The Actuarial Profession
making financial sense of the future

Risk diversification benefits in Insurance

How to recognise them and what to do with them
Purpose of this session

1. What is risk diversification?
2. How do I quantify diversification benefits?
3. How do I manage economic capital diversification benefits?
4. What about the regulatory perspective?
5. Conclusions
Section 1

What is risk diversification?
What is risk diversification?
Dictionary definition: Diversify: to become varied or different

Risk drivers of economic capital

- But for European insurance companies; diversification usually means diluting ALM exposure with
  - Insurance risk
  - Persistency risk
  - Credit risk
  - Operational risk

- Key questions are
  - If it can go wrong, will it?
  - Do all the buses come at once?

Source: Mercer Oliver Wyman Research
What is diversification?

Illustration: Full correlation

Illustration: High risk concentration

Illustration: Independence

Example
- Bonds with the same counterparty
- Factors driving the risk of both loans are identical
  - No diversification benefit

Example
- Credit/Market Risks: 80%-100% correlation
- Similar factors driving risk (e.g. interest rates etc.)
  - Some diversification benefit

Example
- Credit/Life Risks: 0% - 10% correlation
- Different risk factors (e.g. mortality independent from interest rates)
  - Large diversification benefit

Note: Length of arrow indicates size of risk and angle between arrows indicates correlation (90° = independence, 180° = full correlation)
And why does intra-risk diversification seems more palatable than inter risk diversification?

- Established practice for managing insurance risk are based upon assumptions of independence of the underlying risks.
- The burden of proof appears to be higher for the relationship with other forms of risk.
- Is this consistent?

<table>
<thead>
<tr>
<th>Independent risks?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Within risk type</strong></td>
</tr>
<tr>
<td>- Mortality</td>
</tr>
<tr>
<td><strong>Between risk type</strong></td>
</tr>
<tr>
<td>- Operational risk and other risk types</td>
</tr>
<tr>
<td>- Mortality with other risks</td>
</tr>
<tr>
<td>- Persistency with other risks</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Who benefits from recognising diversification?
The interests of policyholders (non-par) and debt holders seem well aligned but shareholders benefit the most

Policyholders (regulators)  Bondholders (rating agencies)  Shareholders (and equity analysts)

Non-profit
- Low interest in returns
- High interest in security

Undiversified
Smaller variability  High risk impact

Has security increased?

Diversified
Reduced risk

Recognise diversification benefits

- But should the shareholders care about diversification within an insurance group?
- A shareholder can achieve the same effect by constructing a portfolio of assets
- Therefore transparency of diversification benefits and any frictional costs is key (and reduces monitoring expenses)

Marginaly less (perceived) risk but same benefits
Shareholders have a wide range of potential benefits from the recognition of diversification

- Less risk
  - Cheaper funding, or less risk to credit rating
  - Reduced share price volatility
  - Improved sales?
- Less capital requirements
  - Better ROC
  - Reduced regulatory capital (pillar II)?
  - Or large amounts of dead regulatory capital

But the bondholders and policyholders get increased security
Section 2

How do I quantify diversification benefits?
Uncertainty over the range of diversification benefits . . . is smaller than you might think . . .

- **‘All the buses come at once’**
  - Bad events 100% correlated
  - No natural hedges

- **Decision range for**
  - Economic capital
  - Regulatory capital

- **‘Cheer up, it will never happen’**
  - Everything independent (apart from natural hedges)
  - The bigger the portfolio the lower the risk

- **‘Law of large numbers’ within risk types**
  - Within a risk type, the larger the portfolio, the lower the risk, e.g. mortality
  - Across risk types, bad events are highly correlated

- **‘Best estimate’ diversification**
  - Based on historical analyses of correlation, and
  - Market prices of traded financial instruments

Appears to be Current FSA perspective

Shareholder perspective
Economic capital should reflect the ‘tail’ correlations between risk factors rather than the full historic data.

Illustration of how correlation between equity markets depends upon market volatility

- During average – 10% returns
- During average – 15% returns

Correlation between Dow Jones and FTSE 100

Usually fitting tail correlations required a pragmatic and conservative adjustment to the observed correlation across the whole probability range.

Source: Prudential Research
Three basis methods of capture the economic capital diversification benefits inherent in a global business

- **Additive**
  - Simple addition of individual economic capital exposures across the group
  - Simplistic, overly conservative
  - Cannot be used in business practice/decision making

- **Aggregate**
  - Use of a variance covariance approach (correlation matrix) to aggregate exposures
  - Dependent on correlations used in the matrix
  - Some subjectivity when aggregating capital figures

- **Economic model**
  - Global asset scenario generator
  - Considers solvency on group basis capturing all cashflows to and from business units
  - Dependency structure based on observable behaviour
First consider the aggregation approach
A group’s risk exposure can be viewed on three separate levels

- **Level 1**: Aggregate standalone risks within a single risk factor within a business unit (e.g. the diversification of insurance risks within a business unit).
- **Level 2a**: Aggregate risks across different risk factors within a business unit (e.g. life risks, credit risks, Market/ALM risks and business/operational risks within the territory)
- **Level 2b**: Aggregate a single risk across business units (e.g. credit risk across the global portfolio)
- **Level 3**: Aggregate risk across different business units to group level
The diversification benefit arises from the difference in risk drivers across different risk types.

### Risk type correlations
- **Credit**
  - 100% with **Market/ALM**
  - Low with **Insurance**
  - Medium with **Persistency**
  - Low with **Operational**

- **Market/ALM**
  - 100% with **Credit**
  - Low with **Insurance**
  - Medium with **Persistency**
  - Low with **Operational**

- **Insurance**
  - Low with **Credit** and **Persistency**
  - 100% with **Market/ALM**
  - Low with **Operational**

- **Persistency**
  - Medium with **Credit** and **Market/ALM**
  - Low with **Insurance** and **Operational**
  - 100% with **Persistency**

- **Operational**
  - Low with **Credit** and **Market/ALM**
  - Low with **Insurance** and **Persistency**
  - Low with **Operational**

High correlation between financial risks

Medium correlation between persistency and market/ALM risks

Low correlation between insurance and other risks

Diversification benefit is largest for smaller or uncorrelated risk types
Secondly consider a more holistic approach . . .
A global economic scenario model allows the generation of correlated asset scenarios across different territories.

- Covering all major asset classes, nominal and real interest rates, equities, property, government bonds, corporate bonds
The global economic model can be used to drive a global solvency model

1. Create global scenario generator

   Global economic model
   Scenario Generator simultaneously modelling asset classes across all geographies

   Territory 1 asset returns
   Territory 2 asset returns
   Territory 3 asset returns

2. Feed into product/BU liability models

   Territory 1
   ... Territory 2
   ... Territory 3

   Group solvency model

   - Captures all cashflows from the business units to the group and vice versa
   - Gives the cumulative probability of default for the group

3. Generate total company level distribution
This approach requires rules on the interaction between the group and business units

- Consider all cash flows between group and business units
- Rules on the amount of capital that must be retained by different businesses based on:
  - Local economic and statutory requirements
  - Any risk driven capital buffer requirements
  - Need to demonstrate solvency to rating agencies, potential customers
- Rules must be consistent with the default tests used in the economic capital calculation
- Care over where you put your capital, you might want it back
This approach requires rules on the interaction between the group and business units

- Explicitly allows for
  - The geographic diversification implied by historic correlations and current market prices
  - The future ability to offset losses in one territory or business with profits from another
- Gives a lower economic capital requirement, but one that is a better reflection of the business risks and the chosen calibration.
- Comprehensive group cashflow and balance sheet modelling for:
  - Group-wide earnings volatility and capital management
  - Analysis of debt-raising initiatives
- Basis for:
  - Regulatory capital discussions
  - Investor communication
  - Rating agency discussions
Section 3

How do I manage economic capital diversification benefits?
Using a group economic model reduces the economic capital requirements significantly.

- Illustration -

**Impact of diversification on capital**

| Available capital | Standalone economic capital | Required economic capital (diversified) | Surplus capital | Additional surplus capital from diversification |

**But**

- How does this affect regulatory requirements? (PS 04/16 and particularly PS 04/20)
- How does it affect the management of the business?

**Key challenges**

- Build robust defence of allocation methodologies
- Stress test, focus on tail correlations
- No implicit risk reduction assumptions (mean reversion)
- Use it in the management of the business
Using a group economic model reduces the economic capital requirements significantly

As economic capital considerations become more established, recognition of diversification benefits will increasingly have an effect on the management of insurance businesses.
The method of identifying diversification benefits can have an important effect on the diversified number

If not using a global economic model:
- Are all drivers of diversification being accurately captured?
  - Offsetting exposure, cashflow profile, risk sensitivity, . . .
- How much subjectivity is there in the aggregation approach?
- Are the size and reason for the diversification benefit reasonable and intuitive?

If are using a global economic model
- Still need to consider basis for diversification against insurance, persistency and operational risk
### Should diversification benefits be allocated to business units?

It depends on how they will be used

<table>
<thead>
<tr>
<th>Calculation of diversification benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Risk measurement</strong></td>
</tr>
<tr>
<td><strong>No</strong></td>
</tr>
<tr>
<td>- For pure measurement purposes it is not strictly necessary to allocate diversified capital back</td>
</tr>
<tr>
<td>- Diversified numbers yield interesting insights</td>
</tr>
<tr>
<td><strong>Risk control (limits/appetite)</strong></td>
</tr>
<tr>
<td>?</td>
</tr>
<tr>
<td>- Effect on group and BU economic capital is only one consideration of many (including regulator/rating agency viewpoints)</td>
</tr>
<tr>
<td>- At BU Risk control should be on standalone basis</td>
</tr>
<tr>
<td><strong>Business unit performance measurement</strong></td>
</tr>
<tr>
<td>?</td>
</tr>
<tr>
<td>- For pricing/hurdle targets, BU should not consider group diversification benefits</td>
</tr>
<tr>
<td>- Any diversification benefits at the business unit level should be considered when measuring the performance of those who create the benefits</td>
</tr>
<tr>
<td><strong>Strategic capital allocation/planning</strong></td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>- The group should try to grow areas where diversification benefits are large</td>
</tr>
</tbody>
</table>
Section 4

What about the regulatory perspective?
Calculation of group economic capital requirements forms the basis of the FSA’s Pillar 2 requirements

- What might a regulator be interested in?
  - First, are the basic capital requirements for each risk and the overall total in the right ballpark?
  - Dependencies probably are important, but how do we know their effect?
  - What happens to these relationships in the tail?
  - Contagion risk?

**Pillar 1**
Solvency requirements

- Rule-based capital requirement
  - Calculated using standard rules specified by The FSA
  - Public filings

  ‘Regulatory’

**Pillar 2**
Supervisory review

- Risk-based capital requirement (or internal capital assessment)
  - Calculated by the company based on its own risk profile and subject to any additional FSA individual company guidance
  - This will be a private filing with the FSA

  ‘Economic’

**Pillar 3**
Market discipline

- Market pressure to maintain adequate capital resources
  - Based on market participants assessing capital structure and adequacy, and risk management practices

  e.g. ‘Rating agency’
Most regulatory bodies are starting to identify the importance of capturing diversification benefits when aggregating capital.

<table>
<thead>
<tr>
<th>APRA</th>
<th>NAIC</th>
<th>Basle accord II</th>
<th>EU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal model based method requires calculation of individual risk factors</td>
<td>Assume risks are either fully correlated or independent</td>
<td>No explicit adjustment for diversification benefits</td>
<td>Current Dutch Council regulatory paper (public domain) referred to by EU as providing a reasonable basis for capturing diversification benefits</td>
</tr>
<tr>
<td>Explicitly allows for the calculation of correlations and interdependencies between risk factors</td>
<td>Independent risks are aggregated using a variance-covariance approach (square-root of sum of squares)</td>
<td>Conservative estimates of diversification benefits included in RWA%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fully correlated risks are simply added</td>
<td>Advanced approach for Operational Risks may allow some additional adjustments to include diversification benefits</td>
<td></td>
</tr>
</tbody>
</table>

But solvency II may allow for risk dependency in a similar way to the IAA Global Framework.
What about a group’s regulatory capital? Why can’t this reflect diversification benefits?

(1) Policyholders and regulators/distributors
- Interests well protected by regulation of insurance companies themselves
- Contagion risk?

(2) Bondholders and rating agencies
- Caveat Emptor
- Equity market regulation
- Corporate Law

(3) Shareholders and equity analysts
- Caveat emptor
- Equity market regulation
- Corporate law
- Dead regulatory capital?

So additional group level capital provides policyholders with extra security over and above that applying at the regulated entity.
Section 5

Conclusions
Diversification benefit conclusions

- Recognising diversification benefits reduces risk and improves security for
  - Policyholders (and regulators)
  - Bondholders (and rating agencies)
  - Shareholders (and analysts)
- Biggest prize is for shareholders
  - Lower economic capital requirements
  - Improved capital management
  - Basis to manage down earnings volatility and cost of capital
- Big opportunity to engage regulator on group capital
  - Policyholder adequately protected at regulated entity level
  - Bondholders and shareholders do not need protection
  - Solvency II?