ESSAYS ON ISSUES
THE FEDERAL RESERVE BANK OF CHICAGO
2015
NUMBER 334

Chicago Fed Letter

How do property and casualty insurers manage risk? The role of reinsurance

by Andy Polacek, senior associate economist

By tempering financial losses, the insurance industry lends resilience to the economy and helps homeowners and businesses recover from natural disasters and other catastrophes. In order to do this, however, the insurance industry must itself be resilient.

In 2005, U.S. property and casualty (P&C) insurance companies paid out a record $72.2 billion in natural disaster- and catastrophe-related claims, more than double the claims paid in 2004, yet very few insurers faced insolvency as a result.[1]

1. Premiums ceded to reinsurers by business line, 2013

Business line	Direct premiums (billions of dollars)	Percent ceded
Auto lines combined	208.7	4.3
Financial and mortgage guaranty	5.2	5.9
Fidelity and surety	6.5	9.0
Medical professional liability	9.8	9.5
Homeowners and farm owners	85.6	11.6
Workers compensation	52.5	12.0
Commercial multiple peril	37.9	12.5
Accident and health	6.7	15.0
Other and product liability lines	58.2	19.7
Other commercial	7.7	27.8
Fire and allied lines combined	44.5	36.6
Marine lines combined	21.2	38.0
Aircraft (all perils)	1.7	39.5

Sources: SNL Financial and author's calculations.

Hurricane Katrina, one of the most destructive storms in U.S. history, caused more than $108 billion in damage in 2005. Insurance played an important role in the Gulf Coast's recovery from the hurricane, with private insurers covering $41.1 billion in damages from property and homeowners' insurance claims, as well as over $2 billion in insured damages to offshore energy facilities. In addition, the National Flood Insurance Program (NFIP) covered $25.8 billion in losses that were due to flooding.[2] This *Chicago Fed Letter* discusses how property and casualty insurers manage risk, focusing in particular on reinsurance.

Insurance and reinsurance

Most Americans have some form of insurance, whether it is car insurance, homeowners insurance, or an extended warranty for an iPhone. In each case, the policyholder pays a premium and the insurer agrees to pay for damages specified in the insurance policy that occur during the life of the contract. Insurers make money when the returns they earn by investing premiums plus the premiums themselves exceed their payments to policyholders.

However, insurers do not know the true cost of an individual policy until after the contract has expired and any losses are known. For example, in a given year, one insured driver may have no accidents, while another causes a five-car pileup that leads to millions of dollars in damages. In order to control the risk of their overall portfolio of insured drivers, insurers rely on the law of large numbers. It is difficult to predict if an individual driver will have an accident in a given year and even more difficult to predict the insured losses due to that accident. However, if a company insures 100,000 drivers, it can estimate the approximate fraction of drivers who will have an accident and predict the total losses within a tight range. By insuring many drivers, the insurance company can better predict average losses per policyholder and set premium prices appropriately. A similar logic applies to other types of insurance as well. However, the law of large numbers does not make it easier to manage some risks, particularly

2. Top ten reinsurers by premiums assumed, 2013

Rank	P&C reinsurance group	Total	Nonproportional	% of total industry
1	Berkshire Hathaway Inc.	5.39	4.69	7.5
2	Swiss Re Ltd.	5.02	2.09	7.0
3	Munich Re America Inc.	3.39	1.10	4.7
4	Everest Re Group Ltd.	3.18	1.35	4.5
5	Alleghany Corp.	3.09	0.94	4.3
6	Fairfax Financial Holdings Ltd.	1.69	0.90	2.4
7	PartnerRe	1.61	0.31	2.3
8	ACE Ltd.	1.45	0.02	2.0
9	Liberty Mutual	1.16	0.11	1.6
10	American International Group Inc.	1.10	0.04	1.5
Total	Top 10	27.08	11.55	37.9
Total	U.S.-based reinsurers	42.85	15.28	60.0
Total	Non-U.S.-based reinsurers	28.58		40.0

NOTE: Top ten reinsurers by premiums assumed from U.S.-based property and casualty insurers in 2013.
SOURCES: SNL Financial and author's calculations.

those associated with extreme events that are geographically concentrated, such as Hurricane Katrina. In order to cope with this type of risk, insurers often use reinsurance.

Reinsurance is insurance for insurers. Just as a policyholder pays a premium and in exchange the insurance company pays for losses associated with that policy, in a reinsurance transaction the primary insurer pays a premium to a reinsurer, and in return the reinsurer covers the losses associated with the reinsurance policy. When a primary insurer uses reinsurance, it retains its obligation to pay valid policyholder claims, and policyholders continue to interact with the primary insurer, not the reinsurer. If the reinsurer defaults on its obligation to the primary insurer, the primary insurer still must pay policyholder claims.

In a typical reinsurance contract, the primary insurer pays the reinsurer a share of the premium it receives and the reinsurer agrees to pay the primary insurer for all or part of a loss that the primary insurer experiences on the block of business that has been reinsured. Some reinsurers, such as Swiss Re, only write reinsurance and do not sell insurance directly to policyholders. Other reinsurers, such as Berkshire Hathaway, are also primary insurers that sell insurance directly to policyholders in addition to providing reinsurance. Reinsurance is a common way to manage risk, and 79% of U.S. life insurance companies and 92% of U.S. P&C insurance companies reported paying reinsurance premiums between 2004 and 2013.[3]

Managing risk with reinsurance

One of the main reasons primary insurers use reinsurance is to manage risks associated with a concentration of policies in a specific geographic region or business line. A concentrated insurance portfolio can lead to volatile earnings. For example, a company that specializes in fire insurance in California would have to make large payments to homeowners if a severe drought caused an unexpectedly large string of wildfires. Of course, the same insurer would have relatively few claims in a year with significant rainfall. This company could use reinsurance to cap its losses in bad years or to share losses in both good and bad years. In either case, reinsurance would allow the company to ensure that it will have the resources necessary to pay claims, even though it is geographically concentrated and specializes in a particular business line. Reinsurance is particularly important for smaller primary insurers whose size may limit their ability to diversify geographically or across business lines.

P&C insurers also use reinsurance to increase their capacity to sell insurance.[4] Most insurers have a limit on the maximum amount of risk they are willing to accept from a single policy, known as a retention limit. An insurer with a potential client seeking a commercial liability insurance policy that would cover up to $500 million in claims could not sell such a policy if its retention limit was $100 million. However, the primary insurer could sell the $500 million policy if it retained $100 million of the coverage and reinsured the remaining $400 million, possibly to a syndicate of four reinsurers that each agreed to cover $100 million in potential losses.

Reinsurance can also increase the capital of the primary insurer. Reinsurance provides capital relief to the primary insurer by removing some insurance risk, which allows the primary insurer to reduce its required reserves. Reserves are liabilities that represent the expected losses from the company's insurance portfolio. To offset reserves, insurers must hold liquid assets such as U.S. Treasury securities or highly rated corporate bonds that they can sell to cover losses in the event of a claim. A primary insurer must hold higher reserves when it is exposed to greater insurance risks. A primary insurer can increase capital through reinsurance because it reduces its insurance risks and, hence, can hold fewer reserves, but it still has some of the assets backing the pre-reinsurance level of reserves.

The flexible nature of reinsurance allows insurance companies to write contracts that fit their specific needs. Reinsurance can be used to help a primary insurer manage risk, increase underwriting capacity, or increase capital. While a variety of reinsurance contract structures exist, they tend to fall into two general categories: proportional reinsurance and nonproportional reinsurance.

Proportional reinsurance

Proportional reinsurance can be thought of as a partnership between the primary insurer and the reinsurer in which risks, premiums, and losses from a given group of policies are shared proportionally. Under a proportional agreement, if the California fire insurer cedes, for example, 10% of the premiums from a group of fire insurance policies, the reinsurer would receive 10% of the premiums and be responsible for 10% of any losses incurred from those policies. Because of the simplicity of the contract, proportional reinsurance is inexpensive and easy to administer. This makes proportional reinsurance ideal for a small insurer looking to manage risk.

Nonproportional reinsurance

Nonproportional reinsurance contracts are typically written to protect the primary insurer from a large-loss event.[5] In a nonproportional agreement, the reinsurer covers losses that exceed some threshold. These policies usually specify the maximum amount of losses that the reinsurer will cover as well.

Consider, for example, a block of California fire insurance policies that are expected to have $1.5 million in claims in an average year, but might experience claims in excess of $10 million during a bad wildfire season. To protect itself from a bad wildfire season, the primary insurer could enter into a nonproportional reinsurance agreement, whereby the reinsurer agrees to cover losses between $10 million and $110 million, while the primary insurer covers losses up to $10 million. Often, nonproportional contracts are written with multiple reinsurers, whereby the different reinsurers cover different "layers" of losses. In our example, a collection of five reinsurers might each agree to cover $20 million in potential losses, with one reinsurer covering losses ranging from $10 to $30 million, another covering losses from $30 to $50 million, and so on. Not only does this arrangement benefit the primary insurer by limiting its maximum loss to $10 million, but it strengthens the insurance industry. Spreading out the potential losses from the California fire insurance policies over multiple companies limits the possibility of an insurance company becoming insolvent as a result of a bad wildfire season.

P&C reinsurance market[6]

Reinsurance is a crucial part of the P&C insurance industry. In 2013, U.S.-based P&C insurers wrote $535 billion in direct premiums and ceded almost $72 billion of those premiums through reinsurance contracts. However, not all direct P&C insurers use reinsurance to the same extent or for the same purposes. In particular, smaller firms and firms in business lines with more-concentrated risks tend to use reinsurance more.

In 2013, the top 20% of P&C insurers by assets ceded 13% of their premiums through reinsurance contracts, while the bottom 80% of firms ceded over 22% of premiums. Larger insurers tend to be less likely to use reinsurance because they are more diversified, both geographically and across business lines.

Consider Travelers Companies Inc., the fourth-largest U.S.-based P&C insurer with assets of $75 billion. In 2013, Travelers received over $22 billion in premiums and insured individuals and companies in every state, as well as Canada. Travelers ceded 7.7% of total premiums received in 2013 to reinsurers. In comparison, Florida Peninsula Holdings LLC (FPH) received $310 million in premiums in 2013, almost entirely for Florida homeowners insurance. The company ceded 58% of those premiums through reinsurance in 2013. Small firms, like FPH, are more reliant on reinsurance to diversify their portfolios and protect against a concentrated loss event such as a Category 5 hurricane.

The use of reinsurance also varies greatly across business lines. Auto insurance (4.3%) is the least reinsured product line, while aircraft insurance (39.5%) is the most reinsured (see figure 1). There are three main reasons why auto insurance requires less reinsurance. First, car accidents are typically uncorrelated events. When a driver insured by Insurance Company A gets into an accident, the likelihood that other Insurance Company A drivers will have accidents does not change. Second, the average car accident claim is relatively inexpensive, even in cases where there are injuries. In 2010, only 2% of payouts exceeded $300,000, and the largest claim paid by insurers was $13 million.[7] Finally, the total number of auto accidents does not change much from year to year, which makes losses fairly predictable and extreme losses unlikely.

In contrast, commercial airline crashes are very rare and, hence, more difficult to predict. In addition, when they do occur, insurance payouts can be very large. So far in 2014, there have been seven commercial airline crashes and tens of millions of flights without incident. For the insurance industry, the most expensive of those disasters will likely be Malaysian Airlines Flight 17. Payouts to the families of plane crash victims are usually capped at $150,000 per passenger, but if Malaysian Airlines is found to have been negligent because it allowed its planes to fly over a war zone, the cap on payouts would be lifted and claims could exceed $1 billion.[8]

A loss in the range of $1 billion would be difficult for even the largest P&C insurers to absorb. This is why primary insurers use reinsurance to make sure that they will not be in the position of having to cover such a large loss themselves. Reinsurance allows the costs of a major disaster to be shared among a primary insurer and potentially several reinsurers and makes insuring large risks, such as those associated with commercial aviation, feasible and more affordable.

The reinsurance industry itself is dominated by large firms. In 2013, the ten largest U.S.-based reinsurers by premiums assumed accounted for $27.1 billion of the total $42.9 billion in premiums ceded by U.S. insurers to U.S. reinsurers (figure 2). An additional $28.6 billion was ceded to non-U.S.-based reinsurers, and the global reinsurance market is also highly concentrated. Approximately 55% of the $190 billion in global

Charles L. Evans, *President*; Daniel G. Sullivan, *Executive Vice President and Director of Research*; Spencer Krane, *Senior Vice President and Economic Advisor*; David Marshall, *Senior Vice President, financial markets group*; Daniel Aaronson, *Vice President, microeconomic policy research*; Jonas D. M. Fisher, *Vice President, macroeconomic policy research*; Richard Heckinger, *Vice President, markets team*; Anna L. Paulson, *Vice President, finance team*; William A. Testa, *Vice President, regional programs, and Economics Editor*; Helen O'D. Koshy and Han Y. Choi, *Editors*; Rita Molloy and Julia Baker, *Production Editors*; Sheila A. Mangler, *Editorial Assistant.*

Chicago Fed Letter is published by the Economic Research Department of the Federal Reserve Bank of Chicago. The views expressed are the authors' and do not necessarily reflect the views of the Federal Reserve Bank of Chicago or the Federal Reserve System.

ISSN 0895-0164

reinsurance premiums were assumed by the ten largest global reinsurers, measured by premiums assumed in 2013.[9]

When a primary insurer uses reinsurance, the primary insurer is exposed to counterparty risk, which is the risk that the reinsurer (the counterparty) will not be able to honor its obligations. Because larger, more diversified reinsurers are likely to be able to cope better with outsized claims, nonproportional reinsurance is more concentrated than proportional reinsurance. In 2013, the top ten U.S.-based reinsurers by premiums assumed accounted for 76% of the total $15.3 billion in nonproportional premiums ceded to U.S. reinsurers, compared with just 56% for proportional reinsurance.

Conclusion

Reinsurance plays a critical risk-management role in the property and casualty insurance industry. Reinsurance allows P&C insurers to manage risks associated with concentrated exposures to business lines and geographies. Without reinsurance, insurance premiums would likely be higher, less insurance would be offered, and some insurance for infrequent events that cause large, concentrated losses, such as natural catastrophes, might not even exist.

---

1 See www.iii.org/issue-update/catastrophes-insurance-issues and www.acegroup.com/bm-en/assets/3q2010newsletterrevised.pdf.

2 www.nhc.noaa.gov/pdf/TCR-AL122005_Katrina.pdf.

3 Data from SNL Financial and author's calculations.

4 Underwriting a policy means the insurer guarantees to pay the policyholder in the event that loss or damage occurs.

5 Antonio Azzano, 2014, "Reinsurance: How insurers protect themselves (part 2)," *Generali Group*, available at www.generali.com/308819/Reinsurance-part-2.pdf.

6 Data from SNL Financial and author's calculations. Note, premiums ceded include only unaffiliated reinsurance transactions. Premiums assumed only include premiums assumed from nonaffiliates.

7 See www.nytimes.com/2012/08/25/your-money/auto-insurance/how-to-know-if-you-have-enough-auto-insurance.html?pagewanted=all&_r=0.

8 See www.washingtonpost.com/blogs/wonkblog/wp/2014/07/19/total-liability-in-mh17-crash-could-climb-to-1-billion/.

9 Data from A.M. Best Company and http://reports.swissre.com/2013/financial-report/financial-year/market-environment/reinsurance-non-life.html.