

Enterprise Risk Management

A Life Actuary's Perspective

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1. Introduction

In my experience actuaries have always been alert to the uncertainties involved in the business of life insurance. For example, it is rare to find a pricing document or appraisal valuation that does not contain a number of sensitivity tests. I therefore found my early exposure to publications with the phrase “Enterprise Risk Management” in the title troubling.

The quantitative techniques didn’t seem to add much to existing actuarial approaches. New methods suggested seemed either overly simplistic or reliant on data impossible to collect. However, the impressive diagrams and the lack of actuarial jargon suggested that this snake oil could become more popular than my Financial Condition Report. I decided that I need to learn more.

This paper is not designed as a technical description of ERM best practice (I have referenced a few excellent sources in an appendix). My aim is more to share a few ideas. I think this is an area which is of relevance to many actuaries.

The opinions expressed in this paper are my responsibility and not those of my employer.

2. What is Enterprise Risk Management?

“A comprehensive and integrated framework for managing credit risk, market risk, economic capital and risk transfer in order to maximise firm value.”

“Enterprise-wide risk management is the process of systematically and comprehensively identifying critical risks, quantifying their impacts, and implementing integrated risk management strategies to maximise enterprise value.”

“Enterprise risk management is a process, effected by an entity’s board of directors, management and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risks to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives.”

The three definitions have common threads. ERM advocates an integrated rather than silo approach to risk management. However there is differing emphasis on the degree to which ERM is a measurement process or a governance process. I have tried to address these two paradigms in this paper.

3. Measuring Risk on an Enterprise Basis

Creating an enterprise risk metric has a number of advantages. For example:

- It allows the company to prioritise its risk management activities.
- It enables risk adjusted performance measurement.
- It can be used as input to capital structure decisions.

Examples of Potential Uses

Example 1

Reinsurance can be used for a number of risk management purposes. However, use of reinsurance would be expected to reduce profit over the longer term. How should a company trade off use of reinsurance against, for example, adopting a more conservative asset position? A suitable enterprise risk metric should allow a company to evaluate alternative options on a consistent basis.

Example 2

Comparing product profitability assuming capital using the GN5 Prudential Reserving requirements may not accurately reflect the relative risk to the insurer's capital. For many yearly renewable products with high up front commission the termination minimum is more significant than any insurance risk component. A return on risk adjusted capital methodology may be more appropriate. The level of risk capital can be determined using an enterprise risk metric.

Economic Capital

The most common approach to devising an enterprise risk metric seems to be to calculate an economic capital. Wikipedia defines economic capital as follows:

The amount of risk capital, assessed on a realistic basis, which a firm requires to cover the risks that it is running or collecting. Typically this is calculated by determining the amount of capital that the firm needs to ensure that its realistic balance sheet stays solvent, over a certain time period, with a pre-specified probability. Firms and financial services regulators should then aim to hold risk capital of an amount equal at least to economic capital.

This definition seems consistent with that from other sources. In practice the aim is to make statements such as:

Company X requires capital of \$200m to remain solvent over a one year time frame with probability 99.95%.

It should be understood that solvency would be considered on a “realistic” rather than prudential basis. This opens up a number of issues which will not be addressed by this paper.

Choice of Time Frame and Probability.

A common approach is to relate the time frame and probability of solvency to a credit rating agency grade. For example a S&P rating of AA is commonly related to a 99.97% probability of solvency over a one year time frame. The firm may base its economic capital rating on its target credit rating to facilitate discussions with rating agencies.

The appropriate time frame may also depend on the risks faced by an enterprise. Life Insurance is regarded as a long term business suggesting a relatively long period is appropriate. Prudential, the UK Insurance Group, have published some information on their economic capital model which is based on remaining economically solvent each year over a 25 year time horizon. The time frame appropriate for a treasury trading desk would clearly be a lot shorter.

Long time periods will require complicated models of management discretion and it is likely that there will be a lack of data to determine model parameters. However short time period models will still require suitable long term input to determine the realistic solvency requirement.

Model Building

It is beyond existing available techniques to directly simulate the impact of risks faced by a life insurer. For example there is a lack of credible data to simulate the joint probability and impact of a global pandemic and a stock market crash.

A more practical approach is:

- produce a broad grouping of risks faced by the enterprise
- produce a loss distribution for each risk group
- use an appropriate statistical technique to combine the loss distributions

A suitable risk grouping for a life insurer could be:

- underwriting/claim risk
- asset/liability risk
- business risk (e.g. persistency, expense, pricing margin)

- operational/event risk

There is clearly a great deal of scope for debate about how risks should be grouped. Credit Risk is often modelled as a separate category but there is a case for integrating it with asset/liability risk. Reinsurer credit risk probably fits with underwriting/claim risk. If an underwriter makes a mistake in assessment, does this relate to underwriting risk or operational risk?

Derivation of Loss Distributions

In order to determine an appropriate loss distribution it is necessary to drill down to the various underlying risks, For example a review of the mortality component of insurance risk categorised the risks faced by the business to be of three types:

- Calamity
- Parameter/Trend
- Stochastic

Calamity risk or catastrophe risk relates to large insurance losses due to a single significant event. Parameter/Trend risk relates to mis-estimation of the long-term cost of claims. Stochastic risk is the short term impact due to random chance.

Different modelling techniques are required for each type. Often judgement is required. It is relatively easy to commence the process of building a Monte Carlo simulation model to analyse stochastic risk. However completing and testing the model may take some time. More careful consideration may suggest that by its very nature this risk is uncorrelated with other risks and is unlikely to contribute significantly to economic capital. Therefore you may not bother building the model as greater focus on other elements of the risks would be of more value.

Unfortunately there is often more difficulty building models for the more important risks. In recent years there has been heightened concern over the calamity risk relating to pandemics (e.g. Bird Flu) but there is a shortage of data to produce overall calamity risk models. It becomes more difficult when you try to integrate the impact of catastrophe reinsurance cover in to your model.

There are clearly advantages to companies that are part of a large group as they can develop centres of excellence in these issues or access expert outside advice on a cost effective basis. Before accepting the results of sophisticated statistical models it is important to understand any underlying assumptions and the sensitivity of the model to estimated parameters.

Combining Loss Distributions

I am going to disappoint any readers who were expecting a discussion of Copulas at this point. These are commonly referred to in actuarial literature as way to combine loss distributions. Unfortunately my work load has not allowed me the leisure to research this topic.

A somewhat less complex approach is used by a number of companies. the basic premise is that the overall economic capital will be less than that implied by the sum of the loss distributions because we would not expect the risks to be 100% correlated.

For each pair of risk types you assign a correlation coefficient. This could be based on an expert analysis or alternatively classified based on judgement within a range such as none, low, medium, high. If the range approach is used then a numerical correlation needs to be assigned to each category e.g. medium could equal 40%. Many happy hours can be spent arguing over the appropriate correlations. From these pairs you can derive a correlation matrix e.g.

	ALM/CREDIT	BUSINESS	EVENT	UNDERWRITING
ALM/CREDIT	100%	65%	0%	15%
BUSINESS	65%	100%	15%	0%
EVENT	0%	15%	100%	0%
UNDERWRITING	15%	0%	0%	100%

Using the loss distribution models you can derive the expected loss over the given time frame and confidence interval for each of your risks. For example your underwriting model might estimate a 99.95% chance that your loss will be less than \$40m. The losses can be expressed as a vector in the same order as the rows in your correlation matrix.

You then combine the risks by multiplying your correlation matrix by your loss vector and then by the transpose of your loss vector (I have included a worked example in appendix 2). A similar approach may be used to aggregate individual risks e.g. you could combine mortality parameter risk and mortality calamity risk with assumption about their correlation.

Your total economic capital can then be allocated back across risk types or by product.

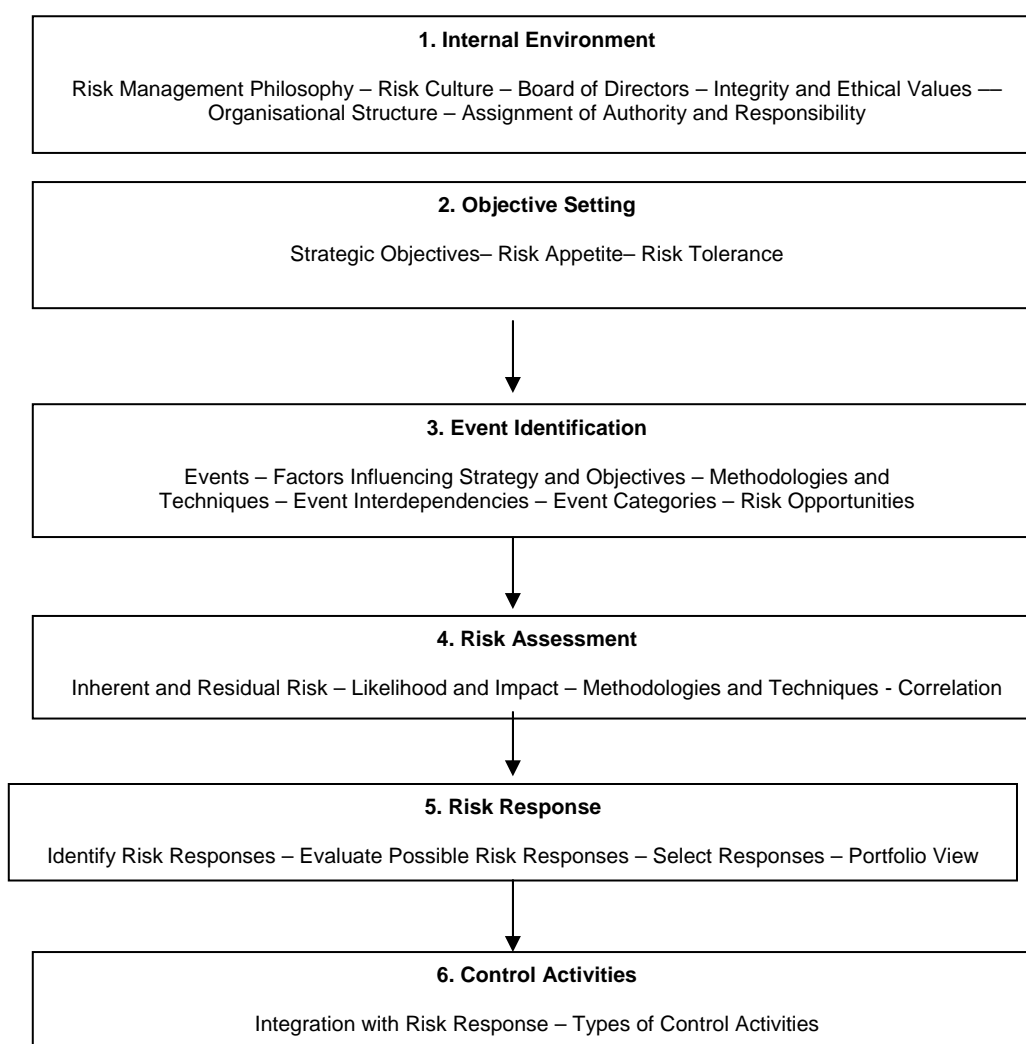
4. ERM as a Governance Process

Sovereign used the work of United States-based ‘The Committee of Sponsoring Organizations of the Treadway Commission (COSO)’ as a best practice source of information on how ERM relates to Governance.

COSO initiated a study project designed to provide guidance in helping organisations manage risk. The study project concluded there was a need to design and build an enterprise risk management framework and to also provide application guidance.

COSO was sponsored by the following significant professional bodies: American Institute of Certified Public Accountants, The Institute of Internal Auditors, Financial Executives International, Institute of Management Accountants and the American Accounting Association. PricewaterhouseCoopers were engaged by COSO to lead the project.

A summary of the key components identified by the COSO report is shown below.



7. Information and Communication

Information – Strategic and Integrated Systems - Communication

8. Monitoring

Separate Evaluations – Ongoing Evaluations

Internal Environment

An appropriate internal environment is required to support ERM. Key aspects are internal culture and then relationship between senior management and the board of directors. The UK Financial Services Authority, amongst others¹, observed that governance and management issues appear to be the root cause of every failure or near failure. These manifest themselves when external shocks occur; internal processes or systems fail or inappropriate risk decisions are made.

Objective Setting

Relating a company's risk appetite and risk tolerance to its strategic objectives is a challenging process. It requires that those strategic objectives are expressed with sufficient clarity to relate them to the various risks that the business is exposed to. This can encourage deeper thinking about those strategic objectives.

The risk appetite and risk tolerance objectives can be related to the outputs of an economic capital model.

Event Identification

A number of sources provide lengthy check lists that allow companies to identify risks faced by the business. It can be a useful exercise to relate these risks to those considered in an economic capital model.

Risk Assessment

Again there is a close alignment between assessing risks properly in order to demonstrate good corporate governance and the modelling those risks within an economic capital model. The processes of event identification and risk assessment can be used to improve board understanding of the business. Techniques to aid this process include risk maps where an attempt is made to graphically plot the severity of risks against their frequency.

¹ Managing Risk: Practical lessons from recent "failures" of EU insurers. William McDonald. Occasional Pares Series No 20, Financial Services Authority.

From a practical perspective it may be best to develop a timetable that ensures coverage of the areas over a one year timeframe rather than attempting to complete the process in one stage.

Risk Response

Determining an appropriate response to an identified risk needs to be in the context of a company's risk appetite and risk tolerance. An insurance company that seeks to eliminate all its insurance risk is unlikely to be profitable over the long term. Identified risks can be retained (assuming sufficient capital), hedged or transferred to a third party. Each of these responses will have an impact on profitability and economic capital. Good governance requires that these decisions are made consciously rather than by default.

In determining the risk response a life insurer also needs to consider the expectations of customers. For example an insurer could significantly reduce the asset/liability risk of participating business by investing purely in government bonds. However customers are likely to have an expectation of a balanced fund approach either from promotional material or historic practice.

Risk Controls

Controls are needed to ensure that the selected risk response is carried out. Correct design and testing of risk controls is not an area covered by actuarial education. However this is an important component of risk management.

Information and Communication

Obtaining and communicating the information required to identify and respond to risks seems an obvious business requirement. However I have found that obtaining suitable data to be a significant issue.

Monitoring

The framework and process needs to be monitored. Firstly risk outcomes needed to be monitored and compared to risk tolerances. To enable this new reporting may need to be developed. I have found that existing financial reporting is often not satisfactory for monitoring outcomes from a risk perspective. We have adopted a quarterly reporting process that incorporates long series of data, particularly in respect of asset and claim risks.

5. Conclusions

Assisting in the development of a risk management framework has been both challenging and enjoyable. The ideas that I have been exposed to have improved my understanding of the business. Hopefully the work has allowed me to produce a higher quality assessment of the financial condition of Sovereign.

Some Recommended Reading

Author	: James Lam
Title	: Enterprise Risk Management – From Incentives to Controls
Comments	: A good pragmatic introduction from an experienced risk management professional.

Author	: Thomas Barton/William Shenkir/Paul Walker
Title	: Making Enterprise Risk Management pay Off
Comments	: Contains five in depth case studies of ERM in practice, unfortunately none from the insurance industry.

Author	: Chris Matten
Title	: Managing Bank capital - Capital Allocation and Performance Measurement
Comments	: Highly recommended book. Many of the concepts are relevant to insurance.

Author	: Christopher Culp
Title	: Structured Finance & Insurance – The ART of Managing Capital and Risk
Comments	: Some excellent ideas on responding to risks

Example of combining loss distributions

Results of Loss Distribution Model

RISK	EXPECTED 1 YEAR LOSS AT 99.95% CONFIDENCE
ALM/CREDIT	\$200m
BUSINESS	\$100m
EVENT	\$50m
UNDERWRITING	\$40m

Express as a matrix

$$TE = \begin{pmatrix} 200 \\ 100 \\ 50 \\ 40 \end{pmatrix}$$

Correlations

RISK	ALM/CREDIT	BUSINESS	EVENT	UNDERWRITING
ALM/CREDIT	100%	65%	0%	15%
BUSINESS	65%	100%	15%	0%
EVENT	0%	15%	100%	0%
UNDERWRITING	15%	0%	0%	100%

Express as a matrix

$$S = \begin{pmatrix} 100\% & 65\% & 0\% & 15\% \\ 65\% & 100\% & 15\% & 0\% \\ 0\% & 15\% & 100\% & 0\% \\ 15\% & 0\% & 0\% & 100\% \end{pmatrix}$$

The economic capital = $\sqrt{(TE \times S \times TE^T)} = \$233m$