SOCIETY OF ACTUARIES

ERM Symposium
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5C - Investment and Reinsurance Counterparty Risk

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Reinsurance Counterparty Risk

A Transition Matrix / Recovery Rate Approach

A presentation at the ERM Symposium
by Stuart Hayes

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Introduction

- What is reinsurance counterparty risk?
- Traditional approaches to quantifying reinsurance counterparty risk
- Benefits of reinsurance counterparty risk analysis

What is reinsurance counterparty risk?

- Counterparty risk
  - "*The risk to each party of a contract that the counterparty will not live up to its contractual obligations…In most financial contracts, counterparty risk is also known as "default risk*"."[1]
  - "*Credit risk…the risk that the issuer of a fixed income security may default*."[2]
- Reinsurance counterparty risk
  - The risk that ceded reinsurance balances will not be collected
  - Insurance companies' incur significant counterparty risk in possible non-collection of ceded balances

Risk of greater uncollectible reinsurance than anticipated

[1]*www.investopedia.com* definition

[2]Fabozzi, *Handbook of Fixed Income Securities*

Traditional approaches to quantifying reinsurance counterparty risk

- Schedule F Penalty
  - A Statutory accounting approach to quantifying uncollectible reinsurance
  - Authorized vs. unauthorized; items in dispute; overdue amounts
  - Little tie to actual counterparty risk
  - Intended as a minimum "bad debt reserve"
- Significant reinsurers' current AM Best ratings
  - Better tie to current financial strength, but usually a qualitative approach
  - Ratings change over time – usually down
  - No available measures of how they change or what happens in default

Difficult to create a distribution of results

Benefits of reinsurance counterparty risk analysis

- Quantify a previously unquantified risk
  - Risks typically modeled in an ERM/EC framework include other major risks P&C Insurance companies face; counterparty risk not always considered
  - Easily incorporated as part of a broader Economic Capital model
- Introduce/Verify a more robust bad debt reserve
  - Schedule F penalty has little to do with actual counterparty risk
- Support Statement of Actuarial Opinion
  - NAIC Annual Statement instructions require due diligence and comment on reinsurance collectibility
- Answer key questions
  - Are ceded reserves collectible?
  - Does current reinsurance structure actually protect surplus?
  - How variable is bad debt? What does a 1 in 200 year event look like?
  - How could systematic risks affect ceded balances?

Modeling Reinsurance Counterparty Risk

Overview

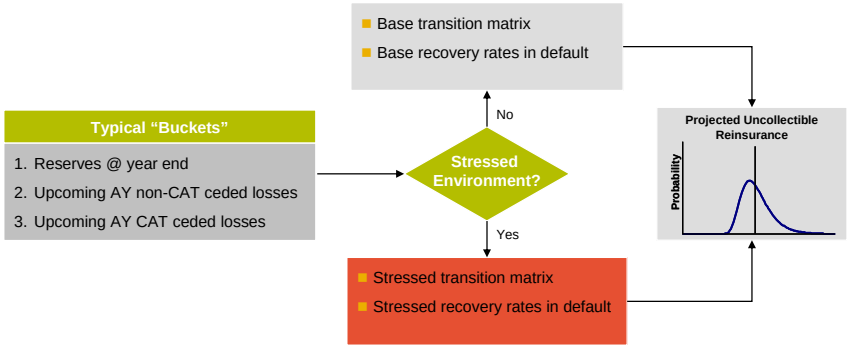
Stressed Scenarios

Transition Matrix

Recovery Rates in Default

Reinsurance Counterparty Risk Analysis — Overview

- Reinsurance Counterparty Risk can be modeled using a transition matrix/recovery rate approach



Reinsurance Counterparty Risk Analysis — Stressed Scenarios

- Stress scenarios trigged by events that would negatively affect the financial soundness of the reinsurance industry:
  - Natural catastrophe events
    - Hurricanes
    - Other (wind)storms
    - Earthquakes
    - Liability catastrophes

    Aggregate industry effect of events over one year considered
  - Financial catastrophe events
    - Bond market downturn
    - Stock market crash

    Economic scenarios used to simulate annual returns
- Stress trigger can be due to individual event (huge hurricane), or combination of smaller catastrophe and/or economic events.

Once triggered, stressed scenario applies for one period only

Reinsurance Counterparty Risk Analysis — Transition Matrix

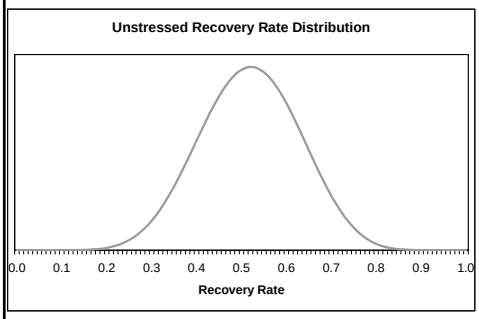
- Example one year base and stressed matrices

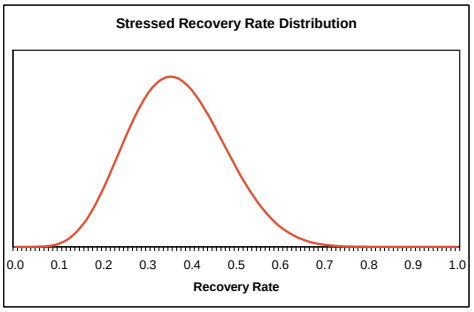
Base Transition Rates				
From/to	**A**	**B**	**C**	**Default**
A	90.0%	5.0%	3.0%	2.0%
B	2.0%	80.0%	10.0%	8.0%
C	1.0%	4.0%	60.0%	35.0%

Stressed Transition Rates				
From/to	**A**	**B**	**C**	**Default**
A	45.0%	24.5%	19.0%	11.5%
B	1.5%	40.0%	35.5%	23.0%
C	0.5%	1.5%	30.0%	68.0%

Reinsurance Counterparty Risk Analysis — Recovery Rates

- Recovery Rate = Proportion of full debt recovered in default
- Average close to 50% over time; individual default situations vary
- Worse in years when defaults are more frequent (stress scenarios)
- Example graphs of base and stressed recovery rate distributions below





Distributions based on Moody's data

Numerical Example

Reinsurance Counterparty Risk Analysis — Numerical Example

- Example Company – simple reinsurance structure
  - 3 Reinsurers – 2 strong; 1 weak
  - $300 Reserve balance with each reinsurer; $900 total ceded reserves
  - Reserve balances all repaid within three years:
    - $100 per year for reinsurers 1 and 3
    - $150/$100/$50 for reinsurer 2

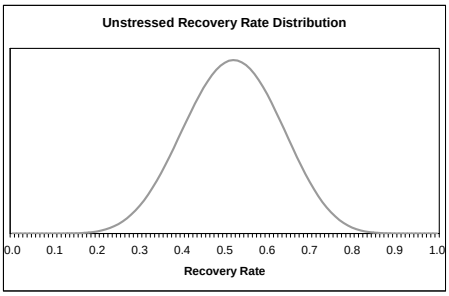
Reinsurer	Beginning Rating	Beginning Reserve Balance
Reinsurer 1	A	$300
Reinsurer 2	A	$300
Reinsurer 3	C	$300
	Total:	$900

Reinsurance Counterparty Risk Analysis - Numerical Example (cont'd)

- **Step 1 – Determine Stress Environment**
  - Aggregate catastrophe information
  - Economic scenario information
  - Compare to trigger levels
- **Assume year 1 returns "unstressed"**

Year 1 → Base (Unstressed) Environment

Base Transition Rates				
From/to	**A**	**B**	**C**	**Default**
A	90.0%	5.0%	3.0%	2.0%
B	2.0%	80.0%	10.0%	8.0%
C	1.0%	4.0%	60.0%	35.0%



Reinsurance Counterparty Risk Analysis - Numerical Example (cont'd)

- **Step 2 – Determine default occurrence**
  - Monte Carlo simulation approach
  - Transition considered for each company individually
  - Only default results in non-payment (transition to lower rating does not directly affect cash flow)

Year 1 Transitions

Base Transition Random Number Ranges				
From/to	**A**	**B**	**C**	**Default**
A	.000-.900	.900-.950	.950-.980	.980-1.000
B	.000-.020	.020-.820	.820-.920	.920-1.000
C	.000-.010	.010-.050	.050-.650	.650-1.000

Reinsurer	Beginning Rating	Random Number Generated	Transition Result	Ending Rating
Reinsurer 1	A	0.40	A	A
Reinsurer 2	A	0.60	A	A
Reinsurer 3	C	0.70	Default	N/A

Reinsurance Counterparty Risk Analysis - Numerical Example (cont'd)

- **Step 3 – Determine non-payment due to any default; remaining reserves**
- **Monte Carlo simulation approach**
  - Recovery rate assigned to any defaults
  - Payout of ceded reserves required for all companies

Year 1 Payment & Reserve Calculations

Reinsurer	Beginning Reserve Balance	Paid Amount	Ending Reserve Balance
Reinsurer 1	$300	$100	$200
Reinsurer 2	$300	$150	$150
Reinsurer 3	$300	$100	$200

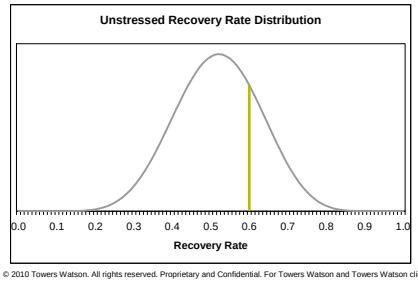
Reinsurance Counterparty Risk Analysis - Numerical Example (cont'd)

- **Step 3 – Determine non-payment due to any default; remaining reserves**
- **Non-Payment Amounts are key finding**

Year 1 Calculations (cont'd)

Reinsurer	Transition Result	Random Number Generated	Recovery Rate	Recovered Amount	Non-Payment Amount
Reinsurer 1	A	N/A	N/A	$100	**$0**
Reinsurer 2	A	N/A	N/A	$150	**$0**
Reinsurer 3	Default	0.75	0.60	$60	**$40**

Company 3 Non-Payment
= Paid Amt. x (1 - Recov. Rate)
= $100 x (1 - 0.60)
= **$40**

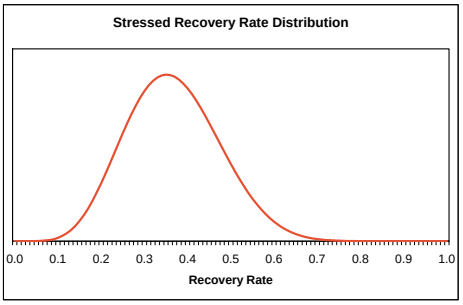


Reinsurance Counterparty Risk Analysis - Numerical Example (cont'd)

- **Assume year 2 returns "stressed" (large catastrophe and/or economic downturn)**

Year 2 → Stressed Environment

Stressed Transition Rates				
From/to	**A**	**B**	**C**	**Default**
A	45.0%	24.5%	19.0%	11.5%
B	1.5%	40.0%	35.5%	23.0%
C	0.5%	1.5%	30.0%	68.0%



Reinsurance Counterparty Risk Analysis - Numerical Example (cont'd)

Year 2 (Stressed) Transitions, Reserve Calculations

Stressed Transition Random Number Ranges				
From/to	**A**	**B**	**C**	**Default**
A	.000-.450	.450-.695	.695-.885	.885-1.000
B	.000-.015	.015-.415	.415-.770	.770-1.000
C	.000-.005	.005-.020	.020-.320	.320-1.000

Reinsurer	Beginning Rating	Random Number Generated	Transition Result	Ending Rating
Reinsurer 1	A	0.50	B	B
Reinsurer 2	A	0.90	Default	N/A
Reinsurer 3	N/A	N/A	Default	N/A

Reinsurer	Beginning Reserve Balance	Paid Amount	Ending Reserve Balance
Reinsurer 1	$200	$100	$100
Reinsurer 2	$150	$100	$50
Reinsurer 3	$200	$100	$100

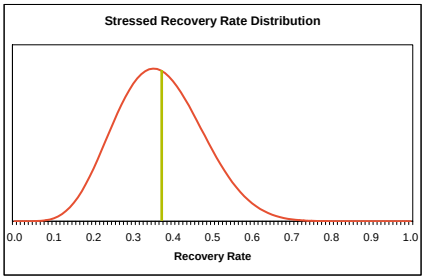
Reinsurance Counterparty Risk Analysis - Numerical Example (cont'd)

Year 2 Calculations (cont'd)

Reinsurer	Transition Result	Random Number Generated	Recovery Rate	Recovered Amount	Non-Payment Amount
Reinsurer 1	B	N/A	N/A	$100	**$0**
Reinsurer 2	Default	0.50	0.38	$38	**$62**
Reinsurer 3	Default	N/A	0.60	$60	**$40**
				Total:	**$102**

Company 2 Non-Payment
= Paid Amt. x (1 - Recov. Rate)
= $100 x (1 - 0.38)
= **$62**

Total Year 2 Non-Payment
= **$62 + $40 = $102**



Reinsurance Counterparty Risk Analysis - Numerical Example (cont'd)

- **Assume year 3 returns "unstressed" environment**

Year 3 (Base) Transitions, Reserve Calculations

Base Transition Random Number Ranges				
From/to	**A**	**B**	**C**	**Default**
A	.000-.900	.900-.950	.950-.980	.980-1.000
B	.000-.020	.020-.820	.820-.920	.920-1.000
C	.000-.010	.010-.050	.050-.650	.650-1.000

Reinsurer	Beginning Rating	Random Number Generated	Transition Result	Ending Rating
Reinsurer 1	B	0.01	A	A
Reinsurer 2	N/A	N/A	Default	N/A
Reinsurer 3	$0	N/A	Default	N/A

Reinsurer	Beginning Reserve Balance	Paid Amount	Ending Reserve Balance
Reinsurer 1	$100	$100	$0
Reinsurer 2	$50	$50	$0
Reinsurer 3	$100	$100	$0

Reinsurance Counterparty Risk Analysis - Numerical Example (cont'd)

Year 3 Calculations (cont'd)

Reinsurer	Transition Result	Random Number Generated	Recovery Rate	Recovered Amount	Non-Payment Amount
Reinsurer 1	A	N/A	N/A	$100	**$0**
Reinsurer 2	Default	N/A	0.38	$19	**$31**
Reinsurer 3	Default	N/A	0.60	$60	**$40**
				Total:	**$71**

Company 2 Non-Payment
= Paid Amt. x (1 - Recov. Rate)
= $50 x (1 - 0.38)
= **$31**

Company 3 Non-Payment
= Paid Amt. x (1 - Recov. Rate)
= $100 x (1 - 0.60)
= **$40**

Total Year 3 Non-Payment
= **$31 + $40 = $71**

Reinsurance Counterparty Risk Analysis - Numerical Example (cont'd)

- Total non-payments by year create uncollectible reinsurance cash flow

Reinsurer	Beginning Reserve Balance	Non-Payment Amounts				Uncollected % of Beg. Reserve
		Year 1	Year 2	Year 3	Total	
Reinsurer 1	$300	$0	$0	$0	$0	0%
Reinsurer 2	$300	$0	$62	$31	$93	31%
Reinsurer 3	$300	$40	$40	$40	$120	40%
Total	$900	$40	$102	$71	$213	24%
PV @ 3%		$39	$96	$65	**$200**	22%

- Company 3: 40% of Beginning reserve uncollected = (1 – 0.60 recovery rate)
- Company 2: 31% of Beginning reserve uncollected < (1 – 0.38 recovery rate), due to default in year 2, after year 1 $150 payment fully collected
- $200 is expected PV bad debt based on this trial = 22% of reinsurance reserves
- Many trials create a distribution of expected uncollectible reinsurance
- Current Year expected/actual ceded amounts should also be considered

Reinsurance Counterparty Risk Analysis — Current & Potential Uses

- Economic capital modeling
- Quantify bad debt due to unrecoverable reinsurance
  - Hold a more appropriate bad debt reserve
  - Manage the exposure to minimize the consequences of uncollectible reinsurance
  - Satisfy regulators and NAIC Annual Statement instructions
- Acquire a better feel for actual protection provided by past, current, and future reinsurance structures
- Raise awareness of actual financial strength of reinsurers
- Plan for potential uncollectibility/cash flow issues
- Securitization of non-payment amounts

Reinsurance Counterparty Risk Analysis — Potential Enhancements

- Stochastic payment patterns
- Momentum-driven transition matrices
- Differing recovery rate distributions by rating preceding default
- Lag between stress trigger and stress scenario occurrence
- Lump-sum settlement in default
- Multiple stress scenario “levels”
- Refined ceded balance payment patterns, time horizons
- More well-defined stress and otherwise adjusted transition matrices

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Questions / Discussion

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