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GIRO Convention

23-26 September 2008
Hilton Sorrento Palace

Solvency II - Diversification

Agenda

- Introduction to diversification
  - Definition and areas where it arises
  - In pre-ICA un-modelled world
  - In the world of models
- Analysis of SII approach for solo entities
- Analysis of SII approach for an insurance group – is diversification appropriately represented?
- Conclusion

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Diversification - Definitions

- Definitions of diversification:-
  - Asset - *"The process of mixing a variety of different investments, types of industries, categories of risk or companies in order to reduce risk"*
  - Insurance - *"Reducing overall risk by aggregating many underlying risks"*
  - Colloquial - *"don't put all your eggs in one basket!"*
- Definition of fungibility:-
- *"Something that is exchangeable or substitutable"*
- It is important to remember that diversification between risks is usually there, but that doesn't always mean that capital can be reduced!

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Where does diversification arise?

- Product lines
- Perils (e.g. fire versus theft versus flood)
- Portfolios (personal lines vs commercial)
- Risk types (credit vs market vs insurance)
- Geography / territory
- Across entities of a group
- Time (e.g. underwriting vs reserving)

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In the pre-ICAS world

- No regulatory benefit from diversification
- Solvency margin calculations were too simple (based on the current 16% of premiums, 23% of claims, etc)
- So as an example, capital would be the same for two equal sized companies even if one was mono-line versus multi-line
- In practice techniques and strategies have been developed to gain benefits of diversification
- Conventional reinsurance has been the most common way to reduce capital by 'diversifying' through reinsurance cession.

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UK ICA regime brought in risk-sensitive capital

- Risk sensitivity in ICAs includes sensitivity to most types of diversification.
- Whether all the benefits from diversification are taken into account is dependent upon:-
  - Sophistication of the regulatory internal model
  - Ability to persuade and convince the FSA that diversification effects are valid, and that they have been modelled in an appropriate manner

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Solvency II – Risk sensitive approach

- Solvency II is being drafted to replace the current solvency requirement.
- High level aim is to set regulatory capital requirements in a “fairer” way across the European market i.e. risk-sensitive.
- As with ICAs this approach naturally includes some diversification benefits – although there has been much debate along the way!
- Solvency II includes provision for internal models, which could potentially allow for all diversification benefits – subject to the same issues as the ICA.
- However the standard formula is intended to act as a benchmark.

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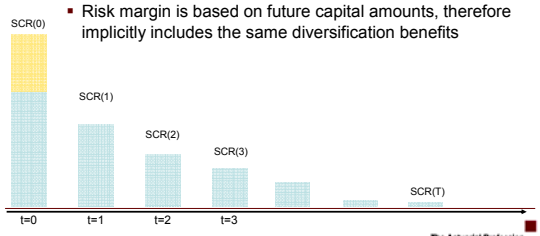
Analysis of SII approach – solo
(1) Restatement of balance sheet

- Diversification affects the balance sheet via the risk margin calculation
- Risk margin is based on future capital amounts, therefore implicitly includes the same diversification benefits



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Analysis of SII approach – solo
(1) Restatement of balance sheet

- One notable exception, where the diversification in the risk margin differs from the underlying capital is between LOBs (as in QIS4).
  - This is based on the belief that a distressed insurer, as it moves into run-off, may be unable to transfer it’s portfolio to a single buyer.
  - This is an unpopular approach with insurers who believe this overstates the risk margin. Primarily they believe that a single buyer could be found.
  - Seems inconsistent with LOB diversification being allowed both (a) in calculation of SCR standard formula and (b) in internal model approach for SCR.
  - Additionally there are conceptual issues with trying to estimate what diversification benefit the third party may actually achieve.

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Analysis of SII approach - solo
(2) Insurance risk module - LOB

- Line of Business – The following is the list of classes specified in QIS 4:-
  - Accident and health – workers' compensation
  - Accident and health – health insurance
  - Accident and health – others not included under first two items
  - Motor, third-party liability
  - Motor, other classes
  - Marine, aviation and transport
  - Fire and other property damage
  - Third-party liability
  - Credit and suretyship
  - Legal expenses
  - Assistance
  - Miscellaneous non-life insurance
- Proportional RI is included in the same "buckets" as above, so no diversification there. Non-proportional RI has an additional 3 classes:-
  - property business;
  - casualty business; and
  - marine, aviation and transport business.

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Analysis of SII approach - solo
(2) Insurance risk module - LOB

- This grouping has caused some issues within the industry:-
  - It is difficult for many companies to split Motor into TPL and Other, as policies are sold covering both parts.
  - MAT is treated as one class, whereas some companies, particularly syndicates at Lloyd's, rely on the diversification between business within this class e.g. Marine and Aviation.
  - This can lead to significant underestimation of the diversification benefit.

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Analysis of SII approach - solo
(2) Insurance risk module - LOB

- This is the correlation matrix used between LOBs, and also between premium (underwriting) risk and reserve risk:-

QIS 4	Motor TPL	Motor Other	MAT	Fire and Property	Third Party Liability	Credit	Legal Expenses	Assistance	Misc	Non-Prop Property	Non-Prop Casualty	Non-Prop MAT
Motor TPL	100%											
Motor Other	50%	100%										
MAT	50%	25%	100%									
Fire and Property	25%	25%	25%	100%								
Third Party Liability	50%	25%	25%	25%	100%							
Credit	25%	25%	25%	25%	50%	100%						
Legal Expenses	50%	50%	25%	25%	50%	50%	100%					
Assistance	25%	50%	50%	50%	25%	25%	25%	100%				
Misc	50%	50%	50%	50%	50%	50%	50%	50%	100%			
Non-Prop Property	25%	25%	25%	50%	25%	25%	25%	50%	25%	100%		
Non- Prop Casualty	25%	25%	25%	25%	50%	50%	50%	25%	25%	25%	100%	
Non-Prop MAT	25%	25%	50%	50%	25%	25%	25%	25%	50%	25%	25%	100%

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Analysis of SII approach - solo
(2) Insurance risk module - Geographic

- Geographical diversification is new to QIS 4, and is based on allocating premiums and reserves to geographical areas based upon the location of the underlying risk – Not necessarily trivial!

EEA Countries (27)
Austria
Belgium
.....
United Kingdom

EFTA Countries (4)
Switzerland
Iceland
Liechtenstein
Norway

Rest of Europe (1)

United States (1)

Canada (1)

North America (1)
(Excluding Canada and US)

South American Countries (12)
Argentina
Chile
...
Uruguay

Central America (1)

Japan (1)

China (1)

Asia (1)
(Excluding Japan and China)

Oceania (1)
Excluding Australia

Australia (1)

Africa (1)

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Analysis of SII approach - solo
(2) Insurance risk module - Geographic

- The diversification is based on the Herfindahl index, which crops up in a few places in SII.

$$DIV_{lob} = \frac{\sum_j (V_{prem,lob,j} + V_{res,lob,j})^2}{\left(\sum_j (V_{prem,lob,j} + V_{res,lob,j})\right)^2}$$

- The sum of squares over the square of the sum…a measure of how disperse the risk is
- It treats each separate entry identically, so writing £1 of premium in Estonia gives as much diversification as £1 in the US.
- US itself is treated as one entity so no diversification benefit within it.
- Equivalent to assuming each country is independent.

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Analysis of SII approach - solo
(2) Insurance risk module - Cat

- In QIS4, the treatment of non life cat risk is divided into three layers
- Diversification within Cat risk depends on the layer used:-
  - Layer 1 is calculated by LOB and each LOB is assumed independent.
  - Layer 2 - each scenario is assumed to be independent
  - Layer 3 - it depends on the partial internal model used

Layer 1
•Standard formula with prescribed factors applied to written premium
•This layer applies only when no regional scenarios are available

Layer 2
•Regional scenarios (natural and man-made catastrophes)
•Includes all specified catastrophes over the materiality scenario (25% of most severe scenario)
•Trans-regional scenarios should be used where appropriate

Layer 3 - optional
•Applied when a firm believes the application of Layers 1 or 2 is unrepresentative of their cat exposure
•Personalised catastrophe scenarios are calculated and explanation provided

- Cat risk is assumed to be independent of premium/reserve risk. For several insurers most of the cat risk diversifies away and does not materially affect the overall insurance risk capital

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Solvency II treatment of diversification (solo) (3) Market risk

Market risk calculation	MKTint	MKTeq	MKTprop	MKTsp	MKTconc	MKTfx
correlation with MKTint	100%	0%	50%	25%	0%	25%
correlation with MKTeq	0%	100%	75%	25%	0%	25%
correlation with MKTprop	50%	75%	100%	25%	0%	25%
correlation with MKTsp	25%	25%	25%	100%	0%	25%
correlation with MKTconc	0%	0%	0%	0%	100%	0%
correlation with MKTfx	25%	25%	25%	25%	0%	100%

- Market risk is estimated as several sub-risks, Interest rate risk, Equity risk etc
- These tests are generally estimated assuming a fall in market value, apart from the interest rate test which takes the maximum loss due to either an "up" or "down" shock.
- Implies that correlations with other tests would need to change sign depending on what scenario leads to the loss.

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Solvency II treatment of diversification (solo) (4) Default risk

- The capital charge for default risk is based on the best estimate of reinsurance recoverables split by reinsurer.
- LGD assumption of 50% along with a probability of default.
- The capital charge per reinsurer is aggregated using an adjusted Herfindahl index.
- The amount of diversification available depends on the number of reinsurers and their rating.

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Solvency II treatment of diversification (solo) (5) Aggregation

	Market	Default	Underwriting risks		
Aggregation of risks	risk	risk	Life	Health	Non-Life
correlation with SCRmkt	100%	25%	25%	25%	25%
correlation with SCRdef	25%	100%	25%	25%	50%
correlation with SCRlife	25%	25%	100%	25%	0%
correlation with SCRhealth	25%	25%	25%	100%	25%
correlation with SCRnl	25%	50%	0%	25%	100%

- Zero correlation between Life and Non-Life - can lead to significant benefit for composite insurers
- 50% correlation between default risk and insurance risk

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Solvency II treatment of diversification (solo) (6) SCR internal model

- If you use SCR internal model then diversification becomes completely "free-form"
  - Unlikely to give same answers as SCR standard formula
    - Eg. Insurance risk module
    - Sum of squares versus copulas or driver analysis
- SCR standard formula with its 'nested hierarchical approach' doesn't allow the possibility of more complex correlations, non-linear relationships, tail correlations etc.

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Solvency II treatment of diversification (solo) Key observations

- SII attempts to allow benefit of diversification using a standard formula - a difficult task
- Correlation technique used is relatively simplistic, and does not capture tail effects, however this may be offset by using prudent correlation coefficients
- "Buckets" used for modelling (LOBs or countries) may not be appropriate, and no diversification is possible within any particular bucket.
- Hierarchical approach does not allow more detailed relationships to be captured e.g. Market and Cat risk

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Solvency II treatment of diversification between entities of a group

- There are two aims to 'SII groups supervision':-
  - Trying to ensure that a group with subsidiaries is not disadvantaged when compared to a single EU entity with branches (avoiding the negative)
  - Giving full credit for diversification between entities (allowing the positive)
- Definition of a "Group"
  - "An insurance group is a financial group consisting of two or more insurers (and possibly other non-licensed entities)."
    (International Association of Insurance Supervisors)
- Some highlights from the draft directive:-
- "A single supervisor, responsible for coordination and exercise of group supervision, shall be designated from among the supervisory authorities of the Member States…"
- "The calculation of the group solvency of the participating insurance or reinsurance undertaking shall be carried out on the basis of the consolidated accounts."

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SII Treatment of Groups - Consolidated approach (1/3)

- The consolidated approach:
  - All the assets are grouped together and can be used to cover the sum of all the liabilities.
  - The solvency capital requirement for the whole group is calculated by taking the consolidated balance sheet and using the standard formula.
  - Modules within the standard formula will have increased diversification benefit e.g. geographic, or within default risk.

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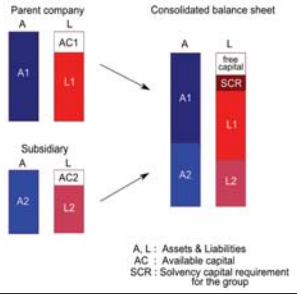
SII Treatment of Groups - Consolidated approach (2/3)



A, L : Assets & Liabilities
AC : Available capital
SCR : Solvency capital requirement for the group

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SII Treatment of Groups - Consolidated approach (3/3)

Advantages and disadvantages of the consolidated approach:

- The main advantage of such a method is that it avoids the problem of double-counting the available capital, provided intra-group transactions have been netted off.
- Furthermore, the approach is simple since neither intra-group transactions nor the legal entity structure has to be modelled.
- However the legal entity structure of the group is completely ignored, which means that assets are available to cover losses independently of their origin. - it assumes that capital is fully fungible.
- This model cannot easily be used for capital management since diversification cannot be directly allocated to the subsidiary.

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Potential alternative Group treatment - Capital and risk transfer instruments (CRTI)

- Capital and risk transfer instruments ("CRTI") are legally binding and clearly formalized financial instruments facilitating the transfer of capital and risk between the legal entities of a group.
- An alternative approach would be to model each individual legal entity and the operation of the CRTIs so that the flow of risk and capital around a group structure can be accurately captured.
- If there are no legally enforceable CRTIs between the entities of the group, available capital is considered to be non-transferable between the subsidiaries and the parent.

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Potential alternative Group treatment - Example CRTIs

Capital transfer instruments	Risk transfer instruments
► Intra-group loans	► Intra-group retrocession
► Guarantees	► Intra-group securitization
► Participation	► ……
► Dividends	
► …..	

➔ *Intra-group capital and risk transfer instruments can only be considered if they are legally binding and accepted by the regulator.*

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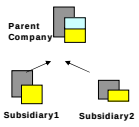
Potential alternative Group treatment - Diversification using CRTIs

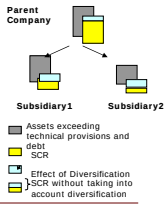
Group Level Diversification: A parent company benefits from group level diversification by taking into account the dependency structure between the risks of its subsidiaries and the risks of the parent company.



Down-streaming of Diversification: A parent company can down-stream group level diversification via capital and risk transfer instruments (e.g. intra-group retrocession, guarantees, etc.) to its subsidiaries.

A guarantee from the parent to a subsidiary allows a subsidiary to reduce the economic capital requirement but increases the capital requirement for the parent.

If there is no formal instrument from the parent to the subsidiary which ensures that the parent will support the subsidiary, then the subsidiary cannot benefit from being part of a group.



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Potential alternative Group treatment - Pros and Cons of using CRTIs

- Advantages:-
  - The main advantage is that such a treatment of groups will more accurately reflect reality.
  - It would allow the impact of a potential CRTI to be estimated enabling the most efficient legal structure to be put in place, or the existing structure to be amended accordingly.
  - Each CRTI would be demonstrable to the Regulator(s).
- Disadvantages:-
  - The main disadvantage is complexity, some groups have hundreds if not thousands of legal entities!
  - It would also be difficult to implement using a standard formula approach.

Conclusions – our hopes for the future!

- Anything is better than 16% of premiums!
- Standard formula can be dissected and proven to be wrong … but it shouldn't be made more and more complex – that won't make it any more convincing!
- Proper quantification of capital savings requires internal model (indeed, requires more sophisticated models!)
- For groups, the diversification effect must be accompanied by a very solid legal basis for obligatory capital transfers in stressed conditions – otherwise justification for capital savings is dubious
  - In practice we believe fungibility is very difficult (not an actuarial topic – one for lawyers and international regulators)
- Diversification is good! For example don't invest in particular assets whilst at the same time insuring their value for third parties. A balance sheet double whammy.