NAIC
National Association of Insurance Commissioners

JOURNAL OF INSURANCE REGULATION

Cassandra Cole and Kathleen McCullough
Co-Editors

Vol. 37, No. 8

The Excess-of-Loss Reinsurance Benefits for Small Insurers

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JIR-ZA-37-08

National Association of Insurance Commissioners

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Printed in the United States of America

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Suite 700
Washington, DC 20001
202.471.3990

NAIC Central Office
1100 Walnut Street
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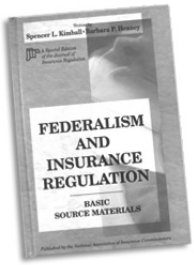

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The Excess-of-Loss Reinsurance Benefits for Small Insurers

Michael Santos*
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Abstract

This paper analyzes profitability and risk effects of the excess-of-loss (EoL) reinsurance coverage for a small insurer. Under the risk-based capital (RBC) standards, the small insurer with EoL reinsurance is more profitable and has smaller standard deviation. Therefore, the limited supply of EoL reinsurance can adversely affect the profitability and competitiveness of small insurers, especially after major catastrophes. Insurance regulators can mitigate this problem by establishing a residual reinsurance market where small insurers can obtain reinsurance.

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1. Introduction and Context

Currently, there are limited number of publications analyzing the adverse effects of the law of large numbers (LLN) and RBC standards and the lack of reinsurance supply for small insurers. This study: 1) shows that the LLN and RBC standards constrain small insurers more than large insurers; 2) demonstrates that a small firm is more profitable with a reinsurance contract (EoL); and 3) proposes a framework for establishing a residual insurance market administered by the NAIC in cooperation with the U.S. states.

This paper is motivated by the following findings:

- ***Small insurers are not well-diversified geographically and in product lines:*** Small insurers are regional, operate in a niche market and provide a limited number of insurance products (Swiss Re, 2012; U.S. Department of the Treasury, 2014).
- ***Small insurers require proportionally more reinsurance***: Small insurers are at a disadvantage relative to larger insurers because direct insurance rates are regulated, but reinsurance rates are not. Therefore, the shortage of reinsurance after major catastrophes affects small insurers more than large insurers (Holzheu, 1999).
- ***Small insurers are more vulnerable to insolvency****:* Large insurers are likely to have greater financial stability than small insurers, and insurance regulators are less likely to liquidate large insurers than small insurers (Shim, 2015; Cummins, Harrington and Klein, 1995).
- ***RBC constraints affect small insurers more than the larger insurers****:* The LLN implies that small insurers have larger standard deviations of the expected losses and hold larger amounts of required capital under the RBC standards (Munch and Smallwood, 1980; Santos et al., 2018).

This paper is organized as follows: Section II provides a background for small insurers and catastrophes. Section III shows how a small workers' compensation insurer's risk and profitability depends on the availability of the EoL contracts. Section III presents fair premium calculations, introduces a multivariate distribution, and shows how to calculate the standard deviation of expected losses and the required capital levels for both small and large insurers. Section IV incorporates the results obtained from the previous section and demonstrates the profitability of a small insurer with EoL by using financial statements. Section V incorporates other studies and considerations, including alternative capital. Section VI suggests a framework for establishing a residual reinsurance market. Finally, Section VII provides conclusions of this paper.

It is recommended that a novice of insurance read all introductory sections that present current literature showing how small insurers are disadvantaged, and how having EoL reinsurance contracts reduces risk and increases small insurer profitability. However, seasoned insurance readers can safely skip Section I through

Section V and start reading Section VI, where an argument about the establishment of residual reinsurance market for small insurers is made.

2. Background: Small Insurers and Catastrophes

The increasing frequency and severity of natural and man-made catastrophes is a challenge to primary insurers, reinsurers and legislators. A primary insurer can protect itself against extreme losses by signing a reinsurance contract or arranging an insurance-linked security (ILS). Historically, after any major natural or man-made disasters, there have been discussions in the insurance industry about the adequacy of reinsurance or ILS to primary insurers.

Natural Catastrophes

Hurricanes, earthquakes, floods, wildfires, tornados, tsunamis and volcanic eruptions are some of the natural catastrophes that cause significant property/casualty (P/C) losses around the world. Often, it is stated that reinsurance supply goes down after major natural disasters. For example, Holzheu (1999) reports a shortage in reinsurance capacity after Hurricane Andrew in 1992 because of bankruptcies and withdrawals among the reinsurers. In addition, Froot and O'Connell (1997, 1999) present historical trends showing reduction in reinsurance supply because of the supply shift in the aftermath of a catastrophic loss. Also, Cummins (2007) reports that U.S. insurers are dependent on the global reinsurance market to provide coverage in light of increasing mega-catastrophes and states, "Insurance price regulation for catastrophe-prone lines of business is a major source of inefficiency in insurance and reinsurance markets."

Further, Berger et al. (1992) find that during the mid-1980s crisis, reinsurers reduced underwriting of some risks or put strict coverage limits, especially on the upper tail of the probability of loss distribution through EoL contracts. Because catastrophic events cause insurers and reinsurers to have significant losses, some theorize that hard insurance markets may result from the catastrophes (Harrington and Niehaus, 2004).

Man-Made Catastrophes

The magnitude of human and P/C losses arising from man-made catastrophes became more concerning to legislators and insurers around the world after the 9/11 terrorist attacks. Michel-Kerjan and Kunreuther (2017) summarize that the Terrorism Risk Insurance Act (TRIA), passed in 2002, established a partnership between the U.S. federal government, private insurers and other commercial enterprises. Towers Watson (2013) assesses reinsurance availability aftermath of

the terrorist attack on the World Trade Center and the Pentagon and predicts that there will be inadequate reinsurance protection for some primary companies, inadequate retrocessional protection for some reinsurers, and failed insurers among less well-capitalized companies in the industry. Further, the report asserts, "After a megacatastrophe, primary insurers reevaluate their reinsurance needs and often seek greater protection. Ironically, at the same time, reinsurers implement tighter risk controls, which tend to reduce the capacity they are willing to offer. We are already seeing the signs of a looming reinsurance capacity shortage."

Small Insurers

Most of the small insurers in the U.S. are regional carriers, work in a niche market and cede a greater percent of their business to reinsurers, therefore requiring proportionally more reinsurance. Another characteristic of a small insurer is being less diversified geographically and in insurance product lines. Swiss Re (2012) reports that small, local and regional insurers have only limited scope to diversify their book of business.

The U.S. Department of the Treasury (Treasury Department) (2017) studies the availability and cost of private reinsurance for small insurers and finds:

- Small insurers generally do not purchase reinsurance from "dollar one" (pro rata) of their exposure. Rather, the reinsurance is generally purchased to apply at some higher loss amount (EoL contracts), below which the small insurer remains exposed to the losses.
- A large percentage of small insurers face significant exposure between their Terrorism Risk Insurance Program (TRIP) deductibles and the program trigger, which has not been addressed by private reinsurance**.**
- The TRIA resulted in the TRIP. Measured against all TRIP-eligible lines combined, small insurers charge a lower premium than non-small insurers.
- Small insurers tend to transfer, or cede, a greater proportion of their direct premiums to reinsurers than larger insurers.

The findings of the Treasury Department (2017) indicate that small primary insurers work regionally, mostly in a niche market, and they are not as well-diversified in product lines or geographical operations as their large competitors are. Therefore, small insurers require proportionally more reinsurance against the volatility of their net income. In addition, the TRIA Federal Advisory Committee (2017) warns, "While direct insurance rates are regulated, reinsurance rates are not, such that small insurers might not be able to pass along such costs to policyholders, which puts small insurers at a competitive disadvantage relative to larger insurers that may not require as much reinsurance."

Furthermore, some researchers report that small insurers have higher insolvency problems in the marketplace. For example, Shim (2015) investigates an insurer's financial stability in the U.S. property-liability insurance industry for the

period of 1992–2010 by using a two-stage least squares technique and finds that on average, large insurers are likely to have greater financial stability than small insurers. Also, Cummins, Harrington and Klein (1995) assert that small insurers are more likely to be vulnerable to insolvency because insurance regulators are less likely to liquidate large insurers than small insurers. Munch and Smallwood (1980) find that capital and surplus requirements are the most effective means for reducing the number of insurer insolvencies, but they note that these high capital and surplus requirements also may restrict potentially valuable services offered by small niche insurers.

Further, Holzheu (1999) analyzes the trends in the U.S. direct insurers' cession behavior for the period of 1993–1997 and finds that the larger providers tend to have lower cession rates than smaller companies, and the smallest companies cede over one-fourth of the direct business they write. In addition, *Insurance Journal* (2002) reports the findings of the Conning research and shows that small insurers' direct expense ratios are at a disadvantage because small insurers cede more premiums to reinsurers. Hemenway (2012) reports those catastrophe-laden and tornado-filled years, 2011 and 2012, could have a debilitating impact on smaller carriers because they often have a lot smaller of a financial cushion with less business from which to draw and pay claims. Also, in an interview published in *Insurance Journal* (2018), Aspen Insurance Holding's CEO explains why Aspen was successful in reinsurance underwriting profits and grew more than 20%. Aspen provided reinsurance to the large and well-capitalized (a national writer or commercial industrial writer) insurers because "the unit of exposure with the undercapitalized companies gives more loss than a unit of exposure to a big properly run insurance company in the catastrophe-prone Florida region." Furthermore, a survey by Reese (2012) reports unique challenges in securing life reinsurance and finds that just over half of the small insurer respondents say they experienced reinsurance challenges. According to the report, the number one challenge for smaller insurance companies was that the price of reinsurance was too high. Also, consistent with other findings, the challenged small insurers ceded 36% of their new face amount compared to the second group of small insurers that, reporting no challenge, ceded 16% of their new face amount.

The Treasury Department (2014) states that risk transfer through reinsurance is particularly important for smaller insurers, which have more limited opportunities to diversify risk through underwriting practices than do larger insurers with risk profiles that include multiple lines of business written in multiple jurisdictions or across broader and more diverse geographic regions. Weiss and Chung (2004) assert that a nonproportional (EoL) reinsurance contract is designed to cover the right tail of the loss distribution and that it is relatively riskier than a proportional (pro-rata) reinsurance. As a result, if reinsurers prefer pro-rata contracts, then small insurers may face difficulty in finding EoL reinsurance, especially in the hard insurance markets. Naturally, both pro-rata and EoL reinsurance contracts reduce the standard deviations of the expected losses, but small firms prefer EoL contracts because the risk of insolvency depends on the right tail of the loss distribution. However, the

reinsurers' preference for pro-rata reinsurance contracts may severely limit the supply of EoL contracts for small insurers.

3. An Analysis of a Small Insurer Providing Workers' Compensation

Workers' compensation insurance is a catastrophe-prone line of P/C insurance. According to Munich Re (2012), workers' compensation insurance firms face unique challenges arising from demographics and natural catastrophes; therefore, the costs are expected to rise in the near future. Further, a study by the California Workers' Compensation Insurance Rating Bureau (WCIRB) explores the workers' compensation severities when a major earthquake catastrophe happens. According to the California WCIRB, "The nature of workers' compensation coverage is such that there is no predefined or specified limit of insurance coverage. The amount for which an insurer is ultimately liable depends on many components, including the severity of injuries, the extent of physical impairment and the duration over which benefits will be paid." Also, the Treasury Department (2017) reports that "a large-scale act of terrorism could create significant aggregation risks for workers' compensation carriers, particularly in the event of broad-based losses arising from a nuclear, biological, chemical or radiological weapons (NBCR) event."

Further, the Insurance Information Institute (2002) reports a breakdown of insurance claims after the 9/11 terrorist attacks and finds that out of 31,232 total claims, 4,748 of them were workers' compensation insurance reported to the Disaster Insurance Information Office (DIIO). Fuge (2001) finds that the resulting workers' compensation payments are estimated to be more than $4 billion for the 9/11 terrorist attacks.

According to the *Report of the President's Working Group on Financial Markets* (2006), commercial property insurance coverage is written through what is called an "all risk" insurance policy, with the exclusion of losses from acts of war. However, this is not the case for the workers' compensation insurance, which covers work-related injury or death even after an act of war or terrorism. Also, a study by Miller et al. (2003) states, "The lack of a strong reinsurance market today has continued to have a negative material impact on the cost of workers' compensation insurance and the ability of the California workers' compensation industry to respond to catastrophic losses." The report further states, "The additional uncertainty of major catastrophic events, such as the impact from terrorism or earthquake on workers' compensation exposures, and the price increases for reinsurance and increasing retention levels should not be surprising. Of the major reinsurance carriers interviewed for this project, none have expressed a commitment to returning or expanding in this market."

Table 1 provides the assumptions of a small hypothetical firm SF (with or without EoL) reinsurance and compares it to a large hypothetical firm (LF) without EoL reinsurance.

Table 1:
Assumptions Made for Small (With and Without EoL) and Large Firms

1. Small and large insurers provide workers' compensation insurance policies, and the benefits of these policies for the insureds are identical.
2. SF (with and without EoL) has 5,000 policyholders, and LF has 100,000 policyholders.
3. The risk characteristics of the policyholders in both pools for SF (with and without EoL) and LF are identical.*
4. SF (with and without EoL) and LF have identical expected loss estimations, identical proportion of the expected loss as administrative costs, loss adjustment costs, commissions to insurance agents and brokers, underwriting costs, and profit loading. Therefore, both SF (with and without EoL) and LF charge the same amount of annual premiums, $1,485.77, to their policyholders.
5. We assume that the risk-based capital (RBC) standard is 99.5% of value at risk (VaR) capital requirement in the U.S., where both SF (with and without EoL) and LF operate.**
6. Workers' compensation policies are issued once at the beginning of each year, and the premiums are collected from policyholders at the beginning of the year.
7. Both SF (with and without EoL) and LF pay the expected insurance losses, loss adjustment expenses (LAE), and commissions to agents and brokers at the end of the year, while the underwriting expense and profit loadings are applied when they occur immediately. All expenses are calculated as a percentage of expected losses.
8. SF (with and without EoL) and LF borrow $6.5 million and $130 million, respectively, through the issue of bonds at 5% interest rate to finance the shortfall in their reserves (both firms borrow $1,300 per policy) for the first year of the operations.
9. At 5% interest cost, SF (with EoL) has additional borrowing of $502,918.56 to cover the shortfall and have $0 surplus at the beginning of the year before starting its operations. Similarly, at 5% interest cost, SF (without EoL) has additional borrowing of $1,727,536 to cover its shortfall and have $0 surplus at the beginning of the year before starting its operations.
10. Market interest rate return on premium investments is also 5% annually.
11. SF (with EoL) uses an EoL reinsurance contract that would pay for the losses that exceeds $500,000 per policy.

* While Conning Holdings Ltd (2016) classifies small insurers in the P/C lines as having less than $500 million capital and surplus, Fitch Ratings (2017) criteria defines them as having less than $750 million. On the other hand, a small life insurer is defined as having less than $1 billion of capital and surplus. For the study above, using $500 million, $750 million, or $750 million for the large firm capital and surplus does not change the results and findings of the paper.
**Assumption 5 is based on an NAIC (2009) report that states the Solvency II PCR (called the Solvency Capital Requirement—SCR) at 99.5% for the VaR over a one-year time horizon.

In addition, Table 2 (see page 8) shows the cost components as a percent of the expected losses, E(L): LAE (15%); commissions to agents and brokers (6%); profit loading (10%); and underwriting (25%).

Furthermore, Table 3 (see page 8) presents the most common financial ratios used in the P/C industry to assess the financial condition of the insurance firms.

Table 2:
Cost Structure for Small (With and Without EoL) and Large Firms*,**

EXPECTED LOSSES AND TYPES OF EXPENSES	PRESENT VALUE of E(L) AND EXPENSES	E(L) AND EXPENSES ($)	% SHARE IN E(L)	TIMING OF PAYMENTS
Expected losses: E(L)	$944.44	$980.00	100%	
Loss adjustment expenses (LAE)	$141.67	$147.00	15%	End of the year
Commissions paid to agents	$56.67	$58.80	6%	End of the year
Profit loading	$98.00	$98.00	10%	Beginning of the year
Underwriting expenses	$245.00	$245.00	30%	Beginning of the year
TOTAL (fair premium)	**$1,485.77**			

* Table 2 has the present values for E(L), LAE, and commissions to agents and brokers because these payments occur at the end of a year.
** Fair premium = PV of E(L) + PV of LAE + PV of commissions paid to agents and brokers + profit loading + underwriting expenses. Thus, the fair premium is equal to $\$1{,}485.77 = \frac{\$980}{1.05} + \frac{\$147}{1.05} + \frac{\$58.80}{1.05} + \$98 + \$245$.

Table 3:
Loss, Expense and Combined Ratios for Small (With and Without EoL) and Large Firms*

Firms**	Loss Ratio	Expense Ratio	Combined Ratio
SF	75.85%	26.75%	102.6%
SF (with EoL)	59.03%	40.27%	99.3%
LF	75.85%	26.75%	102.6%

*Using information from Table 8, loss ratio = (net losses incurred + loss adjustment expenses)/premium earned where the premiums earned and premiums written items are assumed to be the same. Expense ratio = (underwriting expenses + commissions + premium taxes (3%))/ premium earned, and combined ratio = loss ratio + expense ratio. For SF (with EoL), the expense ratio additionally includes "reinsurance premium."
** SF and LF are without EoL reinsurance.

SF and LF have identical loss, expense and combined (loss + expense) ratios because each item in the loss and expense loadings are the same proportion of the fair premium. On the other hand, SF (with EoL) has an additional item as "reinsurance premium." SF and LF (both without EoL reinsurance) have the combined ratios of 102.6%, implying that both firms pay $1.026 for the losses and expenses for every $1 received as premiums. Thus, both firms need investment income to pay for their additional $0.026 losses and expenses. On the other hand, the combined ratio of SF (with EoL) is 99.3%. This implies that SF (with EoL) is more profitable than SF; while SF spends $1.026 for the loading (loss and expenses) for every $1 it receives as premium, SF (with EoL) spends only $0.993 for the loading (loss and expenses) for every $1 it receives as premium.

Table 4 summarizes actuarial E(L), estimations for SF (with and without EoL) and LF based on the expected losses from the workers' compensation policies. A multinomial distribution treats the workers' compensation insurance policies as 5,000 for SF (with and without EoL) and 100,000 trials for LF. According to the multinomial distribution, there is a 95% chance (probability) of having no workplace accidents. There is a 5% chance that a damage may occur; a 3% chance that the loss will be $2,000; a 1% chance the loss is $10,000; a 0.95% chance that the loss is $60,000; and, finally, a 0.05% chance that there is a loss equivalent to $500,000. SF (with EoL) protects itself against the most adverse outcome, the loss of $500,000, by paying $250 [=0.005 x $500,000] to a reinsurer.

Table 4:
Multinomial Distribution of Expected Losses, E(L), and Standard Deviation, SD(L), Estimations for Small (With and Without EoL) and Large Firms*

FIRMS	**SF**	**SF (with EoL)**	**LF**
PROBABILITY OF LOSS: P(L)	LOSS: L	LOSS: L	LOSS: L
95%	$0	$0	$0
3%	$2,000	$2,000	$2,000
1%	$10,000	$10,000	$10,000
0.95%	$60,000	$60,000	$60,000
0.05%	$500,000	$0	$500,000
NO POOLING	**1 policy**	**1 policy**	**1 policy**
Expected loss: E(L)	$980	$730	$980
Standard deviation: SD(L)	$12,623.77	$5,898.06	$12,623.77
POOLING	**5,000 Policies**		**100,000 Policies**
Expected loss: E(L)	$980	$730	$980
Standard deviation: SD(L)	$178.53	$83.41	$39.92

*Standard deviation of the expected losses with no pooling is high and equal to $12,623.77, $5,898.06 and $12,623.77 for SF, SF (with EoL) and LF.
**In general, workers' compensation (WC) premium = Payroll per $100 x Classification Rate x Experience Modifier. The WC rates are specified per $100 of payroll, classification rate reflects the riskiness of the job, and experience modifier adjusts the rate based on past accident experience of the employer. The expected loss of $980 from Table 4 above can cover small firms with five employees in Alaska to 30 employees in Michigan and Texas. This estimation uses the WC rate of $0.50 in Alaska and $0.10 in Michigan and Texas, respectively, from the Council of Petroleum Accountants Societies Inc. (2018) with a class code of 8810 (clerical office employees) and the mean annual wage of $33,910 for the office clerks in the U.S. from the U.S. Bureau of Labor Statistics (2017).

The frequency and severity of the losses for the workers' compensation are the same for both SF and LF without reinsurance. The expected loss for one policy is the same for SF and LF at $980. However, SF (with EoL) has a lower expected loss, $730, because SF (with EoL) eliminates the probability of losing $500,000 (transfers the risk to the reinsurer). On the other hand, the standard deviations of the expected losses per policy for SF is $178.53 [= $12,623.77/SQRT(5,000)], $83.41 [=$5,898.06/SQRT(5,000)] for SF (with EoL) and $39.92 [=

$12,623.77/SQRT(100,000)] for LF. Thus, we can conclude that SF (with EoL) reduces its risk by having a reinsurance contract.

In addition, Table 5 shows the required capital estimations for SF (with and without EoL) and LF. The RBC standards based on the VaR method is set at 0.5% level corresponding to a z-table value of 2.575 (one-sided) from the standard normal distribution. The required capital for each firm can be estimated by multiplying 2.575 with the standard deviations of SF (with and without EoL) and LF. For example, the required capital per policy for SF and LF is $459.71 [= $178.53 x 2.575] and $102.79 [= $39.92 x 2.575], respectively. Similarly, the required return per policy for SF (with EoL) is $214.78 [= $83.41 x 2.575]. Thus, SF has a 0.5% chance that the expected losses for its workers' compensation contract could be $1,439.71 [=$980 + $459.71] or greater, and LF has a 0.5% chance that its expected losses for its workers' compensation contract in the pool could be $1,082.79 [= $980 + $102.79] or greater.

Table 5:
Capital Requirement Estimations for Small (With and Without EoL) and Large Firms

	SF	SF with EoL	LF	Explanation
Number of policies (N)	5,000	5,000	100,000	
Premium received per policy (P)	$1,485.77	$1,485.77*	$1,485.77	P = Fair premium
Total premium	$7,428,849	$7,428,849	$148,576,978	= P*N
E(L) with pooling	$980	$730	$980	
SD(L) with pooling	$178.53	$83.41	$39.92	= SD(L) without pooling/SQRT(N)
z-value	2.575	2.575	2.575	= z-value at 0.5% level
Capital requirement per policy	$459.71	$214.78	$102.79	= z*SD(L)
1-year total capital requirement	$2,298,536.22	$1,073,918.56	$10,279,366.46	= N*z*SD(L)
Capital requirement to premium	30.94%	14.46%	6.92%	= z*SD(L)/Premium

*The reinsurer receives $250 from SF (with EoL) for each workers' compensation insurance policy.

Column 2 and Column 3 in Table 5 compare SF's capital requirement with and without reinsurance. The capital requirement for SF (with EoL) is $214.78 per policy, which is less than the capital requirement for SF, $459.71. Thus, having a reinsurance contract benefits the small firm because the required capital is lower.

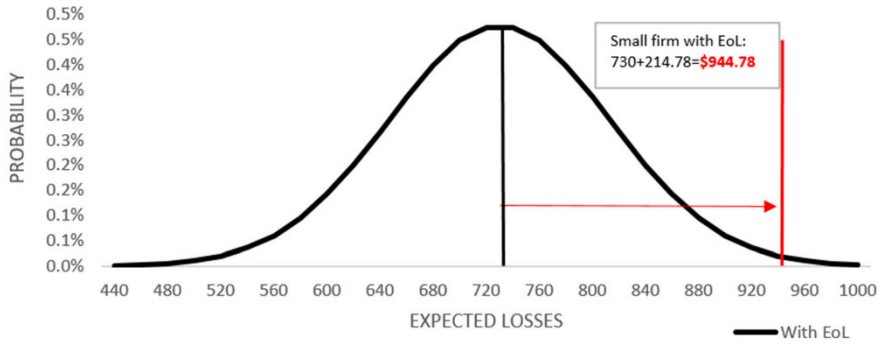
Additionally, Figure 1 shows how the uncertainty (standard deviations) affect both small and large firms. At given the VaR of 99.5%, while the small firm secures financial resources up to $1,439.71 [=$980.00+ $459.71] of losses per policy, the large firm needs only $1,082.79 [= $980.00 + $102.79] of losses per policy at 0.5% significance.

Further, Figure 2 shows that SF (with EoL) has a 0.5% chance that the total damage is $944.78 [= $730.00 + $214.78] or greater. This result is an improvement for the small firm, SF (with EoL) because the case without a reinsurance contract needs $1,439.71 [=$980.00 + $459.71] of losses or greater. In addition, the expected losses per policy for the small firm, SF (with EoL), $730, is lower than that of SF, $980.

Figure 1:
Total Financial Resources Needed for Each Policy to Support Expected Losses at 0.5% for Small and Large Firms*

* Summary statistics: The means for (SF and LF) are $980, and the standard deviations for SF and LF are $178.53 and $39.92, respectively. When the RBC standards use the VaR of 99.5%, the required capital for small and large firms is $1,439.70 and $1,082.79, respectively.

Figure 2:
Total Financial Resources Needed for Each Policy to Support Expected Losses at 0.5% for a Small Firm with a Reinsurance (EoL) Contract*



*Summary statistics: The mean is $730, the standard deviation for SF (with EoL) is $83.41, and the required capital for SF (with EoL) is $214.78 per policy (without EoL, it is $459.71) when the RBC standards are specified at the VaR of 99.5%.

Also, the total capital requirement for SF (with EoL), $1,073,918.56, is lower than that of SF, $2,298,536.22. Further, the capital requirement to premium ratios for SF (without and with EoL) and LF are 30.94% [=$459.71 / $1,485.77], 14.46% [= $214.78 / $1,485.77] and 6.92% [= $102.79 / $1,485.77], respectively. This implies that the capital requirement for SF is 4.47 times proportionally greater than that of LF, and the capital requirement for SF (with EoL) is 2.09 times proportionally greater than that of LF. In general, SF is required to have

proportionally higher amounts of the required capital under the RBC standards, but the capital requirement goes down by obtaining an EoL reinsurance contract.

4. Sample Financial Statements for Small (With and Without Reinsurance Contract) and Large Firms

Table 6 through Table 8 provide the balance sheets and income statements for SF (without and with EoL) and LF. Table 6 shows the assets and liabilities of SF (without and with EoL). The firms are assumed to start their operations on Jan. 1, 2017.

Table 6:
Balance Sheet of Small (Without or With EoL) and Large Firms at the Beginning of the Year Before Starting to its Operations on Jan. 1, 2017*

ASSETS	SF	SF with EoL	LF**
Cash and investments	$15,656,385	$13,181,767	$278,576,978
TOTAL ASSETS	$15,656,385	$13,181,767	$278,576,978
LIABILITIES AND SURPLUS			
Unearned premiums	$7,428,849	$7,428,849	$148,576,978
Loss reserves	$4,900,000	$3,650,000	$98,000,000
Loss adjustment expenses (LAE)	$735,000	$735,000	$14,700,000
Commissions to agents and brokers	$294,000	$294,000	$5,880,000
Required capital	**$2,298,536**	**$1,073,919**	**$10,279,366**
Surplus	**$0**	**$0**	**$1,140,634**
TOTAL LIABILITIES AND SURPLUS	$15,656,385	$13,181,767	$278,576,978

* SF (with or without EoL) and LF have 5,000 and 100,000 policies, respectively, and both firms are charging $1,485.77 for a one-year workers' compensation insurance policy.
** LF has positive surplus of $1,140,634 and does not need any additional borrowing.

Cash and investments (or total assets) of SF (without EoL) is equal to $15,656,385 [= $7,428,849 + 6,500,000 + $1,727,536]. The amount of $7,428,849 is the value of 5,000 policies each with $1,485.77 annual premiums; 6,500,000 is from $1,300 of borrowing for each policy contract; and $1,727,536 is the additional borrowing that makes the surplus item equal to $0. Further, since the firm has not started its operations, unearned premiums is $7,428,849 (none of this amount is earned by the SF yet); loss reserves is $4,900,000 [$980 x 5,000]; LAE is $735,000 [=$147 x 5,000]; commissions to agents and brokers is $294,000 [=$58.80 x 5,000]; required capital is $2,298,536 [=$459.71 x 5,000]; and surplus is equal to $0 [=$15,656,385 – $7,428,849 – $4,900,000 – $735,000 – $294,000 – $2,298,536]. This indicates that SF without EoL needs to borrow $1,727,536 as additional funds. Therefore, total liabilities and equity is equal to $15,656,385.

Similarly, cash and investments [= unearned premiums + initial borrowing + additional borrowing – payment to reinsurer] for the SF (without EoL) is equal to $13,181,767 [= $7,428,849 + 6,500,000 + $502,919 – $1,250,000]. The amount of $7,428,849 is the value of 5,000 policies, each with $1,485.77 annual premiums; 6,500,000 is from initial borrowing of $1,300 for each policy contract; $502,919 is the additional borrowing that makes the surplus item equal to $0; and $1,250,000 [=$250 x 5,000] is the amount of fee paid to the reinsurer for EoL contract to cover losses that are equal to or exceed $500,000 per contract. Similarly, on the liability side, SF (with EoL) has unearned premiums as $7,428,849; loss reserves as $3,650,000; LAE as $735,000; commissions to agents and brokers as $294,000; required capital as $1,073,919; and surplus equal to $0. This indicates that SF (with EoL) needs to borrow $502,919 as additional funds. The balance sheet items for LF are similar to that of SF.

Further, Table 7 presents balance sheet items for SF (without and with EoL) and LF after a one-year period of operations and paying out the losses and expenses on Dec. 31, 2017. For example, after a year, unearned premiums are now earned, and therefore it is equal to $0. Additionally, the assets are lower for all cases because expenses are paid out: loss reserves, LAE, and commissions to agents and brokers are all equal to $0. At the end of the year, the required capital levels are the same, and surplus levels are higher because some of the capital tied to unearned premiums is released.

Table 7:
Balance Sheets for Small (Without and With EoL) and Large Firms After a One-Year Period of Operations and Paying Out the Losses and Expenses on Dec. 31, 2017*

ASSETS	SF	SF with EoL	LF
Cash and investments	$9,727,385	$7,252,767	$159,996,978
TOTAL ASSETS	$9,727,385	$7,252,767	$159,996,978
LIABILITIES AND SURPLUS			
Unearned premiums	$0	$0	$0.00
Loss reserves	$0	$0	$0.00
Loss adjustment expenses (LAE)	$0	$0	$0.00
Commissions to agents and brokers	$0	$0	$0.00
Required capital	**$2,298,536**	**$1,073,919**	**$10,279,366**
Surplus	**$7,428,849**	**$6,178,849**	**$149,717,612**
TOTAL LIABILITIES AND SURPLUS	$9,727,385	$7,252,767	$159,996,978

* SF (with or without EoL) and LF have 5,000 and 100,000 policies respectively, and both firms are charging $1,485.77 for a one-year workers' compensation insurance policy.

Finally, Table 8 (see page 14) shows the income statements of SF (without and with EoL) and LF. Revenues of insurance firms are equal to premium earned plus investment income. It is assumed that the items of premium written and premium earned are equal. Total expenses and losses are equal to the summation of net losses incurred, underwriting expenses, LAE, commissions and premium taxes. Premium taxes are the state taxes and assumed to be 3% charged on premiums earned. In

addition, there is 5% interest charged to SF (without and with EoL) and LF because of $1,300 borrowing per policy and for the additional borrowing of $1,727,536 and $502,919 for SF and SF (with EoL). Table 8 shows that profits (net income) of SF (with EoL), $252,648, is higher than the profits of SF, $185,362, even though SF (with EoL) has paid a fee, $1,250,000, to the reinsurer.

Table 8:
Income Statements for Small (Without and With EoL) and Large Firms on Dec. 31, 2017

REVENUES	SF	SF (with EoL)	LF
Premium earned	$7,428,849	$7,428,849	$148,576,978
Investment income	$721,588	$659,088	$13,928,849
Total income	$8,298,045	$8,087,937	$162,505,827
EXPENSES			
Net losses incurred	$4,900,000	$3,650,000	$98,000,000
Loss adjustment expenses (LAE)	$735,000	$735,000	$14,700,000
Underwriting expenses	$1,470,000	$1,225,000	$29,400,000
Commissions	$294,000	$294,000	$5,880,000
Reinsurance premiums paid	$0	**$1,250,000**	$0
Premium taxes (3%)	$222,865	$222,865	$4,457,309
Total expenses and losses	$7,621,865	$7,376,865	$152,437,309
Earnings before interest and taxes	$676,179	$711,072	$10,068,518
Interest payments	411,377	350,146	6,500,000
Earnings before taxes (EBT)	$264,803	$360,926	$3,568,518
Federal taxes (30%)	$79,441	$108,278	$1,070,555
Net Income	$185,362	**$252,648**	$2,497,962

*SF (with or without EoL) and LF have 5,000 and 100,000 policies, respectively, and both firms are charging $1,485.77 for a one-year workers' compensation insurance policy. SF with EoL has an excess-of-loss reinsurance agreement and pays $250 to the reinsurer per insurance policy.

5. Other Studies and Considerations

Park and Xie (2014) address the interconnectedness between reinsurers and U.S. P/C insurers and illustrate the potential systemic risk caused by the interconnectedness of the insurance sector through reinsurance. On the demand side, Cole and McCullough (2006) examine the effect of the state of the international reinsurance market capacity and profitability on the demand for reinsurance by U.S. insurers using data from 1993–2000 and find that the state of the U.S. reinsurance market significantly affects the overall demand for reinsurance. In addition, Doherty and Tinic (1981) show that reinsurance is compatible with the share price maximization objective of the insurance companies and that there is sufficient motivation on the part of insurance companies to spread risks through reinsurance, even in the absence of regulations designed to protect policyholders' interests. However, Bernard and Tian (2009) claim that insurance companies have adverse incentives and do not protect themselves against extreme losses from the right tail

of the loss distribution when compulsory VaR risk management requirements are imposed.

Recently, alternative capital (ILS) has been touted to solve the reinsurance shortage problem. According to a report from the Insurance Information Institute (2015), the alternative capital constituted 12% of the global reinsurance market at the end of 2014. The report states that alternative capital is concentrated in the insurance products for the natural catastrophes such as hurricanes, earthquakes or other disasters. The alternative capital capacity has been growing steadily over time because of the participation of hedge funds, sovereign wealth funds, pensions and mutual funds by using products such as catastrophe bonds, collateralized reinsurance and reinsurance sidecars. For example, Aon Benfield (2017) reports that the global reinsurer capital stands at $605 billion, with $516 billion being traditional capital and $89 billion as alternative capital made up with sidecars, industry loss warranties and collateralized reinsurance. A study by Braun and Weber (2017) predicts that ILS will reach almost a quarter of the global P/C reinsurance limit or approximately $101 billion by the end of 2018.

6. Past Legislation and the Case for a Residual Reinsurance Market

Efforts to legislate catastrophe-prone insurance lines in the U.S. go back to the 1970s after observing insurance shortages in the market after major natural disasters. According to Cleary and Boutchee (2002), the NAIC worked on a proposal in the mid-1990s to implement a voluntary, tax-deferred, pre-event catastrophe reserves for insurers and allow them to set aside a portion of premiums as reserves against future catastrophic events. Also, the NAIC (2008) states, "The United States Congress has considered many proposals to address catastrophic loss. In fact, since the early 1970s, only three Congresses (the 98th through the 100th—1983 to 1988) have failed to consider significant natural disaster legislation. Nevertheless, the only federal program currently in operation is the National Flood Insurance Program (NFIP), which is under Federal Emergency Management Agency (FEMA) jurisdiction."

Additionally, for reinsurance legislation, the NAIC (2012) proposes a federal legislation framework encompassed in a model law, the *Credit for Reinsurance Model Law* (#785), and regulation, the *Credit for Reinsurance Model Regulation* (#786), to modernize reinsurance regulation in the U.S. The goal is to improve state-based regulation of reinsurance by providing a uniform implementation throughout all the U.S. states. In 2010, Congress passed the federal Nonadmitted and Reinsurance Reform Act (NRRA) but did not implement the NAIC's proposal. However, the NRRA provided an avenue for the states to implement reinsurance collateral reforms on an individual basis without restricting them from working with the NAIC and acting together. Thus, the NAIC's efforts preserved the delicate balance between the state and federal jurisdictions and suggested a uniform

framework for all insurers and reinsurers operating in the U.S. through the NAIC's leadership.

When reinsurance supply is significantly down, there are calls for reinsurance regulation at the state and federal levels to fill the reinsurance gap left from the private reinsurance sector. For example, England and Yousey (1998) examine two major proposals (H.R. 219 and H.R. 230) introduced during the 105th Congress to deal with the lack of reinsurance after natural disasters. H.R. 219 suggested direct auctioning of reinsurance coverage to private insurers, reinsurers and state disaster programs. Also, H.R. 230 offered a federally run auction of reinsurance contracts that could be purchased by both state programs and private insurers. Later, these proposals were culminated in the *Assumption Reinsurance Model Act* (#803) (NAIC, 1999). As England and Yousey (1998) indicate, while the H.R. 219 proposal puts the burden on the states by reinsuring state disaster programs, H.R. 230 passes the cost of reinsurance to all taxpayers nationwide.

Also, Lewis and Murdock (1996) investigate the market for disaster insurance in the U.S. and find that insurance markets are limited in their ability to diversify catastrophic risk; therefore, they propose a federal reinsurance program to auction the catastrophe EoL contracts for insurers.

There is a case to be made for a residual reinsurance market based on a three-tier model for all catastrophic insurance as suggested by Litan (2005) and Penner (2006). According to them, "In the first tier, individuals would be required to cover small losses through deductibles and limited copayments; private and state insurance and reinsurance would cover moderate losses in a second tier; and in the third, the federal government would cover extremely large losses that would otherwise drive private insurers from the marketplace." The second tier can be strengthened by a residual reinsurance market that serves all insurers who cannot find the reinsurance needs in the private market. Thus, especially, smaller insurers that are capital-constrained by the RBC standards will have a chance to protect themselves, especially during major natural or man-made catastrophes. According to Balcombe (2016) and Gambardella (2018), there are about 150 reinsurers operating in the U.S., and the reinsurance industry is somewhat concentrated. Their report, based on the data from the Reinsurance Association of America (RAA), indicates that "foreign reinsurers account for 65.5% of U.S. reinsurance activity, leaving U.S. reinsurers with 34.5% of domestic demand," with Berkshire Hathaway Reinsurance Group, General Re and Reinsurance Group of America Inc. (RGA) holding about 37% and 9.9% of the market share.

The fact is that there is a limited number of reinsurers operating in each U. S. state and, therefore, a solution to reinsurance supply should include all reinsurers operating nationwide (including international reinsurance providers). The suggested residual reinsurance market below has several advantages: 1) starting residual reinsurance markets for the traditional primary markets, such as personal automobile liability and workers' compensation, can provide assurance for its success since these markets have uniform products with well-established insurance agency-broker framework; 2) the burden of reinsurance supply stays in the private sector, and the losses are shared among all reinsurers nationwide (including

international player participating on the U.S. soil); and 3) there is room for the states and federal government to observe and learn from these experiments and carry them into other markets such as reinsurance for property insurance losses from natural or man-made disasters.

The following are suggested frameworks for the residual reinsurance market:

1. Initial residual reinsurance markets should correspond to the existing compulsory primary insurance markets. For example, the residual insurance market for personal automobile liability and workers' compensation can be two major experimental areas to start. Property insurance should be left out from the initial residual reinsurance markets because of its immense size and the interactions with other existing programs—i.e., Fair Access to Insurance Requirements (FAIR) Plans, as well as Beach and Windstorm Plans. In addition, there is room for ILS to grow as a substitute for the traditional reinsurance products and protect insurers against property insurance losses.
2. The residual insurance market should be at the national level to include all domestic and international reinsurers operating on the U.S. soil.
3. The NAIC should have leadership to organize and govern the residual reinsurance markets. Because the NAIC has access to the opinions of the insurance commissionaires from all states, it is possible to achieve a high level of coordination among states to establish a viable residual market. Due to sensitivities involved in federal or state legislation proposals, the NAIC should lead states to act together and establish a reinsurance residual market nationwide with the same uniform rules.
4. The residual reinsurance market should provide EoL contracts to cover the VaR of the RBC standards. For example, a 99.5% of VaR for the RBC implies that EoL reinsurance contracts cover the tail probability of loss at 0.5%. In other words, the reinsurer fee for a tail probability of 0.5% should correspond to: (0.005) x (expected losses at 0.5% likelihood) plus other processing fees.
5. The reinsurance residual market can use one of the following residual market types that are currently used in the primary residual markets (Harrington and Niehaus, 2004): 1) assigned risk plan; 2) joint underwriting association; and 3) reinsurance facility.

With the assigned reinsurance residual market, primary market insurers can request reinsurance contracts (proportional or nonproportional) from reinsurers. If the reinsurers reject their applications several times, then the rejected primary market insurers can apply to the assigned risk plan. A reinsurance agent can assign the rejected primary insurer to one of the reinsurance providers. At the end of the year, the losses from the assigned residual reinsurance market can be pooled and distributed to registered reinsurers based on each reinsurer's national market share.

Under the joint underwriting association, primary insurers who were rejected by the reinsurers several times can reapply for reinsurance coverage through the

help of a reinsurance agent. The rejected primary insurer can be assigned to one of the several selected reinsurers who take responsibility to process reinsurance contracts for all reinsurers nationwide. At the end of the year, these reinsurers calculate the losses and assess each reinsurer based on the national market share.

On the downside, the reinsurance residual market has potential costs for U.S. taxpayers. Additionally, some in the business community may push back against the establishment of a reinsurance residual market because of the prior reinsurance market experiences in primary insurance lines such as in North Carolina's auto market. Baker and Logue (2017) and Lehrer (2008) report a complex and subsidized auto insurance reinsurance facility with growing problems. Therefore, the NAIC can lead a discussion about the pros and cons of a proposed residual reinsurance market before implementing any steps.

7. Conclusions

Small insurers are at a disadvantage against large players because they have small insurance pools, resulting in large standard deviations of the expected losses and RBC capital requirements.

A small insurer is more profitable and has lower risk with an EoL contract. Therefore, small firms may be adversely affected if they cannot secure the reinsurance contract during hard insurance markets.

However, insurance regulators can create a residual reinsurance market where small insurers can secure reinsurance. As a result, small firms with EoL reinsurance have lower risk and higher profitability, and they can compete better in the insurance marketplace. Browne and Hoyt (1995) see the number of companies as the proxy for the degree of competition in the insurance market, and Heck (2017) claims that "small and mid-sized insurance carriers inject competition into the markets and provide coverage that may otherwise be unavailable in certain regions and serving specific niche markets." Therefore, the creation of a residual reinsurance market can achieve higher levels of small firm participation, as well as achieve larger number of market participants to promote market efficiency in traditional and niche markets.

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Cummins, J. David and Richard A. Derrig, eds., 1989. *Financial Models of Insurance Solvency*, Norwell, Mass.: Kluwer Academic Publishers.

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