The Actuarial Profession
making financial sense of the future

31st ANNUAL GIRO CONVENTION

12-15 October 2004, Hotel Europe, Killarney, Ireland

Valuing Reinsurance from a Buyer's Perspective

Simon Pollack
HSBC Insurance Brokers Ltd
simon.pollack@hsbc.com, +44 20 7661 2492

Dean Dwonczyk
Paterson Martin Ltd
dean.dwonczyk@patersonmartin.com, +44 20 7929 1113

Part 1

Valuation framework, "whose risk is it anyway?", communication tools

Overview

1. Hierarchy of Risk Aversion
2. The “Capital” viewpoint *(owning a balance sheet)*
3. The “P&L” viewpoint *(owning a loss ratio)*
4. Capital vs. P&L viewpoints
   Case-study based on hypothetical company
5. Internal reinsurance - best of both worlds?
6. Conclusions

The Actuarial Profession
making financial sense of the future

1. Hierarchy of Risk Aversion

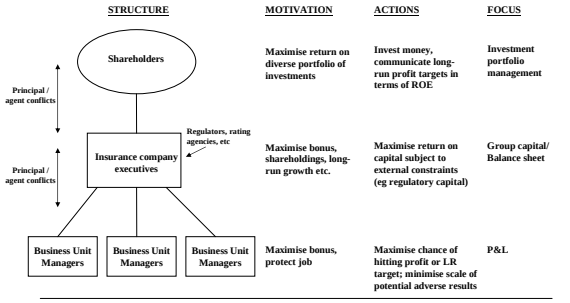
The Actuarial Profession
making financial sense of the future

1.1. Who makes the decisions?

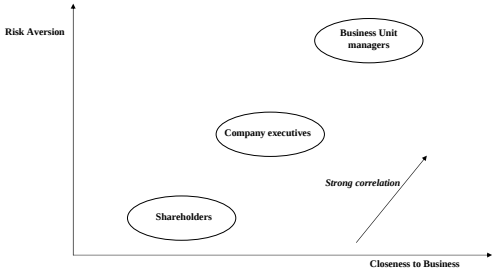
- Individuals maximise their own utility
- The challenge of principal / agent relationships is to align interests
- Risk Aversion depends on your viewpoint and your performance targets
- Reinsurance decisions reflect Risk Aversion

The Actuarial Profession
making financial sense of the future

1.2. Who does what; how they do it



1.3. Risk Aversion = undiversifiability*



(closer ⇒ diversification away from Business Unit risk is more difficult)

*** With apologies to lovers of elegant language**

2. The “Capital” viewpoint

2.1. Framing performance by Capital

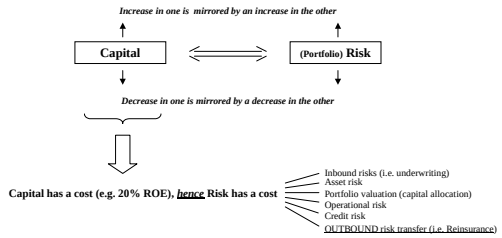
- Performance targets for Executives are often *Capital*-based
  - e.g. “Here is a balance sheet. Maximise profits subject to constraints from S&P & FSA”
  - We assume this aligns interests with SHs

Reinsurance strategy should be 100% aligned with capital strategy

- Capital management is inherently a risk / reward tradeoff discipline, and Reinsurance affects both risk and reward

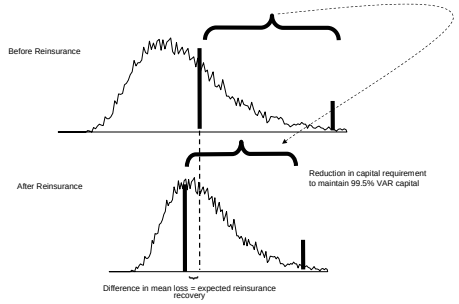
The Actuarial Profession
making financial sense of the future

2.2. The Duality of Capital and Risk



The Actuarial Profession
making financial sense of the future

2.3. Marginal capital



The Actuarial Profession
making financial sense of the future

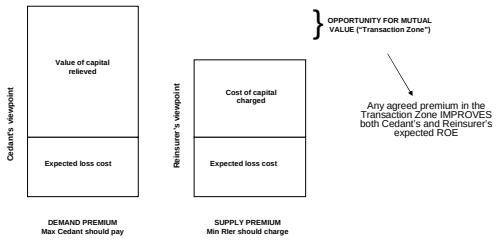
2.4. Reinsurance economics

- A theoretical price comprises 2 components:
  1. Expected Loss Cost ("ELC")
  2. Capital component *(cost of capital charged, or value of capital relieved)*

  (friction costs ignored for ease of illustration)
- ELC should (big "should"!) be same for Cedant and Reinsurer
- True value comes from Reinsurer's capital component being lower than Cedant's
  - Arises because Reinsurers are professional diversifiers

The Actuarial Profession
making financial sense of the future

2.5. Reinsurance economics



The Actuarial Profession
making financial sense of the future

3. The "P&L" viewpoint

The Actuarial Profession
making financial sense of the future

3.1. Business-unit performance targets

- Fluid capital allocation, reacting tactically to market conditions by altering capital level, dynamic and iterative business planning
  - This could be written by the Brothers Grimm
- In practice, motivation is guided by reference to single “performance target” each year
- This gives P&L accountability to Business-unit managers

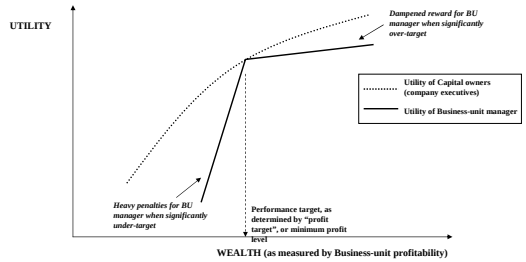
The Actuarial Profession
making financial sense of the future

3.2. P&L not Capital accountability?

- Managers with P&L accountability have the autonomy to make positive decisions
- Managing by capital in practice is too complex
  - Communicating a P&L-based performance target is easy
  - It will often be translated into a Loss Ratio-type measure
  - In itself this may be determined with reference to Group ROE measures, but it fails to capture the Risk Appetite

The Actuarial Profession
making financial sense of the future

3.3. The downside of P&L targets



The Actuarial Profession
making financial sense of the future

3.4. “Loss Potential”

- Define “Loss Potential” as rational risk measure
  - Given P&L performance measurement, and resulting non-differentiable utility curve (!)
- Loss Potential =
  - PROBABILTY of missing target, MULTIPLIED BY
  - AVERAGE SEVERITY of miss, should it occur
    - (If don’t include second part, Cat RI rarely gives value)

The Actuarial Profession
making financial sense of the future

4. Capital vs. P&L viewpoints

The Actuarial Profession
making financial sense of the future

4.1. Reinsurance diagnostics

- Provide graphical diagnostic tools
- Illustrate where conflicts of interest may arise
- Help determine what is the best RI and from whose perspective
  - *Remember: all conclusions drawn here are strictly RATIONAL given the decision-maker’s perspective*

The Actuarial Profession
making financial sense of the future

4.2. Hypothetical insurance group

- Group comprises 10 (identical) Business-units
  - Each BU has attritional claims, large claims, Cat claims
    - Attr: mean 50m +/-2m SD
    - Large: 10 on average, each mean 0.5m +/-2m SD
    - Cat: 50% chance of event, with mean 5m +/- 20m SD
  - Each BU can choose from range of RI options
    - Risk RI deductibles 1,2,..,10m; Cat RI deductibles 5,10,..,50m
  - Central case has 99% VAR, 20% ROC, BU profit target 0 (i.e. the "line in the sand" for performance measuring), RI priced as mean plus load on SD (15% for risk, 30% for cat)

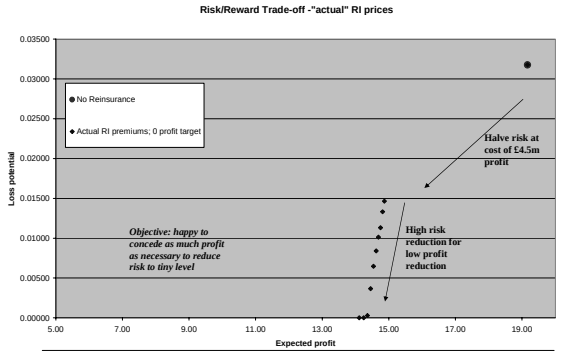
4.3. Illustrating Risk/Reward trade-offs

- The following graphs show:
  - From a BU perspective...
  - For each RI case…
  - the impact of buying that RI…
  - on both the profitability of the BU…
  - and the risk that it runs (defined by Loss Potential)
  - (illustrate both actual RI prices and at various Demand Premiums)
- Therefore this is Risk/Reward at BU level

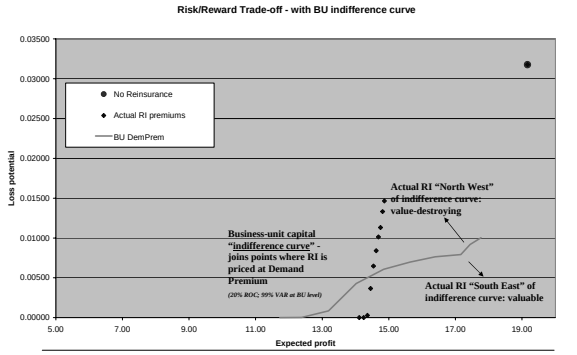
4.4. Illustrating Risk/Reward trade-offs

- We compare:
  - BU view based on "owning" a P&L
  - BU view *as if* "owning" a balance sheet
  - Group view (actually owning a balance sheet)
    - This is the "view" with which actual reinsurance strategy should be aligned

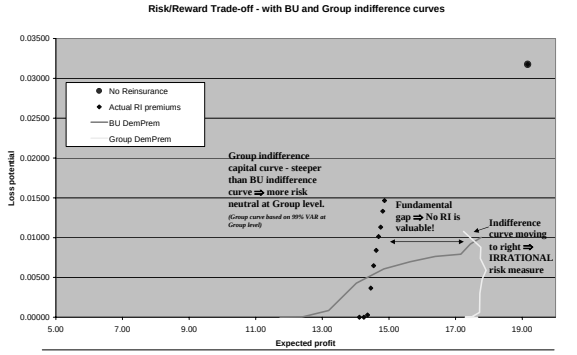
4.5. How a BU manager (instinctively) makes decisions



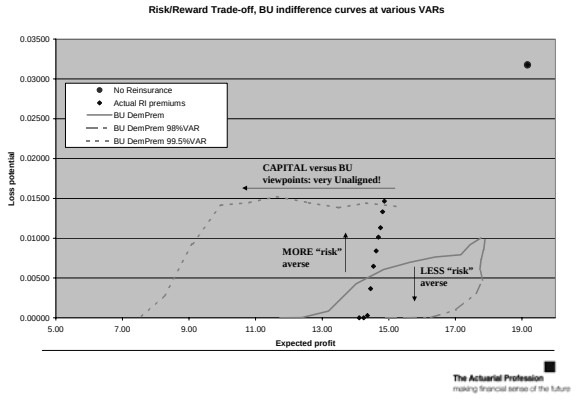
4.6. Capital-based indifference curve on Loss Potential-based graph



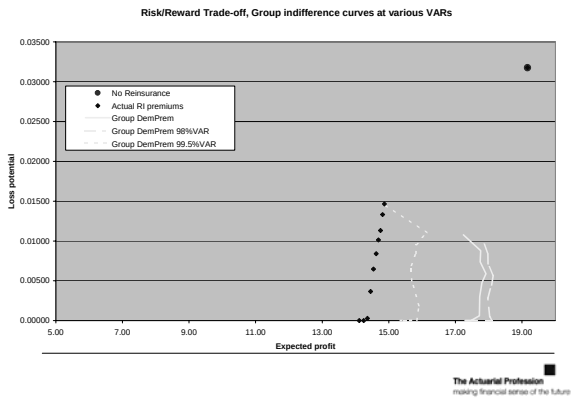
4.7. Group capital indifference curve: nearly vertical



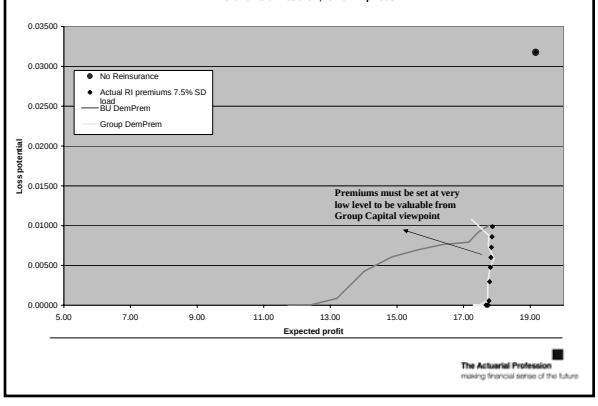
4.8. Sensitivity testing the VARs at BU level



4.9. Sensitivity testing the VARs at Group level

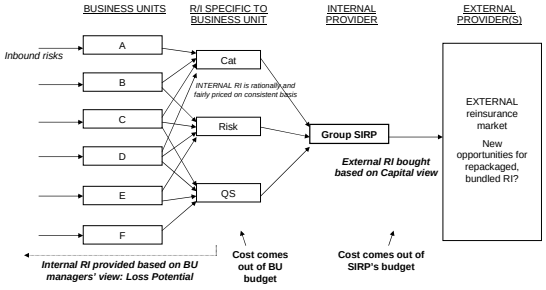


4.10. How low must the reinsurers' load be to create value?



5. Internal Reinsurance
- Best of both worlds?

5.1. Structured Internal RI Pool (SIRP)



5.2. Benefits of SIRP

- SIRP retains "cultural" benefits of BU autonomy & accountability
- Transfer pricing framework formally established
  - Equitable, risk management discipline, regulatory reasons
- Retains capital value within the Group
  - And less exposure to vagaries of RI underwriting cycle
- Economies of scale & data / info / analysis
- *(Many other benefits can be identified)*

5.3. Internal RI can go wrong

- Price based on actual quotes
  - Not fair transfer price; exposure to cycle
- Price negotiable, like open market RI
  - Most “powerful” person beats down less powerful
- Internal vehicle has no veto rights
  - Dustbin of risks
- Commercially realistic prices
  - Group should not subsidise Business-units

The Actuarial Profession
making financial sense of the future

6. Conclusions

The Actuarial Profession
making financial sense of the future

6.1. Different views can be aligned

- Principal - agent conflicts are inherently present in any practical Group / Business-unit situation
- That Group RI buying is more sensible is intuitively clear - we have tried to provide COMMUNICATION FRAMEWORKS for this
- Properly implemented Internal Reinsurance can combine BU autonomy and Group capital benefits

The Actuarial Profession
making financial sense of the future

Part 2

> Some additional things to consider when designing the valuation model.

The Actuarial Profession
making financial sense of the future

A Typical Scenario

- Based on historic purchases, gut feel and/or the results of an actuarial investigation/ DFA model the reinsurance buyer discusses the proposed reinsurance protection for the upcoming year with the brokers and/or markets.
- If involved the brokers try to place the cover getting a range of different prices/cover options.
- The reinsurance buyer then chooses a number of contracts from the range on offer based on:
  - A number of subjective factors including consistency of program, consistency of markets, broker reciprocity, etc..
  - A number of objective factors including the rate paid last year for equivalent cover, the terms and conditions, the creditworthiness of the reinsurers and the results of DFA modelling.

The Actuarial Profession
making financial sense of the future

A Typical DFA Model Approach

- Stochastic simulation model calibrated using (as far as possible) the company's own data rather than industry data.
- Actuarial approach based on exposures, historic claims experience and historic premium rate changes.
- Line by line analysis.
- Assumptions regarding the (in)dependence of risks within line and between lines.
- Account of inflation/ the time value of money.

The Actuarial Profession
making financial sense of the future

Modelling Approach – A Typical Data Request

Exposures
- Risk Profiles showing:
  - Size bands
  - Aggregate GNPI
  - Number of risks/policies

Claims
- Actuarial Ultimate Incurred Loss Ratios or loss triangles to derive UILRs for past risk years.
- Individual FGU incurred claims cost listing (adjusted to actuarial estimates) for past risk years.

Premiums
- Gross Net Premium Income corresponding to the claims cost risk years for past risk years.
- Rate Change Indices.

Reinsurance
- Key terms.

Valuation Model Extras

- Reinsurance is equivalent to capital. Valuing it using the demand premium approach is a good way, and perhaps the only way, to go. But:
  - Reinsurance might be valuable but sub-optimal. Can the valuation model help to pick this up?
  - A better model will produce better results.
  - The presentation of the results is all important. A great model with a complicated/insufficient results format is of no use to management.

Example Numerical Information

Line	Layer Number	Expected Reinsurance Premium 1	Average Net Recovery 2	Probability that there is a Recovery 3	Probability that the Net Recovery is positive 4	Protection Index - Average Net Recovery as a % of Gross Layer Loss (where there is a layer loss) 5
Property Per Risk	Layer 1	1,625,000	-28,542	56.6%	40.6%	69.4%
Property Per Risk	Layer 2	1,000,000	-751,391	15.2%	11.2%	86.7%
Property Per Risk	Layer 1,2	2,625,000	-779,933			70.3%
Marine	Layer 1	140,000	117,881	53.5%	43.8%	79.1%
Marine	Layer 2	180,000	-137,611	27.4%	3.7%	91.0%
Marine	Layer 3	200,000	-200,000	0.0%	0.0%	100.0%
Marine	Layer 1,2,3	520,000	-219,729			80.1%
Casualty	Layer 1	2,035,000	-1,342,631	64.2%	7.3%	100.0%
Casualty	Layer 2	594,000	-249,606	26.3%	23.7%	100.0%
Casualty	Layer 1,2	2,629,000	-1,592,237			100.0%

Not everyone likes and understands graphs

Example Numerical Information

Line	Average Aggregate Gross Loss 1	Aggregate Gross Loss at the 15% level of confidence 2	Aggregate Gross Loss at the 95% level of confidence 3	Average Aggregate Net Loss 4	Average Aggregate Net Loss minus Average Aggregate Gross Loss 5	Percentage Ranking of the 15% Percentile of the Gross Loss (col 2) in the Net Loss distribution 6	Percentage Ranking of the 95% Percentile of the Gross Loss (col 3) in the Net Loss distribution 7
Property Per Risk	45,868,581	35,774,377	63,950,116	46,654,539	785,958	8.5%	97.0%
Marine	4,728,861	3,527,500	6,963,819	4,947,519	218,659	2.7%	97.7%
Casualty	17,864,055	15,260,517	22,896,134	19,454,912	1,590,857	0.2%	97.0%

The Actuarial Profession
making financial sense of the future

Example Numerical Information – Property Per Risk – Some Report Wording

£10m x £10m Layer 1 Cover – We believe that there is a 57% chance of making one or more recoveries and that even though the expected reinsurance premium is £1.6m the average net of recoveries price is near zero. Notably because of reinstatement premiums and because of reinstatement limits, the average net recovery as a percentage of gross layer loss is only 69%. That is to say that, after taking account of the reinstatement premium and the cases where the cover has been exhausted, on average, the net recovery is 69% of the gross recovery assuming infinite and free reinstatements. The maximum simulated net recovery was £13.5m.

The number of reinstatements currently purchased is 1 and 1 respectively. We simulated that 4 and 2 claims will hit the layers at the 99% confidence level. Hence, it could be worthwhile to purchase one or two more reinstatements on Layer 1.

The reinsurance cover has significantly reduced the probability of high total claims cost in 2004. The aggregate gross loss at the 95% confidence level is £64m. That is, we estimate that there is a 95% probability that the total claim cost for property per risk class claims in 2004 will be less than or equal to £64m. After taking account of the reinsurance (both premiums and recoveries) we estimate that the probability that the total claims cost is less than or equal to £64m rises to 97.0%; a significant improvement.

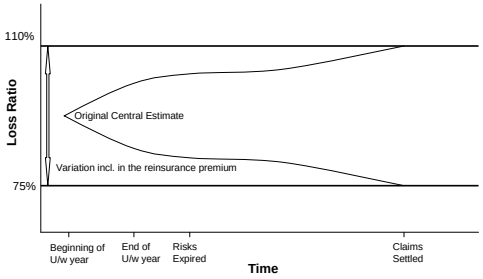
The Actuarial Profession
making financial sense of the future

Setting Expectations with the “Information Ratio”

- The decreasing funnel of doubt. It’s all a matter of changing your perspective.
- For some classes the uncertainty at the beginning of the underwriting year is enormous (new LOBS, uncertain renewals, long tail etc..)
- The Kreps Formula prices reinsurance according to the expected loss plus a multiple of the standard deviation of loss.
- Information and, more particularly, appropriately summarised information at renewal should reduce the reinsurance premium.
- Terms and conditions that reduce volatility and/or vary premium can substantially affect the risk element of the reinsurance premium.

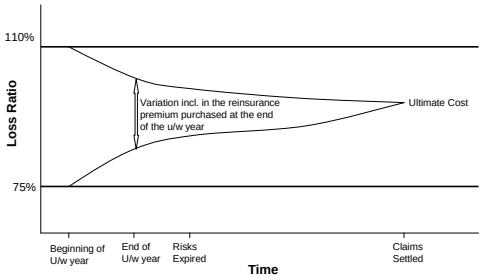
The Actuarial Profession
making financial sense of the future

The Increasing Funnel of Doubt



The Actuarial Profession
making financial sense of the future

The Decreasing Funnel of Doubt



The Actuarial Profession
making financial sense of the future

Setting Expectations with the "Information Ratio"

- Information (and its interpretation) is the reason that buyers and sellers fall out over pricing.
- The (optimistic) underwriter bases his views on the expected book and on the micro information.
- The (pessimistic) reinsurer bases his views on the "worst case" book and on market information. Often the micro information is not made available.
- An information ratio (starting at near 0 and ending at 100 when all claims are settled) is another way of describing the decreasing funnel of doubt.
- This approach can help the buyer and the seller to better understand each other and to help the buyer to understand the value of the risk being transferred.

The Actuarial Profession
making financial sense of the future

Naivety of the Trigger Approach to the Credit Rating of Reinsurers

- Insurers are wrong to use a binary approach outside of DFA model to selecting reinsurers.
- Reinsurer Default and Reinsurer Dispute can be properly modelled (and priced).
- Insurers would benefit by opening the market out to wider price and terms competition. There would also be diversification benefits.
- Credit risks can be transferred in the capital market.
- Insurers see the long term to recovery as an important reason for using only A-rated and above reinsurers. This is sub-optimal. Risks aside, it is easy to prove that many more reinsurance contracts should be being commuted than is presently the case.