EVALUATING SYSTEMIC RISK

Property & Casualty Reinsurance

IAIS Reinsurance Subcommittee and Reinsurance Transparency Subgroup

Toronto Canada
27, July 2011
Definitions of Systemic Risk

Financial Stability Board

• “The risk of disruption to the flow of financial services that is (i) caused by an impairment of all or parts of the financial system; and (ii) has the potential to have serious negative consequences for the real economy.”

• “Fundamental to this definition is the notion that systemic risk is associated with negative externalities and/or market failure and that a financial institution’s failure or malfunction may impair the operation of the financial system and/or the real economy.”
Definitions of Systemic Risk

Federal Reserve Chairman Ben Bernanke

"The possibility that the failure of a large interconnected firm could lead to a breakdown in the wider financial system; systemic risks threaten the stability of the financial system as a whole and consequently the broader economy, not just that of one or two institutions."
(Re)insurance Business Model

The (re)insurance business model is not a source of systemic risk.

- It is fundamentally different from other financial institutions.
- Inverted production cycle: obligations are pre-funded at the inception of the policyholder relationship.
- Lack of leverage limits interconnectedness.
- (Re)insurance obligations are not callable. Cash outflows may only be triggered by an external insured event.
- Insured loss events are not correlated with financial crises or economic cycles.
FSB Systemic Risk Attributes

The FSB has identified four primary attributes for the evaluation of systemic risk

- Size
- Interconnectedness
- Substitutability
- Time / Liquidity
Size - Reinsurance recoverables are not systemic risk amounts relative to U.S. financial markets or economy.

- US GDP: 14,658
- US FDIC Insured Banks—Total Assets: 13,321
- S&P 500 Market Cap: 11,891
- US P&C Industry Total Assets: 1,516
- US P&C Industry Capital & Surplus: 521
- Global Reinsurance Industry Capital & Surplus: 470
- Merck & Co Market Cap: 104
- US P&C Net-Net Recoverable from Reinsurers: 96
Size - Small relative size / reinsurance credit risk is further reduced by offsetting amounts.

<table>
<thead>
<tr>
<th>U.S. P&amp;C Industry Exposure to Reinsurance Recoverables</th>
</tr>
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<tbody>
<tr>
<td><strong>2009 Results</strong></td>
</tr>
<tr>
<td>Total Assets</td>
</tr>
<tr>
<td>Reinsurance Recoverables on Paid Losses</td>
</tr>
<tr>
<td>Policyholders' Surplus</td>
</tr>
<tr>
<td>Net Recoverables (Paid, Case &amp; IBNR, net of amounts owed to reinsurer)</td>
</tr>
<tr>
<td>Less Funds Held</td>
</tr>
<tr>
<td>Less LOCs, Trust Funds, &amp; Other Collateral</td>
</tr>
<tr>
<td>Equals Net Net Recoverable</td>
</tr>
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**Recoverables Analysis**

- Net Net Recoverable as % of PHS: 18.4%
- Net Net Recoverable as % of Total Assets: 6.3%
- Recoverable on Paid Loss as % of PHS: 2.8%
- Recoverable on Paid Loss as % of Total Assets: 1.0%
Interconnectedness - Insurance risk is spread broadly and globally. Reinsurance is a net credit enhancement for many cedents.

Top US P&C Groups
3rd Party Reinsurance Net-Net Recoverables Concentration

- Swiss Re
- Berkshire Hathaway
- Munich Re
- Lloyd's of London
- Nationwide
- Everest Re
- Transatlantic Re
- Hannover Re
- XL Group plc
- Fairfax
- All Other Reinsurers

A+
AA+
AA-
A+
BBB*
A+
A+
AA-
A
A-

*Note: Nationwide's AM Best Rating = A+. Approximately 90% of this net-net recoverable is due from Nationwide Indemnity Co., an entity used to run off asbestos and environmental obligations.
Interconnectedness & Substitutability

P&C industry cessions to the global reinsurance market are only 20% of gross premium.

U.S. P&C Industry: Reinsurance Utilization Rates

- Reinsurance Utilization
Substitutability - Capital is quickly replaced following significant events. Alternative forms of capital have become more prevalent.

**Post CAT-Event Capital Raised**

<table>
<thead>
<tr>
<th></th>
<th>KRW</th>
<th>9/11 Events</th>
<th>Andrew</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Capital Raised</td>
<td>$52.2 B</td>
<td>$22.2 B</td>
<td>$7.0 B</td>
</tr>
<tr>
<td>Est. Loss Industry Wide</td>
<td>$65.0 B</td>
<td>$41.0 B</td>
<td>$15.5 B</td>
</tr>
<tr>
<td>New Capital % of Est. Loss</td>
<td>80.3%</td>
<td>54.1%</td>
<td>45.2%</td>
</tr>
</tbody>
</table>
New capital inflow into reinsurance shows high substitutability

New capital flows into nat cat reinsurance industry and nat cat reinsurance rates

- Reinsurance rates increase for years following big catastrophes
- This attracts steady inflow of capital in the industry through new entrants or capital increases of existing reinsurers (including side cars and cat bonds)
- In addition, capital base of reinsurers is also progressively rebuilt after large natural catastrophes through the higher reinsurance rates

Reinsurance capacity has always increased after natural catastrophes – insurance capacity is highly substitutable

Source: Thomson, Guy Carpenter, AON Benfield, Dealogic, Oliver Wyman analysis
Substitutability - Catastrophe Bond Market Growth Continues

RISK CAPITAL ISSUED AND OUTSTANDING, 1997 – 2011 YTD

Risk Capital Amount (U.S.$, Millions)

- Risk Capital Issued
- Risk Capital Outstanding at Year End

Source: GC Securities  As of May 31, 2011
Substitutability - Capital flows follow the reinsurance cycle.
Reinsurance absorbs insurance industry volatility and adds stability.

Combined Ratio

U.S. P&C Insurance Cycle

55.0% 45.0% 35.0% 25.0% 15.0% 5.0% -5.0% -15.0%

P&C % Chg NPW
P&C ROE
U.S. P&C Reinsurance Cycle

55.0% 45.0% 35.0% 25.0% 15.0% 5.0% -5.0% -15.0%

Reins % Chg NPW
Reins ROE

ROE and Growth in NPW
Time/Liquidity - (Re)insurance obligations are not callable, significantly limiting the systemic risk potential.

US P&C Recoverables on Paid Losses Compared to Surplus and Assets

$14 Billion Reinsurance Recoverable on Paid Losses are the only amounts currently due. Reflects the illiquid nature of insurance and reinsurance obligations.
Time/Liquidity - Liability reinsurance losses emerge over many years.

Historical Loss Development Paid Losses Excess Reinsurance

RAA Historical Loss Development Study, 2009 Edition
Reinsured property catastrophe losses also emerge more slowly than might be expected.
Assumptions Underlying A Global Reinsurance Stress Test Scenario
Reinsurer capital was minimally impacted by the financial crisis. It recovered quickly and remains adequate for demand.

Change in Reinsurer Capital

- 2007: $411B
- 2008: $342B (-17%)
- 2009: $402B (18%)
- 2010: $470B (17%)
- Q1 2011: $440B (-6%)

Source: Individual Company Reports, Aon Benfield Analytics
Economic losses are 5 to 20 times greater than reinsured losses.

The Range can be impacted by:

- type of reinsurance (XOL v. QS)
- type of peril (take-up rate/exclusions)
- e.g. Earthquake/Flood
- location (insurance penetration)
- e.g. developed v. developing economies
- level of government participation in the reinsurance market
Natural Catastrophes in differently insured countries

Classification of the world by property insurance premium (non-life including health) per capita

Source: MR NatCatSERVICE as at July 2010
Economic Losses are 5 to 20 Times Greater than Reinsured Losses

Reinsurance is not nearly as significant a source of risk compared to uninsured loss.

### Hurricane Katrina

- **Economic Loss**: 125 Billions
- **Paid By Reinsurers**: 22 Billions

### U.S. 1-in-250 Yr EQE

- **Economic Loss**: 109 Billions
- **Paid By Reinsurers**: 4 Billions

### 9/11/2001 Terrorist Attack

- **Economic Loss**: 200 Billions
- **Paid By Reinsurers**: 23 Billions

### Average of Significant Historical Events

- **Economic Loss**: 13.4%
- **Paid By Reinsurers**: 86.6%
Worldwide Natural Disasters 1980 - 2011
Overall Economic versus Insured Losses

Insured losses are a small portion of economic losses: Reinsurance loss is an even smaller portion.

Source: MR NatCatSERVICE © 2011 Munich Re
Stress Test Scenario: 100% Solvency Ratio
Creating an extreme scenario: What would it take to bring down a major reinsurer?

- To start with: let’s focus on a leading global reinsurer to see what amount of losses would be needed to reduce its capital base to 100% of the solvency ratio. Let’s use published data for Munich Re and Swiss Re (the global TOP2) and think of this hypothetical reinsurer as a simple average of the two market leaders (thus all numbers used in this example will be based on a simple average of the respective Munich Re and Swiss Re number).

- Taking into account an average 2009 solvency ratio of 253% for this hypothetical reinsurer and available capital of $33.7 bn., a fall to the 100% solvency ratio level (capital at $13.3 bn.) would imply a cumulated loss event in the magnitude of $~20.4 bn.

- This would imply a loss more than ten times the loss from Hurricane Katrina (~$1.9bn. for Munich Re and Swiss Re on average), the by far largest (re)insured loss event in history.

- Thus, it would take such an extremely large loss event (or equivalently, a series of very large loss events taking place within a short period of time) just to bring the level of capital to 100% of the solvency margin. One should therefore extend this stress scenario to the entire industry to see what level of economic loss would cause the whole reinsurance industry’s capital to fall to a 100% solvency ratio level.

<table>
<thead>
<tr>
<th>Solvency Ratio</th>
<th>Equivalent Available Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>253%</td>
<td>$33.7 bn</td>
</tr>
<tr>
<td>100%</td>
<td>$13.3 bn</td>
</tr>
<tr>
<td>$33.7bn - $13.3bn</td>
<td>Hypothetical reinsurance loss must be $\geq$ $~20.4bn$</td>
</tr>
</tbody>
</table>

Hypothetical reinsurance loss equals more than 10-times Hurricane Katrina loss

Such an extreme loss event would still only reduce capital to a 100% solvency ratio, meaning that this hypothetical reinsurer remains a going concern and all claims are paid.

Source: Munich Re, Swiss Re
Extreme scenario at 100% solvency ratio shows: Respective economic loss would by far exceed the reinsurance industry loss.

- Assuming similar solvency ratios\(^1\) for the rest of the industry and using numbers on total industry capital\(^2\), it would take a loss to the reinsurance industry of $\sim 266.1$ bn. to create such a scenario that reduces industry capital to a 100% solvency ratio level.

- In contrast to these already very large numbers, the estimated total economic loss from such a series of extreme events is likely to be close to $1,986$ bn. (for comparison again: the economic loss from Hurricane Katrina was $\sim 125$ bn.).

- All of the Great Natural Catastrophes that have occurred World-wide from 1950 – 2010 amount to $2,100$ bn. (adjusted to 2010 values), which is about the size of loss from a series of events occurring in a single year that would be needed to bring industry capital down to a 100% solvency ratio.

The respective total economic loss of this extreme scenario would by far exceed the reinsurance industry loss. Moreover at a 100% solvency ratio, the reinsurance industry would not see widespread default as the existing capital base and reserves would be sufficient to pay the claims.

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1) clearly a simplifying assumption, as solvency ratios differ between reinsurers; 2) taken from Aon Benfield’s estimate that global reinsurance capital is $440$ bn.

Source: RAA Analysis Based on Underlying Assumptions Provided by a Munich Re and Swiss Re Analysis
Great natural catastrophes worldwide 1950-2010

The total economic losses used in the global stress test are greater than all of the great natural catastrophes worldwide between 1950-2010.

Total Economic Loss of $2,100 Billion
(Adjusted to 2010 Values)

- $1,670 Billion (80%)
- $430 Billion (20%)

Uninsured Losses  Insured Losses

Source: Munich Re Nat Cat SERVICE, As of January 2011
Stress Test Scenario:
40% Solvency Ratio
### Extreme Stress Test Scenario Analysis

<table>
<thead>
<tr>
<th>Solvency Ratio</th>
<th>Swiss Re / Munich Re Combined</th>
<th>Global Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>253%</td>
<td>33.7</td>
<td>440.0</td>
</tr>
<tr>
<td>100%</td>
<td>13.3</td>
<td>173.9</td>
</tr>
<tr>
<td>40%</td>
<td>5.3</td>
<td>69.6</td>
</tr>
</tbody>
</table>

| Implied Cuml. Loss @ 100% | 20.4 | 266.1 |
| Implied Cuml. Loss @ 40%  | 28.4 | 370.4 |

### Economic Loss Scenarios Needed to Reduce Industry Capital to 100% of Solvency Ratio

<table>
<thead>
<tr>
<th>Global Re Loss</th>
<th>Global Economic Loss</th>
<th>Example Type of Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>102.0</td>
<td>1,330.4</td>
<td>Hurricanes (U.S. /Developed Economies)</td>
</tr>
<tr>
<td>152.2</td>
<td>1,985.7</td>
<td>Mix of Global Events</td>
</tr>
<tr>
<td>370.8</td>
<td>4,837.9</td>
<td>Earthquake/Flood w/low take-up rate</td>
</tr>
</tbody>
</table>

### Economic Loss Scenarios Needed to Reduce Industry Capital to 40% of Solvency Ratio

<table>
<thead>
<tr>
<th>Global Re Loss</th>
<th>Global Economic Loss</th>
<th>Example Type of Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>142.0</td>
<td>1,852.2</td>
<td>Hurricanes (U.S. /Developed Economies)</td>
</tr>
<tr>
<td>211.9</td>
<td>2,764.4</td>
<td>Mix of Global Events</td>
</tr>
<tr>
<td>516.2</td>
<td>6,735.2</td>
<td>Earthquake/Flood w/low take-up rate</td>
</tr>
</tbody>
</table>
Extreme scenario at 40% solvency ratio shows: Respective economic loss would by far exceed the reinsurance industry loss.

- Assuming similar solvency ratios\(^1\) for the rest of the industry and using numbers on total industry capital\(^2\), it would take a loss to the reinsurance industry of $\approx 370.4\text{ bn.}$ to create such a scenario.

- In contrast to these already very large numbers, the estimated \textbf{total economic loss} from such a series of extreme events is likely to be close to $\textbf{2,764 bn.}$

- For comparison, a loss of $\text{2,800 bn.}$ equates to nearly twice the amount of economic losses from all hurricanes and earthquakes that occurred in the U.S. between 1900 and 2005 based on normalized loss statistics as published in studies by Dr. Roger Pielke—University of Colorado.

- The respective \textbf{total economic loss} of this extreme scenario would by far exceed the reinsurance industry loss. Moreover the reinsurance industry’s loss would largely be paid given their present $\text{440 bn.}$ in capital.

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1) clearly a simplifying assumption, as solvency ratios differ between reinsurers; 2) taken from Aon Benfield’s estimate that global reinsurance capital is $\text{440 bn.}$

Source: RAA Analysis Based on Underlying Assumptions Provided by a Munich Re and Swiss Re Analysis
Economic losses (not reinsurance losses) are the true source of systemic risk following extreme loss events.
U.S. Financial Institutions
Impairment History and
Implications for P&C Reinsurance
Systemic Risk
Insurance impairments attributed to reinsurance as the cause of failure are historically insignificant.


- Deficient Loss Reserves/Inadequate Pricing: 40.3%
- Rapid Growth: 13.6%
- Alleged Fraud: 7.8%
- Catastrophe Losses: 7.1%
- Affiliate Impairment: 7.8%
- Investment Problems (Overstatement of Assets): 7.3%
- Misc.: 8.6%
- Sig. Change in Business: 3.6%

Insurance impairments are insignificant compared to bank impairments in past crises and over several economic cycles.

FDIC Insured Failed Institutions Compared to P&C Insurer Impairments 1969-2010
Adjusted to 2010 Dollars

Insurance impairments attributed to reinsurance failure are insignificant over the same period.

Adjusted to 2010 Dollars

P&C Insurers' Total Assets (Reinsurance Cause of Failure)

Reinsurance failure is not a significant cause of insurance impairment and pales in comparison to the systemic risk in the banking industry. - View 1

**Total Assets of FDIC Insured Failed Institutions Compared to P&C Insurer Impairments 1969-2010**

Adjusted to 2010 Dollars

- $5,630 Billion 98%
- $115 Billion 2%

- $113 Billion 98%
- $1.8 Billion 2%

- Impaired FDIC Insured Institutions
- Impaired P&C Insurers
- Reinsurance Cause of Failure
Reinsurance failure is not a significant cause of insurance impairment and pales in comparison to the systemic risk in the banking industry. - View 2

FDIC Insured Failed Institutions Compared to P&C Insurer Impairments 1969-2010

Adjusted to 2010 Dollars

- Total Assets of Impaired FDIC Insured Institutions: 5,630
- Total Deposits of Impaired FDIC Insured Institutions: 3,210
- Impaired P&C Insurers' Total Assets: 115
- Total Assets of Impaired P&C Insurers (Reinsurance Cause of Failure): 1.8

Billions

- Total Assets of Impaired FDIC Insured Institutions
- Total Deposits of Impaired FDIC Insured Institutions
- Impaired P&C Insurers' Total Assets
- Total Assets of Impaired P&C Insurers (Reinsurance Cause of Failure)
Reinsurance failure is not a significant cause of insurance impairment and pales in comparison to the systemic risk in the banking industry. - View 3

Total Assets of FDIC Insured Failed Institutions Compared to P&C Insurer Impairments 1969-2010

Adjusted to 2010 Dollars

$5,630 Billion

$115 Billion

$1.8 Billion

- Impaired FDIC Insured Institutions
- Impaired P&C Insurers
- Reinsurance Cause of Failure
Reinsurance Association of America
www.reinsurance.org

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