The Role of Reinsurance in a Total Risk Management Program

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Overview

- Risks faced by an (re-)insurer (JB)

- Need for aggregate loss distributions (SM)

- Measures of risk (SM)

- Creating aggregate distributions (SM)

- Strategy design and implementation (JB)

Risks Faced by Insurers

- Lowe & Stanard (Spring 1996 Forum) risks faced by an insurance enterprise
    - Liability Risk
    - Asset Risk
    - Business Risk

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Risks Faced by Insurers

- Underwriting Risk

- Balance Sheet Risk

- Business Risk

- Organizational Risk

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Aggregate Loss Distributions

- Analysis of risks shows understanding of liabilities is key
- Insurance liabilities variable in amount and timing
- Initial focus is on amount of loss
  - Suggests an accident year ultimate view
  - Future work to consider timing risk (see my upcoming DFA Seminar talk in Chicago)

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Aggregate Loss Distributions

- Design criteria for producing aggregates
  - Include all lines of business, all liabilities
  - Appropriate treatment of catastrophes
  - Capture correlation
    - Within year, between line
    - Between years

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Aggregate Loss Distributions

- All lines of business
  - Total risk management program must take portfolio view
    - Achieving balance at department / business unit levels expensive and serves no economic purpose
  - Risk fundamentally a question of aggregation

Aggregate Loss Distributions

- All lines of business
  - Effect of adding uncorrelated risk on extreme percentiles is less than expected, especially after considering pricing
    - Example: Expected loss ratio 80% on $375M premium, losses lognormal with CV 0.20
    - 99%ile loss ratio is 124%
    - Add ILW type loss, 5% chance of $50M payout, 95% chance of $0M payout, priced at 50% loss ratio

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Aggregate Loss Distributions

- Example continued
  - ILW premium is $2.5M / 0.5 = $5.0M
  - 99%ile losses increase by only $4.8M to $471M
  - 99%ile loss ratio unchanged at 124%
  - Shows combined effect of adding lower loss ratio business and portfolio effect on losses
  - Computation is based on conditional probability:
    $P(L+S<x) = P(L<x-s|S=s)P(S=s) + P(L<x|S=0)P(S=0)$
    $= 0.05\ P(L<x-s) + 0.95\ P(L<x)$
    where L = base losses, S = added ILW losses

Aggregate Loss Distributions

- Catastrophes
  - Major source of variability in liabilities
  - Major source of correlation between lines of business
  - Sophisticated models available to quantify amount and distribution of losses
  - Recommend modeling cat losses separately from non-cat losses

Aggregate Loss Distributions

- Capture correlation
  - Cat, discussed above
  - Non-cat correlations in loss ratios largely driven by **pricing** (year-to-year) and **property**
    - Beware statewide splits of data which introduce hard-to-model correlations
  - One-year accident year plans can incorporate common pricing movements
  - Allows realistic model of loss ratio

Measures of Risk

- Risk management process requires quantifiable measures of risk and setting targets for risk constraints

- Measures should capture **solvency** and **stability** constraints

- **Solvency** is related to probability of loss in excess of a key threshold, such as combined ratio which would trigger down-grade
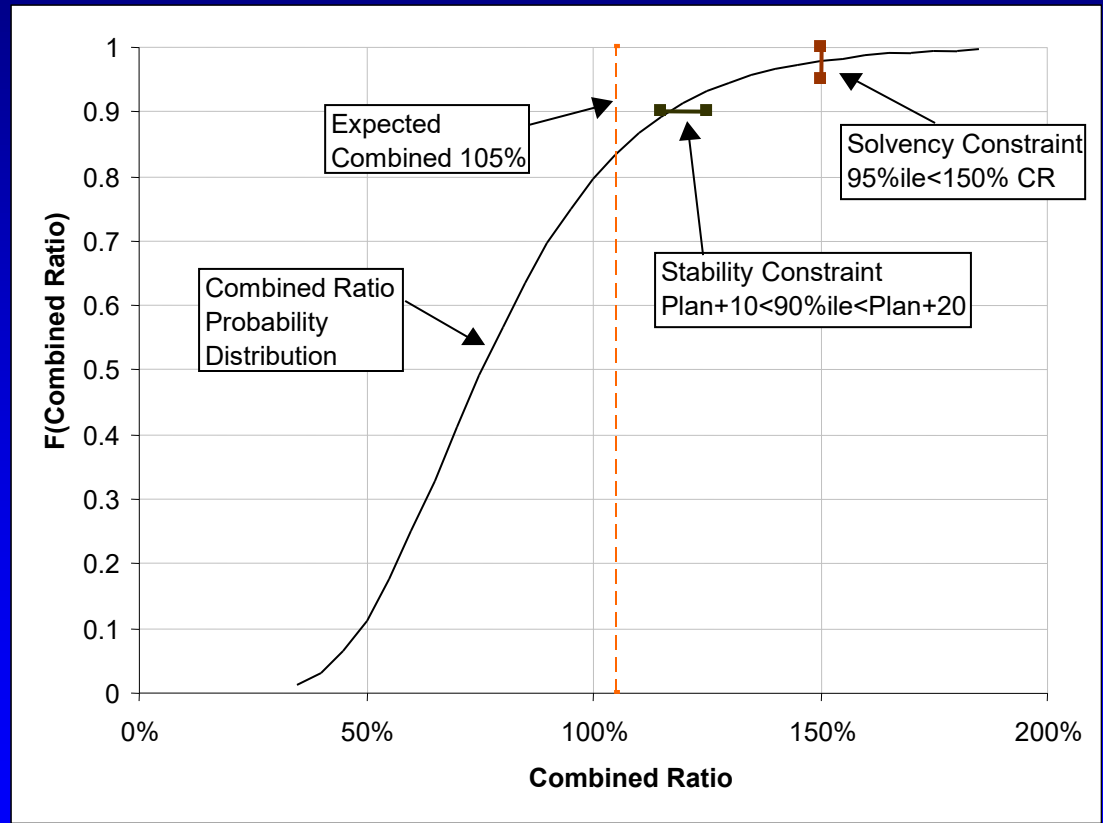
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Measures of Risk

- **Stability** is desire for actual results to be reasonably close to plan

- Possible measures include variance, standard deviation, CV, down-side risk

- Percentile related measures more direct

  - 1 year out of 10, combined ratio should be between plan + x and plan + y

  - Lower bound is guide to suitable risk appetite

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Measures of Risk

- Graphic illustrates constraints
  - Stability is horizontal constraint
  - Solvency is vertical constraint

Chart: F(Combined Ratio) vs Combined Ratio

- Expected Combined 105%
- Combined Ratio Probability Distribution
- Stability Constraint Plan+10<90%ile<Plan+20
- Solvency Constraint 95%ile<150% CR

Creating Aggregate Loss Distributions

- Many tools available for making aggregates
  - See other sessions at CARe!
- Frequency and severity approach
- Stratify book by attachment and limit
- Model cats separately
- Method of moments to match three moments for large books

Creating Aggregate Loss Distributions

- Fast Fourier Transform methods
  - Programming overhead to set up
  - S. Wang Proceedings paper (www.casact.org)
- Simulation too slow
- Recursive methods more of academic interest and very computationally intensive

Creating Aggregate Loss Distributions

- Correlation between lines: use Iman-Conover shuffling method or other copula based method
  - Again, see Wang's paper
  - Gives sample from multivariate distribution with desired correlation structure
  - Easy to implement
  - Can be done in Excel
  - Basis for correlations in At Risk

Strategy Design

- **GOAL:** Maximize profit objective subject to risk constraints
  - Requires quantifiable **measures** of risk
  - Requires **targets** for risk constraints
  - Requires **structuring** risk management program to meet targets
  - Requires **monitoring** of performance against targets

Strategy Design

- Quantifiable Measures of Risk
  - Solvency Measures
    - Probability of Ruin
    - Probability of Impairment
    - Probability of Employment
  - Stability Measures
    - Probability of Combined Ratio > x%
    - Probability of Exceeding Plan by y%
    - Probability of Under Performing the Market by z%

Strategy Design

- Establishing Targets
- Structuring Risk Management Program
  - Mix of Business
  - Net Retained Lines
  - Reinsurance!
- Implementation

Implementation

- Use of Reinsurance
  - Have a defined purpose for reinsurance
    - Promote Stability
    - Promote Solvency
    - There are other uses for reinsurance
  - Evaluate the benefit provided versus the cost
  - Continue to monitor performance against expectations

Reinsurance vs. Capital Markets

	Reinsurance	**Securitization**
Risk Matching	Tailored	Standardized
Accounting	Reinsurance	Varies/Complex
Trans. Expense	Low	High
Price	??	??!