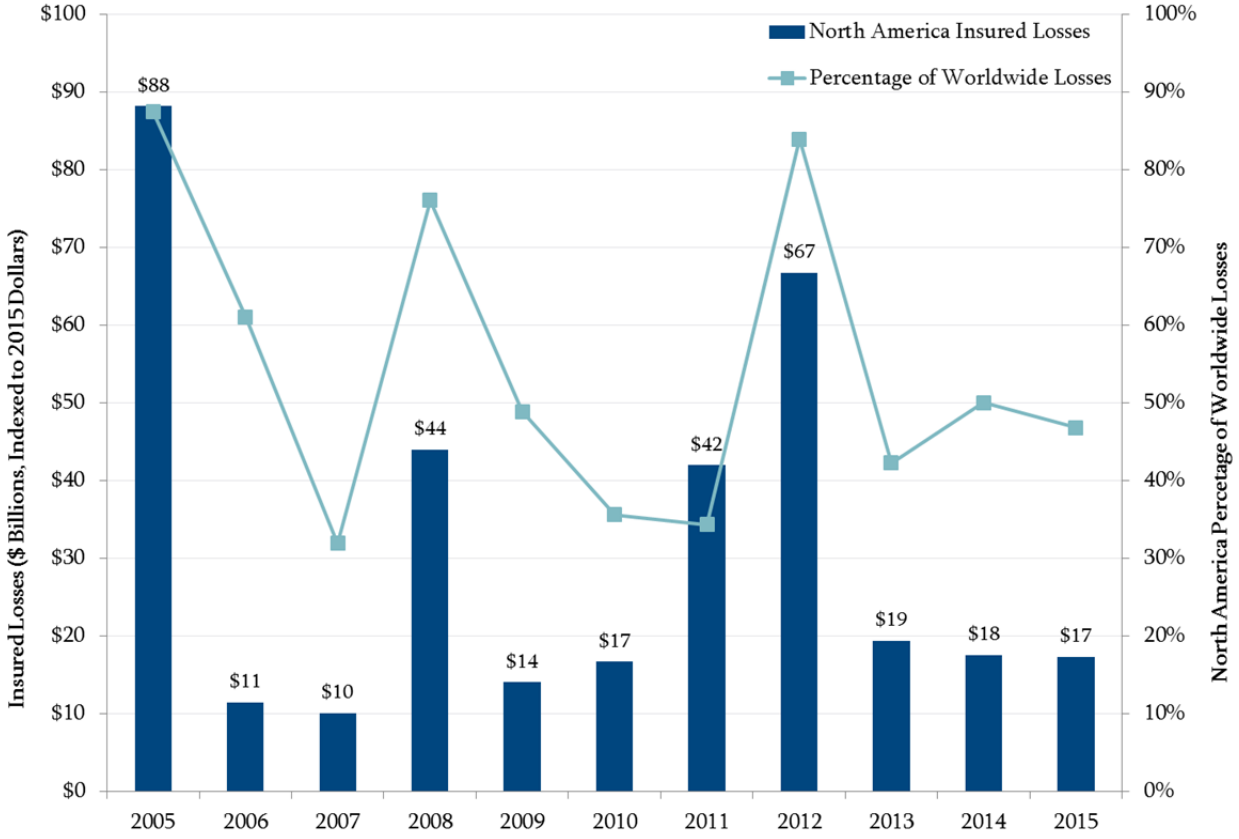
32 A.M. Best regularly addresses the "Top 50 Global Reinsurance Groups." *See* A.M. Best, Global Reinsurance—Segment Review: Innovation: The Race to Remain Relevant, September 5, 2016, p. 6, available at http://www.naic.org/documents/cipr_events_impact_rating_amb_globe.pdf.

33 International Association of Insurance Supervisors, Reinsurance and Financial Stability, July 19, 2012, p. 19.

of the worldwide insured losses ranges from 32 percent in 2007 to close to 90 percent in 2012.

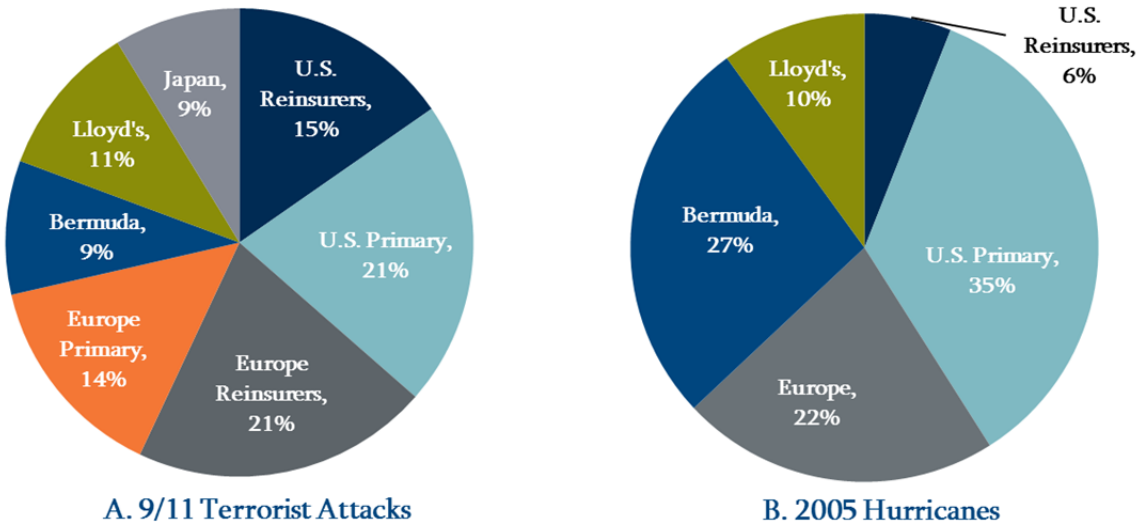
Figure 5. North America Insured Catastrophe Losses (2005 - 2015)



Source: Swiss Re, Natural Catastrophes and Man-Made Disasters.

Second, U.S. businesses and customers have recovered tens of billions of dollars of losses from foreign insurers and reinsurers. Figure 6 shows the regional distribution of insurance payments for the U.S. 9/11 terrorist attacks and 2005 hurricane trio (Wilma, Rita, and Katrina). In each case, almost 60 percent of the insurance payments came from foreign insurers and reinsurers.

Figure 6. Distribution of 9/11 and 2005 Hurricane Insurance Payments



Source: 9/11: GFIA, Affiliate Reinsurance Does Not Present Base Erosion Concerns Which May be Present in Other Cross-border Transaction, 2013; 2005 (Wilma, Rita, and Katrina): J. David Cummins, "The Bermuda Insurance Market: An Economic Analysis," 2008.

Finally, anecdotal evidence suggests that the fraction of foreign reinsurance is higher for high-risk lines of business, such as commercial liability insurance, homeowners insurance in catastrophe-prone states, earthquake insurance, and reinsurance covering extreme losses. For example, foreign reinsurers account for two-thirds of U.S. property catastrophe reinsurance.[34] In the state of Florida, Bermuda reinsurers provided 70 percent of the private reinsurance to the Florida homeowner insurers in 2008, and foreign reinsurers altogether provided 94 percent.[35] More recent statistics published in 2016 show that 91 percent of private insurance for Florida homeowner insurers is from international reinsurers, and 32 of the 38 top reinsurers providing coverage in Florida are international. Similarly, 98 percent of the reinsurance to the Florida government safety-net, the Florida Citizens Property Insurance Corp, is provided by international reinsurers.[36]

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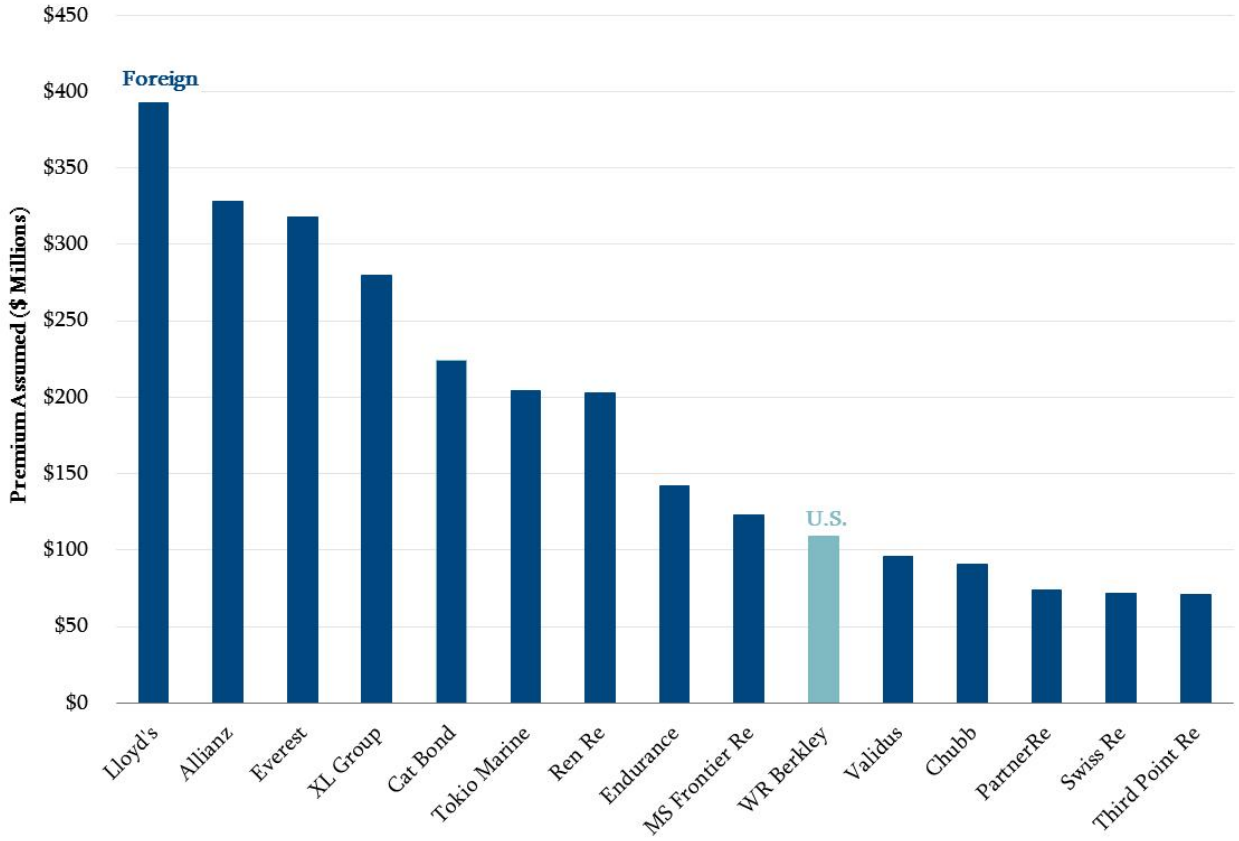
[34] Donald Kramer, "Statement of the Association of Bermuda Insurers and Reinsurers," Hearing before the Senate Finance Committee, September 26, 2007, p. 2, available at: http://www.finance.senate.gov/imo/media/doc/092607testdk.pdf?.

[35] Raymond James, *op cit*, p. 4. As will be discussed further in Section V below, Florida's property catastrophe risk insurance relies heavily on state-sponsored reinsurance through Florida Hurricane Catastrophe Fund.

[36] Dowling & Partners, IBNR Weekly #15, April 21, 2016, pp. 2, 7, 9.

Figure 7. Top Reinsurers Assuming Florida Business in 2015



Source: Dowling & Partners, IBNR Weekly, October 6, 2016, at p. 6. Most Cat Bonds are issued in foreign jurisdictions.

In 2014, more than 60 percent of the reinsurance purchased by U.S. insurers came from foreign-based reinsurers or subsidiaries of reinsurers, and 92 percent came from foreign-owned reinsurers or U.S. subsidiaries of these reinsurers.[37]

Figure 8 shows the total ceded premiums and net recoverables, broken down by domicile of reinsurer. In 2014, total premiums ceded offshore were $72.5 billion, and the net recoverables totaled $116.2 billion. Bermuda, the United Kingdom, and Germany were the top 3 domiciles for reinsurance. In particular, during the 1990s and 2000s, the growth of Bermuda reinsurance played a prominent role in providing reinsurance following major U.S. natural catastrophes.[38]

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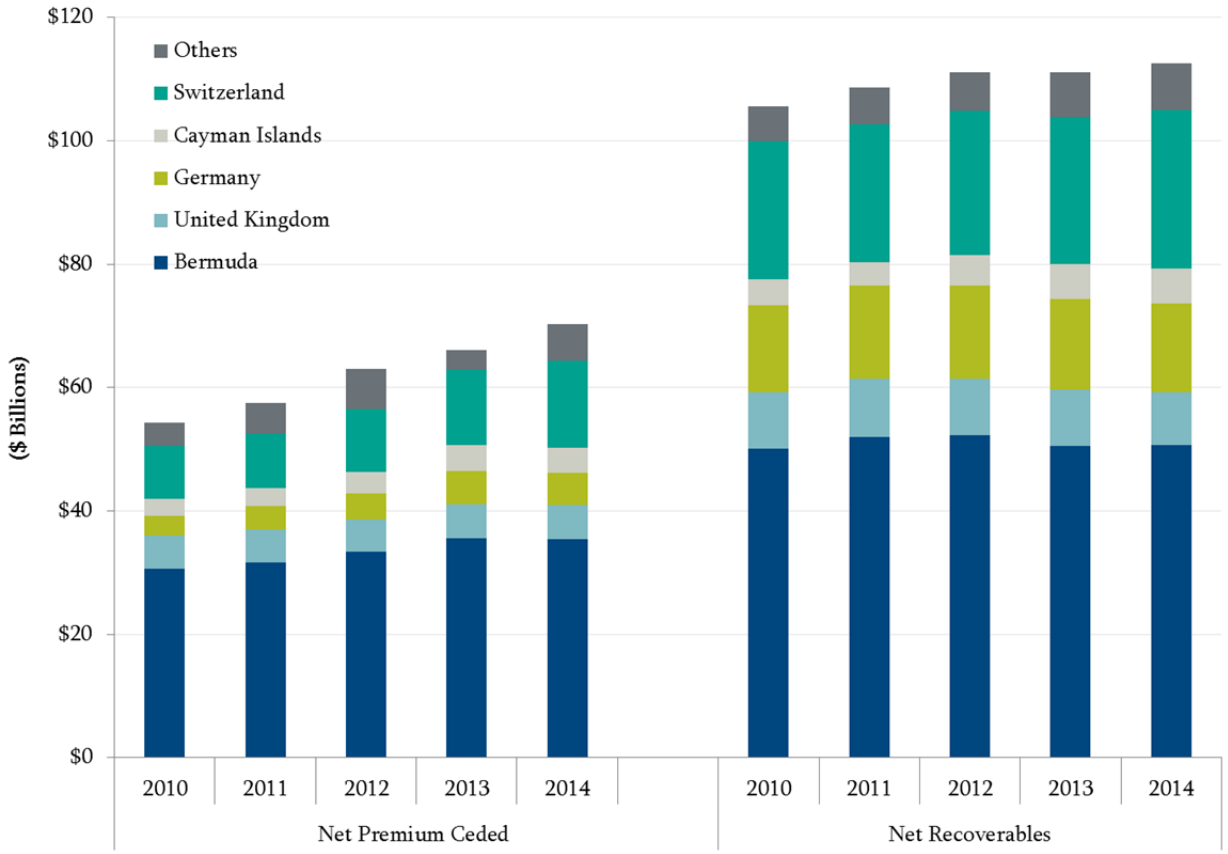
[37] Reinsurance Association of America, Offshore Report, 2014, available at http://www.reinsurance.org/uploadedFiles/RAA/Industry_Data_Center/Offshore_Report_2011_Data/Offshore_Report_2014data.pdf

[38] FIO, "Report Providing an Assessment of the Current State of the Market for Natural Catastrophe Insurance in the United States," September 2015, p. 47.

Figure 8. U.S. Reinsurance Ceded Offshore (Affiliates and Non-Affiliates)



Source: Reinsurance Association of America.

C. The Role of Foreign Insurers for the U.S. Catastrophic Risks

More broadly, foreign insurers are important providers of primary insurance, especially for high-severity, low-frequency risks, in U.S. markets. The P&C insurance industry includes more than 1,300 primary insurer groups and independent insurers.[39] Out of the top 25 insurer groups, which account for 70 percent of U.S. direct insurance and operate over 500 insurance subsidiaries (Figure 9),[40] five are foreign-owned insurers. Overall, foreign-owned insurer groups and independent companies underwrite 15 percent of the U.S. direct insurance (Figure 9).

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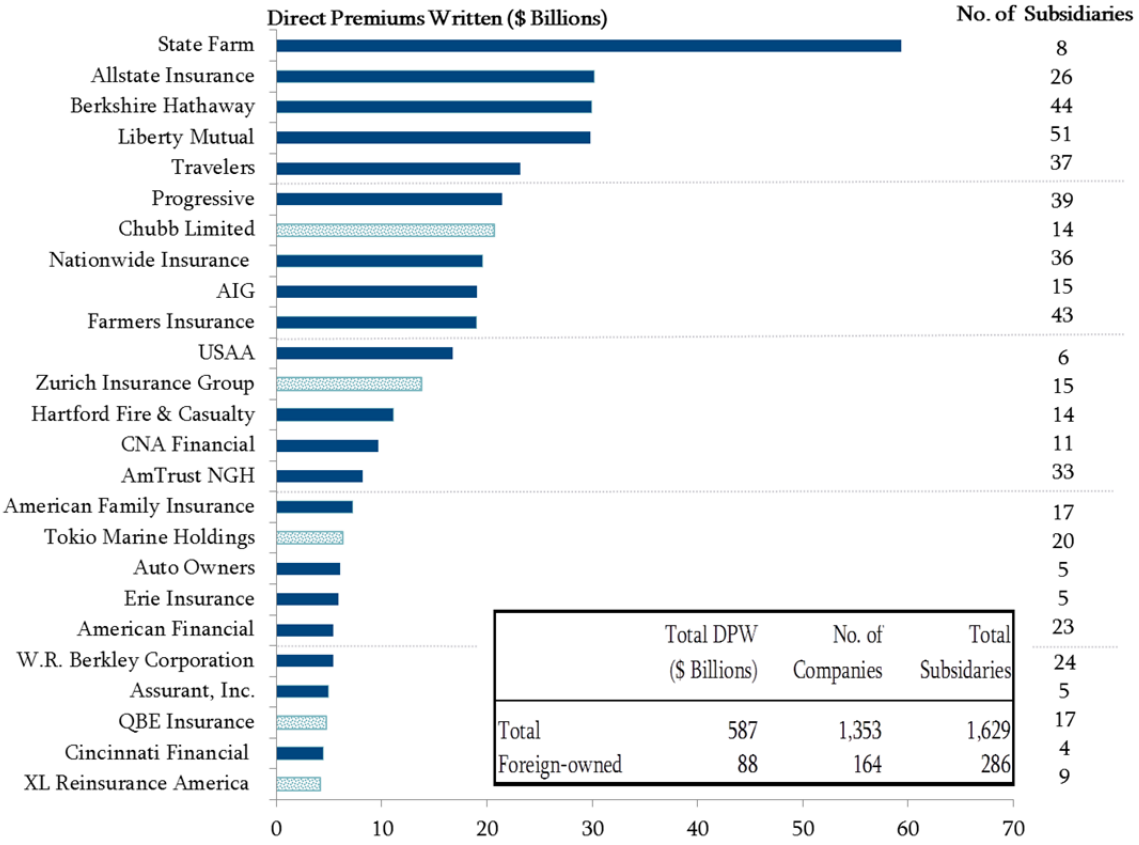
[39] Some insurers specialize in single lines to benefit from their underwriting edge or experience in that line. Multi-line insurers benefit from increased product diversification and the ability to serve as a one-stop shop for consumers (lowering consumer transaction costs).

[40] Insurance groups in the U.S. often establish subsidiaries or branches in the local markets to comply with state-level insurance regulatory law and to enhance better client relationships. Some may exist due to past acquisitions.

Figure 9. Top 25 Insurance Groups in the U.S. —Ranked by Direct Premiums Written in 2015

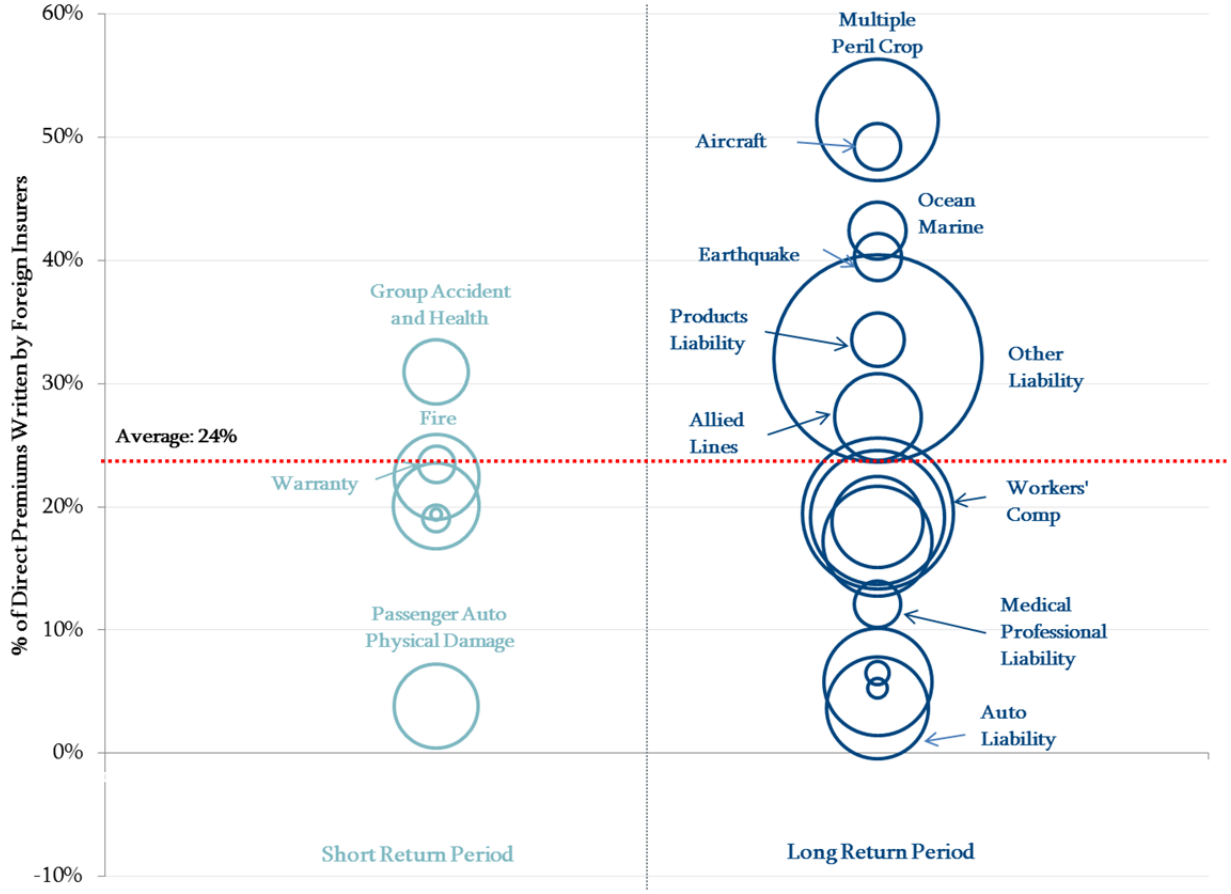


Source: NAIC.

Note: Groups highlighted light blue are foreign owned. Foreign ownership is defined as 50 percent ownership. Berkshire Hathaway includes its insurance/reinsurance businesses only.

Foreign insurers focus more on insuring against two types of events compared to U.S. insurers: (1) infrequent but high impact lines such as natural disasters (Section II.B); and (2) insurance lines such as products liability where there can be a significant time lag between when a reinsurance period is entered into and when the recoverable is received. We refer to these lines collectively as long-return period lines. For the long-return lines, investment returns earned during the time lag between premiums inflows and claims outflows are critical to offering affordable reinsurance and insurance to the U.S. Figure 10 shows the percentage of total direct premiums written by foreign-owned groups in the U.S. for each insurance line. In 2015, foreign-owned groups comprised more than 20 percent of premiums for 21 different insurance lines out of 33 lines, many of which have long-return periods. For example, foreign groups represented 43 percent of the direct premiums for Ocean Marine insurance, and 40 percent for Earthquake. Prior years showed similar results.

Figure 10. Percent of Direct Premiums Written by Foreign-Owned Groups (2015)



Source: NAIC.

Note: Diameter of circle represents amount of direct premiums written by foreign-owned groups.

The importance of foreign insurers can further be seen in selected coastal states. Take commercial multiple peril as an example.[41] As shown in Figure 11, foreign insurers represent a large portion of U.S. commercial multiple peril insurance in many states vulnerable to hurricanes. In Florida alone, four large foreign insurance groups (Zurich, Chubb, QBE, and Swiss Re) underwrote 18.7 percent of CMP premiums in 2015.[42]

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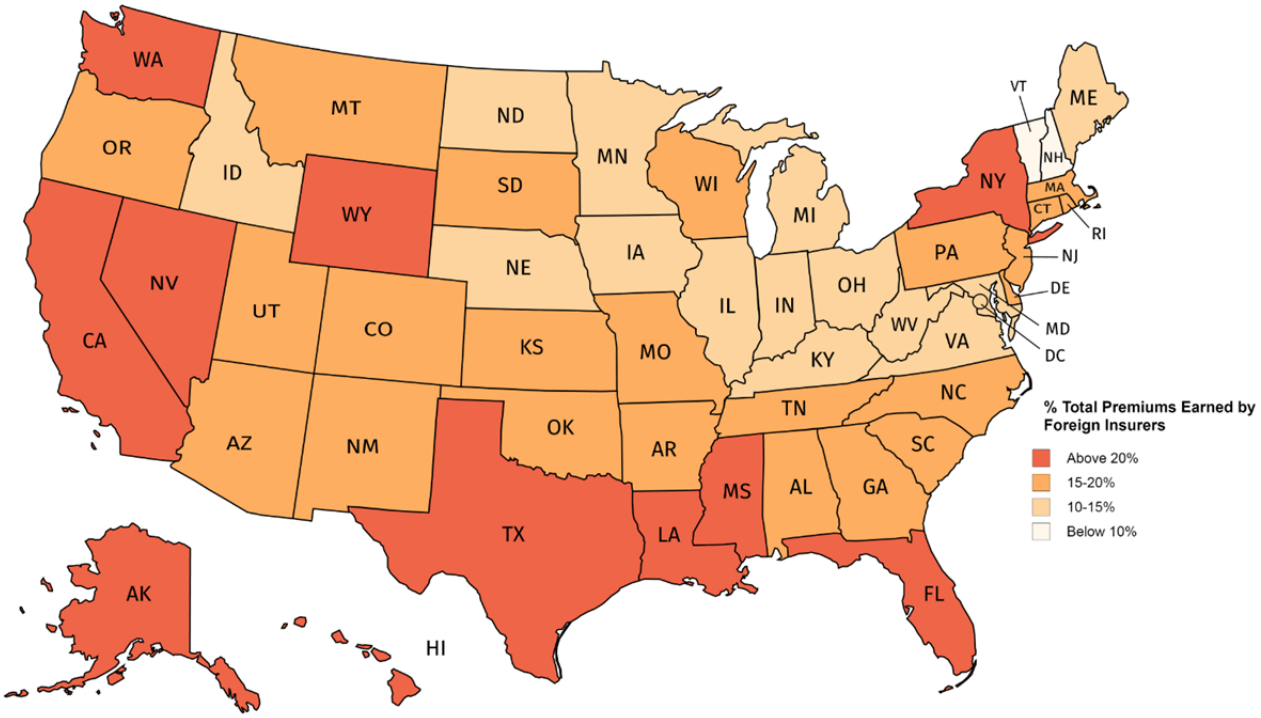
41 According to the Insurance Information Institute, 48 percent of the insured losses from Hurricane Sandy were covered by the commercial multiple peril line. (Superstorm Sandy: Impacts for Insurers, Reinsurers and the Debate on Climate Change, March 1, 2013, p. 7, available at: http://www.iii.org/sites/default/files/docs/pdf/Sandy-030113.pdf.)

42 Dowling & Partners, IBNR Weekly, October 6, 2016, p. 6.

Figure 11. Direct Premiums Earned by Foreign-Owned Groups in Commercial Multiple Peril



Source: SNL Financial.

Note: The percentage is calculated using 2011-2015 average.

Likewise, foreign insurers play an important role in covering earthquake risk in the states at great risk of earthquakes. Foreign insurers underwrote over half of the earthquake premiums in California.

A key reason why the U.S. relies heavily on foreign reinsurance is that foreign reinsurers are more nimble and better able to raise capital in a global market than U.S.-owned firms, which are handicapped by the U.S. insurance regulatory system. Insurance is state regulated, and insurers need to be licensed by each state in which they operate. The licensing process is lengthy and complex, sometimes taking months or years, which makes starting a new insurance or reinsurance company in a timely fashion almost impossible. Regulation also impedes the ability of insurers to quickly adjust rates or coverage terms. As a result, U.S. firms have shied away from the highly volatile risks, and Bermuda firms have embraced such risk.[43]

[43] U.S. members of Congress have recognized some of the problems with the existing state regulation system in the Dodd-Frank Bill (H.R. 4173, the comprehensive U.S. financial services reform bill), where the U.S. Treasury will gain power to pre-empt state law that is inconsistent with international solvency regulation agreements which Treasury can negotiate with foreign governments.

III. The Economics of Reinsurance and Affiliate Reinsurance

The amount of insurance an individual P&C company can sell is partly a function of how much capital it maintains. The greater the expected volatility of its loss claims, the more capital the company is required to hold to satisfy regulators and rating agencies that the insurance company will be able to pay its policyholder claims. Capital acts as a shock absorber for volatility—it gets depleted when times are bad and accumulates when times are good.

Capital is a scarce resource in the insurance industry. When insurance companies are not able to cover their losses, or when lack of capital limits their ability to write insurance in the first place, the burden can fall to government and ultimately taxpayers. Effective management of capital is thus a primary concern of U.S. insurance companies, regulators, and rating agencies.

A. Reinsurance and Insurance Risk Management

An insurer transfers (or cedes) premiums collected from customers to a reinsurer that agrees contractually to share a portion of the insured losses. Because reinsurance transfers the actual risk, the insurer typically does not have to maintain capital or reserves to cover the losses it cedes. Reinsurance enhances the efficiency of the insurance market in several ways.[44]

First, reinsurance allows an insurance company to reduce the volatility of its losses, therefore increasing the amount of insurance it can support with its existing capital. Insurance companies accomplish this by reinsuring exposure to particular risks or concentrations of risk. Reinsurers can bear these risks more efficiently because they assume them from a variety of sources, thereby reducing correlation among exposures.

To illustrate, an insurance company that writes a substantial amount of California homeowners insurance can reduce the potential volatility of its losses by ceding some of its exposure to losses from earthquakes to a reinsurer. An insurance company that writes a substantial amount of Florida homeowners insurance can achieve the same goal by ceding to a reinsurer some of its exposure to losses from hurricanes. Because the occurrence of California earthquakes and Florida hurricanes is uncorrelated, the volatility of losses from the reinsurer's pool of risks, which includes both sets of exposures, will be lower than that from the pool of risks held by either of the primary insurers. In addition to writing more business, an insurer covered by reinsurance can provide a higher limit of protection than its capital assets would otherwise allow. By allowing for more efficient use of capital, reinsurance makes the coverage of risk—particularly, the risk of catastrophic losses—more affordable for insurers and thus more affordable for insurance consumers.

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[44] See also FIO (2014), pp. 11–14.

A second way that reinsurance enhances economic efficiency is by facilitating the transfer of risk and capital within individual groups of affiliated insurance companies. As market conditions change, the relative profitability of insurance in different regions and lines of business shifts over time. Reinsurance allows the parent company to build capital in a centrally managed pool and then deploy it quickly to subsidiaries around the globe in response to these changing conditions. For instance, after the 9/11 World Trade Center terrorism attack and Hurricane Katrina, foreign reinsurance companies quickly mobilized to replenish their capital base, which they used to fund additional risk-bearing entities and to support new business written by their U.S. subsidiaries and other entities.

This capital-generation function of reinsurance helps to lessen the effects of the cycles and crises to which the insurance industry is susceptible.[45] Following catastrophic losses in 2004 and 2005, reinsurers raised about $30 billion in new capital, including through new equity capital for startup companies, seasoned equity issues and catastrophe bonds.[46] Despite the large unexpected losses, reinsurance prices began to soften as early as the end of 2006 and the beginning of 2007.

Third, reinsurance enhances the efficiency of the insurance market by channeling risk to entities that have highly specialized expertise. For example, Bermuda's reinsurers specialize in the highly volatile lines of business characterized by large, infrequent claims, such as hurricanes and earthquakes and class action lawsuits. They provide sophisticated data analysis and risk modeling capabilities critical to helping insurers understand how diversification affects their expected losses and capital requirements. Small insurance companies in particular benefit from the technical and financial expertise that these specialty reinsurance companies provide.

The reinsurance market is global because the insurance industry needs to be able to diversify risk across the widest possible geographic area. Natural disasters tend to be dispersed worldwide, and as a result, they can be better managed in a diversified risk pool. Indeed, demand for catastrophic risk insurance has become more international (Figure 12). In 2011, the world experienced the largest ever insurance loss of over $130 billion due to earthquakes in Japan and New Zealand, tornadoes in the U.S. (more than $8 billion in losses in a single day), and flooding in Thailand. The cluster of several catastrophic events in one year reaffirms the important lesson that extraordinary losses can and do occur in places where catastrophic losses are unexpected (Thailand) and on a scale that is much larger than expected (New Zealand and the U.S.).

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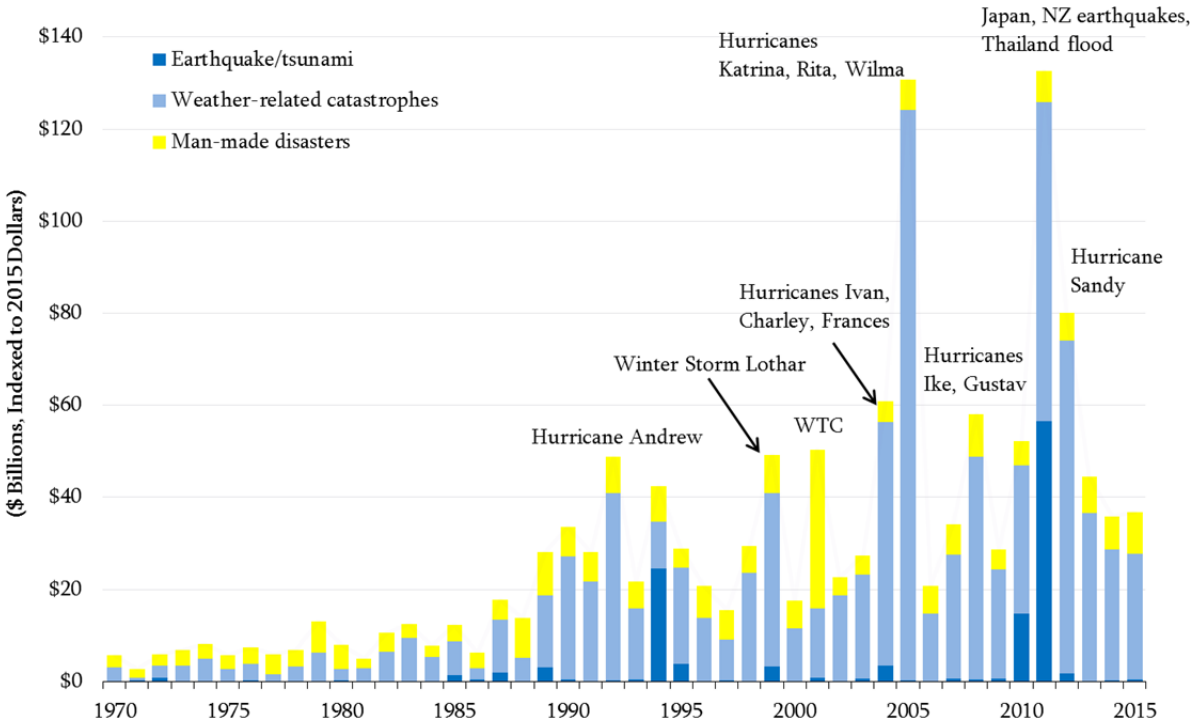
[45] J. David Cummins, Georges Dionne, Robert Gagné and Abdelhakim Nouira, "The Costs and Benefits of Reinsurance," June 4, 2008, p. 6, available at: http://ssrn.com/abstract=1142954.

[46] *Ibid.*, p. 6.

Figure 12. Worldwide Catastrophe Losses (1970–2015)



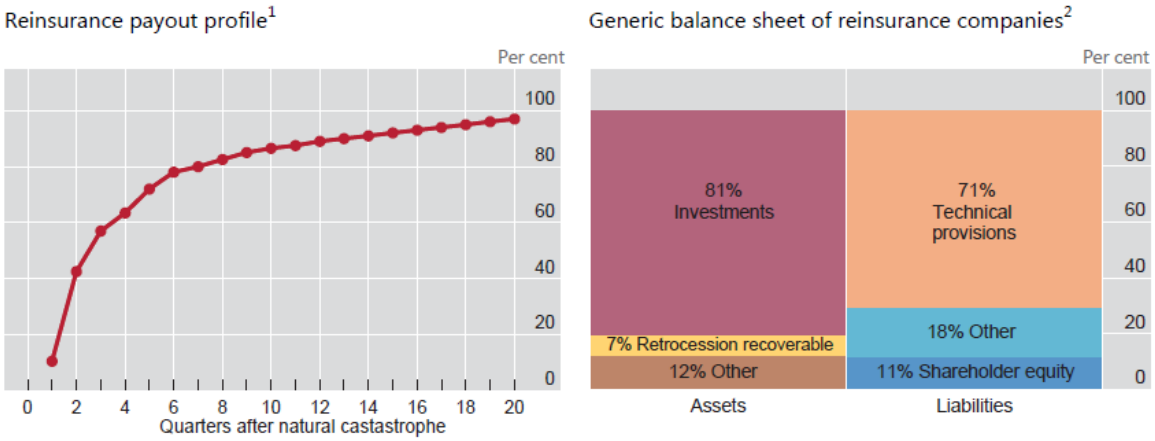
Source: Swiss Re, "Natural Catastrophes and Man-Made Disasters in 2015: Asia Suffers Substantial Losses," Sigma Study No 1/2016.

Insurers collect premiums upfront for protection against an event that may or may not happen. If the event does not occur, insurers are able to invest that premium in a low-risk portfolio of assets, and the insurer passes that benefit to policyholders in the form of lower premiums. Figure 13 (left-hand panel) shows the average payout profile for reinsurance.[47] Statistics on reinsurance payments show that claims are typically settled over an extended period. On average, about 60 percent of the ultimate obligations are paid within a year and 80 percent within two years, and it takes more than five years after a natural disaster strikes for the cumulative payout to reach 100 percent. If the risk event does not occur, the premiums are accumulated as invested assets (Figure 13, right-hand panel) to strengthen the reinsurers' balance sheet against the ultimate risk.[48] Insurers cover losses by selling their investments.

[47] The insurance contract used in the figure is for one particular type of reinsurance, excess of loss contracts. Other types of reinsurance contracts exhibit very similar payout patterns. See Reinsurance Association of America, Catastrophe Loss Development Study, 2013, Exhibit AJ-3.

[48] If sufficient premiums accumulate, the excess can also be paid out as dividends.

Figure 13. Catastrophe Payouts and Reinsurers Balance Sheet

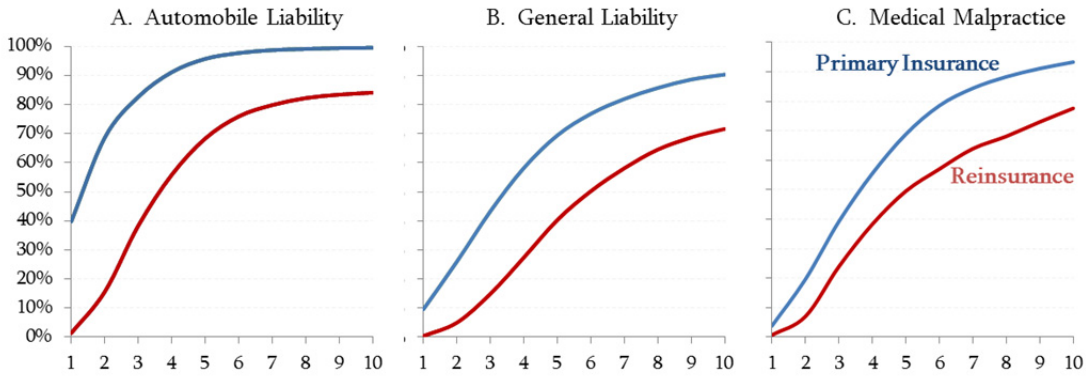


[1] Cumulative percentage of ultimate payout on catastrophe excess of loss contracts, based on worldwide observations with respect to the historical paid loss development until 2011. [2] Combined balance sheet of the five largest reinsurance companies outside Gen Re and Lloyd's, normalised to express percentage breakdown.

Source: Sebastian von Dahlen and Goetz von Peter, 2012, "Natural catastrophes and global reinsurance – exploring the linkages," Bank of International Settlement Quarterly Review (December).

Premium setting relies on investing premiums until a loss event occurs and this investment income reduces policyholder premiums. Investment income is particularly important for reinsurance premiums setting because insurers seek additional coverage for high-severity, low-frequency risks, where the amount of time between a loss event and payout is long and uncertain. Figure 14 compares the time patterns of average loss payouts under primary insurance and reinsurance for three lines of insurance coverage.

Figure 14. Time Patterns of Loss Paid under Primary Insurance and Reinsurance



Source: Reinsurance Association of America, Historical Loss Development Study, 2015.

B. THE NON-TAX BUSINESS PURPOSES OF AFFILIATE REINSURANCE

U.S. P&C companies rely heavily on other companies in the same insurance group (*i.e.*, affiliates) for reinsurance. Table 3 shows the distribution of U.S.-owned P&C insurers in terms of the fraction of premiums received from their customers that they ceded to a related reinsurer in 2009 and 2015. In 2009, almost half of the U.S.-owned insurers ceded at least 50 percent of their premiums to an affiliate and nearly a third of them ceded at least 90 percent.

The pattern is very similar in 2015: half of the U.S.-owned insurers ceded at least 60 percent of their premiums to an affiliate, and close to 40 percent of them ceded at least 90 percent.

Table 3. Distribution of U.S.-Owned P&C Companies by Net Premiums Ceded to Related Reinsurers as a Percent of Gross Premiums

	Horst Frisch Analysis Year 2009		Brattle Analysis Year 2015	
Net Premiums Ceded to Affiliates/Gross Premiums	Number of Companies	Percent of All Companies	Number of Companies	Percent of All Companies
>= 0%	677	100%	789	100%
>= 10%	413	61%	535	68%
>= 20%	385	57%	496	63%
>= 30%	365	54%	472	60%
>= 40%	350	52%	445	56%
>= 50%	330	49%	420	53%
>= 60%	302	45%	394	50%
>= 70%	284	42%	370	47%
>= 80%	253	37%	343	43%
>= 90%	213	31%	305	39%

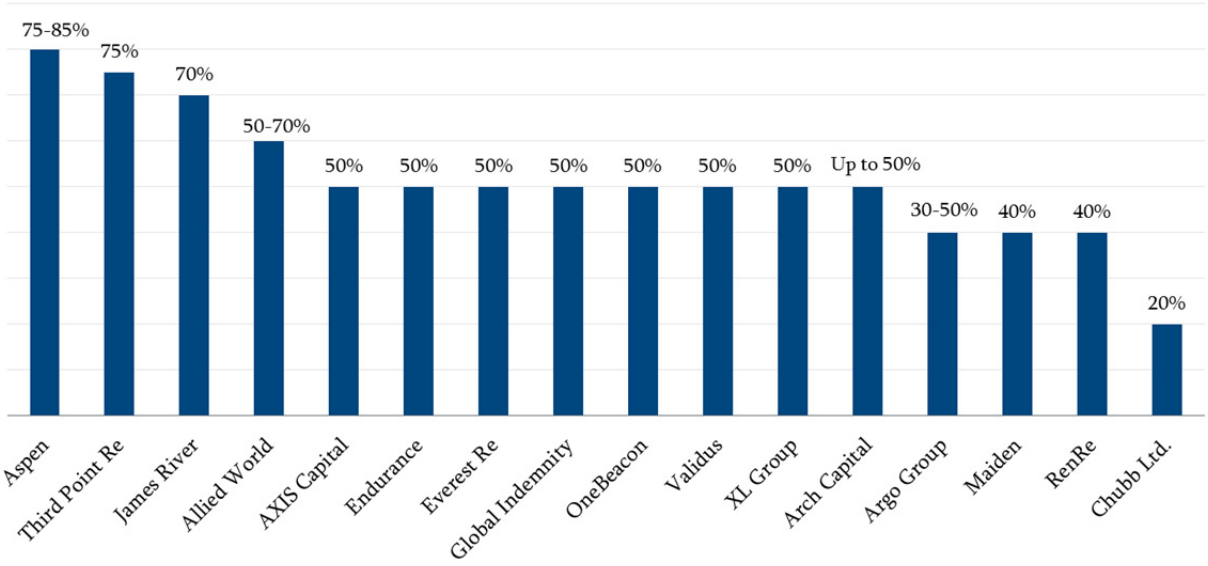
Notes: (1) The sample includes only companies that belong to a U.S. owned insurance group which has at least $500 million in gross premiums written (GPW) in a given year. Companies with less than $10 million in annual GPW were excluded in an effort to eliminate laragely inactive companies.

(2) Foreign control is defined here as 50 percent or greater ownership by foreign persons.

(3) Net premiums ceded to affiliates equals reinsurance premiums ceded to affiliates less reinsurance premiums assumed from affiliates. Gross premiums written are defined here as direct insurance premiums written plus written assumed reinsurance premiums from unrelated insurance companies.

Similarly, according to industry statistics, subsidiaries of foreign-owned insurers ceded a substantial share of their insurance premiums to their offshore affiliates (Figure 15). It is not hard to understand why affiliate reinsurance would play a central role in the insurance market. Absent reinsurance, regulators would require each company within an insurance group to have enough capital on a standalone basis to support the business it writes. With offshore affiliate reinsurance, U.S. subsidiaries can reduce the total amount of capital needed to support their business. Reinsurance becomes an integral part of an insurer's capital structure as recognized in regulatory and accounting rules.

Figure 15. Self-Reported Percentage of Loss Coverage by Offshore Reinsurance Affiliates



Source: Dowling & Partners, IBNR, December 1, 2016, at p. 6.

One must look beyond this common risk-pooling function, however, to understand why affiliate reinsurance is so prevalent. Most important, affiliate reinsurance is a response to the problems of adverse selection and moral hazard.[49] These problems arise because the insurer often knows more than the reinsurer about the risks it insures, and this information asymmetry creates an incentive for the insurer to transfer the worst risks to the reinsurer (adverse selection) and/or to be lax in its underwriting (one form of moral hazard).[50] If the insurer and the reinsurer are part of the same corporate group, their incentives are better aligned. Stated differently, vertical integration serves to internalize the costs of adverse selection and moral hazard.[51] This is especially beneficial with respect to the coverage of low-

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[49] See, for example, Lawrence S. Powell, and David W. Sommer, "Internal Versus External Capital Markets in the Insurance Industry: The Role of Reinsurance," *Journal of Financial Service Review*, Vol. 31, 2007, pp. 173–188; and Lawrence S. Powell, David W. Sommer, and David L. Eckles, "The Role of Internal Capital Markets in Financial Intermediaries: Evidence from Insurer Groups," *The Journal of Risk and Insurance*, 2008, Vol. 75, No. 2, pp. 439-461.

[50] Scott E. Harrington and Patricia M. Danzon, "Price Cutting in Liability Insurance Markets," *Journal of Business*, 1994, v67n4:511-538.

[51] One of the central questions in economics has been why and when firms opt to vertically integrate—*i.e.*, to acquire goods and services internally versus through an external market exchange. Most theories of vertical integration turn on the presence of some type of market imperfection. Traditional theories emphasized issues of market power (*e.g.*, a firm may seek to capture monopoly profits earned downstream by gaining control of a distribution channel). Over time, however, economists have focused increasingly on the critical role of transaction costs. One branch of work in this area, led by Oliver Williamson (the 2009 Nobel Prize laureate in economics), has looked at conditions under

Continued on next page

frequency, high-loss events such as natural catastrophes and product liability lawsuits, where the information asymmetry between the insurer and reinsurer is most pronounced.

Second, as a tool for inter-company transfer of risks, affiliate reinsurance is central to the group structure of the insurance industry. As discussed above, insurance groups organize subsidiaries around the world to diversify risk across geographic area. Use of affiliate reinsurance allows an insurance group to transfer risk far more quickly and easily than it could with non-affiliate reinsurance, which requires lengthy negotiations with a third party over the terms and price of the contract — a contract that typically must be renegotiated annually. Because of its greater flexibility, affiliate reinsurance is also less susceptible to price increases and supply restrictions over the hard-market phase of the underwriting cycle.

These two explanations are closely linked. Affiliate reinsurance allows for the relatively rapid transfer of risk in large part because the costs of adverse selection and moral hazard have been internalized. Conversely, negotiations over non-affiliate reinsurance are complex and time consuming largely because a third-party reinsurer must scrutinize potential risks for evidence of these problems. Non-affiliate reinsurers have devised mechanisms to reduce the cost of adverse selection and moral hazard. These mechanisms are expensive, which raises the cost of non-affiliate reinsurance.[52]

While other sources of risk sharing such as catastrophe bonds share the same asymmetrical information problems as non-affiliate reinsurance, the catastrophe bond market is still relatively small compared to the reinsurance market.[53] As a result, there is still no good substitute for affiliate reinsurance.

Continued from previous page

which giving decision making authority to management in a combined firm (vertical integration) is more efficient than contracting out. Another branch of work, for which economists Joseph Stiglitz and George Akerlof won the Nobel Prize, emphasizes that information asymmetries lead to costly moral hazard and adverse selection problems, and that firms integrate vertically to internalize and control these costs. The differences between these branches of work are less important than the similarities, however—namely, a view that the governance structure that an individual firm voluntarily adopts tends to be the most efficient one possible, given the nature of its transactions.

[52] It should be noted that affiliate reinsurance transactions in the U.S. are subject to both insurance regulators at the state level (protection of policyholders' interest) and the IRS (the arm's-length transfer pricing principle).

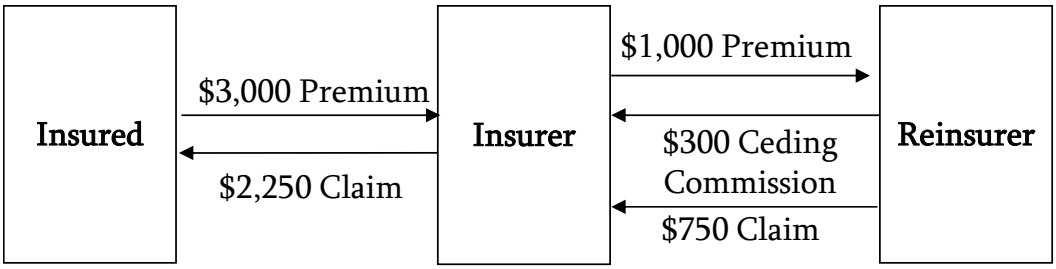
[53] Artemis, "Q3 2016 Catastrophe Bond & ILS Market Report," 2016, p. available at: http://www.artemis.bm/artemis_ils_market_reports/downloads/q3_2016_cat_bond_ils_market_report.pdf?scRef=slipcase.

C. Tax Treatment of Offshore Affiliate Reinsurance: Current law and Proposed Change

Currently, an offshore reinsurer that derives income abroad from reinsuring risks that originate in the U.S. is generally not subject to U.S. federal income tax. For example, if a U.S. insurer cedes $1,000 in premiums and receives a 30 percent ($300) ceding commission,[54] income on the net premium ceded of $700 is earned and taxed abroad, because that is where the risk resides (Figure 16). Bermuda reinsurers, however, pay a 1 percent U.S. federal excise tax on the full amount of the ceded premiums ($1,000 in our example).[55]

In this hypothetical, let us assume that following a loss event, the reinsurer pays the insurer a reinsurance claim of $750. The U.S. insurer in this example can deduct the gross premiums ceded ($1,000) from its U.S. federal income tax return but it must treat the ceding commission ($300) as taxable income. Moreover, because the U.S. insurer receives $750 insurance recovery (claim) from the reinsurer, it reduces its deduction for losses by the same amount. Over time, especially in the present value sense, the deduction for the ceded premium tends to be offset by all but the difference between ceded premium (net of ceding commission) and reinsured losses.

Figure 16. Offshore Reinsurance



Tax legislation proposed in the last decade attempted to impose a tax on offshore affiliate reinsurance. These proposals arose from some U.S.-owned insurance groups' claims that offshore affiliate reinsurance is nothing but a tax-avoidance strategy. Previously, the proposed legislation would outright deny deduction of "excess" reinsurance premium, relative to certain industry average, ceded to offshore affiliates. The latest proposal, the Warner/Neal Bill, would still disallow foreign-owned insurers from deducting premiums that they cede to their offshore affiliate reinsurers. However, when the risks materialize and

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[54] Most reinsurance of U.S. subsidiaries by foreign affiliates is proportional reinsurance. With proportional reinsurance, the reinsurer pays a "ceding commission" that covers the originating insurer's underwriting and administrative costs as well as its estimated lost profit potential.

[55] Under existing U.S. tax treaties, reinsurers based in a number of other countries such as Germany and Switzerland pay no federal excise tax.

reinsurance recoveries come back to the U.S. insurers, these recoveries would be excluded from taxable income.[56]

By disallowing the premium deduction, this proposal would significantly increase the cost of capital for insurance companies by reducing and postponing the recognition of reinsurance expense for tax purposes. The deduction is postponed because losses occur after premiums are paid.

The following simplified example demonstrates how the proposal would affect foreign-owned insurers and their policyholders. Consider an insurance company that purchases excess-of-loss reinsurance with a $100 million limit. The expected profit margin is 5 percent and the interest rate is 5 percent. Table 4 illustrates how the law change would affect a foreign insurer's after-tax net income when it buys reinsurance from a non-US affiliate, versus any other company for a range of loss probabilities.

Table 4. Illustration of Effect of Offshore Reinsurance under New Proposal ($)

Return Period (Years)	Probability of Loss (%)	Reinsurance Premium (Status Quo)	Reinsurance Premium (Proposal)	Percent Increase (%)
10	10%	10,500,000	11,872,831	13.1%
25	4%	4,200,000	5,398,476	28.5%
50	2%	2,100,000	2,973,560	41.6%
100	1%	1,050,000	1,594,754	51.9%
250	0.4%	420,000	646,140	53.8%

Notes: Authors' calculation, available upon request.

The reinsurance premium and the effect of the proposal depend on the probability of the loss occurring. For example, if the probability of losses in this layer is 10 percent, *i.e.*, this type of loss occurs on average once every ten years, the annual reinsurance premium is $10.5 million under the status quo.[57] Under the proposal, a foreign insurer ceding reinsurance to an offshore affiliate effectively pays $11.9 million, 13 percent more for reinsurance under the status quo. As the probability of loss decreases, the increase in price of reinsurance increases. The tax proposal's impact on infrequent lines of insurance such as natural disasters will be significantly higher than on high-frequency risks. Moreover, given the continuing focus on

[56] Technical Explanation, at p. 12. Alternatively, the foreign-owned insurer could elect to be treated as a U.S. insurer for tax purposes.

[57] Expected loss = 0.1 × $100 million = $10 million, profit = 0.05 × $10 million = $0.5 million, and premium = $10 million + $0.5 million = $10.5 million.

catastrophic losses and their effects on Federal spending,[58] the proposed law is at odds with public policy that seeks to have disasters insured in the private sector.[59]

IV. Analysis of Economic Impact

In this section, we analyze the economic impact of the proposed tax on offshore affiliate reinsurance through a statistical analysis of comprehensive NAIC financial data. First, we estimate how reinsurers would respond to the imposition of the tax. To estimate the impact of the Warner/Neal Bill, we first estimate the amount by which offshore affiliate reinsurance used by foreign firms would drop. We assume that, for long-return lines, the level of reinsurance would drop to match the level of offshore affiliate reinsurance by U.S. groups for those lines.

We then use a three-step approach that combines regression analysis with a mathematical simulation of the U.S. insurance market to estimate the effect of the tax on (1) the supply of reinsurance (step one) and (2) the supply and price of primary insurance (steps two and three).

A. Impact on the Supply of Reinsurance (Step One)

In step one of our analysis, we estimate the direct effect of the proposed tax on the supply of reinsurance. Table 5 shows the amount of reinsurance ceded by foreign groups.

Table 5. Reinsurance Ceded by Foreign Insurers (2015, $ Millions)

	Reins. Ceded to Offshore Affiliates	Reins. Ceded to Non-Affiliates	Total
Long-Return Lines	27,948	18,589	46,537
Short-Return Lines	7,465	2,890	10,355
Total	**35,413**	**21,479**	**56,892**

Source: NAIC.

[58] See Cummins, David, Michael Suher, and George Zanjani, 2010. "Federal Financial Exposure to Natural Catastrophe Risk," in Deborah Lucas (Ed.) Measuring and Managing Federal Financial Risk, University of Chicago Press, ISBN: 0-226-49658-9. http://www.nber.org/chapters/c3036.

[59] See GAO, *Natural Disasters: Public Policy Options for Changing the Federal Role in Natural Catastrophe Insurance,* (Washington, D.C.: Nov. 26, 2007). http://www.gao.gov/assets/270/269745.pdf

Because of the significant price impact on long-return lines as shown in Table 4, we assume that, if the Warner/Neal Bill were imposed, the foreign insurers would reduce their offshore affiliate reinsurance. In 2015, we calculate that foreign groups cede $27.9 billion via offshore affiliate reinsurance in long-return lines of insurance, which is equal to approximately 49 percent (=$27.9 billion / $56.9 billion) of the total reinsurance ceded by foreign groups.

First, we estimated the level by which affiliate reinsurance in the long-return lines will decrease. We assume that the imposition of the tax will cause the level of offshore affiliate reinsurance to drop to the level of use by U.S. companies for each line, which implies a drop of $25 billion (see Table 6).[60]

Table 6. Change in Amount of Reinsurance in Long-Return Lines ($ Millions)

	U.S. Firms			Foreign Firms (2015)				
Lines	Reins. Ceded to Offshore Affiliates (1)	Gross Premiums Written (2)	Ceded as % of GPW (3)=(1)/(2)	Reins. Ceded to Offshore Affiliates (4)	Gross Premiums Written (5)	Ceded as % of GPW (6)=(4)/(5)	Decrease (7)= (5)*(3)-(4)	Decrease as % of Reins. Ceded (8)=(7)/(4)
Allied lines	810	18,958	4.3%	2,540	12,812	19.8%	2,187	86.1%
Farmowners multiple peril	11	3,531	0.3%	56	211	26.5%	55	99.1%
Homeowners multiple peril	786	77,571	1.0%	1,292	7,015	18.4%	1,254	97.0%
Commercial multiple peril	980	31,045	3.2%	1,850	9,537	19.4%	1,673	90.5%
Ocean marine	33	2,761	1.2%	677	1,912	35.4%	658	97.1%
Inland marine	343	14,382	2.4%	1,356	5,059	26.8%	1,280	94.4%
Medical professional liability - occurrence	54	2,356	2.3%	52	350	14.8%	52	99.5%
Medical professional liability - claims made	381	6,870	5.6%	354	939	37.7%	311	87.9%
Earthquake	118	1,647	7.2%	409	1,126	36.3%	342	83.6%
Workers' compensation	2,547	44,873	5.7%	3,494	10,756	32.5%	3,088	88.4%
Other liability - occurrence	1,691	26,442	6.4%	5,370	16,017	33.5%	4,528	84.3%
Other liability - claims made	623	12,690	4.9%	3,490	10,720	32.6%	3,093	88.6%
Excess workers' compensation	79	472	16.8%	219	1,043	20.9%	108	49.4%
Products liability - occurrence	90	1,833	4.9%	547	1,382	39.6%	498	91.1%
Products liability - claims made	10	342	2.9%	131	273	48.1%	125	95.1%
Private passenger auto liability	1,214	111,179	1.1%	430	3,439	12.5%	418	97.0%
Commercial auto liability	949	18,872	5.0%	1,161	5,044	23.0%	1,012	87.1%
Rein: Non-prop. assumed property	16	5,925	0.3%	3,257	4,354	74.8%	3,246	99.7%
Rein: Non-prop. assumed liability	35	2,641	1.3%	1,218	3,181	38.3%	1,180	96.9%
Rein: Non-prop. assm financial lines	1	57	2.4%	44	158	27.6%	41	94.2%
Long-Return Lines Total	**10,771**	**384,447**	**2.8%**	**27,948**	**95,329**	**29.3%**	**25,148**	**90.0%**
All Lines Total	**15,312**	**496,160**	**3.1%**	**35,413**	**110,840**	**31.9%**		

Sources and Notes: NAIC. The data for U.S. firms is calculated using 5-year average (2011-2015). We limit our analysis to those lines of business that have a long return period.

Of course, U.S. subsidiaries would partially offset this loss of offshore affiliate reinsurance by raising their level of capital and/or non-affiliate reinsurance, so as to maintain their existing book of business. Neither is a perfect substitute for affiliate reinsurance, however. Compared to reinsurance of any kind, capital is more expensive because it does not provide for diversification, and it is less flexible because it carries a greater regulatory burden. Likewise,

[60] We estimate this ratio based on their average use of offshore affiliate reinsurance from 2011-2015. We use an average to smooth one-year effects.

non-affiliate reinsurance is more expensive than affiliate reinsurance, because it entails additional transaction costs, including the costs of adverse selection and moral hazard.

To estimate the net impact of this "offset" process, we calculate the level of substitution between affiliate insurance on the one hand, and capital and non-affiliate reinsurance on the other. We analyze over 10,000 observations from the NAIC data, each of which represents a financing decision made by a foreign-owned or U.S. insurer between 1996 and 2015. We control statistically for the level of risk facing individual firms by taking into account risk-related measures such as the insurer's business mix, the geographic concentration of its business, and the size and age of the firm.

We estimate that, for each dollar of affiliate reinsurance that is lost, insurers would substitute 36 cents worth of non-affiliate reinsurance and 34 cents worth of capital, assuming that the supply of insurance remained constant.[61] This implies that the $25 billion drop in affiliate reinsurance would be offset by a $9 billion increase in non-affiliate reinsurance (=$25 billion × .36) and a $9 billion increase in capital. Thus, assuming a constant supply of insurance, imposition of the proposed tax would lead to a net loss of $16 billion in reinsurance ($25 billion less $9 billion).

The calculation above assumes that the insurance supply remains constant, but when we account for the supply change, our estimate of the net loss in reinsurance increases somewhat—to $18.3 billion (Table 7). (We do not actually relax this assumption until step two of our analysis, but we report the results here for clarity of exposition.) This is a significant decline: it represents about one-eighth of *all* the reinsurance ceded by U.S. insurers[62] and more than 30 percent of all the reinsurance ceded by foreign insurers in the U.S.[63] Among long-return lines of insurance, the reduction represents 39 percent of all reinsurance ceded by foreign insurers.[64] For certain lines of business, the proposed tax would lead to an even higher percentage loss, as shown in Figure 17. For example, approximately 60 percent of the excess-of-loss reinsurance for liability and property would be eliminated.

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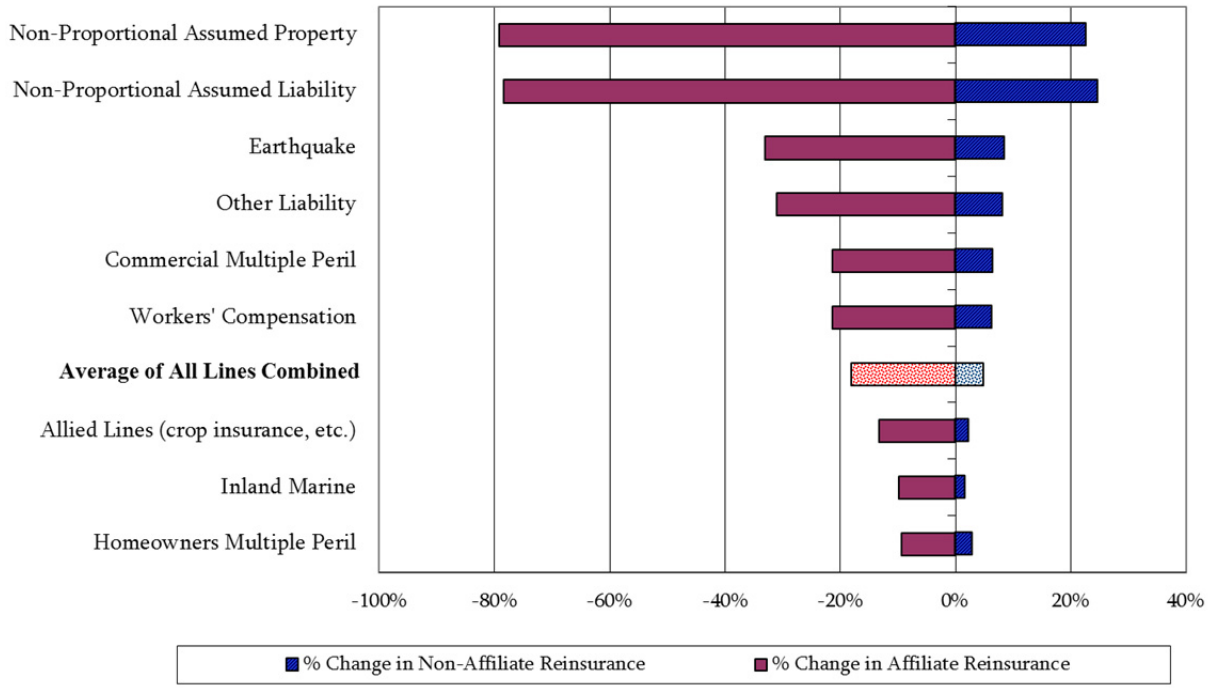
61 In technical terms, the substitution coefficient of non-affiliate reinsurance for affiliate reinsurance is 0.36 and the substitution coefficient of capital for affiliate reinsurance is 0.34. (See Appendix A.) These results are consistent with the academic literature as well as our discussions with industry officials.

62 It is calculated as $18,274 million (Table 7, column [4]) divided by $139,762 million (Table 7, column [2]).

63 It is calculated as $18,274 million (Table 7, column [4]) divided by $56,892 million (total reinsurance ceded by foreign-owned insurers in Table 5).

64 39% = $18,274 million / $46,537 million (Table 5).

Figure 17. Impact of Offshore Affiliate Reinsurance Tax Proposals on Affiliate and Non-Affiliate Reinsurance

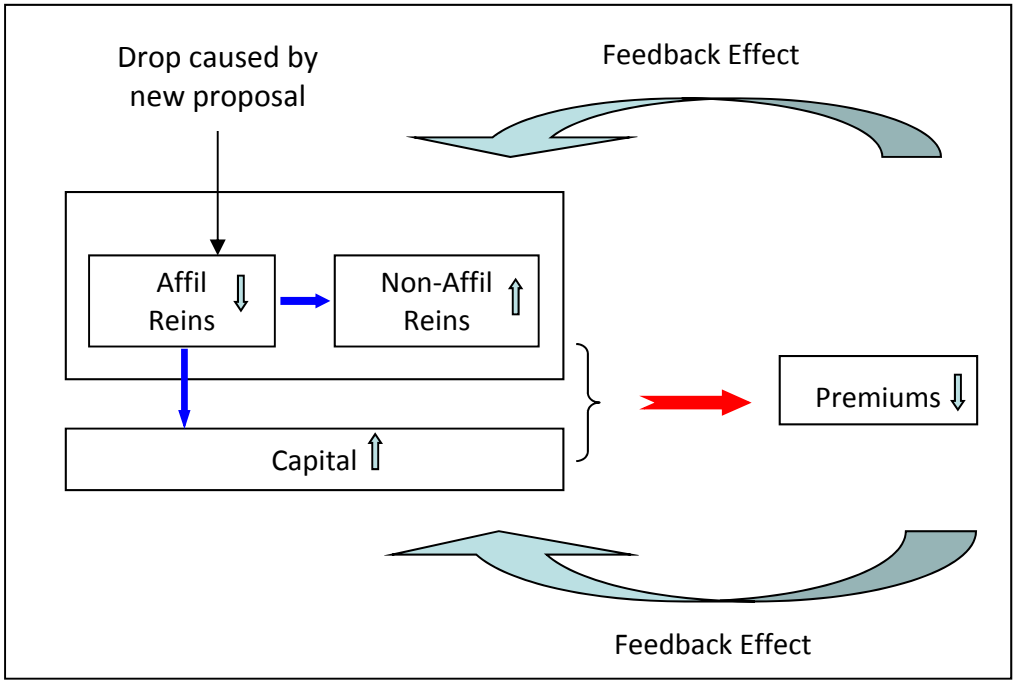


B. Impact on the Supply of Insurance (Step Two)

In step two of our analysis, we trace the impact of a tax on offshore affiliate reinsurance through to its effect on the supply of primary insurance. First, we use regression analysis to estimate the impact on the insurance supply of the two direct effects we identified in step one—namely, a net decrease in the supply of reinsurance purchased by U.S. insurers and an increase in their supply of capital. Specifically, we employ a statistical model that measures the percent change in total insurance written as a function of the percent change in both reinsurance and capital. We use the same basic sample of companies that we analyzed in step one, although we drop those companies for which we lack sufficient data to measure a change in their behavior over time.

Our regression analysis indicates that the supply of primary insurance would drop by 0.57 percent for each 1 percent decrease in the amount of reinsurance purchased by U.S. insurers and would go up by 0.15 percent for each 1 percent increase in the amount of capital they maintain. Overall, these results accord well with economic intuition: one would expect a one unit decrease in reinsurance to cause the supply of insurance to drop by more than the equivalent increase in capital would cause it to rise, because of the greater "leverage" that reinsurance provides relative to capital.

Figure 18. Simulation of Proposed Legislation on U.S. Insurance Market



Although our regression analysis captures part of the process by which the insurance market would respond to the proposed tax on offshore affiliate reinsurance, it does not capture all of it. Specifically, while the supply of primary insurance would drop in response to the combination of direct effects analyzed above (less reinsurance and more capital), the drop in the insurance supply would in turn reduce the need for capital and reinsurance (Figure 18).

To reflect this dynamic process, we develop a mathematical simulation of the P&C market that captures the simultaneous changes in reinsurance, capital and insurance premiums. The simulation begins with figures on premiums written and reinsurance purchased by U.S. insurers by line of business. We use the results of our two regression analyses to calculate aggregate figures for the amount of non-affiliate insurance and capital that U.S. subsidiaries would substitute to offset the loss of foreign affiliate reinsurance. We simulate as well the decrease in reinsurance and capital that would follow from the drop in premiums written.

Based on this dynamic-effects simulation (Table 7), we calculate that the overall supply of insurance would decline from $654.7 billion to $645.4 billion, a drop of $9.3 billion (= $654.7 billion - $ 645.4 billion), or about 1.4 percent overall. Given the parameters on capital-reinsurance substitutions and the relationship between supply of insurance and total reinsurance, our model predicts a $2.0 billion drop in capital as a result of the proposed bill (from $726.1 billion to $724.1 billion). Table 7 also shows our results by line of business. (The last two columns will be discussed in the next sub-section.) In Table 6 above, we assume that only long-return lines of insurance would be affected by the proposed tax. The impact of the proposed tax will nevertheless include short-return lines, because total

insurance capital decreases. All else equal, a smaller capital base in the U.S. lowers the supply of insurance.

Table 7. Simulated Impact of the Warner/Neal Bill on U.S. P&C Industry ($ Millions)

	2015		Change					
Lines	Gross Premium Written (GPW)	Total Reins Ceded	GPW	Change in Total Reins Ceded	Change in GPW	% Drop in GPW	% Increase in Price	% Drop in Coverage
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Fire	15,884	6,026	15,878	(1.7)	(6.3)	-0.04%	0.02%	-0.06%
Allied lines	29,825	16,507	29,027	(1,783.8)	(798.5)	-2.68%	1.45%	-4.06%
Farmowners multiple peril	4,198	638	4,177	(37.7)	(21.5)	-0.51%	0.28%	-0.79%
Homeowners multiple peril	94,218	13,296	93,725	(860.9)	(493.2)	-0.52%	0.28%	-0.80%
Commercial multiple peril	42,541	7,806	41,918	(1,161.1)	(623.5)	-1.47%	0.79%	-2.24%
Mortgage guaranty	4,988	323	4,986	(0.1)	(2.1)	-0.04%	0.02%	-0.06%
Ocean marine	4,309	2,021	4,070	(507.0)	(239.9)	-5.57%	3.01%	-8.32%
Inland marine	24,125	12,971	23,650	(1,053.8)	(474.6)	-1.97%	1.06%	-3.00%
Financial guaranty	559	139	558	(0.0)	(0.2)	-0.04%	0.02%	-0.06%
Medical professional liability - occurrence	2,547	277	2,527	(34.4)	(19.6)	-0.77%	0.42%	-1.18%
Medical professional liability - claims made	7,809	1,583	7,695	(215.5)	(114.5)	-1.47%	0.79%	-2.24%
Earthquake	2,676	1,036	2,553	(252.1)	(123.3)	-4.61%	2.49%	-6.92%
Group accident and health	5,359	1,436	5,357	(0.3)	(2.1)	-0.04%	0.02%	-0.06%
Credit accident and health (group and indiv.)	172	157	172	(0.1)	(0.1)	-0.04%	0.02%	-0.06%
Other accident and health	3,316	477	3,315	(0.1)	(1.4)	-0.04%	0.02%	-0.06%
Workers' compensation	60,995	14,472	59,873	(2,153.2)	(1,121.6)	-1.84%	0.99%	-2.80%
Other liability - occurrence	44,467	17,215	42,830	(3,368.5)	(1,637.1)	-3.68%	1.99%	-5.56%
Other liability - claims made	24,766	7,374	23,642	(2,200.1)	(1,124.3)	-4.54%	2.45%	-6.82%
Excess workers' compensation	1,352	425	1,314	(76.4)	(38.3)	-2.84%	1.53%	-4.30%
Products liability - occurrence	3,291	1,370	3,120	(354.3)	(171.5)	-5.21%	2.81%	-7.81%
Products liability - claims made	525	238	480	(93.1)	(45.5)	-8.66%	4.67%	-12.73%
Private passenger auto liability	124,674	7,797	124,471	(277.3)	(203.7)	-0.16%	0.09%	-0.25%
Commercial auto liability	25,327	4,541	24,954	(694.0)	(373.4)	-1.47%	0.80%	-2.25%
Auto physical damage	90,976	7,675	90,938	(1.9)	(37.7)	-0.04%	0.02%	-0.06%
Aircraft (all perils)	1,911	1,106	1,910	(0.3)	(0.7)	-0.04%	0.02%	-0.06%
Fidelity	1,325	209	1,325	(0.1)	(0.5)	-0.04%	0.02%	-0.06%
Surety	6,223	1,239	6,221	(0.3)	(2.5)	-0.04%	0.02%	-0.06%
Burglary and theft	305	77	305	(0.0)	(0.1)	-0.04%	0.02%	-0.06%
Boiler and machinery	3,230	1,682	3,229	(0.4)	(1.2)	-0.04%	0.02%	-0.06%
Credit	2,083	1,128	2,082	(0.3)	(0.8)	-0.04%	0.02%	-0.06%
International	139	68	139	(0.0)	(0.1)	-0.04%	0.02%	-0.06%
Warranty	3,268	2,384	3,267	(0.6)	(1.2)	-0.04%	0.02%	-0.06%
Rein: Non-prop. assumed property	10,149	4,100	8,964	(2,309.8)	(1,185.9)	-11.68%	6.31%	-16.93%
Rein: Non-prop. assumed liability	5,489	1,503	5,060	(807.0)	(428.7)	-7.81%	4.22%	-11.54%
Rein: Non-prop. assm financial lines	201	52	186	(27.8)	(14.8)	-7.38%	3.98%	-10.92%
Write-ins for other lines of business	1,479	412	1,479	(0.1)	(0.6)	-0.04%	0.02%	-0.06%
Total	654,705	139,762	645,394	(18,274)	(9,311)	-1.42%	0.77%	-2.17%
Capital	**726,140**		**724,095**					

Notes:

[1] - [2]: NAIC 2015 Annual Report.

[3] - [5]: Simulation results.

[6]: [5] / [1].

[7]: [6] × 0.54 (price elasticity of primary insurance, see Table A6).[8]: (1 + [6]) / (1 + [7]) - 1.

C. Impact on the Price of Insurance (Step Three)

In step three of our analysis, we estimate the impact of the proposed tax on the price of insurance. Adopting the standard approach taken in the academic literature, we define "price" as the ratio of premium earned to losses incurred. The intuition is straightforward: the price that a consumer pays for insurance is equivalent to the premium charged per unit of risk, where risk is defined as losses incurred. (Loss incurred, or the amount of risk insured, is the insurance equivalent of "quantity" in classic microeconomics.)

In keeping with a basic tenet of economics, a decline in the supply of insurance will lead to an increase in price. The magnitude of the increase will depend on the sensitivity of prices to changes in the industrywide supply of insurance. Note the supply of insurance is defined as premiums, not the amount of risk insured or losses incurred. To calculate the price effect in the current context, we observe the change in the price of insurance as a function of supply using industrywide NAIC data that includes standalone insurance companies as well as those that belong to insurance groups.

We estimate that the price of insurance would increase by 0.54 percent for every 1 percent decrease in the industrywide supply of insurance. (In technical terms, the price elasticity of primary insurance is equal to -0.54.) This translates into an overall increase in price of 0.8 percent per unit of insurance, as shown in the second to the last column of Table 7. Based on the amount of insurance written in 2015, U.S. consumers would have to pay an additional $5 billion[65] a year in premiums to obtain the same insurance coverage.

The second to last column of Table 7 shows the percent increase in price by line of business. Note that some lines would experience a price increase far higher than the overall average. For example, we estimate that the price of earthquake insurance would increase by 2.5 percent. Non-proportional reinsurance lines would also see a significant increase in price: property (6.3 percent), liability (4.2 percent), and financial (4.0 percent). The product liability coverage lines would see significant price increases as well (2.8 and 4.7 percent, respectively, for occurrence and claims made).

The last column reports the change in insurance coverage for each line of business: given a reduction in premiums and an increase in the price per unit of risk, the insurance coverage must drop by more than the increase in price. For example, the overall reduction of insurance supply of 1.4 percent and a 0.8 percent increase in the price result in an insurance coverage drop by 2.2 percent (= (1 - 0.014)/(1 + 0.008) – 1). The drops in non-proportional reinsurance lines and the earthquake line are far larger than the overall average drop.

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[65] $5 billion = $9.3 billion (from Table 7, column [5]) × 0.54 (price elasticity of primary insurance, see Table A6).

D. BORDER TAX ADJUSTMENT ANALYSIS

In their Tax Reform Task Force Blueprint,[66] House Republicans, led by Speaker Paul Ryan (R-WI) and Ways and Means Committee Chair Kevin Brady (R-TX), proposed in June 2016 a number of far reaching changes in the U.S tax system such as a move from a worldwide to a territorial tax system, a corporate tax cut from the current 35 percent to 20 percent, and implementation of border adjustments ("border taxes") where a tax is rebated when a product is exported to a foreign country and is imposed when a product is imported from a foreign country.[67] The purported goal of the latter is to "eliminate the incentives created by our current tax system to move or locate operations outside the United States," and "allow U.S. products, services, and intangibles to compete on a more equal footing in both the U.S. market and the global market."[68]

The specific treatment of offshore reinsurance under the Blueprint is unclear; however, all offshore reinsurance could be subject to the border adjustment provision if reinsurance ceded offshore is defined by final legislation as a service that is imported. While developed country value-added tax systems, to which this proposal can be analogized, excluded (or zero rated) reinsurance,[69] we have analyzed the impacts of the proposal as if it were deemed to apply to reinsurance. Accordingly, the tax penalty, 20 percent of import taxes on ceded reinsurance, would be equivalent to a denial of deduction of premiums paid to the reinsurer. The overall impact of the comprehensive Blueprint is beyond the scope this report. However, border taxes by themselves could have a profound impact on the taxation of U.S. reinsurance. Unlike the Warner/Neal Bill, which focuses only on affiliated offshore reinsurance with a long time lag between the reinsurance and recoverables, the Blueprint would affect all offshore reinsurance, regardless of whether the reinsurers are affiliated or non-affiliated, and regardless of whether the insurance recovery is long-return or not. Because of the heavy reliance by U.S. insurers on foreign reinsurance to diversify the low-frequency but high-severity natural catastrophes and legal liabilities, the imposition of border taxes could lead to a sharp drop in the use of reinsurance at least in the immediate term, and the supply of primary insurance in the U.S.

Below, we provide an illustration of the potential impact of the border adjustment on the insurance market. We assume for the purposes of this illustration that the border adjustment

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66 House Republicans, "A Better Way: Our Vision for a Confident America", June 24, 2016, available at http://abetterway.speaker.gov/_assets/pdf/ABetterWay-Tax-PolicyPaper.pdf.

67 The Blueprint, pp. 25 - 27.

68 The Blueprint, p. 28.

69 Ernst & Young, "VAT and CST: Tax Treatment of Insurance in Developed Countries", January 18, 2017. Developed economies deem reinsurance to be an export of risk, non-territorial in nature, characterized by complex, bilateral cash flows, or for other purposes.

would cause a 50 percent drop in each of offshore affiliate and non-affiliate reinsurance (Column [4] in Table 8), which amounts to a total drop of $69.9 billion. Because the provision affects both forms of reinsurance, we do not allow for a substitution between non-affiliate and affiliate reinsurance. This assumed reduction is about 3.8 times the total drop in reinsurance under the Warner/Neal Bill ($18.3 billion from Table 7).

Table 8. Impact of Border Adjustments on U.S. P&C Industry ($ Millions)

	2015		Change					
	Gross Premium Written (GPW)	Total Reins Ceded	GPW	Change in Total Reins Ceded	Change in GPW	% Drop in GPW	% Increase in Price	% Drop in Coverage
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Fire	15,884	6,026	14,243	(3,013.2)	(1,641.3)	-10.33%	5.58%	-15.07%
Allied lines	29,825	16,507	25,657	(8,253.7)	(4,168.6)	-13.98%	7.55%	-20.01%
Farmowners multiple peril	4,198	638	3,994	(319.1)	(204.7)	-4.88%	2.63%	-7.32%
Homeowners multiple peril	94,218	13,296	89,890	(6,648.0)	(4,328.4)	-4.59%	2.48%	-6.90%
Commercial multiple peril	42,541	7,806	40,125	(3,903.2)	(2,416.6)	-5.68%	3.07%	-8.49%
Mortgage guaranty	4,988	323	4,860	(161.7)	(127.9)	-2.56%	1.38%	-3.90%
Ocean marine	4,309	2,021	3,781	(1,010.6)	(528.5)	-12.26%	6.62%	-17.71%
Inland marine	24,125	12,971	20,828	(6,485.3)	(3,296.3)	-13.66%	7.38%	-19.60%
Financial guaranty	559	139	518	(69.6)	(40.8)	-7.30%	3.94%	-10.82%
Medical professional liability - occurrence	2,547	277	2,451	(138.5)	(95.4)	-3.74%	2.02%	-5.65%
Medical professional liability - claims made	7,809	1,583	7,328	(791.3)	(481.2)	-6.16%	3.33%	-9.18%
Earthquake	2,676	1,036	2,395	(517.9)	(281.0)	-10.50%	5.67%	-15.30%
Group accident and health	5,359	1,436	4,943	(718.1)	(415.9)	-7.76%	4.19%	-11.47%
Credit accident and health (group and indiv.)	172	157	138	(78.4)	(34.7)	-20.14%	10.88%	-27.98%
Other accident and health	3,316	477	3,162	(238.7)	(154.8)	-4.67%	2.52%	-7.01%
Workers' compensation	60,995	14,472	56,714	(7,236.2)	(4,280.4)	-7.02%	3.79%	-10.41%
Other liability - occurrence	44,467	17,215	39,796	(8,607.6)	(4,671.0)	-10.50%	5.67%	-15.31%
Other liability - claims made	24,766	7,374	22,669	(3,686.8)	(2,096.8)	-8.47%	4.57%	-12.47%
Excess workers' compensation	1,352	425	1,233	(212.6)	(119.8)	-8.85%	4.78%	-13.01%
Products liability - occurrence	3,291	1,370	2,924	(685.0)	(366.7)	-11.14%	6.02%	-16.19%
Products liability - claims made	525	238	463	(118.9)	(62.6)	-11.92%	6.44%	-17.24%
Private passenger auto liability	124,674	7,797	121,555	(3,898.3)	(3,119.8)	-2.50%	1.35%	-3.80%
Commercial auto liability	25,327	4,541	23,915	(2,270.6)	(1,411.8)	-5.57%	3.01%	-8.33%
Auto physical damage	90,976	7,675	88,162	(3,837.6)	(2,814.3)	-3.09%	1.67%	-4.69%
Aircraft (all perils)	1,911	1,106	1,634	(552.8)	(276.4)	-14.47%	7.81%	-20.67%
Fidelity	1,325	209	1,258	(104.7)	(66.7)	-5.03%	2.72%	-7.54%
Surety	6,223	1,239	5,846	(619.4)	(377.9)	-6.07%	3.28%	-9.05%
Burglary and theft	305	77	282	(38.6)	(22.6)	-7.41%	4.00%	-10.97%
Boiler and machinery	3,230	1,682	2,800	(841.0)	(430.4)	-13.33%	7.20%	-19.14%
Credit	2,083	1,128	1,797	(564.2)	(286.3)	-13.74%	7.42%	-19.70%
International	139	68	121	(34.0)	(17.6)	-12.69%	6.85%	-18.29%
Warranty	3,268	2,384	2,705	(1,191.9)	(563.0)	-17.23%	9.30%	-24.27%
Rein: Non-prop. assumed property	10,149	4,100	9,046	(2,049.9)	(1,103.6)	-10.87%	5.87%	-15.82%
Rein: Non-prop. assumed liability	5,489	1,503	5,055	(751.7)	(433.8)	-7.90%	4.27%	-11.67%
Rein: Non-prop. assm financial lines	201	52	186	(25.9)	(15.1)	-7.50%	4.05%	-11.10%
Write-ins for other lines of business	1,479	412	1,361	(206.2)	(118.6)	-8.02%	4.33%	-11.83%
Total	654,705	139,762	613,834	(69,881.1)	(40,871.3)	-6.24%	3.37%	-9.30%
Capital	**726,140**		**689,069**					

Notes:

[1] - [2]: NAIC 2015 Annual Report.

[3] - [5]: Simulation results.

[6]: [5] / [1].

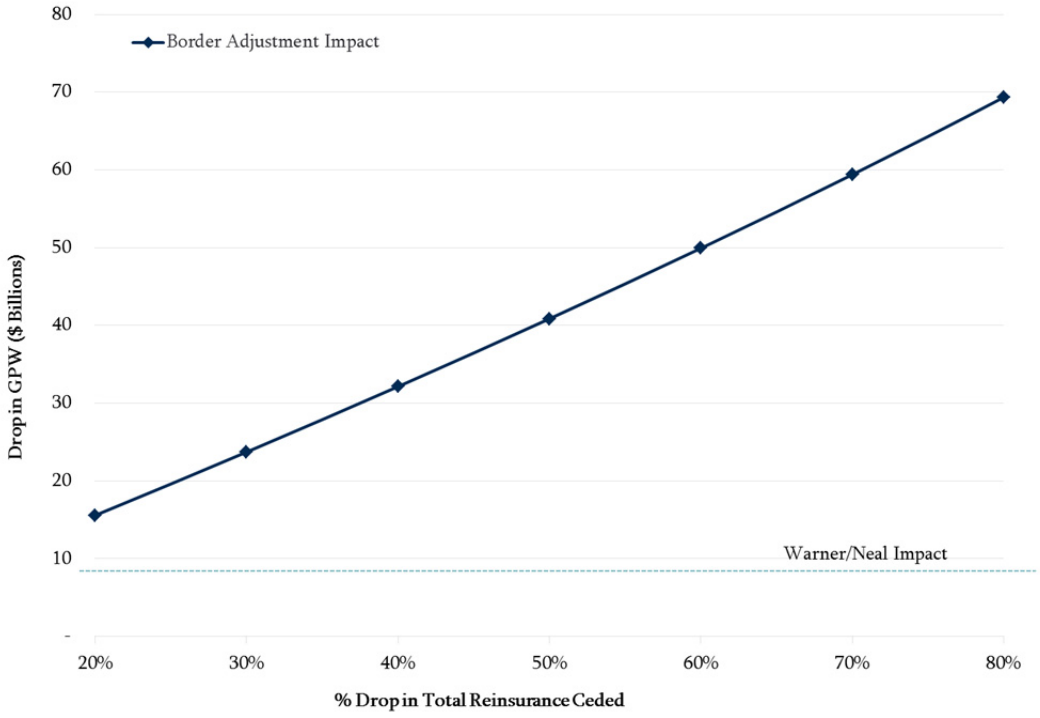
[7]: [6] × 0.54 (price elasticity of primary insurance, see Table A6).

[8]: (1 + [6]) / (1 + [7]) - 1.

Based on these parameters, and viewed independently from other components of the Blueprint, the resulting impact would be a drop of gross premiums written of $40.9 billion (=$654.7 billion - $613.8 billion, Table 8), which is 4.4 times larger than what we predict under the Warner/Neal Bill ($9.3 billion from Table 7). This amplified impact, relative to the 3.8 times reduction in total offshore reinsurance, is because the across-the-board tax deprives the U.S. insurers of the opportunity to substitute one type of reinsurance for another type. Hence, the only option available is a reduction in the supply of reinsurance, offset somewhat by the potential adjustment in the U.S.-based capital.

Because the border adjustment proposal would place the industry in uncharted territory and the proposal lacks specific details, let alone whether insurance would be exempted from the border tax, the impact of the border adjustment is uncertain. In Figure 19 below, we show the potential impact of the proposal on the U.S. insurance market under a range of scenarios.[70]

Figure 19. Border Adjustment Impact on Gross Premiums Written ($ Billions)



- At the low end, for example, a 20 percent reduction in reinsurance would lead to a $15.6 billion drop in the supply of U.S. insurance, which is 67 percent greater than the impact

[70] Our estimates ignore the potential impact from foreign exchange rate changes caused by the border adjustments. We note, however, foreign reinsurance companies writing US business will incur the majority of the related expenses such as claims, claims reserves, loss adjustments expenses, *etc.* in US dollars.

we calculated under the Warner/Neal Bill, and U.S. consumers would pay $8.4 billion more to obtain the same coverage.

- At the high end, an 80 percent reduction in reinsurance would lead to a $69.3 billion drop in the supply of U.S. insurance, which is 7.5 times the impact we calculated under the Warner/Neal Bill, and U.S. consumers would pay $37.4 billion.
- If we apply our analysis of the Warner/Neal Bill and assume the 39 percent reduction in reinsurance ceded by foreign firms in long-return lines similarly applied to all firms and all lines, the impact would be a $31.2 billion drop in the supply of U.S. insurance, and U.S. consumers would pay $16.9 billion more to obtain the same coverage.

We note that our estimates above do not capture all of the adverse consequences of the border adjustment tax for several reasons. First, under the border adjustment proposal, the diversification benefits obtained by U.S. insurance companies exporting risks to foreign reinsurers would be materially diminished.[71] This dramatic change in the diversification benefits to the U.S. insurance and reinsurance industry would cause larger price increases than predicted by our quantitative analysis, which is based on the observed behavior of insurers and reinsurers between 1995 and 2015. Second, after nearly a decade of low reinsurance rates in the U.S., which some reinsurers have already reduced U.S. reinsurance premiums in many lines below the actuarial cost of the exposure, reinsurers' ability to absorb any tax impact is limited. The ability to replace lost insurance coverage is further limited given the regulatory hurdles in setting up U.S. insurance operations and difficulties in raising external equity capital quickly. Thus, reinsurers and insurers would have to pass on the price impact directly onto insurance consumers. Third, our simulation model ignores some practical constraints such as mandatory requirements for insurance (for home mortgage, commercial real estate, commercial financing, *etc.*) which limit the extent to which insurance can drop. Inelastic demand in these circumstances would force further increases in price of insurance. Moreover, rating agencies and regulators demand insurers maintain robust equity and reinsurance coverage regardless of pricing, further contributing to constraints on reduction of demand. These impacts will be particularly severe in certain coastal states such as Florida where local insurance companies struggle to raise equity and diversification of risk is most critical. Finally, we note that mutual insurance companies, which provide a material portion of U.S. primary insurance coverage (36% of P&C market and 63% of life by assets),[72] would be more negatively impacted by the reduction in reinsurance. This is because mutual insurers are capitalized by premiums and retained earnings, lacking access to external equity capital.

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[71] Losing access to the U.S. insurance risks would also negatively impact foreign reinsurers' ability to effectively diversity their non-U.S. risks.

[72] NAIC & The Center for Insurance Policy and Research, Capital Markets Special Report, April 28, 2015. Available at: http://www.naic.org/capital_markets_archive_index.htm

V. State-Level Impact

Our analysis thus far has focused on how a tax on offshore affiliate reinsurance would affect U.S. consumers nationwide. In this section, we estimate the impact of the tax on individual states, in two ways. First, because most of the line-by-line reinsurance data are available only at the national level, we allocate the estimated national impact to individual states in proportion to the direct premiums written by state and line-of-business. We present the results for all states and selected lines of business (see Appendix B for all fifty states and the District of Columbia).

However, the results from the linear allocation obscure the fact that some states and regions are more vulnerable than others, hence more reinsurance in catastrophe-prone states. For example, using reinsurance by insurers with more than half of their operations in a single census division, two economists at the Federal Reserve Bank of Chicago observed that insurers with the most operations in the South Atlantic and West South Central divisions transferred 32 and 33 percent of insurance premiums to reinsurers.[73] As a benchmark, the study placed the national average at 17 percent. Recognizing that the nationwide estimates significantly understate the impact of the tax on certain sub-national markets, we modify the three-step approach we used to derive those estimates so as to incorporate a proxy for state-level data on reinsurance. By way of illustration, we use this approach to show how the tax will affect multiple peril property insurance in seven coastal states such as Florida, Louisiana, Texas, and New York.

A. Linear Allocation of Nationwide Impact

Our first approach is a simple linear allocation of the nationwide impact that we estimated in Section IV to individual states, based on the value of premiums written in each state. For example, we know that U.S. insurers wrote $1.6 billion of earthquake insurance in California in 2015, out of a national total of $2.4 billion (Table 2). If we apply our estimated nationwide price increase for earthquake insurance (2.5 percent) to that figure, we find that Californians would have to pay an additional $24 million for earthquake insurance for the same coverage as a result of the tax ($1.6 billion × .025 = $40 million).

In Appendix B, we present these results for all 50 states plus District of Columbia, and 15 lines of business.[74] Table 9 below shows the total estimated cost increase for the same

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[73] Florentine M. Eloundou Nekoul and Alejandro Drexler, "Do insurers in catastrophe-prone regions buy enough reinsurance?" 2016, available at: https://www.chicagofed.org/~/media/publications/chicago-fed-letter/2016/cfl360-pdf.pdf.

[74] We limit our analysis to those lines of business that have a long return period. In addition, although the non-proportional reinsurance lines would experience among the highest nationwide price

Continued on next page

insurance coverage as in 2015, by state, for all 15 lines of business combined. The hardest-hit states (California, Florida, New York, Texas, New Jersey, Illinois and Pennsylvania) have large, diverse economies with huge exposure to property and liability losses.

Table 9. State-Level Impact—Linear Allocation ($ Millions)

	Direct Premiums Written (2015)	Increase in Cost in Selected Lines
California	54,157	481
Florida	36,433	259
New York	35,896	335
Texas	35,277	271
Illinois	18,609	172
Pennsylvania	17,587	139
New Jersey	16,362	131
Michigan	13,155	79
Georgia	13,038	88
Ohio	11,132	79
Top 10 Total	**251,646**	**2,033**
All States Total	**444,248**	**3,458**

Source: Appendix B. States are ranked by its direct premiums written in 15 lines in 2015.

B. Modified Three-Step Analysis Using Tail Risk

Because of this heavy reliance on reinsurance, particularly foreign reinsurance, the proposed tax will have an especially large effect on the price of multiple peril insurance in coastal states—more so than our nationwide estimates suggest.

To estimate the actual effect of the tax on multiple peril insurance in these coastal states, we run a modified version of our three-step analysis. Since state-level data on reinsurance is not reported, we obtained data from Risk Management Solutions (RMS), a nationally recognized authority on catastrophe risk-modeling, on selected states' contribution to the total risk that the U.S. faces from the kind of homeowners multiple perils (HMP) and commercial multiple perils (CMP) losses that occur only once every 100 or 250 years (almost all such risk, known as "tail risk," is reinsured).

Using RMS data, we calculate the hurricane risk attributable to the HMP and CMP and auto lines attributable to certain states (see Table 10). For example, we calculate the reduction

Continued from previous page

increases, the data on premiums written for those lines is not reported by state. Thus, they are not included in the analysis.

attributable to Florida's HMP line as follows. According to RMS, Florida's HMP line covers approximately 35.9 percent of hurricane risk across all states and all lines. Based on that figure as well as the percentage of hurricane risk attributable to other states' HMP lines, we calculate that the hurricane risk covered by Florida's HMP line is 64.9 percent of the hurricane risk covered by all states' HMP lines. Thus, we allocate 64.9 percent of the reduction in HMP reinsurance to Florida. We perform similar calculations for other states and for the CMP and auto lines.

Table 10. Hurricane Risk in Selected States (100-Year Basis)

	RMS Data				Brattle Calculation		
	Auto	Commercial	Residential	Total	Auto	Commercial	Residential
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
Florida	1.26%	27.87%	35.90%	65.02%	68.52%	65.09%	64.85%
Louisiana	0.05%	1.20%	1.74%	2.99%	2.47%	2.81%	3.15%
Texas	0.20%	5.69%	6.91%	12.81%	11.05%	13.29%	12.49%
New Jersey	0.07%	1.20%	2.15%	3.42%	3.72%	2.81%	3.88%
New York	0.09%	2.95%	3.13%	6.17%	4.77%	6.88%	5.66%
South Carolina	0.01%	0.19%	0.35%	0.55%	0.45%	0.44%	0.63%
North Carolina	0.01%	0.19%	0.61%	0.82%	0.80%	0.45%	1.11%
Other	0.15%	3.52%	4.55%	8.22%	8.22%	8.22%	8.22%
Total	**1.83%**	**42.81%**	**55.35%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**

Notes:

[1] – [3]: RMS. The split of "other" is calculated by the authors. Tail risk on 250-year basis for those states and lines are similar, thus it is not reported.

[4]: [1] + [2] + [3].

[5]: [1] / Sum of [1].

[6]: [2] / Sum of [2].

[7]: [3] / Sum of [3].

We describe our results below. These allocations would be reasonable estimates under extreme circumstances, such as following a catastrophic event.

Based on this analysis, we estimate that the tax would have the following effects in Florida:

- increase the price of CMP insurance by 6.7 percent, which represents $367 million a year in reduced supply of insurance; and
- increase the price of HMP insurance by 1.9 percent, or $282 million a year in reduced supply.

We estimate that the tax would have the following effects in Louisiana:

- increase the price of CMP insurance by 1.6 percent, which represents $17 million a year in reduced supply; and

- increase the price of HMP insurance by 0.5 percent, or $15 million a year in reduced supply.

Similarly, the effects in Texas are:

- increase the price of CMP insurance by 1.5 percent, which represents $81 million a year in reduced supply; and
- increase the price of HMP insurance by 0.4 percent, or $60 million a year in reduced supply.

The HMP and CMP impacts on other hurricane-prone states are summarized in Table 11.

Table 11. Impact on HMP and CMP in Hurricane-Prone States ($ Millions)

	2015		Change			
State	Gross Premium Written (GPW)	Total Reins Ceded	GPW	Change in Total Reins Ceded	Drop in GPW	% Increase in Price
Homeowner Multiple Peril (HMP)						
Florida	8,047	8,622	7,765	(774)	(282)	1.9%
Louisiana	1,649	419	1,634	(28)	(15)	0.5%
Texas	7,989	1,660	7,929	(111)	(60)	0.4%
New Jersey	2,509	516	2,490	(34)	(19)	0.4%
New York	4,881	753	4,853	(49)	(28)	0.3%
South Carolina	1,537	84	1,534	(5)	(4)	0.1%
North Carolina	2,335	148	2,329	(9)	(6)	0.1%
Coastal States Total	28,946	12,203	28,533	(1,010)	(412)	0.8%
Other States	65,272	1,093	65,192	150	(81)	0.1%
All States	**94,218**	**13,296**	**93,725**	**(861)**	**(493)**	**0.3%**
Commercial Multiple Peril (CMP)						
Florida	2,941	5,081	2,574	(1,197)	(367)	6.7%
Louisiana	578	219	561	(35)	(17)	1.6%
Texas	2,864	1,038	2,783	(165)	(81)	1.5%
New Jersey	1,402	219	1,385	(32)	(18)	0.7%
New York	1,402	537	3,408	(79)	(43)	0.7%
South Carolina	451	34	449	(5)	(3)	0.3%
North Carolina	926	35	923	(5)	(3)	0.2%
Coastal States Total	10,564	7,164	12,081	(1,518)	(532)	2.7%
Other States	31,977	642	29,837	357	(91)	0.2%
All States	**42,541**	**7,806**	**41,918**	**(1,161)**	**(623)**	**0.8%**

Moreover, these figures may underestimate the impact of the proposed tax because much of the reinsurance for catastrophe risks, including hurricanes, is provided in the two lines of

business labeled non-proportional reinsurance (liability and property).[75] As we showed in Section IV, these two lines of business would also see significant price increases—4.2 percent and 6.3 percent, respectively—as a result of the proposed tax. Given that non-proportional reinsurance has become a key input to HMP and CMP, those increases will contribute to yet higher prices for multiple peril insurance.

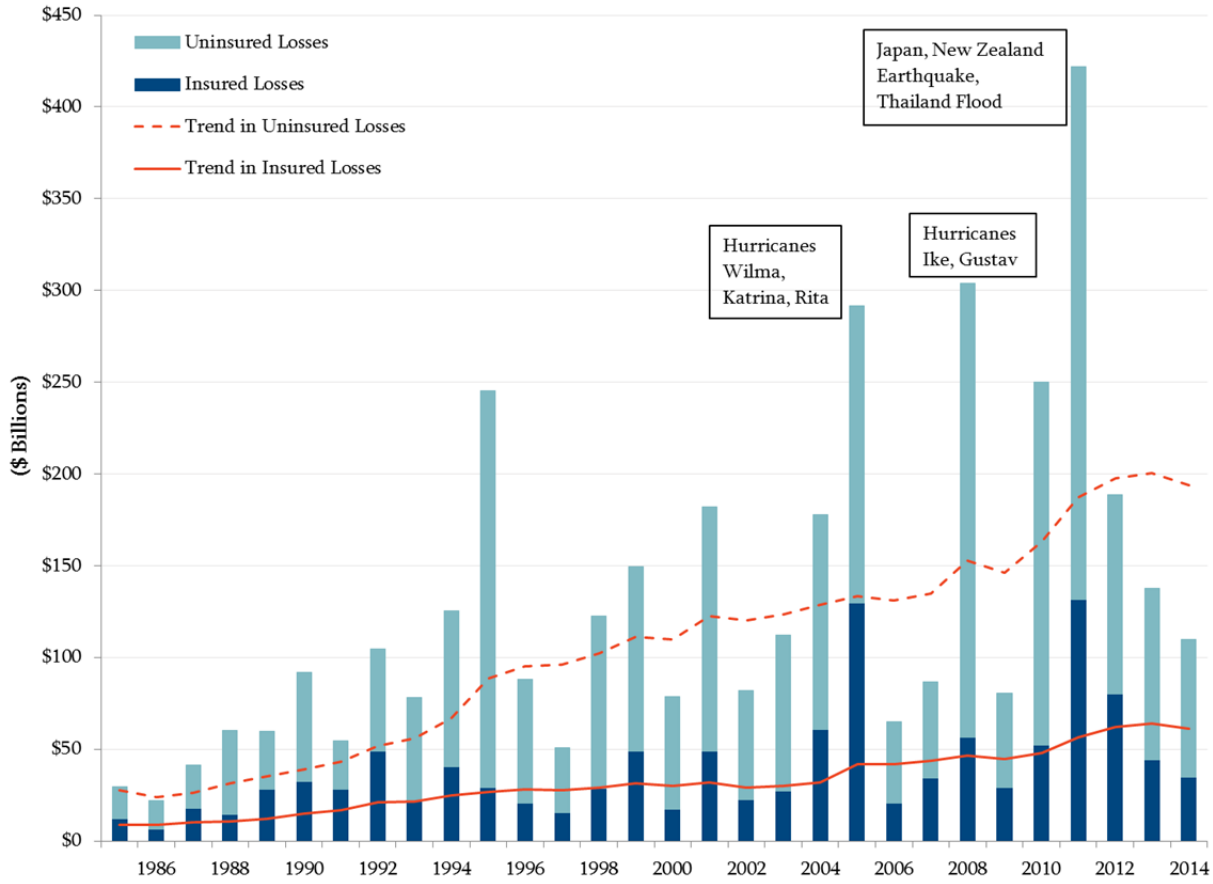
VI. Conclusion

We analyze how the U.S. insurance industry would respond to the imposition of a large tax on one particular tool for risk management—the purchase of reinsurance by U.S. subsidiaries from their foreign affiliates. We find that the supply of reinsurance would contract by 13 percent or more because neither of the alternatives to affiliate reinsurance (capital and non-affiliate reinsurance) is an adequate substitute. This severe contraction of reinsurance in turn would harm the market for primary insurance: supply would drop, and prices would rise by 0.8 percent, on average, and significantly more in some lines of business. U.S. consumers, overall, would have to pay $5 billion more a year for insurance while at the same time total insurance coverage would decline 2.2 percent. The burden of reduced supply and higher prices would fall disproportionately on those states most vulnerable to catastrophic losses, such as California, Florida, New York, Louisiana, and Texas.

Moreover, the contraction of the reinsurance would widen the "protection gap," the difference between economic and insured losses. We note from Figure 20 that the trend in overall losses is increasing faster than in insurance losses, which indicates a growing "gap" in coverage for catastrophic losses.

[75] We understand that, although NAIC requests that companies report non-proportional reinsurance for HMP and CMP under "Reinsurance: Non-Proportional Assumed Liability," some companies report it under "Reinsurance: Non-Proportional Assumed Property."

Figure 20. Gap between Insurance Losses and Overall Losses



Source: Swiss Re, "Underinsurance of Property Risks: Closing the Gap," No. 5/2015.

Insurance provides critical support to compensate consumers facing losses, and underinsurance represents a gap between the economic losses and insured losses. The gap between the overall losses and insured losses has widened since 1980 and is still growing. Less than half of overall losses are insured worldwide.[76] This protection gap extends not just to natural catastrophes, but to any catastrophic loss event. The increasing prevalence of natural and man-made catastrophes makes closing this gap more important. If not properly managed, part of this gap will fall almost surely on the government as as an emergency relief safety net.

[76] Swiss Re, "Underinsurance of Property Risks: Closing the Gap," Sigma No. 5/2015, p. 4.

Appendix A. Regression Analysis and Simulation

This appendix provides more details of the regression analyses and simulation of the U.S. P&C insurance market under the proposed legislation. The regression analyses consist of three separate regressions. First, we estimate the degree of substitutability of non-affiliated reinsurance and capital (surplus) for affiliated reinsurance. In the second regression, we investigate the sensitivity of insurance premiums written to ceded reinsurance and surplus. The last regression assesses the impact of a change in industry-wide growth of premiums written on the price of insurance, defined as the ratio of premiums earned over the losses incurred. Finally, this appendix describes a simulation of the U.S. P&C insurance market under the proposed legislation. Each of these steps is described in greater detail below.

REGRESSION ANALYSIS #1: SUBSTITUTION FOR AFFILIATED REINSURANCE

Insurance companies manage their business through three main tools — surplus, affiliated reinsurance, and non-affiliated reinsurance. They are jointly determined. In the regression framework, this results in a system of simultaneous equations where surplus, affiliated, and non-affiliated reinsurance should all be treated as endogenous variables. Because the tax proposals would directly impact the affiliated reinsurance, we estimate the responses from the other two variables. More specifically, the two regressions are:

$$RCTNA_{i,t} = \beta_0 + \beta_1 * NetRCTA_{i,t} + \beta_2 * Surplus_{i,t} + \beta_3 * Ln(Age_i) + \beta_4 * CatExposure_{i,t} + \beta_5 * HERFGEO_{i,t} + \beta_6 * HERFLOB_{i,t} + \beta_7 * Ln(Assets_{i,t}) + \beta_8 * Mutual_i + \Sigma\beta_n * LineShare_{i,t} + \varepsilon_{i,t},$$

$$Surplus_{i,t} = \varphi_0 + \varphi_1 * NetRCTA_{i,t} + \varphi_2 * RCTNA_{i,t} + \varphi_3 * Ln(Age_i) + \varphi_4 * Ln(Assets_{i,t}) + \varphi_5 * CoC_t + \Sigma\varphi_n * LineShare_{i,t} + \zeta_{i,t}.$$

where the variables are defined as in Table A1.[77]

[77] Note the affiliate reinsurance is defined as the reinsurance ceded to affiliates less reinsurance assumed from affiliates.

Table A1: Description of the Variables in Regression Analysis #1

Variable	*Variation Dimensions*	*Description*
RCTNA	Across companies and time	Reinsurance ceded to non-affiliates divided by gross premiums written, where the latter measure is defined as direct premiums written plus reinsurance assumed from non-affiliates.
NetRCTA	Across companies and time	Reinsurance ceded to affiliates (net of reinsurance assumed from affiliates) divided by gross premiums written.
Surplus	Across companies and time	Surplus (i.e., total assets net of total liabilities) divided by gross premiums written.
Age	Across companies	Age of the company as of 2008.
CatExposure	Across companies and time	Direct premiums written by the insurer in property insurance lines in coastal states and earthquake coverage in California divided by total direct premiums written.
HERFGEO	Across companies and time	Herfindahl index of geographic concentration based on direct premiums written in each state by the insurer.
HERFLOB	Across companies and time	Herfindahl index of line of business concentration based on direct premiums written in line of business by the insurer.
Assets	Across companies and time	Total assets of the insurer.
CoC	Across time	Cost of capital assuming the beta of 1, defined as the market risk premium plus the 3-month Treasury bill rate.
Mutual	Across companies	A dummy variable equal to 1 if the insurer is a mutual and to 0, otherwise.
LineShare	Across companies and time	Direct premiums written in each of the lines of business divided by total direct premiums written.

To account for endogeneity of the reinsurance variables and surplus in the above equations, we utilize the instrumental variable (2-stage least squares) method. Under this method, we first regress the two endogenous variables in each equation on the independent variables listed in Table A1 as well as the natural logarithm of the number of affiliates, and the company-to-group size ratio (defined as the ratio of the insurer's assets to the sum of the group's assets). These additional instruments play a role in explaining the instrumented (endogenous) variables.[78] In the second step, we run the above equations using the fitted values for the endogenous variables from the first step.

The first regression is in many ways similar to the one performed in Powell and Sommer (2005)[79] and Mayers and Smith (1990).[80] As affiliated and non-affiliated reinsurance are not perfect substitutes, the expected coefficient on NetRCTA variable is between zero and negative one. The other variables are included in the regression to control for other factors affecting the dependent variable:[81]

- The age variable, a proxy for informational asymmetries inherent in reinsurance transactions among non-affiliated entities, is expected to have a positive sign: as insurers get more informed about one another over time, older insurers should be able to find non-affiliated reinsurance more easily than the newly formed ones.
- Catastrophe exposure should increase demand for non-affiliated reinsurance because of higher capitalization requirements.[82]

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78 For example, affiliated reinsurance may be affected by the company-to-group size ratio. If the company is large relative to the entire group, its affiliates may be unable to assume a large share of the premiums that the company decided to cede. On the other hand, the number of affiliates may be important in explaining the affiliated reinsurance as larger number of affiliates can result in better chances of finding an affiliated insurer ready to assume reinsurance from the company in question. Furthermore, if each of the affiliates is targeting a different line of business or geographic area, then the group companies may distribute their risks internally.

79 Powell, Lawrence and David Sommer, "Internal versus External Capital Markets in the Insurance Industry: The Role of Reinsurance," *SSRN*, 2005.

80 Mayers, David and Clifford W. Smith, Jr, "On the Corporate Demand for Insurance: Evidence from the Reinsurance Market," *Journal of Business*, 1990, vol. 63, no. 1, pt 1.

81 Two variables in Powell and Sommer (2005)—tax-exempt interest income and publicly traded dummy variable—are not included because they are not statistically significant. We also exclude the industry leverage variable since it was collinear with another exogenous variable.

82 The link between catastrophe exposure and affiliated reinsurance is less clear-cut. Powell and Sommer (2005) provide reasons for why insurers with high catastrophe exposure may have fewer incentives to cede less to their affiliates. One of the explanations is that some subsidiaries are created to pigeonhole catastrophic loss risks so that they do not impact other group members.

- Geographic and line of business concentration could affect demand for reinsurance, although their impact is an empirical matter: On one hand insurers having high geographic or line-of-business concentrations are more susceptible to catastrophic loss. On the other hand, as Powell and Sommer (2005) argue, insurers concentrating in fewer lines or geographic areas may choose less risky lines or choose less risky clients inside their chosen lines.
- Company size, measured by the natural logarithm of total assets, is a proxy for financial strength of an insurer. Thus larger companies may have fewer incentives to shift part of their risk via reinsurance transactions than smaller companies exposed to greater risk of insolvency.
- Organizational form of the insurance company may also play a role as found in Mayers and Smith (1990). For example, the agency problems may be less alarming for mutual insurers because their policyholders are also the equity holders of the company. The expected sign is positive.
- Following Mayers and Smith (1990) and Powell and Sommer (2005), we include the percentage share variables for each line of business, which are proxies for different risks in terms of expected magnitude, cash flow uncertainty and timing.[83] These differences across the lines may potentially impact insurer's demand for reinsurance.
- Finally, we expect a negative relationship between surplus and reinsurance since higher surplus implies higher cushion against unexpected future losses and, all else equal, creates less incentives for seeking reinsurance.

As for the second equation, both types of reinsurance are expected to have negative coefficient estimates. Line variables are important as companies with a different business mix may have different capitalization requirements. The coefficient estimate on company size is likely to be negative as larger companies are likely to be both financially stronger and better diversified and will therefore require less surplus per unit of premiums written. We include age to account for the possible impact of the years the company has been in business on its surplus. The expected sign on the cost of capital variable is negative as its higher value makes it costly to hold an extra dollar of surplus per unit of premiums written.

Following the academic literature, we delete observations with abnormal values such as negative assets, ceded or assumed reinsurance, and direct premiums written. We also remove

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[83] Note that for the purposes of calculating the "Line shares" variables, 31 proportional lines are regrouped into 24 lines by combining "Medical malpractice – occurrence" with "Medical malpractice – claims made", "Other liability – occurrence" with "Other liability – claims made", "Products liability – occurrence" with "Products liability – claims made", as well as combining the three accident and health lines into one line and the three auto lines into one line. We subsequently drop the line variable for "Commercial multiple peril" to avoid singularity in the regression.

observations with a surplus ratio larger than ten or negative, HERFGEO, HERFLOB, and leverage variables outside the zero to one interval, as well as catastrophic exposure and company-to-group asset ratio variables exceeding one.[84]

Table A2 provides a summary of the estimation results.[85]

Table A2: Estimation Results

	RCTNA	Surplus
Constant	1.782***	2.846***
	[0.158]	[0.480]
NetRCTA	-0.315***	-1.552***
	[0.0129]	[0.116]
RCTNA		-3.339***
		[0.355]
Surplus	0.140***	
	[0.0482]	
Ln(Age)	-0.0128***	0.0570***
	[0.00394]	[0.00843]
CatExposure	0.252***	
	[0.0329]	
HERFGEO	-0.0536***	
	[0.0106]	
HERFLOB	-0.0605***	
	[0.0144]	
Ln(Assets)	-0.0840***	-0.0729***
	[0.00907]	[0.0211]
CoC		-1.607***
		[0.195]
Mutual	-0.0351***	
	[0.0102]	
Observations	14,581	14,581

Standard errors are shown in brackets.
Dependent variables are RCTNA and Surplus.
** significant at 10%.*
*** significant at 5%.*
**** significant at 1%.*

[84] We also eliminate all reciprocal and Lloyd's member companies, as well as those which are not part of an affiliated group or which have been created less than two years prior to the observation year. Additionally, we limit our attention to companies that write direct premiums in excess of USD 50 million and those who have reinsurance assumed from non-affiliates not exceeding 75 percent of gross premiums written. The former restriction is imposed to capture only the non-trivial participants who are active in the market, while the latter restriction is imposed to eliminate the companies who primarily act as reinsurers.

[85] The coefficient estimates for 23 line variables and the year dummies are not reported.

All of the variables that are statistically significant have the expected signs.[86] As our objective is to quantify the sensitivity of non-affiliated reinsurance and surplus to changes in affiliated reinsurance, we are particularly interested in coefficients on net affiliated reinsurance and surplus in the first equation and coefficients on net affiliated and non-affiliated reinsurance in the second equation. Taking into account that surplus and non-affiliated reinsurance are endogenous in this system, we quantify their sensitivities to a unit shock in affiliated reinsurance ratio as follows:

$$\partial \text{ RCTNA}/\partial \text{ NetRCTA} = (\beta_1 + \beta_2\varphi_1)/(1-\beta_2\varphi_2) =$$

$$= (-0.315+(0.140)\times(-1.552))/(1-(0.140)\times(-3.339)) = -0.36$$

$$\partial \text{ Surplus}/\partial \text{ NetRCTA} = (\varphi_1 + \varphi_2\beta_1)/(1-\beta_2\varphi_2) =$$

$$= (-1.552+(-3.339)\times(-0.315))/(1-(0.140)\times(-3.339)) = -0.34$$

Therefore, all else equal, a unit negative shock to affiliated reinsurance to premiums written ratio will translate into 0.36 units of increment in non-affiliated reinsurance to premiums written ratio and 0.34 units of increment in surplus to premiums written ratio.

REGRESSION ANALYSIS #2: IMPACT OF REINSURANCE AND SURPLUS ON INSURANCE PREMIUMS

The analysis in the second regression analysis follows Powell, Sommer, and Eckles (2008).[87] Because in the first step of our analysis we have already assessed the impact on surplus and aggregate (*i.e.*, affiliated plus non-affiliated) ceded reinsurance ratios from a unit change in affiliated reinsurance ratio, in the second step we intend to quantify the magnitude of a change in the gross premiums written by a company per unit change in the aggregate ceded reinsurance. We define our regressions in terms of the growth rates rather than levels. As in the first step of our analysis, we use NAIC data from 1996 through 2015. The following regression is estimated:

$$\Delta\text{GPW}_{i,t} = \gamma_0 + \gamma_1{*}\Delta\text{RC}_{i,t} + \gamma_2{*}\Delta\text{Surplus}_{i,t} + \gamma_3{*}\Delta\text{HERFLOB}_{i,t} + \gamma_4{*}\Delta\text{HERFGEO}_{i,t} + \gamma_5{*}\Delta\text{CatExposure}_{i,t} + \gamma_6{*}\Delta\text{LongTail}_{i,t} + \gamma_7{*}\text{Mutual}_i + \Sigma\,\gamma_k{*}\text{YearK}_t + \Sigma\,\gamma_m{*}\text{CompanyM}_i + \eta_{i,t},$$

where the variables are defined as in Table A3.

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[86] We note the sign on surplus is positive. This demonstrates that decreases in reinsurance ceded to non-affiliates are primarily replaced by reinsurance ceded to affiliates. In other words, non-affiliate and affiliate reinsurance are better, faster substitutes than non-affiliate reinsurance and capital.

[87] Powell, Lawrence, David Sommer, and David Eckles, "The Role of Internal Capital Markets in Financial Intermediaries: Evidence from Insurer Groups," *The Journal of Risk and Insurance*, 2008, Vol. 75, No. 2, 439-461.

Intuition behind this regression specification is straightforward. All else equal, increased reliance on reinsurance should allow an insurance company to write more premiums since by ceding reinsurance it partially protects itself from the risk of unexpected losses. Thus the expected sign on the ceded reinsurance variable is positive in our regression. Instead of relying on reinsurance, an insurance company may increase its surplus, which serves as a cushion against unexpected losses. Keeping everything else constant, increased surplus should enable the company to write more insurance premiums. Thus the growth in surplus represents the company's ability to write more premiums without ceding more reinsurance. Therefore, it is expected that the growth in surplus variable does also have a positive coefficient.

Table A3: Description of the Variables

Variable	*Variation Dimensions*	*Description*
ΔGPW	Across companies and time	Percentage change in the gross premiums written.
ΔRC	Across companies and time	Change in the sum of RCTNA and NetRCTA variables.
ΔSurplus	Across companies and time	Percentage change in surplus, where surplus is defined as the difference between insurer's assets and liabilities.
ΔHERFLOB	Across companies and time	Change in the level of the line-of-business concentration.
ΔHERFGEO	Across companies and time	Change in the level of the geographic concentration.
ΔCatExposure	Across companies and time	Change in the level of the catastrophe exposure.
ΔLongtail	Across companies and time	Change in the level of long tail exposure, defined as the ratio of direct premiums written in long tail (liability) lines to the total direct premiums written by the insurer.
Mutual	Across companies	A dummy variable equal to 1 if the insurer is a mutual and to 0, otherwise.
Year	Across time	Year dummies.
CompanyM	Across companies	Company fixed effects / dummies.

While surplus adjustments and ceded reinsurance volumes are important drivers of gross premiums written, one needs to control for risk exposure variables as well: even if an insurer keeps the ceded reinsurance ratio and surplus levels constant, decreasing its underwriting exposure via less geographic, line of business concentration or catastrophe exposure should enable it to increase the gross premiums written. An insurer's ability to write premiums may also depend on the change in the relative magnitude of premiums written in the long-tail lines. On the one hand, higher long-tail exposure may mitigate the pressure on the insurer's capital due to losses being discounted over a longer horizon and therefore allow the insurer to increase gross premiums written, all else equal. On the other hand, long-tail lines are associated with higher uncertainty, and increasing long-tail exposure may require additional capital. Depending on which of the two effects dominates, the sign on the long-tail variable can be either negative or positive. Mutual dummy is included to control for the organizational form of the insurer. We also add the year and company dummies to control for fixed effects.

Similar to our regression analysis #1, we drop all the companies whose direct premiums written were less than USD 50 million. To account for possible endogeneity of the growth in ceded reinsurance variable, we utilize the instrumental variable (2-stage least squares) approach by using the all of the remaining independent variables in the regression above as well as the line share variables (see Step 1 regressions). As an additional sensitivity test, we estimate regression where both ceded reinsurance and surplus growth are treated as endogenous variables.

The estimation results are reported in Table A4. In the last column of Table A4, we also report the original estimates from a similar regression in Powell, Sommer, and Eckles (2008) which was estimated using the Generalized Least Squares approach while using the first lag of the growth in surplus variable and treating both change in reinsurance and growth in surplus as exogenous variables. The coefficient on the change in reinsurance ratio is positive and significant in all three regressions. The coefficient on the percentage change in surplus is significant in the first and third regressions. The coefficient on the reinsurance variable is also relatively stable across different specifications, which, however, is not the case with the surplus growth variable.

Table A4: Estimation Results

	Exogenous Surplus	Endogenous Surplus	Powell, Sommer, and Eckles (2008)
Constant	-0.0119	-0.0114	0.072***
	[0.0771]	[0.0776]	[0.011]
ΔRC	0.574**	0.571**	0.562***
	[0.239]	[0.240]	[0.029]
ΔSurplus	0.153***	0.304	0.137***
	[0.0113]	[0.230]	[0.026]
ΔHERFLOB	-0.00347	-0.00222	-0.017
	[0.0377]	[0.0380]	[0.044]
ΔHERFGEO	-0.366***	-0.358***	-0.534***
	[0.0379]	[0.0398]	[0.054]
ΔCatExposure	-0.244***	-0.249***	-0.046
	[0.0662]	[0.0672]	[0.051]
ΔLongtail	0.137***	0.132***	0.199***
	[0.0350]	[0.0360]	[0.051]
ΔMutual	-0.0425***	-0.0403***	-0.029***
	[0.00838]	[0.00907]	[0.011]
Observations	15,512	15,512	4,984

Standard errors are shown in brackets.
Dependent variable is ΔGPW.
** significant at 10%*
*** significant at 5%*
**** significant at 1%*

Simulation Analysis: Interaction of Reduction in Industry-wide Premiums and Change in Reinsurance and Capital Levels

Given the parameters estimated from regression analyses #1 and #2, we conduct a simulation to estimate the impact on the U.S. P&C industry. This simulation is necessary because of the feedback loops (see Figure 18 in the report). As the regression analyses show, each insurance company's offering of insurance policies (premiums), and its risk management in terms of capital and reinsurance depend on a number of factors such as size, cost of capital, geographic and line concentration. After controlling for these factors, we estimate the key regression coefficients to reflect the responses of an average insurance company. They correspond to the industry-wide premiums and capital. Hence, we use the industry-wide statistics to simulate the tax proposal's impact. An additional advantage of this approach is that using the industry aggregates smooths out the "noise" contained in each individual company's premium and capital levels.

In particular, the following equations are used in the simulation:[88]

$$\frac{\text{RCTNA}_i}{\text{GPW}_i} - \frac{\text{RCTNA}(-1)_i}{\text{GPW}(-1)_i} = \beta_1 \left(\frac{\text{RCTA}_i}{\text{GPW}_i} - \frac{\text{RCTA}(-1)_i}{\text{GPW}(-1)_i}\right) \quad \text{for each } i, \qquad (1a)$$

$$\frac{\text{CAPITAL}}{\sum_i \text{GPW}_i} - \frac{\text{CAPITAL}(-1)}{\sum_i \text{GPW}(-1)_i} = \beta_2 \left(\frac{\sum_i \text{RCTA}_i}{\sum_i \text{GPW}_i} - \frac{\sum_i \text{RCTA}(-1)_i}{\sum_i \text{GPW}(-1)_i}\right). \qquad (1b)$$

Equation (1a) is the substitution function of non-affiliate reinsurance (RCTNA_i) for affiliate reinsurance (RCTA_i). The functional form of reinsurance ratios follows from the specification in regression analysis #1. Equation (1b) models how capital responds to changes in reinsurance in aggregates. Note that since premium levels (for both direct insurance and reinsurance) are available for each NAIC line, but capital is only available for each line, the regression coefficient for non-affiliate reinsurance (β_1) is applied to each NAIC line, but the coefficient for capital (β_2) is applied to all lines combined. In the equations above (34 lines plus capital), all variables denoted with a (-1) suffix are known, and NetRCTA_i is also known. We need to solve for RCTNA_i, Capital, and GPW_i. At this stage, there are a total of 35 equations and 69 unknowns (34 RCTNA_i, 1 Capital, and 34 GPW_i).

From regression analysis #2, we know how GPW_i would react if there are changes in reinsurance ratios and capital growth:

$$\frac{\text{GPW}_i}{\text{GPW(-1)}_i} - 1 = \gamma_1 \left(\frac{\text{RCTA}_i + \text{RCTNA}_i}{\text{GPW}_i} - \frac{\text{RCTA(-1)}_i + \text{RCTNA(-1)}_i}{\text{GPW}(-1)_i}\right) + \gamma_2 \left(\frac{\text{CAPITAL}}{\text{CAPITAL(-1)}} - 1\right) \qquad (2)$$

Equation (2) adds 34 additional constraints on the unknowns. Thus, equations (1a), (1b), and (2) can now be solved simultaneously to obtain RCTNA_i, Capital, and GPW_i.

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[88] The simulation is performed on industry-wide premiums from SNL Financial. Because SNL Financial eliminates inter-company reinsurance, the reinsurance premiums assumed to and ceded from affiliates represent reinsurance between NAIC-reporting entities and non-reporting entities. At the industry level, we choose to define gross premiums written and reinsurance ceded to affiliates differently from those for each individual the regression analyses. In particular, we include reinsurance assumed from affiliates (these are from non-NAIC-reporting entities) in gross premiums written, and not to net reinsurance assumed from affiliate from reinsurance ceded to affiliates.

In our simulation exercise, we choose the following parameters:

Regression #1: $\beta_1 = -0.36$, $\beta_2 = -0.34$

Regression #2: $\gamma_1 = 0.57$, $\gamma_2 = 0.15$

REGRESSION ANALYSIS #3: PRICING IMPACT OF REDUCTION IN INSURANCE PREMIUMS

In the last regression analysis, we look at how insurance pricing paid by the insured changes per one percent change in the industry-wide premiums written. We define the price of insurance charged by an insurer in each year as the ratio of net premiums earned by the company in that year over the losses incurred. Both the definition of the price and the nature of our Step 3 analysis bear certain resemblance to Weiss and Chung (2004)[89] who analyzed reinsurance prices in non-proportional property and liability lines.

While in the previous two exercises of our empirical analysis we were dealing only with the insurance companies which have affiliates, in this step we include both companies which have affiliates and stand-alone companies not affiliated with any other insurer. The reason is simple – the prices are determined based on competition among all participants both group-member companies and stand-alone insurers. Additionally, since the main focus of our Step 3 is the pricing impact of a change in growth rate of industry-wide premiums written and this variable varies only across time and not in the cross section, we restrict our attention to the subset of companies that were in existence prior to 1996 and that do not have any missing or incomplete data since 1996.

For the company-specific information we use NAIC data. For industry-wide gross premiums written we use data from Total US PC Industry Underwriting and Investment Exhibit as reported by Highline Data. Our regression has the following form:

$$\text{Ln}(\text{Price}_{i,t}) = \delta_0 + \delta_1 * \text{Ln}(\text{Price}_{i,t-1}) + \delta_2 * \text{TreasuryRate}_t + \delta_3 * \Delta\text{GPW}_{t-1} + \delta_4 * \text{STL}_{i,t-1} +$$

$$\delta_5 * \text{Ln}(\text{Assets}_{i,t-1}) + \delta_6 * \text{Foreign}_i + \delta_7 * \text{Mutual}_i + \Sigma\, \delta_m * \text{CompanyM}_i + \xi_{i,t},$$

where the variables are defined as in Table A5.

[89] Weiss, Mary A. and Joon-Hai Chung, "U.S. Reinsurance Prices, Financial Quality, and Global Capacity," *The Journal of Risk and Insurance*, 2004, Vol. 71, No. 3, 437-467.

Table A5: Description of the Variables

Variable	*Variation Dimensions*	*Description*
Price	Across companies and time	Price of insurance defined as premiumS earned divided bv the insurer's losses incurred.
Treasury Rate	Across time	Constant maturity 1-year treasury rate obtained from H-15 database of the Federal Reserve.
ΔGPW	Across time	Percentage change in industry-wide gross premiums written.
STL	Across companies and time	The ratio of policyholders surplus over total liabilities of the insurer.
Assets	Across companies and time	Total assets of the insurer.
Foreign	Across companies	A dummy variable equal to 1 if the insurer is owned by a parent domiciled outside the United States and to 0, otherwise.
Mutual	Across companies	A dummy variable equal to 1 if the insurer is a mutual and to 0, otherwise.
CompanyM	Across companies	Company fixed effects / dummies.

The intuition behind the choice of the variables is as follows. First, we expect that reduction in the growth of gross premiums written will lead to higher prices charged by the companies. Thus our expectation is that the sign on the industry-wide premiums growth variable is negative. Lagged price variable is included to capture the time dependency of prices throughout underwriting cycle. Further, according to the "risky debt hypothesis,"[90] the buyers of insurance are concerned with the financial quality of the insurance companies. Therefore more financially sound firms command higher prices. Surplus-to-liability ratio and the size of the company, measured by the natural logarithm of total assets, are included as proxies of the financial strength. The expected sign is positive for both variables. Additionally, we include dummy variables for organizational structure (Mutual), ownership domicile (Foreign), as well as company fixed effects.

[90] Cummins, J. David and Patricia M. Danzon, "Price, Financial Quality, and Capital Flows in Insurance Markets," *Journal of Financial Intermediation*, 1997, Vol. 6, 3-38.

The regression results are reported in Table A6. As can be seen from Table A6, a 1 percent decline in the growth of industry-wide premiums written will lead to a 0.54 percent increase in the price of insurance. As a robustness check, we also re-estimated our regression using panel fixed effects estimator and found the results to be nearly identical, with the coefficient on ΔGPW equal to -0.54 and statistically significant at the 1 percent level. Estimation using the lagged 1-year Treasury rate produces a coefficient that is slightly larger (in absolute value) but is still statistically significant at the 1 percent level.

Table A6: Estimation Results

Constant	1.805***
	[0.274]
Ln(Price (lagged))	0.135***
	[0.00721]
Treasury Rate	-1.226***
	[0.256]
ΔGPW (lagged)	-0.541***
	[0.103]
STL (lagged)	0.000
	[0.000]
Ln(Assets (lagged))	-0.0253**
	[0.0104]
Foreign	-0.0158
	[0.0280]
Mutual	-0.106**
	[0.0440]
Observations	19,255

Standard errors are shown in brackets.
Dependent variables is Ln(Price).
** significant at 10%.*
*** significant at 5%.*
**** significant at 1%.*

Appendix B. State-Level Increase in the Cost of Insurance for Selected Lines of Business

State-Level Impact of Warner/Neal Proposal: Linear Allocation (page 1 of 6)

($ in Thousands)

A. State-by-State Direct Premium Written (DPW) in 2015

Line of Business	Total DPW	Alabama	Alaska	Arizona	Arkansas	California	Colorado	Connecticut	Delaware	District of Columbia
Allied lines	12,290,243	196,178	29,906	119,302	118,168	788,076	156,788	111,834	25,762	28,050
Farmowners multiple peril	4,086,173	74,050	633	15,988	28,608	209,485	78,943	5,894	5,756	0
Homeowners multiple peril	89,123,076	1,657,676	164,273	1,519,049	863,215	7,462,747	2,024,785	1,408,185	244,064	151,109
Commercial multiple peril	39,226,781	568,579	107,869	610,403	323,955	4,552,394	761,544	638,210	303,839	163,331
Ocean marine	3,074,234	37,875	37,391	19,143	16,690	280,178	12,813	87,409	7,658	3,642
Inland marine	19,962,268	276,656	146,994	326,165	202,259	2,585,927	352,208	293,154	77,972	110,974
Medical professional liability	9,317,817	122,485	23,547	220,314	64,074	752,021	160,999	157,007	33,662	26,459
Earthquake	2,812,354	8,029	25,182	8,840	31,615	1,643,302	10,800	8,277	1,173	2,610
Workers' compensation	57,168,518	349,379	281,738	841,693	259,624	12,334,022	1,057,358	892,281	197,234	198,170
Other liability - occurrence	38,624,333	395,822	116,545	550,967	211,779	4,254,913	699,062	574,896	232,457	129,450
Other liability - claims made	20,884,641	198,705	37,507	243,533	105,847	2,982,274	404,400	432,537	98,441	235,126
Excess workers' compensation	1,180,828	22,482	4,829	13,249	7,888	239,208	13,034	23,420	1,659	2,635
Products liability	3,547,454	33,851	4,370	36,666	17,710	463,741	64,623	57,727	7,579	5,254
Private passenger auto liability	119,311,710	1,508,342	275,311	2,384,847	903,538	13,076,221	2,172,631	1,652,325	531,599	161,084
Commercial auto liability	23,637,523	332,404	53,597	361,338	231,834	2,532,792	351,663	307,229	89,433	34,675
Total	444,247,953	5,782,515	1,309,693	7,271,498	3,386,803	54,157,302	8,321,652	6,650,385	1,858,287	1,252,569

B. State-by-State Allocated Cost Increase

Line of Business	% increase in cost	Alabama	Alaska	Arizona	Arkansas	California	Colorado	Connecticut	Delaware	District of Columbia
Allied lines	1.45%	2,836	432	1,725	1,708	11,393	2,267	1,617	372	406
Farmowners multiple peril	0.28%	205	2	44	79	580	219	16	16	-
Homeowners multiple peril	0.28%	4,686	464	4,294	2,440	21,095	5,724	3,981	690	427
Commercial multiple peril	0.79%	4,500	854	4,831	2,564	36,027	6,027	5,051	2,405	1,293
Ocean marine	3.01%	1,139	1,124	575	502	8,423	385	2,628	230	109
Inland marine	1.06%	2,939	1,561	3,465	2,149	27,470	3,741	3,114	828	1,179
Medical professional liability	0.70%	857	165	1,541	448	5,260	1,126	1,098	235	185
Earthquake	2.49%	200	626	220	786	40,876	269	206	29	65
Workers' compensation	0.99%	3,469	2,798	8,358	2,578	122,472	10,499	8,860	1,958	1,968
Other liability - occurrence	1.99%	7,869	2,317	10,954	4,210	84,592	13,898	11,429	4,621	2,574
Other liability - claims made	2.45%	4,871	919	5,970	2,595	73,108	9,913	10,603	2,413	5,764
Excess workers' compensation	1.53%	344	74	203	121	3,662	200	359	25	40
Products liability	3.07%	1,039	134	1,126	544	14,238	1,984	1,772	233	161
Private passenger auto liability	0.09%	1,331	243	2,105	797	11,540	1,917	1,458	469	142
Commercial auto liability	0.80%	2,647	427	2,877	1,846	20,166	2,800	2,446	712	276
Total		38,931	12,141	48,286	23,367	480,902	60,969	54,638	15,238	14,589

The above figures illustrate the impact of the proposal to insurance consumers in the state and were calculated by applying the estimated national increase in insurance costs to direct premiums written in the state. Only lines of business with a long return period were included. These figures do not include additional increases in costs that would result from the non-proportional reinsurance lines and international, which are not reported on a state by state basis. A blended rate of increase was used for products liability as the split between claims made and occurrence policies was not available on a state-by-state basis.

State-Level Impact of Warner/Neal Proposal: Linear Allocation (page 2 of 6)

($ in Thousands)

A. State-by-State Direct Premium Written (DPW) in 2015

Line of Business	Total DPW	Florida	Georgia	Hawaii	Idaho	Illinois	Indiana	Iowa	Kansas	Kentucky
Allied lines	12,290,243	2,633,607	266,334	92,178	27,323	322,788	185,235	119,701	146,407	100,240
Farmowners multiple peril	4,086,173	23,481	118,657	460	57,224	170,482	201,698	194,132	233,692	158,011
Homeowners multiple peril	89,123,076	8,772,206	2,844,022	368,755	315,632	3,423,857	1,851,696	731,293	1,104,651	1,115,395
Commercial multiple peril	39,226,781	2,221,245	981,971	174,298	195,885	1,721,225	803,114	373,834	380,403	506,951
Ocean marine	3,074,234	313,912	55,871	15,693	5,071	92,191	29,554	7,598	8,857	26,726
Inland marine	19,962,268	1,210,054	569,706	95,576	87,785	754,952	317,942	195,492	188,199	257,611
Medical professional liability	9,317,817	572,191	241,936	27,272	30,210	499,549	116,197	66,109	61,133	106,286
Earthquake	2,812,354	23,490	14,871	11,557	3,597	67,210	36,466	5,844	7,119	41,992
Workers' compensation	57,168,518	2,650,681	1,446,665	261,805	368,128	2,826,687	889,525	770,150	473,902	512,806
Other liability - occurrence	38,624,333	3,553,134	842,589	184,005	133,068	2,407,058	579,093	376,473	280,947	296,053
Other liability - claims made	20,884,641	940,579	585,572	80,060	59,009	1,398,117	273,444	164,262	141,885	158,932
Excess workers' compensation	1,180,828	60,679	39,563	5,311	1,897	60,481	13,038	10,427	11,026	19,112
Products liability	3,547,454	209,081	89,599	9,310	12,906	160,032	82,981	40,974	39,258	29,057
Private passenger auto liability	119,311,710	11,507,025	4,209,292	411,791	458,875	3,689,342	1,870,338	768,221	838,873	1,731,028
Commercial auto liability	23,637,523	1,741,263	731,313	84,856	104,101	1,015,310	443,805	222,219	182,763	289,741
Total	444,247,953	36,432,627	13,037,960	1,822,927	1,860,710	18,609,283	7,694,127	4,046,729	4,099,114	5,349,940

B. State-by-State Allocated Cost Increase

Line of Business	% increase in cost	Florida	Georgia	Hawaii	Idaho	Illinois	Indiana	Iowa	Kansas	Kentucky
Allied lines	1.45%	38,075	3,850	1,333	395	4,667	2,678	1,731	2,117	1,449
Farmowners multiple peril	0.28%	65	328	1	158	472	558	537	647	437
Homeowners multiple peril	0.28%	24,797	8,039	1,042	892	9,678	5,234	2,067	3,123	3,153
Commercial multiple peril	0.79%	17,578	7,771	1,379	1,550	13,621	6,356	2,958	3,010	4,012
Ocean marine	3.01%	9,437	1,680	472	152	2,771	888	228	266	803
Inland marine	1.06%	12,854	6,052	1,015	933	8,020	3,377	2,077	1,999	2,737
Medical professional liability	0.70%	4,002	1,692	191	211	3,494	813	462	428	743
Earthquake	2.49%	584	370	287	89	1,672	907	145	177	1,045
Workers' compensation	0.99%	26,320	14,365	2,600	3,655	28,068	8,833	7,647	4,706	5,092
Other liability - occurrence	1.99%	70,640	16,752	3,658	2,646	47,855	11,513	7,485	5,585	5,886
Other liability - claims made	2.45%	23,057	14,355	1,963	1,447	34,273	6,703	4,027	3,478	3,896
Excess workers' compensation	1.53%	929	606	81	29	926	200	160	169	293
Products liability	3.07%	6,419	2,751	286	396	4,914	2,548	1,258	1,205	892
Private passenger auto liability	0.09%	10,155	3,715	363	405	3,256	1,651	678	740	1,528
Commercial auto liability	0.80%	13,864	5,823	676	829	8,084	3,534	1,769	1,455	2,307
Total		258,777	88,148	15,348	13,788	171,771	55,792	33,230	29,106	34,273

The above figures illustrate the impact of the proposal to insurance consumers in the state and were calculated by applying the estimated national increase in insurance costs to direct premiums written in the state. Only lines of business with a long return period were included. These figures do not include additional increases in costs that would result from the non-proportional reinsurance lines and international, which are not reported on a state by state basis. A blended rate of increase was used for products liability as the split between claims made and occurrence policies was not available on a state-by-state basis.

State-Level Impact of Warner/Neal Proposal: Linear Allocation (page 3 of 6)

($ in Thousands)

A. State-by-State Direct Premium Written (DPW) in 2015

Line of Business	Total DPW	Louisiana	Maine	Maryland	Massachusetts	Michigan	Minnesota	Mississippi	Missouri	Montana
Allied lines	12,290,243	466,070	41,209	120,137	208,668	172,071	290,126	126,563	182,225	30,578
Farmowners multiple peril	4,086,173	13,541	4,607	26,987	3,257	142,183	145,046	22,557	169,216	65,832
Homeowners multiple peril	89,123,076	1,851,819	387,943	1,628,226	2,155,538	2,658,451	2,013,736	957,972	1,912,187	300,539
Commercial multiple peril	39,226,781	530,484	226,195	636,161	1,124,973	1,066,692	707,248	328,052	764,843	174,613
Ocean marine	3,074,234	185,278	26,244	96,325	86,661	65,390	24,997	17,810	37,043	3,435
Inland marine	19,962,268	413,479	73,960	329,301	459,290	529,603	370,689	179,506	333,903	84,257
Medical professional liability	9,317,817	102,058	46,581	276,782	300,740	190,342	78,305	48,354	141,780	41,208
Earthquake	2,812,354	6,262	2,035	12,270	20,926	8,340	6,850	17,364	91,411	4,692
Workers' compensation	57,168,518	834,136	220,659	962,920	1,150,611	1,197,085	998,846	361,104	923,617	287,327
Other liability - occurrence	38,624,333	679,003	98,490	644,263	892,538	785,542	646,259	215,410	594,042	114,925
Other liability - claims made	20,884,641	190,396	58,243	355,301	847,588	441,886	412,874	90,991	349,832	43,784
Excess workers' compensation	1,180,828	50,313	3,113	12,084	24,079	35,167	1,208	11,493	39,372	6,290
Products liability	3,547,454	44,140	8,271	47,936	101,034	89,938	87,711	19,101	56,364	11,084
Private passenger auto liability	119,311,710	2,373,772	356,032	2,563,615	2,647,008	5,153,560	1,851,128	912,578	1,841,243	339,566
Commercial auto liability	23,637,523	545,084	93,909	413,885	584,015	618,902	357,317	244,087	393,455	96,894
Total	444,247,953	8,285,835	1,647,489	8,126,192	10,606,927	13,155,152	7,992,340	3,552,942	7,830,531	1,605,024

B. State-by-State Allocated Cost Increase

Line of Business	% increase in cost	Louisiana	Maine	Maryland	Massachusetts	Michigan	Minnesota	Mississippi	Missouri	Montana
Allied lines	1.45%	6,738	596	1,737	3,017	2,488	4,194	1,830	2,634	442
Farmowners multiple peril	0.28%	37	13	75	9	394	401	62	468	182
Homeowners multiple peril	0.28%	5,235	1,097	4,603	6,093	7,515	5,692	2,708	5,405	850
Commercial multiple peril	0.79%	4,198	1,790	5,034	8,903	8,442	5,597	2,596	6,053	1,382
Ocean marine	3.01%	5,570	789	2,896	2,605	1,966	751	535	1,114	103
Inland marine	1.06%	4,392	786	3,498	4,879	5,626	3,938	1,907	3,547	895
Medical professional liability	0.70%	714	326	1,936	2,104	1,331	548	338	992	288
Earthquake	2.49%	156	51	305	521	207	170	432	2,274	117
Workers' compensation	0.99%	8,283	2,191	9,561	11,425	11,887	9,918	3,586	9,171	2,853
Other liability - occurrence	1.99%	13,499	1,958	12,809	17,745	15,617	12,848	4,283	11,810	2,285
Other liability - claims made	2.45%	4,667	1,428	8,710	20,778	10,832	10,121	2,231	8,576	1,073
Excess workers' compensation	1.53%	770	48	185	369	538	18	176	603	96
Products liability	3.07%	1,355	254	1,472	3,102	2,761	2,693	586	1,731	340
Private passenger auto liability	0.09%	2,095	314	2,262	2,336	4,548	1,634	805	1,625	300
Commercial auto liability	0.80%	4,340	748	3,295	4,650	4,928	2,845	1,943	3,133	771
Total		62,050	12,387	58,378	88,534	79,080	61,370	24,019	59,135	11,978

The above figures illustrate the impact of the proposal to insurance consumers in the state and were calculated by applying the estimated national increase in insurance costs to direct premiums written in the state. Only lines of business with a long return period were included. These figures do not include additional increases in costs that would result from the non-proportional reinsurance lines and international, which are not reported on a state by state basis. A blended rate of increase was used for products liability as the split between claims made and occurrence policies was not available on a state-by-state basis.

State-Level Impact of Warner/Neal Proposal: Linear Allocation (page 4 of 6)

($ in Thousands)

A. State-by-State Direct Premium Written (DPW) in 2015

Line of Business	Total DPW	Nebraska	Nevada	New Hampshire	New Jersey	New Mexico	New York	North Carolina	North Dakota	Ohio
Allied lines	12,290,243	79,597	70,405	29,167	334,645	42,186	653,181	277,822	49,373	240,699
Farmowners multiple peril	4,086,173	216,270	7,843	3,150	2,622	25,354	41,296	58,237	115,129	163,692
Homeowners multiple peril	89,123,076	649,522	535,066	383,096	2,556,089	489,700	5,220,744	2,376,336	196,937	2,785,059
Commercial multiple peril	39,226,781	262,711	310,843	231,881	1,424,250	225,469	3,706,915	935,094	143,982	1,265,653
Ocean marine	3,074,234	5,422	6,696	11,249	135,249	2,764	406,485	44,524	1,570	52,694
Inland marine	19,962,268	176,152	158,983	79,832	552,530	103,030	1,508,686	526,154	79,718	559,011
Medical professional liability	9,317,817	33,171	71,348	37,784	423,483	51,208	1,651,460	180,665	9,754	265,801
Earthquake	2,812,354	2,701	19,481	2,579	19,597	2,525	53,503	13,809	989	29,806
Workers' compensation	57,168,518	388,612	364,126	265,035	2,434,552	296,101	5,523,560	1,487,632	7,042	20,656
Other liability - occurrence	38,624,333	222,279	221,423	132,493	1,506,419	162,480	4,593,756	675,759	140,940	947,199
Other liability - claims made	20,884,641	98,574	124,106	55,903	825,150	57,934	2,537,878	470,353	37,132	606,723
Excess workers' compensation	1,180,828	5,547	17,891	4,058	37,039	6,521	59,256	28,957	0	74,265
Products liability	3,547,454	23,443	59,778	13,200	205,513	10,255	302,454	86,663	14,861	114,097
Private passenger auto liability	119,311,710	582,233	1,342,378	395,181	4,851,134	768,815	7,724,377	2,777,884	205,695	3,351,659
Commercial auto liability	23,637,523	140,435	197,144	89,479	1,053,833	139,010	1,912,401	561,356	91,591	654,731
Total	444,247,953	2,886,669	3,507,510	1,734,084	16,362,103	2,383,354	35,895,952	10,501,247	1,094,714	11,131,743

B. State-by-State Allocated Cost Increase

Line of Business	% increase in cost	Nebraska	Nevada	New Hampshire	New Jersey	New Mexico	New York	North Carolina	North Dakota	Ohio
Allied lines	1.45%	1,151	1,018	422	4,838	610	9,443	4,017	714	3,480
Farmowners multiple peril	0.28%	599	22	9	7	70	114	161	319	453
Homeowners multiple peril	0.28%	1,836	1,513	1,083	7,225	1,384	14,758	6,717	557	7,873
Commercial multiple peril	0.79%	2,079	2,460	1,835	11,271	1,784	29,336	7,400	1,139	10,016
Ocean marine	3.01%	163	201	338	4,066	83	12,220	1,338	47	1,584
Inland marine	1.06%	1,871	1,689	848	5,869	1,094	16,026	5,589	847	5,938
Medical professional liability	0.70%	232	499	264	2,962	358	11,551	1,264	68	1,859
Earthquake	2.49%	67	485	64	487	63	1,331	343	25	741
Workers' compensation	0.99%	3,859	3,616	2,632	24,174	2,940	54,847	14,772	70	205
Other liability - occurrence	1.99%	4,419	4,402	2,634	29,949	3,230	91,328	13,435	2,802	18,831
Other liability - claims made	2.45%	2,416	3,042	1,370	20,228	1,420	62,214	11,530	910	14,873
Excess workers' compensation	1.53%	85	274	62	567	100	907	443	0	1,137
Products liability	3.07%	720	1,835	405	6,310	315	9,286	2,661	456	3,503
Private passenger auto liability	0.09%	514	1,185	349	4,281	678	6,817	2,451	182	2,958
Commercial auto liability	0.80%	1,118	1,570	712	8,391	1,107	15,227	4,470	729	5,213
Total		21,129	23,809	13,028	130,627	15,238	335,405	76,592	8,865	78,665

The above figures illustrate the impact of the proposal to insurance consumers in the state and were calculated by applying the estimated national increase in insurance costs to direct premiums written in the state. Only lines of business with a long return period were included. These figures do not include additional increases in costs that would result from the non-proportional reinsurance lines and international, which are not reported on a state by state basis. A blended rate of increase was used for products liability as the split between claims made and occurrence policies was not available on a state-by-state basis.

State-Level Impact of Warner/Neal Proposal: Linear Allocation (page 5 of 6)

($ in Thousands)

A. State-by-State Direct Premium Written (DPW) in 2015

Line of Business	Total DPW	Oklahoma	Oregon	Pennsylvania	Rhode Island	South Carolina	South Dakota	Tennessee	Texas	Utah
Allied lines	12,290,243	189,727	72,262	297,035	39,834	182,313	33,594	181,959	1,829,521	50,515
Farmowners multiple peril	4,086,173	161,694	64,656	103,859	276	13,152	116,988	143,342	285,031	13,563
Homeowners multiple peril	89,123,076	1,595,082	749,220	3,248,515	370,153	1,601,721	221,501	1,909,045	7,994,072	489,732
Commercial multiple peril	39,226,781	527,709	459,370	1,704,178	150,488	471,680	128,504	696,206	2,674,326	259,607
Ocean marine	3,074,234	20,981	32,858	60,086	45,318	28,162	1,063	55,573	311,755	10,467
Inland marine	19,962,268	244,026	232,083	667,865	79,338	298,246	61,416	378,711	1,985,336	139,310
Medical professional liability	9,317,817	99,583	93,174	655,048	31,129	65,229	17,003	229,468	295,300	63,050
Earthquake	2,812,354	18,858	79,096	16,953	2,421	40,740	1,007	78,908	35,706	44,999
Workers' compensation	57,168,518	810,551	678,682	2,724,970	213,035	729,091	180,816	858,644	2,741,890	422,609
Other liability - occurrence	38,624,333	435,724	352,997	1,594,385	141,659	347,527	85,332	606,562	3,319,129	257,854
Other liability - claims made	20,884,641	163,864	159,154	899,989	82,713	138,482	34,811	307,945	1,516,605	128,419
Excess workers' compensation	1,180,828	24,391	11,690	43,210	1,864	10,982	1,297	20,336	31,155	4,083
Products liability	3,547,454	42,861	36,359	143,084	11,223	42,802	11,132	56,039	297,827	30,635
Private passenger auto liability	119,311,710	1,325,907	1,664,350	4,442,481	532,672	2,004,321	229,958	1,974,694	9,683,925	988,494
Commercial auto liability	23,637,523	311,135	248,739	985,726	80,395	288,538	66,454	392,528	2,275,072	181,504
Total	444,247,953	5,972,095	4,934,689	17,587,384	1,782,519	6,262,987	1,190,877	7,889,960	35,276,650	3,084,839

B. State-by-State Allocated Cost Increase

Line of Business	% increase in cost	Oklahoma	Oregon	Pennsylvania	Rhode Island	South Carolina	South Dakota	Tennessee	Texas	Utah
Allied lines	1.45%	2,743	1,045	4,294	576	2,636	486	2,631	26,450	730
Farmowners multiple peril	0.28%	448	179	287	1	36	324	397	789	38
Homeowners multiple peril	0.28%	4,509	2,118	9,183	1,046	4,528	626	5,396	22,597	1,384
Commercial multiple peril	0.79%	4,176	3,635	13,486	1,191	3,733	1,017	5,510	21,164	2,054
Ocean marine	3.01%	631	988	1,806	1,362	847	32	1,671	9,372	315
Inland marine	1.06%	2,592	2,465	7,095	843	3,168	652	4,023	21,090	1,480
Medical professional liability	0.70%	697	652	4,582	218	456	119	1,605	2,066	441
Earthquake	2.49%	469	1,967	422	60	1,013	25	1,963	888	1,119
Workers' compensation	0.99%	8,048	6,739	27,058	2,115	7,240	1,795	8,526	27,226	4,196
Other liability - occurrence	1.99%	8,663	7,018	31,698	2,816	6,909	1,696	12,059	65,988	5,126
Other liability - claims made	2.45%	4,017	3,902	22,062	2,028	3,395	853	7,549	37,178	3,148
Excess workers' compensation	1.53%	373	179	662	29	168	20	311	477	63
Products liability	3.07%	1,316	1,116	4,393	345	1,314	342	1,721	9,144	941
Private passenger auto liability	0.09%	1,170	1,469	3,920	470	1,769	203	1,743	8,546	872
Commercial auto liability	0.80%	2,477	1,980	7,848	640	2,297	529	3,125	18,114	1,445
Total		42,329	35,452	138,797	13,740	39,509	8,720	58,229	271,089	23,353

The above figures illustrate the impact of the proposal to insurance consumers in the state and were calculated by applying the estimated national increase in insurance costs to direct premiums written in the state. Only lines of business with a long return period were included. These figures do not include additional increases in costs that would result from the non-proportional reinsurance lines and international, which are not reported on a state by state basis. A blended rate of increase was used for products liability as the split between claims made and occurrence policies was not available on a state-by-state basis.

State-Level Impact of Warner/Neal Proposal: Linear Allocation (page 6 of 6)

($ in Thousands)

A. State-by-State Direct Premium Written (DPW) in 2015

Line of Business	Total DPW	Vermont	Virginia	Washington	West Virginia	Wisconsin	Wyoming
Allied lines	12,290,243	13,607	182,854	142,402	36,752	137,281	17,988
Farmowners multiple peril	4,086,173	14,677	75,397	71,375	14,364	174,985	28,801
Homeowners multiple peril	89,123,076	190,047	2,126,210	1,585,812	427,551	1,344,228	188,617
Commercial multiple peril	39,226,781	135,019	779,795	791,229	204,764	686,942	101,855
Ocean marine	3,074,234	5,163	64,187	130,224	3,704	35,530	1,053
Inland marine	19,962,268	39,910	424,448	462,227	76,795	257,320	47,527
Medical professional liability	9,317,817	16,305	193,276	160,753	63,887	78,561	23,777
Earthquake	2,812,354	28,341	18,759	169,354	1,281	5,864	2,952
Workers' compensation	57,168,518	196,611	981,402	24,346	323,086	1,941,027	6,291
Other liability - occurrence	38,624,333	67,933	703,094	711,312	151,056	672,689	85,548
Other liability - claims made	20,884,641	37,405	546,543	364,190	49,938	291,400	18,305
Excess workers' compensation	1,180,828	1,406	25,197	24,203	4,990	9,159	276
Products liability	3,547,454	6,592	54,397	54,248	11,987	81,717	5,993
Private passenger auto liability	119,311,710	173,906	2,753,821	2,947,369	671,203	1,556,803	173,265
Commercial auto liability	23,637,523	42,935	480,476	420,902	123,786	382,244	59,221
Total	444,247,953	969,856	9,409,854	8,059,947	2,165,144	7,655,750	761,470

B. State-by-State Allocated Cost Increase

Line of Business	% increase in cost	Vermont	Virginia	Washington	West Virginia	Wisconsin	Wyoming
Allied lines	1.45%	197	2,644	2,059	531	1,985	260
Farmowners multiple peril	0.28%	41	209	198	40	484	80
Homeowners multiple peril	0.28%	537	6,010	4,483	1,209	3,800	533
Commercial multiple peril	0.79%	1,069	6,171	6,262	1,620	5,436	806
Ocean marine	3.01%	155	1,930	3,915	111	1,068	32
Inland marine	1.06%	424	4,509	4,910	816	2,733	505
Medical professional liability	0.70%	114	1,352	1,124	447	550	166
Earthquake	2.49%	705	467	4,213	32	146	73
Workers' compensation	0.99%	1,952	9,745	242	3,208	19,274	62
Other liability - occurrence	1.99%	1,351	13,978	14,142	3,003	13,374	1,701
Other liability - claims made	2.45%	917	13,398	8,928	1,224	7,143	449
Excess workers' compensation	1.53%	22	386	371	76	140	4
Products liability	3.07%	202	1,670	1,666	368	2,509	184
Private passenger auto liability	0.09%	153	2,430	2,601	592	1,374	153
Commercial auto liability	0.80%	342	3,826	3,351	986	3,043	472
Total		8,180	68,723	58,462	14,264	63,059	5,480

The above figures illustrate the minimum impact of the proposal to insurance consumers in the state and were calculated by applying the estimated national increase in insurance costs to direct premiums written in the state. Only lines of business with a long return period were included. These figures do not include additional increases in costs that would result from the non-proportional reinsurance lines and international, which are not reported on a state by state basis. A blended rate of increase was used for products liability as the split between claims made and occurrence policies was not available on a state-by-state basis.

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