

Biennial Convention 2007

# Adventures in Risk

23-26 September 2007 • Christchurch, New Zealand



Institute of Actuaries of Australia



## Pricing Alternative forms of Commercial insurance cover

**Andrew Harford**



## Pricing alternative covers

- Types of policies
- Overview of Pricing Approaches
- Total claim cost distribution
- Discounting Cash flows
- Adjusting quote for differences in cover
- Conclusion



## Types of Policy

- Conventional
- Policies where insurer only pays some claims
  - Aggregate
  - XOL
- Policies involving premium adjustments
  - Burner
  - CED



## Pricing alternative covers

- Types of policies
- **Overview of Pricing Approaches**
- Total claim cost distribution
- Discounting Cash flows
- Adjusting quote for differences in cover
- Conclusion



## Role of underwriter

- Quote for conventional
  - Exposure
  - Claim experience
  - Changes over time
- Breakdown of premium
  - Expected claim number and size
  - Expenses
  - Cost of reinsurance
  - Profit



## Pricing approaches

- Aggregates and XOLs - insurer does not pay all claims and receives fixed premium
- CEDs and Burners - insurer pays all claims but there are premium adjustments
- Different approach required for the two groups:
  - Adjusting for differences in cover
  - Discounting expected cash flow



## Pricing alternative covers

- Types of policies
- Overview of Pricing Approaches
- **Total claim cost distribution**
- Discounting Cash flows
- Adjusting quote for differences in cover
- Conclusion



## Distribution of total claim cost

- Need a distribution of total claim costs:

$$T = X_1 + X_2 + \dots + X_N$$

- For aggregate need it to assess cost of claims over aggregate limit
- For Burners and CEDs also need this distribution
- Derive using assumptions about distribution of claim numbers and claim sizes





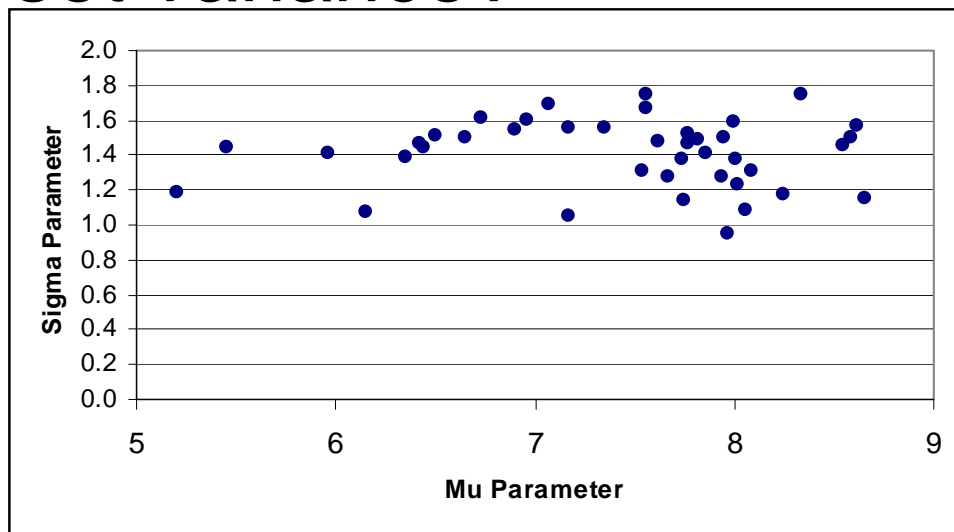
## Claim number distributions

- Choose the **form** of the distribution: Poisson, Negative binomial, ...
- Choose **parameters** of the distribution
- Set expected value equal to underwriters assessment
- Model different claim types separately



## Claim size distributions

- Choose the **form** - Lognormal, Gamma, ...
- Test validity of selection
- Use underwriter's assessment to set mean
- How to set variance?





## Simulation

- Quick with modern computing power
- Simple to implement
- Easy to understand
- Flexible - Calculate other items of interest



## Other considerations

- Development delays
- Model and parameter uncertainty
- Accumulations





## Pricing alternative covers

- Types of policies
- Overview of Pricing Approaches
- Total claim cost distribution
- **Discounting Cash flows**
- Adjusting quote for differences in cover
- Conclusion



## Discounting expected cash flows

- Burners and CEDs insurer pays all claims
- Premium adjustments depending on claims
- Simulate potential claims for a year and the premium adjustments they generate
- Calculate the expected value of future premium adjustments
- Discount expected premium adjustments and make equal to Conventional quote



## Discounting expected cash flows

- Considerations :
  - credit rating of insured
  - development of claims
  - Uncertainty in constructing claim distributions



## Pricing alternative covers

- Types of policies
- Overview of Pricing Approaches
- Total claim cost distribution
- Discounting Cash flows
- **Adjusting quote for differences in cover**
- Conclusion



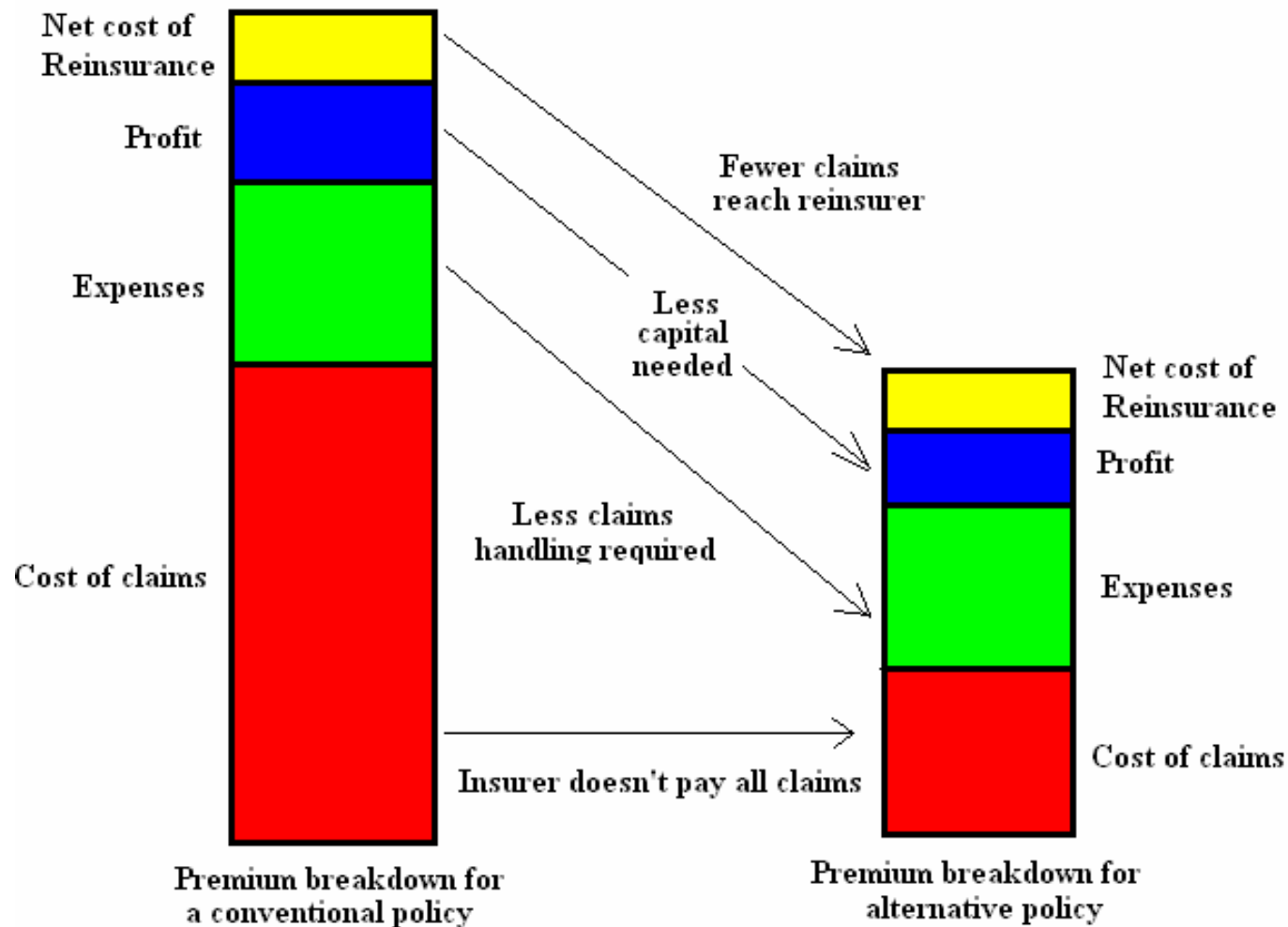


## Adjusting for differences in cover

- Underwriter produces quote for conventional policy
- Start of with underwriters assessment and adjust for differences in cover



## Adjusting for differences in cover





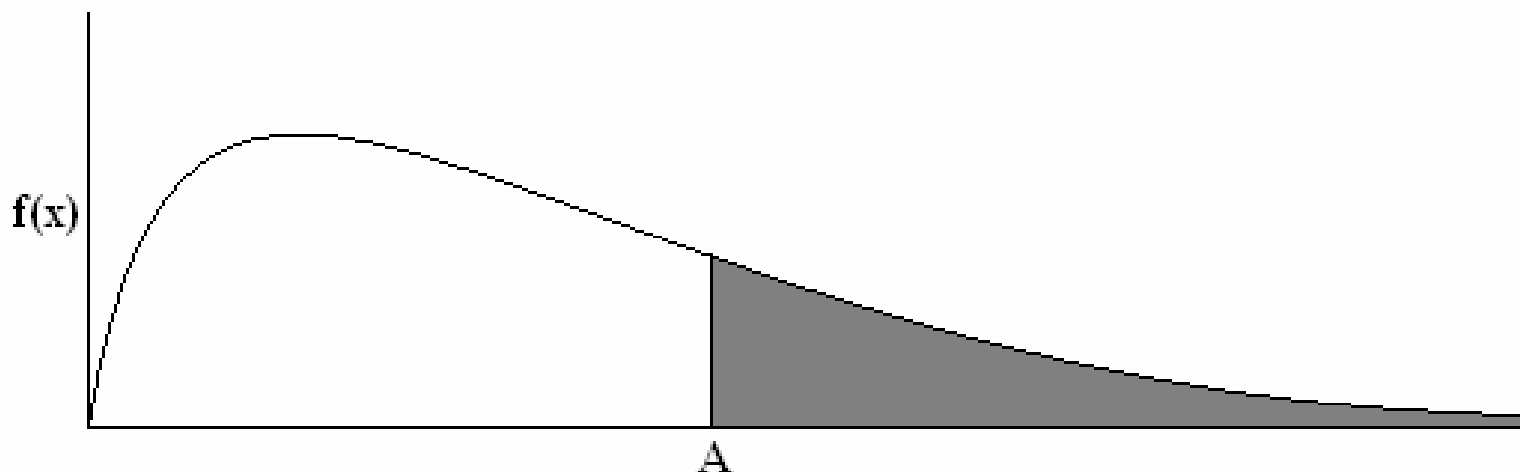
## Adjusting for differences in cover

- Suitable for Aggregates and XOLs
- Ensures consistency with underwriter's quote
- Relies on skill of underwriter



## Expected cost of claims

- For aggregate compute  $\text{Max}(T-A, 0)$  in each simulation and get average





## Expenses

- Claims handling
  - Claims handled by client or insurer?
- Underwriting
  - Time involved preparing quote
- Overheads



## Reinsurance

- Reinsurance recoveries calculated for each simulation for the conventional and the alternative risk
- Derive ratio for average recovery from conventional and from alternative
- Apply this ratio to reinsurance margin in conventional quote



## Investment income

- Delays in paying claims:
  - Typically involves larger claims
- Not usually material on short tail lines



## Profit

- No consensus
- Consider level of capital needed for conventional policy versus capital for alternative policy
- Benchmark
  - game theoretic approach
  - Average amount of marginal capital needed to write risk
  - difficult to apply in practice





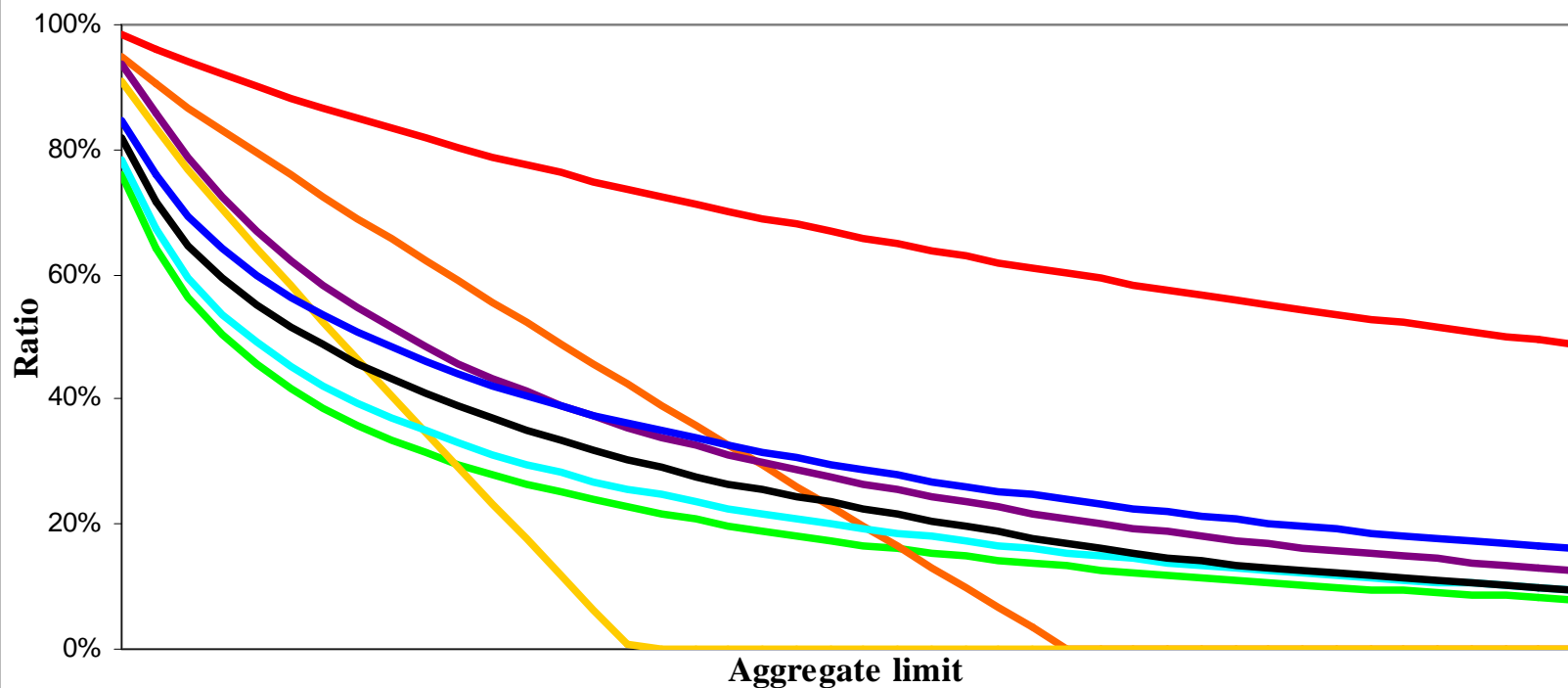
## Profit – some approaches

- Standard deviation
- Value at risk
- Probability of meeting claims to some level
- Proportional hazards
- Capital consumption



## Profit – comparison of methods

How the ratio for each method varies with the Aggregate limit



- Aggregate cost as a percentage of conventional cost
- Method 2 - 99% probability
- Method 3 - VAR
- Method 4 - PH transform,  $r=0.95$
- Method 1 - based on standard deviation
- Method 2 - 98% probability
- Method 4 - PH transform,  $r=0.8$
- Benchmark - Equal probability of insolvency



## Pricing alternative covers

- Types of policies
- Overview of Pricing Approaches
- Total claim cost distribution
- Discounting Cash flows
- Adjusting quote for differences in cover
- **Conclusion**



## Conclusion

- Modifying the underwriter's quote
  - Consistency
  - Tractability
  - Simplifies some of the calculations
  - Use knowledge & skill of underwriter