

Risk Appetite: Linkage with Strategic Planning

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Executive Summary

With recent advances in computational capability, progressive and complex models have been created to assist risk management. At the same time, regulators, rating agencies, and investment markets have put more attention on risk controls of financial institutes. Those factors, however, did not prevent financial institutions from going bankrupt or needing a government bailout in the past few years. Most of the defaulted financial firms stated they had good risk management policies and implementation and the resources spent on risk management were not trivial.

The firms failed for different reasons but clearly their “good risk management” went wrong. Without a clear understanding of the risks of their business, decision makers adopted risky strategic plans. Advanced risk management models and stress testing may help with assessing the quantitative impact of risks, but understanding the company’s core competence and the risks before taking them is far more important.

It is critical to have clear answers to the following questions before making decisions:

- What is the company’s competence in the market?
- Are the decision makers familiar with the risks involved including the tail risks and understand their potential impact?
- Is the company capable of surviving extreme events?

Risk appetite articulates the level of risk a company is prepared to accept to achieve its strategic objectives. Risk appetite frameworks help management understand a company’s risk profile, find an optimal balance between risk and return, and nurture a healthy risk culture in the organization. It explains the risk tolerance of the company both qualitatively and quantitatively. Qualitative measures specify major business strategies and business goals that set up the direction of the business and outline favorable risks. Quantitative measures provide concrete levels of risk tolerance and risk limits, critical in implementing effective risk management.

Risk appetite represents the willingness and the ability to take risk. Due to the sophisticated nature of financial institutions, it requires a lot of effort to fully understand the constraints and the ability to assume risk. Therefore, it is a gradual cognitive process to be updated from time to time if you enter new markets, new business and have new understanding of risks assumed.

With the help of several case studies, this paper tries to explain the role of a risk appetite framework in effective risk management and how it can be used to make more informed strategic decisions. The paper does not seek a golden rule for risk appetite framework and the integration of risk appetite and strategic decision making. Assumptions validation, parameter calibration and model risks are not the focus of this paper either.

It is hoped this paper will formalize the thinking process of assessing the risks of strategic plans and reflecting them in the risk appetite framework. It is an integrated interactive process.

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1. Introduction

Risk appetite has been playing a more important role in systematically determining an institution's level of risk tolerance and influencing its strategic planning. Similar to the risk objective in an investment policy statement for individual investors, risk appetite is used in different areas of strategic planning to better facilitate the analysis of risk versus return and improve decision making. With both quantitative and qualitative analysis of the company's risk profile, risk appetite provides a holistic picture for investors and senior management.

This research paper explores the current practices of risk appetite framework in insurance companies. It also discusses the reasons and the ways risk appetite should be embedded in strategic planning, including asset allocation, new business budgeting, capital allocation, liquidity management and performance measurement. Sections 2 to 7 cover the following:

- **Section 2: Risk Appetite, Risk Tolerance and Risk Limit Setting**
The principal, process and major components of risk appetite, risk tolerance and risk limit setting are discussed. It focuses not only on the quantitative aspects such as capital at risk (CaR), earnings at risk (EaR) and economic capital, but also on several qualitative components such as target credit rating and reputation risk. Constraints from local regulators, group regulators, rating agencies and investors also are critical components in strategic planning. How those constraints are reflected and the corresponding implications also are discussed. The full picture should at least include the following types of risk: interest rate, credit (both credit spread risk and credit impairment), equity, foreign exchange, concentration, asset liability mismatch, liquidity, insurance, catastrophe and operation.
- **Section 3: Risk Appetite and Asset Allocation**
After risk appetite is set, it should be embedded in the investment decision. How risk appetite can be embedded in asset allocation with regards to capital adequacy and earning volatility are discussed in this section.
- **Section 4: Risk Appetite and New Business Budgeting**
The mix of new business is an important determinant in the strategic landscape of insurance companies. What kind of business mix can better fit the requirement of risk tolerance and also maximize the risk-adjusted return on capital (RAROC) is an important factor in informed business decisions. In this section, both the strategic and technical sides of the implementation will be demonstrated, with consideration of the company's CaR and EaR.
- **Section 5: Risk Appetite and Capital Allocation**
Capital allocation takes into account the link between target business mix and its impact on risk profile. Target business mix incorporates existing business and planned new

business sales. This section addresses some major considerations when aligning capital allocation with risk appetite.

- **Section 6: Risk Appetite and Liquidity Management**

Liquidity has become more important, especially under stress situations such as the financial crisis. This also is where the appropriate risk appetite plays a critical role in protecting capital adequacy. The tolerance level of liquidity risk can be determined considering both the capital market situation and the company's idiosyncratic situation, by looking backward and forward. This naturally leads to a consistent and comprehensive framework that relies on the characteristics of asset and liability profiles.

- **Section 7: Risk Appetite and Performance Measurement**

Performance measurement also is a critical component in a company's strategy as only effective and fair performance measurement can incentivize managers to achieve the return and risk objectives. An example in which performance measurement is linked to risk-adjusted measures consistent with a risk appetite statement is presented.

Section 7 is followed by the conclusion.

2. Risk Appetite, Risk Tolerance and Risk Limit Setting

2.1 Literature Review

2.1.1 Risk Appetite Definition

Risk appetite, or risk preference, has long been used when discussing utility functions, measures of relative satisfaction in economics. It is often discussed in terms of the investment decision. In the area of risk management in the insurance community, risk appetite means a high-level view of the risks the insurer is willing to accept in pursuit of value.

Several sources, such as regulators, consultants, academics and professional associations, provide a definition of risk appetite. Some definitions are given below:

The total risk exposure an organization will undertake to achieve its objectives.¹

The amount of risk, on a broad level, an organisation is willing to take on in pursuit of value. Or, in other words, the total impact of risk an organization is prepared to accept in the pursuit of its strategic objectives.²

Often taken to be the maximum amount of risk a company is willing to accept in pursuit of its mission/objectives/plans.³

¹ Chase-Jenkins, "Risk Appetite," 12.

² KPMG, "Understanding and Articulating," 3.

³ Chaplin, "Risk Appetites," 3.

Risk appetite framework has the following focuses. These appeared in articles published by consulting firms and rating agencies.

- Protecting and creating value for the business⁴. Risk appetite describes risk with quantitative measures and facilitates the analysis of the risk/return trade-off. This helps senior management make informed decisions to maximize the risk-adjusted return for the shareholder.
- Ensuring the consistency between risk appetite and risk limits⁵. Both rating agencies and investors are concerned about whether risk appetite is properly aligned with the risk limits being set for business operations. The financial crisis clearly proved that some companies failed to do so. Lots of government bailouts and large-scale capital raising from the market took place to keep the companies solvent. These actions imply that the risk taken exceeded the risk appetite for some companies.
- Integrating into business strategy and corporate culture⁶. Risk appetite acts as a guideline for risk-taking activities. Keeping risk appetite in mind for business decisions and operations facilitates risk identification and monitoring.

We cannot find any academic papers that have in-depth discussion of risk appetite.

2.1.2 Rating Agency's View

Rating agencies have put more focus on assessing risk management practices when evaluating credit ratings. Other motivations such as using a more refined risk-based capital model and/or economic capital model when assessing capital adequacy also may promote a better understanding of the risks of the business. Those together encourage senior management to make more efforts to enhance their understanding and management of assumed risk and potential risk.

Standard & Poor's clearly states that risk appetite is an essential component for an enterprise risk management (ERM) score of strong or above: "We expect insurers with strong ERM frameworks to have a well-defined risk appetite framework that supports the effective selection of risks, establishing the risks that the insurer wishes to acquire, avoid, retain and/or remove."⁷

S&P published the methodology used for assessing an insurer's risk appetite framework in 2006. In 2010 after the financial crisis, a more refined and detailed assessment methodology was published as S&P found that "the financial crisis exposed a number of weaknesses in insurers' risk appetite frameworks with some insurers having been quite active in seeking

⁴ Deloitte & Touche LLP. "Global Risk," 5

⁵ Bowser et al., "Refined Methodology," 9.

⁶ Barnes, "Evaluating Risk Appetite," 3, Deloitte & Touche LLP. "Global Risk," 10-12, and KPMG, "Understanding and Articulating," 9.

⁷ Bowser et al., "Refined Methodology," 3.

risks that they may not have fully understood and could not manage within their specified risk tolerances. While most insurers have set risk limits, many insurers found, in hindsight, that these did not adequately reflect their risk appetite or were poorly understood.”⁸

S&P also emphasized the importance of the integration of risk appetite into a company’s strategy and culture: “Standard & Poor’s examines whether an enterprise has a clearly articulated risk appetite process and the degree to which this process is integrated with its strategy and culture.”⁹

Clear and formal linkage between risk appetite and strategic planning is favourable in ERM ratings/credit ratings, which is one of the motivations of many ERM projects.

2.1.3 Risk Appetite in Solvency II Framework

The European Union’s Solvency II framework directive has clearly emphasized the integration of risk management and decision making:

That risk-management system shall be effective and well integrated into the organisational structure and in the decision-making processes of the insurance or reinsurance undertaking with proper consideration of the persons who effectively run the undertaking or have other key functions.¹⁰

It links good risk management practices with meeting capital requirements to survive a 1-in-200-year event:

In order to promote good risk management and align regulatory capital requirements with industry practices, the Solvency Capital Requirement should be determined as the economic capital to be held by insurance and reinsurance undertakings in order to ensure that **ruin occurs no more often than once in every 200 cases** or, alternatively, that those undertakings will still be in a position, **with a probability of at least 99.5%, to meet their obligations to policy holders and beneficiaries over the following 12 months.**¹¹

In a Committee of European Insurance and Occupational Pensions Supervisors (CEIOPS) consultation paper, it is explained that an effective risk management system includes:

- A clearly defined and well documented risk management strategy that includes the objectives, key principles, risk appetite and assignment of responsibilities across all the activities of the undertaking and is consistent with the undertaking’s overall business strategy;
- Adequate written policies that include a definition and categorisation of the risks

⁸ Ibid., 2.

⁹ Barnes, “Evaluating Risk Appetite,” 3.

¹⁰ European Union, “Directive of the European Parliament,” 158.

¹¹ Ibid., 24. Emphasis is the authors’ own.

faced by the undertaking, by type, and the levels of acceptable risk limits for each risk type, implement the undertaking's risk strategy, facilitate control mechanisms and take into account the nature, scope and time horizon of the business.¹²

It covers all aspects of risk appetite framework: enterprise risk tolerance, and appetite for each risk category and risk limit, although the terms used are not exactly the same.

2.1.4 Current Practices of Insurance Companies

Some survey reports¹³ about risk management practices and risk appetite produced by consulting firms are available to gain a high-level view of how risk appetite was implemented in financial institutions. The landscape may have improved since the surveys were done as the recent credit crisis increased the awareness of the importance of risk management.

A survey conducted by Towers Perrin in 2009¹⁴ indicated that although 84 percent of respondents expected to have a documented risk appetite statement within 12 months of the survey, only 40 percent demonstrated consistency between risk appetite and risk limits.

Deloitte's fifth Global Risk Management Survey¹⁵ covering 130 financial institutions in 2007 reveals a similar result. Sixteen percent of respondents did not have a statement of the firm's risk appetite while others had one that was either approved or informal/not approved by the board of directors. The survey also shows that the integration between risk management and other management initiatives was low. Only 42 percent of executives indicated that ERM programs were well integrated with strategic planning.

Twenty-two insurance companies, including five reinsurance companies,¹⁶ were selected to explore risk appetite and its integration with strategic planning with information from their 2010 annual reports.

Some key findings are listed below:

- Fifteen out of 22 companies (68 percent) clearly mentioned risk appetite framework as part of the risk management sections in their 2010 reports.
- For companies that did not mention risk appetite in their annual report, capital adequacy was stated as its important management goal. For companies that mentioned risk appetite, both capital adequacy and earnings volatility were important considerations in risk

¹² CEIOPS, "CEIOPS' Advice," 17-18.

¹³ Chase-Jenkins, "Risk Appetite," and Deloitte, "Global Risk Management."

¹⁴ Chase-Jenkins, "Risk Appetite," 5&9.

¹⁵ Deloitte, "Global Risk Management," 12.

¹⁶ The companies selected include ACE Ltd., Admiral Group PLC, American International Group Inc. (AIG), Allianz Group, Allstate Corp., Aviva PLC, AXA Group, Berkshire Hathaway Inc., General Reinsurance AG (Gen Re), HDI-Gerling (2009), ING Group, Lloyd's, MetLife Inc., Manulife Financial, Munich Re, PartnerRe, Prudential PLC, Prudential Financial Inc., Standard Life PLC, Sun Life Financial Inc., Swiss Re and Zurich Financial Services Group.

management.

- Fourteen out of 15 companies that mentioned risk appetite framework stated that risk appetite played a role in strategic planning/business decisions.
 - Three companies mentioned that risk appetite was considered when deciding asset allocation.
 - Ten companies mentioned that risk appetite was considered to maximize risk-adjusted return.
 - Fifteen companies mentioned that risk appetite was considered in capital allocation.
- All 15 companies that mentioned risk appetite framework claimed to have risk limit and risk-monitoring processes consistent with risk appetite.

Though details about how risk appetite is integrated with strategic planning are unavailable due to confidentiality concerns, there is a clear trend that companies with risk appetite frameworks not only focus on protecting value but also on creating value from risk appetite.

2.2 Risk Appetite Framework

Traditional measures used by insurance companies to manage business are numerous. Examples include:

- New business volume/market share
- Persistency rate
- Embedded value of existing and new businesses
- Appraisal value
- Operating profit

With these measures, and a conservative approach to reserving capital, sometimes the outcome could also be too optimistic. In reality, tail events do occur. An appropriate risk appetite framework is more concerned with the impact of tail events on the company's financial condition. With stochastic analysis, stress testing and correlation analysis, the distribution and range of possible outcomes may be discovered. These are very useful tools for senior management's strategic planning.

Risk appetite framework

A fundamental step in a risk appetite framework is to define the organization's willingness and ability to take risk based on the input from the board of directors and senior executives. Just as an individual investor must evaluate his or her risk appetite or risk objective when managing personal portfolios and setting reasonable return requirements, an institution needs to look at its unique situation to define its risk appetite.

Risk appetite is a high-level view of the risks the insurer is willing to assume in pursuit of value. When insurers define the optimal level of risk, the ultimate priority is to serve shareholders' benefits. Before setting up the risk appetite, it is essential to have a clear picture of the market and the company's core competency. This will facilitate the decision on the type

and magnitude of risk to be taken consistent with business strategies and market situation. At the same time, the desired risk profile shall satisfy the constraints set by other parties such as regulators, rating agencies, policyholders, debt holders, senior management and employees.

Some external changes have expedited the process of setting risk appetite. S&P has required a clear statement of risk appetite as a foundation of “strong” or “excellent” ERM rating. Solvency II also requires insurers to explicitly consider their risk appetite.

Risk appetite framework normally includes three increasingly detailed levels:

- **Enterprise risk tolerance:** The aggregate amount of risk the company is willing to take, expressed in terms of
 - Capital adequacy
 - Earnings volatility
 - Credit rating target

It represents the company’s long-term target and shall be revised only if there are fundamental changes to the company’s financial profile, market situation and strategic objective. Risk appetite helps prevent default by preserving capital position. This is required by regulators, rating agencies, policyholders and debtholders. These stakeholders show little or no interest in the upside of risk taking. On the other hand, shareholders are interested in the upside resulting from risk taking and low earnings volatility.

- **Risk appetite for each risk category:** Enterprise risk tolerance needs to be allocated to risk appetite for specific risk categories and business activities, such as selling life insurance policies or underwriting property and casualty risks, or taking more market risk versus credit risk. By doing this, the company’s resources, such as capital, can be allocated to the areas in which the company feels comfortable or has competitive advantage. When determining or updating risk appetite for different risk categories, the platform, analytic tools and conclusions also are instrumental in identifying risk-taking activities that have relatively high risk-adjusted return.
- **Risk limit:** Risk limits are the most granular level used for business operation. It translates enterprise risk tolerance and risk appetite for each risk category into risk-monitoring measures. The consistency between risk limit and enterprise risk tolerance helps the company realize its risk objective and maximize risk-adjusted return.

Risk appetite includes both qualitative and quantitative measures. The following risk metrics are normally considered in setting risk appetite given a specified time horizon:

Quantitative measure

- **Capital/equity at risk:** Used under local statutory/rating agencies/economic basis. It can be stated as the maximum acceptable capital at risk would be X percent of current available capital with a certain probability. Alternatively, with a probability of Y percent, the company can still stand solvent.

- **Earnings at risk:** Used under local accounting/U.S. Generally Accepted Accounting Principles (U.S. GAAP)/International Financial Reporting Standards (IFRS) basis. It can be stated as the maximum acceptable earning at risk would be X percent of expected/target earning with a certain probability. Alternatively, with a probability of Y percent, the earnings will be non-negative.
- **Embedded value/market consistent embedded value (EV/MCEV):** It can be stated as the maximum acceptable decrease in EV/MCEV would be X percent of expected/target EV/MCEV with a certain probability.

The examples in the above quantitative measures are value at risk (VaR). A more conservative measure is tail value at risk (TVaR), aka conditional tail expectation (CTE). TVaR takes the average of all possible values above VaR. For a variable with high skewness, TVaR is a more conservative and appropriate choice.

Qualitative measure

- **Credit ratings:** Lowest desired financial strength rating or debt rating.
- **Risk preferences:** Certain risks that an insurer does not want to take, such as not underwriting business in catastrophe prone regions.
- **Franchise value:** How much can be decreased due to adverse publicity, poor reputation or regulatory intervention.

There are several issues that need careful consideration when implementing a risk appetite framework. Although those limitations are kept in mind, this paper focuses on the philosophy and approaches of embedding risk appetite in corporate strategic planning. The following topics are critical but out of the scope of this paper:

- Assumptions setting and validation such as correlation assumption in tail events and probability assigned to certain tail events.
- Model risk that the model does not reflect the real market dynamics due to incorrect model specification, assumptions calibration errors and implementation errors, etc.

Enterprise risk tolerance statement

Below is an example of an enterprise risk tolerance statement. Examples of risk appetite for each risk category will be given in section 2.5.

- **Credit rating**
 - **Financial strength rating:** Achieve and maintain an AA financial strength rating on a global basis (S&P rating) and maintain a buffer of more than 50 percent of one year's net income above the minimum capital requirement for the AA rating.
 - **Debt rating:** Achieve and maintain an A rating for senior unsecured debt.
- **Earnings at risk:** The probability of negative IFRS/U.S. GAAP earnings for one year is less than 5 percent.

- **Capital at risk:** The probability of a 15 percent loss of IFRS/ U.S. GAAP equity for one year is less than 0.5 percent. The probability of a capital deficiency under the economic framework is 0.05 percent according to the target financial strength rating.
- The company has extremely high risk aversion to reputation risk.

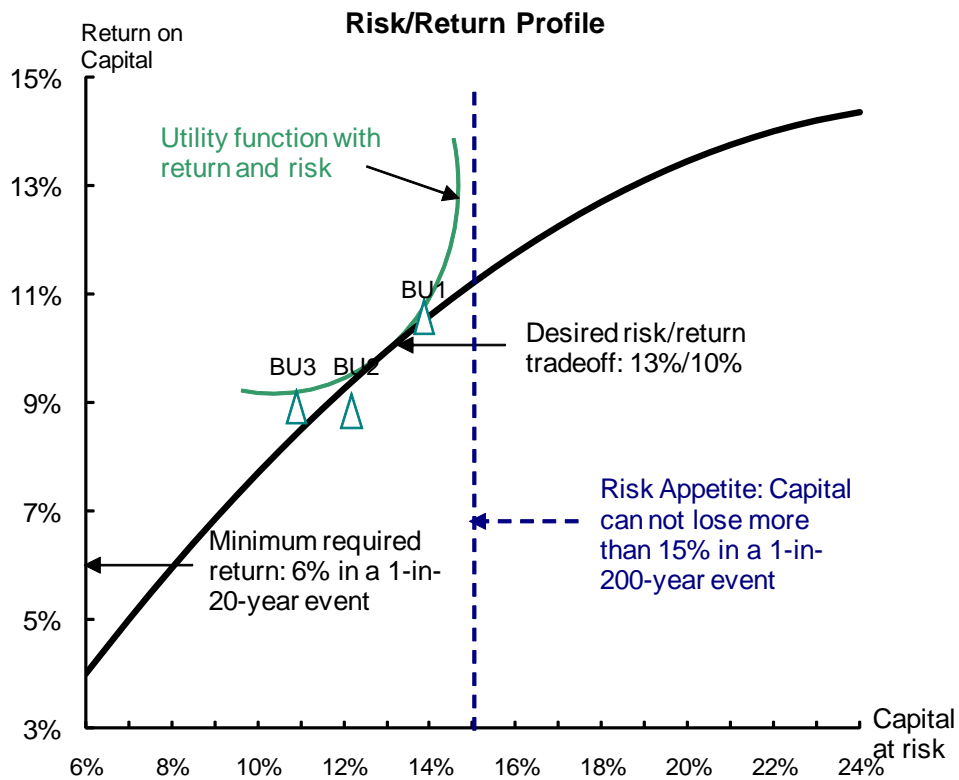
Figure 2.2.1 Illustrative Quantitative Risk Appetite Statement

Measures	Earnings at Risk	Capital at Risk	Economic Capital
Confidence interval	95%	99.5%	99.95% (based on target financial strength rating)
Stressed metric	IFRS/GAAP earnings	IFRS/GAAP equity	Available economic capital
Interpretation	Potential negative IFRS earnings during a 'moderate' stress scenario (i.e. 1 in 20 years)	Potential 15% available capital reduction of net value during a 'severe' stress scenario (i.e. 1 in 200 years)	Potential available economic capital < required economic capital during an 'extreme' stress scenario (i.e. 1 in 2000 years)

Risk appetite and business analysis

With risk appetite in place, the risk/return profile and the constraints of the business are quantified, which helps prevent exceeding enterprise risk tolerance when making strategic decisions. Below is a graph that shows the use of capital at risk in finding the optimal risk/return trade-off.

Figure 2.2.2 Risk Return Analysis Based on Capital at Risk



- Capital at risk (CaR) is used to describe the risk. It is a holistic risk measure of capital adequacy.
- Return on capital (ROC) is chosen as the return measure as it is something investors will earn.
- The utility function can be considered as nondifferential curves, each of which represents a certain risk-adjusted return. It represents the investor's degree of risk aversion. In the example, the risk-adjusted return or utility of business unit (BU) 1 is greater than those of BU2.
- Target ROC is 10 percent.
- A minimum ROC of 6 percent represents the risk appetite for earnings volatilities: The company does not want to see earnings drop by more than 40 percent in a 1-in-20-year event.
- A maximum CaR of 15 percent of capital represents the risk appetite of capital adequacy: The company does not want to lose more than 15 percent of its capital in a 1-in-200-year event.
- An efficient frontier is built to represent the risk-return opportunities through stochastic/scenario analysis.

The most desirable position would be 10 percent ROC with 13 percent CaR. It is within all the constraints and maximizes the risk-adjusted return. In this example, business units 1 to 3 are operating with an expected return above the minimum requirement and CaR below the risk tolerance. BU1 and BU3 lay on the efficient frontier while BU2 still has some room to improve its risk/return profile. If the market is segmented and BU2 is in a market with a lower market risk premium, the company's capital allocation and new business plan might consider capital reallocation from BU2 to other more efficient BUs. This is a simple example of how risk appetite framework interacts with strategic planning.

Percentiles in risk measures

Appropriate percentages adopted in different quantitative risk measures are important to different objectives. There are several considerations when determining the percentile:

- The higher the target credit rating, the higher the percentage used in risk measures. Some companies refer to default experience data published by rating agencies to determine the appropriate percentage to use, especially in capital management, or calculating CaR.
- Different risk measures may use different percentiles. For example, TVaR, aka CTE, is more conservative than VaR. TVaR may look at a 1-in-40-year event instead of 1-in-200-year event as specified in Solvency II. EaR and CaR also may share different percentages, as during extreme events caused by systematic risk, the investors are more concerned about the solvency than the earnings. However, in the business decision process under normal circumstances, the same percentages might be chosen for both EaR and CaR.
- Tail events may change from time to time. For example, in the nonlife

insurance/reinsurance industry, return periods¹⁷ are very likely to change after certain big events. The industry and catastrophe modellers put more load on U.S. hurricanes after Katrina in 2005. This implies that even if the percentage does not change in each risk measure, the severity of the tail events needs to be updated based on new information.

- Companies with different types of business usually view key tail events with different probabilities. For example, a reinsurer specialising in the U.S. energy insurance business is more concerned with a hurricane in the Gulf of Mexico, which may have an assigned probability of 0.2 percent, or a 1-in-500-year event. Meanwhile, pension business writers are much more exposed to longevity risk. A tail event of 5 percent mortality improvement expected with a probability of 0.5 percent, or a 1-in-200-year event, could be more appropriate for the pension industry.
- Sometimes the percentage is not important but the deterministic stress events, either based on historical experience or hypothesized events, are critical. There are always some assumptions to be made while assigning a probability of occurrence to certain events. Sometimes it is hard to reach agreement on those event-related probabilities. In those cases, designing strategies to remain solvent when those stress events happen are more meaningful than trying to allocate a probability to those events. This is common in catastrophe and pandemic risk management.

Backtesting

All the quantitative risk measures in a risk appetite framework are very sensitive to economic assumptions and are subject to model risk. A difficulty normally encountered when using those risk measures is validation. A 1-in-200-year event is rare and may not be experienced during a lifetime. Therefore, it is hard to demonstrate the credibility of the CaR or EaR against reality. However, without a proper process to test those measures against experience, those quantitative measures are likely to be misunderstood, misused or even manipulated. This would totally be against the objective of risk appetite framework. A possible solution to overcome this is to backtest the measures against reality at a less severe confidence level. For example, use 80 percent CaR and test it against the experience in the past five years. Alternatively, use 99.5 percent CaR and test it against $N \times 1\text{-in-10-year event}$; N can be based on the relationship between a 1-in-10-year event and a 1-in-200-year event implied by historical data or forward-looking assumptions.

People may doubt backtesting as forward-looking views evolve quickly, especially in a highly uncertain world with more and more emerging risks. This is true and also a major limitation of backtesting. On the other hand, history repeats. Backtesting helps us learn from history and adjust our view of the future. In the past decade, examples of extreme events affecting companies' risk appetite and strategic decision are numerous.

- After recent earthquakes (2010 in Chile, Haiti and New Zealand, and 2011 in Japan), RMS Inc., a market leader in catastrophe (CAT) modelling, backtested the catastrophe

¹⁷ A 200-year return period means a 1-in-200-year event.

model and released a new version with updated natural catastrophe model parameters. This will have an impact on the whole industry regarding the capital requirement for CAT business and may reduce the number of market players.

- The variable annuity (VA) market in Japan felt the squeeze after the 2008 financial crisis. There had been tremendous growth since 2002. The market share of VA business decreased significantly due to the increasing awareness of the material downside risks for insurance companies.
- After the events of Sept. 11, 2001, many global insurers and reinsurers invested much more capital in aviation businesses. The hard market lasted almost five years.

From the examples above, it is obvious that backtesting of key assumptions could improve corporate strategic decisions such as efficient capital allocation to business lines, the timing of exit plans and rate adjustment.

2.3 Risk Governance and Risk Appetite

A clear risk appetite statement sets the guideline from the top for risk management. Normally it needs to be approved by the board and included in company's risk policies. Setting up a risk appetite framework is not a trivial task. It usually requires the following steps:

- 1) Bottom-up analysis of the company's current risk profile.
- 2) Interviews with the board of directors regarding the level of risk tolerance.
- 3) Alignment of risk appetite with the company's goal and strategy.
- 4) Formalization of the risk appetite statement with approval from the board of directors.
- 5) Establishment of risk policies, risk limit and risk-monitoring processes consistent with risk appetite.
- 6) Design and implementation of the risk-mitigation plan to be consistent with risk appetite.
- 7) Communication with local senior management for their buy in.

With risk appetite and risk limits in place, all the risk management activities have the same ultimate goal: ensuring risk-taking activities are consistent with risk appetite. A risk limit system provides measures for monitoring the risk position and not exceeding the level of risk tolerance.

Risk appetite needs to be revisited when there is a large change in business strategy, market situation or financial condition. Normally there is a yearly review with the board of directors to determine if any changes need to be made.

2.4 Constraints

With a clearly defined risk appetite, constraints are known when making strategic decisions. It

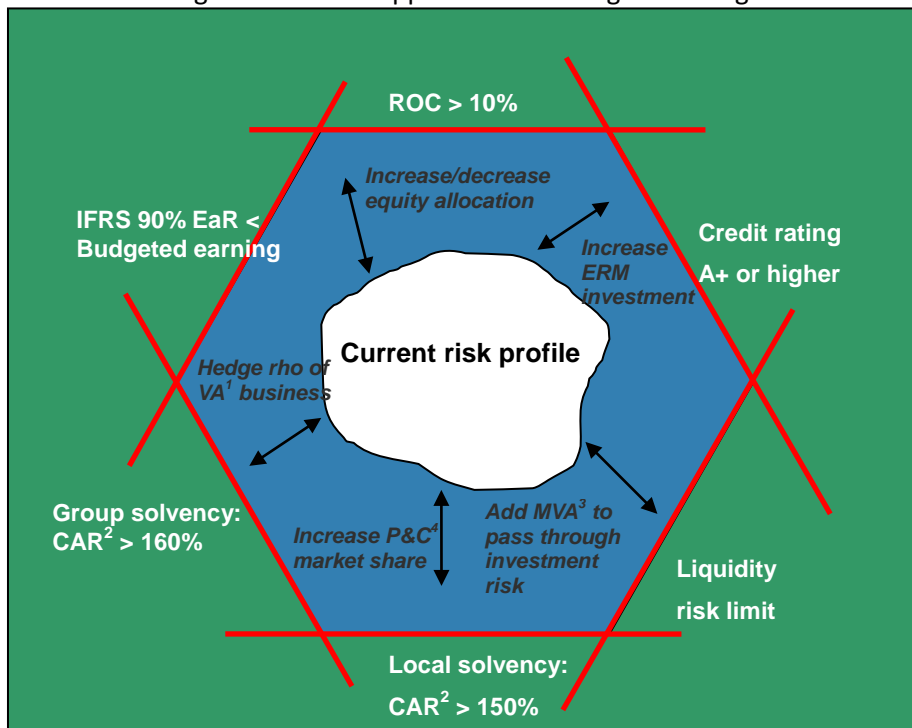
shows the line that cannot be crossed to remain consistent with risk tolerance.

A global company may face the following constraints:

- Local statutory requirements: capital adequacy
- Group solvency requirements: capital adequacy
- Rating agency capital requirements
- Economic capital sufficiency
- IFRS/U.S. GAAP earning volatility
- Embedded value earning volatility

Figure 2.4.1 below shows the interaction between the constraints defined in risk appetite and strategic planning.

Figure 2.4.1 Risk Appetite and Strategic Planning



Notes:

¹VA: Variable annuity

²CAR: Capital adequacy ratio, normally calculated as available capital/required capital

³MVA: Market value adjustment

⁴P&C: Property and casualty insurance

The green rectangle is a whole set of possible strategic plans. The blue hexagon illustrates the space where the strategic plan will keep the company within the risk tolerance limit. Its borders, the red lines, represent the components of the risk appetite framework. It could be enterprise risk tolerance or risk limit. The white pool in the middle is an example of the current risk profile. Starting from here, we can implement different strategic plans to reach the maximum risk-adjusted return or other strategic goals in the blue hexagon. As an example,

there are five strategies considered to improve the risk profile and create value:

- 1) Increase P&C market share: Business expansion requires capital expenditures, which will reduce the capital adequacy ratio if there is no capital-raising activity planned.
- 2) Add MVA to pass through investment risk: Adjusting product features to transfer risk to policyholders is a risk-mitigation technique. In this case, liquidity risk caused by mass lapse behaviour due to either credit rating downgrade or disintermediation risk is reduced.
- 3) Increase ERM investment: Enhancing risk management policies and implementation such as the risk appetite framework will improve the rating of ERM and benefit the business. It may also help achieve a credit rating upgrade, which also reduces the borrowing cost.
- 4) Increase/decrease equity allocation: Riskier asset investment helps improve the earnings expectation and grow the capital in the long term. However, at the same time, more risks are taken such as high probability of capital deficiency and high earnings volatility.
- 5) Hedge rho of VA business: A hedging program reduces earnings volatility and stabilizes capital position at a cost of taking a long position in derivative markets or dynamic hedging implementation. In this case, hedging the interest rate risk of VA business reduces CaR and EaR.

2.5 Risk Appetite for Each Risk Category and Risk Limit

Enterprise risk tolerance can be further broken down into a risk preference for each risk category. Risk preference is normally stated quantitatively (VaR limit) and qualitatively (do not bear certain types of risk). To efficiently and clearly communicate risk appetite to business units and different operation functions, risk appetite needs to be translated into risk limits in a quantitative way. This ensures the stated risk appetite is followed. Modelling is a key tool used to create reasonable and credible linkage between overall risk appetite and risk limits. Major risk categories are discussed below to give an example of how risk preference can be translated into risk limits. Another important piece is diversification benefits because of imperfect correlation among risk factors, business lines and business units. Risk tolerance has a material impact on setting risk appetite for individual risk categories and limits as well.

While a lot of focus has been put on the quantitative aspects, companies are much more likely to fail due to taking unidentified or unheeded risks. This is important to keep in mind before setting up the risk appetite for each risk category. In the recent financial crisis, we saw big players in the insurance industry get huge government bailouts to remain solvent. The cause was not life or P&C insurance but insurance business on financial products. The lesson learned was that a true and comprehensive picture of risks being taken and the exposure to each risk category is far more important than quantitative risk measures. Those risk measures are very sensitive to assumptions and as a result are exposed to a high level of model risks. The list below includes most of the risk categories on which the insurance industry has been focusing. Though it is desirable to have an inclusive list, new risks are emerging and need to be identified and analyzed.

2.5.1 Market Risk

Market risk appetite reflects constraints caused by risk-taking activities in interest rate risk, equity risk, foreign exchange risk, alternative investments and volatilities of the financial market. The appetite of market risk could be stated as:

- The company could not lose more than 10 percent of IFRS equity in a 1-in-200-year event.
- The company will not participate in any strategy that bets on the direction and magnitude of the foreign exchange rate movement (currency hedging) or change in equity volatility (no butterfly¹⁸ or straddle¹⁹ investment strategies).

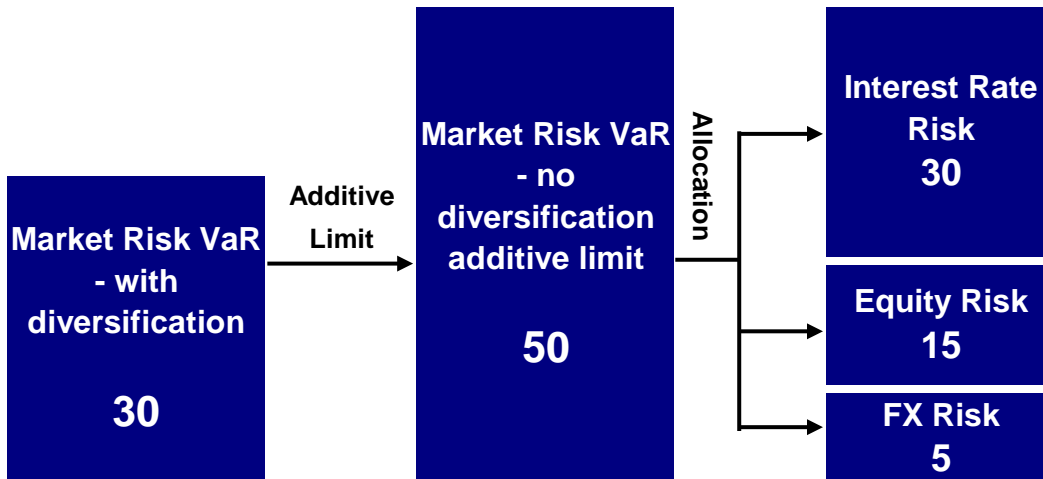
Appetite for market risk should be mapped to asset allocation limits, foreign exchange (FX) limits, fixed income securities duration limits and/or asset liability mismatch (ALM) limits. At this stage, strategic decisions have already been made to maximize the risk-adjusted return. Therefore, the allocation of each risk type is already known. A case study of the linkage between risk appetite and asset allocation is presented in section 3. Below is a description of market risk limit setting.

To determine the risk limits, the first step is to allocate VaR for market risk to each sub risk type: FX, interest, equity, etc. A simple example is shown below.

¹⁸ “A **butterfly** is a limited risk, nondirectional options strategy that is designed to have a large probability of earning a small limited profit when the future volatility of the underlying is expected to be different from the implied volatility.” *Wikipedia*, s.v. “butterfly (options),” accessed January 31, 2012, http://en.wikipedia.org/wiki/Butterfly_%28options%29.

¹⁹ “A **straddle** is an investment strategy involving the purchase or sale of particular option derivatives that allows the holder to profit based on how much the price of the underlying security moves, regardless of the *direction* of price movement.” *Wikipedia*, s.v. “straddle,” accessed January 31, 2012, <http://en.wikipedia.org/wiki/Straddle>.

Figure 2.5.1.1 Market Risk Budgeting



Consider the company has the following interest rate risk profile:

Figure 2.5.1.2 Interest Rate Risk Profile

	Value	Duration	Duration Mismatch
Asset	200	10	15
Liability	160	25	
1 in 200 year event: Interest rate drop 2%			
Δ asset	40 = 200*10*2%		
Δ liability	80 = 160*25*2%		
Δ surplus	-40		

The current risk profile for interest risk exceeds risk appetite for interest rate by \$10 million.²⁰ A duration mismatch limit consistent with the risk appetite for the interest rate needs to be worked out.

Based on the current balance sheet, the duration mismatch needs to be reduced to 12.5 years so the loss for a 1-in-200-year event is \$30 million. The increase of asset value under a 1-in-200-year event needs to be \$50 million so that the change in surplus is equal to \$30 million. Divide \$50 million by asset value \$200 million and then by the 2 percent interest rate change. The desired asset duration is now equal to 12.5 years. The duration mismatch limit is duration of liability – duration of asset (25 years – 12.5 years = 12.5 years).

In reality, duration itself, even with convexity, might not do a good job as there are a lot of management actions to reduce risk exposure when things go wrong. On the other hand, the policyholder may behave in a way that makes things worse. Calculating a limit without considering those factors could be misleading. Therefore, dynamic modeling is a key and difficult component in deriving a reasonable limit. Dynamic management actions include dynamic investment strategy, dynamic policyholder dividend setting, dynamic credit interest rate setting and dynamic premium resetting. Dynamic policyholder behaviors include

²⁰ All dollar figures are USD unless otherwise noted.

dynamic lapse and dynamic premium payment.

2.5.2 Credit Risk

Credit risk consists of downgrade and default risks related to investment and reinsurance activities. The risk appetite statement for credit risk is in a similar format to that of market risk. An example could be:

- a. The company could not lose more than 5 percent of IFRS equity in a 1-in-200-year event.
- b. The company will not invest in any bonds that have a credit rating below BBB.

Appetite for credit risk is mapped into credit limit such as obligor limit or reinsurance counterparty credit rating limit.

2.5.3 Insurance Risk

Insurance risk, aka underwriting risk, includes mortality, morbidity, lapse and expense risks. It will impact both the value of new business (VoNB) and the reserve of in-force business. Appetite for insurance risk defines the risk tolerance of those risk types to limit potential losses. An example could be:

- The company cannot lose more than 5 percent of IFRS equity in a 1-in-200-year event due to the insurance risk's impact on reserves.
- The company cannot lose more than 50 percent of VoNB in a 1-in-200-year event due to the insurance risk's impact on pricing.

Translating appetite for insurance risk into risk limit is not straightforward. To be more effective and easier to monitor, an existing experience monitoring framework needs to be relied on. A possible choice is the A/E ratio²¹ and/or loss ratio. A stress test under a 1-in-200-year event needs to be done to get the A/E ratio limit. It is calculated as the expected payment under the stress test divided by the expected payment with a best estimate assumption. The regular experience study results can be monitored against the limit to protect from insurance risk. For expense risk, a limit in terms of amount might be a better choice for risk-monitoring purposes. However, for a company with diversified products featured even within each product line, this approach may create practical issues regarding the required efforts and timing for experience monitoring at the product level. In addition, for new products or new product features, it is often challenging to set assumptions and a risk limit. From this perspective, it may be more valuable as a tool to identify risks and adverse trends than to set a limit.

A risk limit and risk-monitoring report for insurance risk may look like the following.

²¹ A/E ratio: Actual payment/expected payment. For example, the payment could be the death benefit for mortality risk or the surrender benefit for lapse risk. It is used to track experience of insurance assumptions.

Figure 2.5.3.1 Illustrative Insurance Risk Monitoring Report

Risk Metric for insurance risk	Risk Limit	Current position
A&H* Loss ratio deviation from pricing**	+5%	+7%
A/E mortality rate for life	115%	108%
A/E mortality rate for annuity	90%	94%
A/E Lapse rate for non-lapse supportive	130%	135%
A/E Lapse rate for lapse supportive	90%	95%
Expense overrun	\$2.5 million	\$2.36 million

A&H Loss ratio and lapse rate exceed risk limit and need mitigation plan

*A&H: Accident and health products

** pricing target ratio may float from 35-90%, depending on mix of business

Another consideration of insurance risk is the possible offsetting impact of life insurance business and annuity business on mortality risk. It is a natural hedging and should be considered if any reflection is appropriate when setting the limit. Other hedging instruments in the asset portfolio such as longevity bonds should be taken into account as well.

2.5.4 Catastrophe Risk

A company's exposure to catastrophe risk has attracted more attention due to climate change, pandemics and a growing number of natural disasters. Risk exposure could devour a company's available liquidity quickly if such a catastrophe occurs and the company runs the risk of bankruptcy without sufficient liquidity. An example of appetite for catastrophe risk could be:

- The company cannot lose more than 20 percent of IFRS equity in a 1-in-200-year event.
- The company cannot lose more than 20 percent of IFRS equity if the 1918 Spanish flu pandemic happens again.

Risk limit regarding catastrophes can be easily aligned with risk appetite via net amount at risk (NAaR). NAaR is the sum assured minus the reserve. It is the additional amount that has to be paid in excess of what has been reserved. Monitoring real-time NAaR against the limit prevents excessive risk exposure.

2.5.5 Liquidity Risk

In a catastrophic event, insurance companies face high liquidity requirements, mass policy lapses due to disintermediation risk and credit rating downgrade. Lessons of bankruptcy due to insufficient liquidity are numerous. Appetite for liquidity risk could be:

- a. The company maintains liquidity for a 1-in-200-year event over a time horizon of three months.
- b. The company maintains liquidity at the confidence level of 99.5 percent while the liquidity cost to meet cash payments at the confidence level of 99.5 percent (1 in 200 years) is less than 25 percent of capital.

Appetite for liquidity risk would constrain investment choices as it would indicate the level of liquid asset investment. It is a major constraint and the company may have a lower risk tolerance of it than that of other risk categories due to the devastating impact. This point will be discussed in section 6 with an example.

2.5.6 Concentration Risk

Concentration risk relates to the risks caused by a dominating position in a risk category, product line, region, distribution channel or asset class. Appetite for concentration risk could be:

- The company has a natural diversification of geographic concentrations of insurance and political risks.
- The company has a range of product offerings including both life and annuity products and thereby reduces exposure to concentrations of mortality or longevity risk.

Appetite for concentration risk is an important element in strategic planning, especially when developing business plans. A business development strategy that causes concentration in a certain risk category or business line will put the company in danger because of the lack of diversification. A good risk limit or risk-monitoring system can track the real experience to identify significant deviation from appetite for concentration risk.

2.5.7 Terrorism Risk

Terrorism causes deaths, injuries, business interruption and adverse market movement. It hurts the company's financial strength and business. An example of appetite for terrorism risk could be:

- The company cannot lose more than 20 percent of IFRS equity in a terrorism event.
- The company has a contingency plan in place for continuing business operations in the event of terrorism.

Risk limit related to terrorism risk focuses on the concentration of policyholders' locations. For example, the company may stop underwriting life insurance coverage for additional lives working in the same building once the total sum assured on the lives in the building reaches \$100 million. Without sufficient reinsurance coverage to cap the maximum possible claim amount, location concentration can have a disastrous impact in a terrorism event.

2.5.8 Operational Risk

Appetite for operational risk normally is qualitative, such as "the company disallows any behaviors that will damage our reputation." Appetite for operational risk may not be translated to quantitative risk limit but is ensured by company policy and/or internal control. Brand management and antimoney laundering and compliance policies are examples of reputation and legal risk management.

2.5.9 Diversification Benefit

Insurance companies manage to provide protection from insured risk at a reasonable price due to the pooling of individual exposures. Diversification among risk categories, products and geographic regions reduces the aggregate level of risk. The diversification benefit is a critical factor in determining the current risk profile with a bottom-up approach and setting the risk limit from the top down. It is also the most important factor in economic capital management when considering both the high sensitivity to the assumption of dependency and its magnitude in reduction of required economic capital. Therefore, prudence is highly needed when quantifying the diversification benefit and using it as an argument in business decisions. Increased correlation in a tail event is a good example. Normally, there is a geographic diversification benefit in capital management that takes into consideration the nonperfect correlation among countries and regions. In some tail events, such as the financial crisis, the correlation between countries tends to increase quickly due to the contagion factors. Low interest rates, high credit risk and widespread panic among investors could happen in all countries in a region at the same time. The high diversification benefits considered in business decisions in normal situations were gone immediately and the once huge amount of excess capital disappeared. Therefore, making a reasonable diversification assumption and keeping it from manipulation is critical in risk management and business decision.

Several approaches to quantifying diversification are adopted in a risk appetite framework. Those methods incorporate a higher correlation of tail events in different ways.

- Correlation matrix approach: This approach uses a correlation matrix to aggregate the value distributions or certain percentiles of different risk factors.
- Copula approach: Instead of assuming a linear correlation as used in the correlation matrix approach, the copula approach determines joint distribution based on marginal distributions and a copula function. It allows better modelling of tail events where much higher correlations were seen than in normal circumstances.
- Structural scenario approach: This approach uses stochastic global scenarios that include all the risk factors. The correlations between risk factors are incorporated in the stochastic scenarios. Asset and liability portfolios are assessed under those scenarios to obtain value distribution.

Different approaches are appropriate for different purposes. When determining the diversification benefit among different risk categories such as market risk and insurance risk, and among geographic regions, correlation matrix and copula approaches are often used. Sometimes different correlation matrices are used at different percentiles to reflect the higher correlation in tail events. This, somehow, compensates for the disadvantage of assuming linear correlation in the correlation matrix approach. When calculating the diversification benefit among risk factors within each risk category, such as interest, equity, foreign exchange and volatility under market risk category, the structural scenario approach is more appropriate as it can build the causal relationship into scenario generation. For example, interest rate, equity return and currency value are highly dependent on a macroeconomic environment.

Building in the relationship of those risks in a macroeconomic environment in global scenarios provides more insights about the underlying causes of market movement and, therefore, facilitates effective management actions.

3 Risk Appetite and Asset Allocation

Strategic asset allocation (SAA) is used to determine a long-term policy portfolio reflecting the desired systematic risk exposure. Tactical asset allocation (TAA), on the other hand, specifies the allowable deviation from SAA to take advantage of short-term market opportunities. A numerical example is given below.

Figure 3.1 Asset Allocation Plan

<u>Asset class</u>	<u>SAA</u>	<u>TAA</u>
Bond	50%	+/-7% (43%~57%)
Equity	30%	+/-10% (20%~40%)
Cash	20%	+/-3% (17%~23%)

Before risk appetite frameworks became part of corporate governance, insurance companies decided asset allocation based on the return objective and risk consideration for each business line and surplus, separately. Segmented investment portfolios supporting different product lines lead to multiple return objectives.

Return objective

- Minimum return: statutory rate set by actuarial assumptions to fund statutory reserve. Assets chosen are based on the duration matching strategy.
- Enhanced margin: competitive return earned to fund a well-defined liability and a reasonable profit.
- A surplus account usually has a riskier asset allocation to achieve higher returns.

Risk considerations

- Valuation concerns: adverse market movement that lead to reduced surplus so risk exposure is limited to a safe capital adequacy level.
- Cash flow volatility: low tolerance of income loss.
- Reinvestment risk: duration and/or convexity match between asset and liability portfolios.
- Credit risk: need to reduce credit risk through a diversified portfolio.
- Disintermediation risk: periods of large cash outflows when a high interest rate leads to more policy loan lapses, which decrease the duration of liability.
- Regulatory and legal constraints about eligible investment.

When determining asset allocation, those considerations can help realize return objectives while protecting from the identified risks. However, without a clearly defined risk appetite, or the analysis framework supporting risk appetite, there is no holistic thought of the relationship of risk and return or the correlation of all the identified risks. For example, reinvestment risk

and disintermediation risk have negative correlations. Low interest rate implies high reinvestment risk and low disintermediation risk. With risk appetite in the picture, strategic asset allocation will play a better role in ensuring the realization of both risk and return objective. After the high level objective is determined, appropriate and different return objectives can be set for individual segments to achieve the overall goal.

Case study

A simple example below shows the difference in the asset allocation decision processes and results.

Figure 3.2 Illustrative Balance Sheet and Earnings

Balance sheet: (USD million)

Earnings: (USD million)



Two available asset classes:

	Expected return	Risk — Volatility
Bond	5%	8%
Equity	9%	10%

Risk free rate: 3%

Correlation between bond return and equity return: 20%

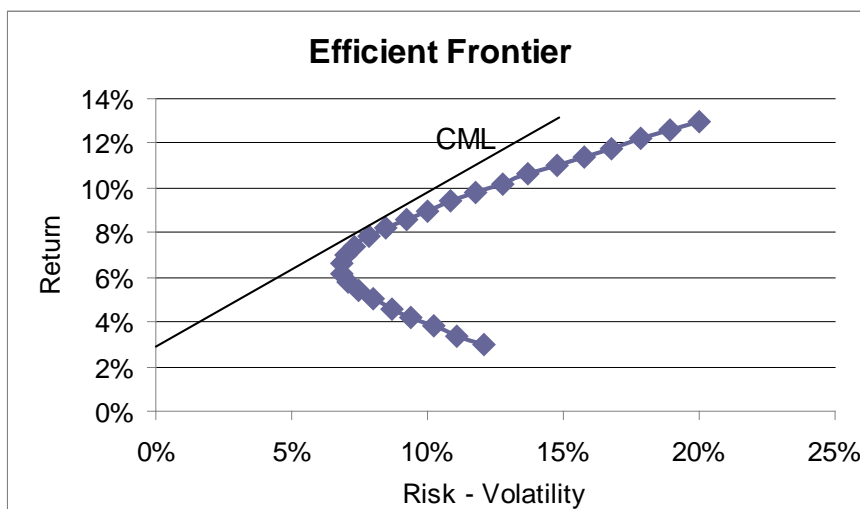
Required return: 8.5%

A typical asset allocation process without risk appetite would construct the efficient frontier and capital market line (CML).²² In Figure 3.3, we can see that CML touches on the efficient frontier when the expected return is 8 percent. Assume the borrowing cost is the risk-free rate. To achieve an 8.5 percent return objective, the most efficient way is to borrow 20 percent risk-free assets and invest the entire available fund in the tangent risky portfolio (25 percent in bond and 75 percent in equity). However, in reality, there are considerations that make it deviate from the theoretical optimal solution. The borrowing cost could be higher and there might be high cash flow volatility as the dividend income is not very stable compared to bond coupon payments and redemptions. In this analysis, it is apparent the risk considerations are not combined in an efficient way. Different risk considerations might drag the desired asset allocation in the opposite direction and there is no effective way to find out the optimal or

²² CML is the tangent line of the efficient frontier and it crosses the risk-free rate at zero risk.

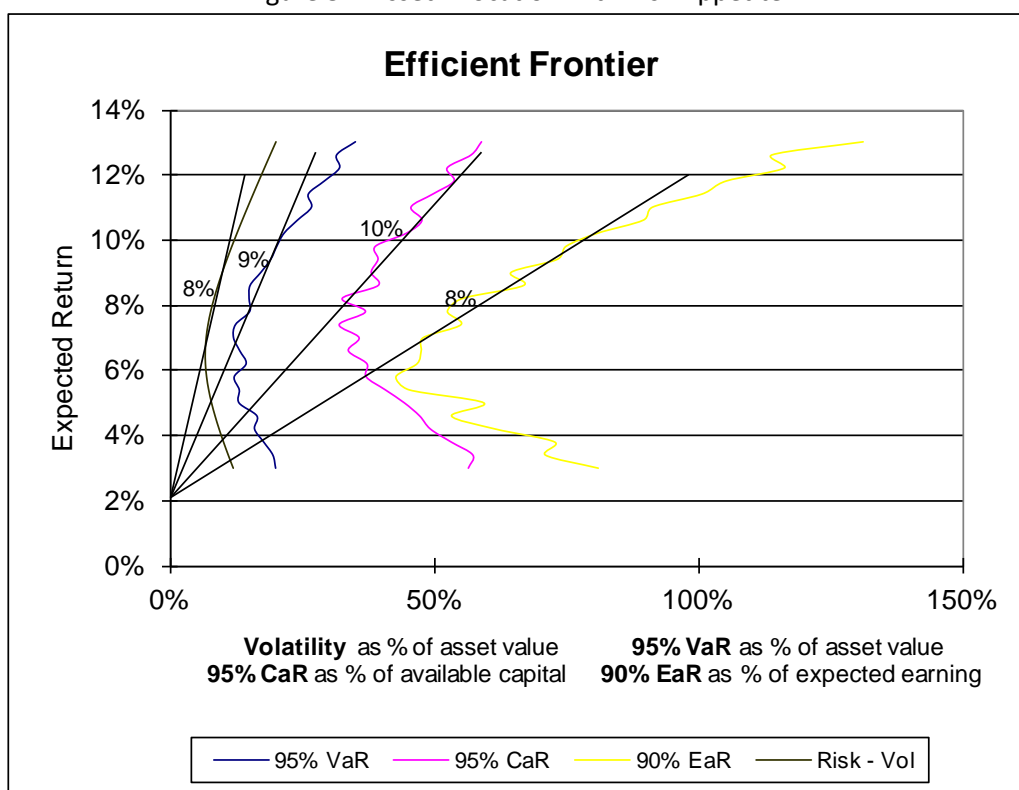
suboptimal position to manage everything in a balanced way.

Figure 3.3 Asset Allocation without Risk Appetite



With a mandatory risk appetite in place, strategic asset allocation can be used to consider risk holistically. Figure 3.4 shows three additional comprehensive risk measure candidates highly related to risk appetite.

Figure 3.4 Asset Allocation with Risk Appetite



Notes:

Volatility is presented as percent of asset value.

VaR is presented as percent of asset value.

CaR is presented as percent of current available capital.

EaR is presented as percent of expected earnings.

With those risk measures, the tangent risky portfolio also changes.

Figure 3.5 Tangent Risky Portfolio Under Different Risk Measures

Risk measures	Expected return	Bond	Equity
Volatility (traditional one)	8%	25%	75%
95% VaR	9%	0%	100%
95% CaR	10%	-25% ²³	125%
90% EaR	8%	25%	75%

- VaR at 95 percent: It incorporates interest rate, credit, equity and FX risks. Using a risk measure with a confidence level consistent with the risk appetite statement is more appropriate than using volatility as a 1-in-20-year event. This is of more concern than utilizing one standard deviation.
- CaR at 95 percent: It is a quantitative component in the risk appetite statement. It also implies the asset allocations that are not allowable. For example, if the risk appetite is to not lose more than 50 percent of capital in a 1-in-20-year event, then all the efficient portfolios with expected returns higher than 11 percent are not appropriate as 95 percent CaR of those portfolios exceed 50 percent loss of capital.
- EaR at 90 percent: Like CaR, it is one of the key risk measures in risk appetite. Figure 3.4 shows that portfolios with expected returns higher than 11 percent would have 90 percent earnings at risks greater than 100 percent expected earnings. In other words, negative earnings are expected to happen in a 1-in-10-year event.

Risk appetite can help refine risk measures in strategic asset allocation and also help a company consider asset allocation from a holistic perspective.

Then can those efficient frontiers be constructed? With the calculation engine that can support risk appetite analysis, it is highly probable the efficient frontiers can be derived by running the engine with a set of asset allocation plans.

Tactic asset allocation normally determines the allowable range according to the volatility of asset classes. The higher the volatility, the wider the range. The logic would be that a volatile asset class also presents high alpha, which an experienced portfolio manager may take advantage of. Risk appetite may add extra constraints as we need to test if the upper and lower bounds of TAA can trigger the situation that CaR and/or EaR exceed risk tolerance. If

²³ Negative means short selling, which is probably forbidden for insurance companies. Therefore, in this case, relying solely on 95 percent CaR cannot give a feasible and optimal asset allocation and the suboptimal allocation plan should be used.

that happens, the TAA band needs to be narrowed until it is in line with risk appetite. From this new perspective, risk appetite helps ensure that alpha-seeking behaviors (TAA) will not put capital/earning position at high risk.

4 Risk Appetite and New Business Budgeting

Insurance companies normally prepare new business budgets of certain return or value measures each year. On the other hand, clients, shareholders, employees and regulators are interested in understanding the amount of risk the company will take in the future. Some commonly used return or value measures are traditional embedded value of new business for life insurance and combined ratio for non-life insurers.²⁴

These return or value measures do not fully and accurately consider the level of risk being taken. Therefore, other measures need to be used to explain the impact of the new business on the future risk profile. New business budgets and risk appetite have to find an effective way to communicate with each other so that the risk tolerance will not be broken.

One candidate of the measures to be considered is the risk-adjusted return on capital (RAROC). In the insurance industry, RAROC takes into consideration the expected profit and risk over the entire life of a policy. It allows for a consistent comparison of activities across different types of risks and businesses.

Other candidates, such as market consistent embedded value (MCEV), adjust the approach of value measurement used by traditional embedded values of new business. MCEV takes into account the cost of nonhedgeable risks, the cost of options and guarantees offered in the insurance contracts, and the frictional cost of capital explicitly.

In the following case study, RAROC is used as the key measure considered in business planning. There are several versions of RAROC definitions in the real world. It is specified for the case study as follows.

$$\text{RAROC} = \frac{\text{PV (underwriting profit)} + \text{PV (investment income on capital)}}{\text{PV (required capital)}} (1-t)$$

where PV stands for present value

PV (underwriting profit) = PV (premium) – PV (claims) – PV (acquisition costs) –

PV (other expenses)

Required capital is the required economic capital

t : effective corporate tax rate

²⁴ Combined Ratio = $\frac{\text{Premium} - \text{Loss} - \text{External Expenses (commission)} - \text{Management Expense}}{\text{Premium}}$

Case study

Reinsurance company ABC started writing worldwide property and casualty business and several lines of products in 2011. Senior management is preparing a 2012 new business plan, which includes:

- New business mix projection for 2012
- Total premium target of 2012 for each business unit

Normally, there is another step in preparing the new business mix for each business unit that is consistent with the new business mix at the total company level and the allocation plan among business units. For simplicity, it is assumed that each business unit shares the same new business mix as that of the total company.

Step 1: New business mix projection for 2012

Assume the financial results in statutory reporting, as of Dec. 31, 2011, are as follows.

Figure 4.1 2011 Reinsurer ABC Business Mix (USD million)

Year 2011	Premium income	Underwriting profit	Profit margin ²⁵
Auto liability	10	0.9	9.0%
Specialty liability	15	1.5	10.0%
CAT (catastrophe)	50	7.5	15.0%
Homeowners/farm owners	25	0.8	3.2%
Company	100	10.7	10.7%

Reinsurer ABC has a relatively high exposure to catastrophe risk. Half of its business covers natural catastrophe, which is also the main contributor to the underwriting profit in terms of amount. Therefore, it seems to make sense that premium income planned for CAT should at least be kept at the 2011 level.

However, the profit margin does not reflect the risks the company has taken. Figure 4.2 lists the required capital and RAROC for each business line. As a startup reinsurance company, the available capital of reinsurer ABC is \$250 million at the end of 2011. For simplicity, it is assumed 50 percent of the reinsurance contracts will expire on Dec. 31, 2011, which has a required capital of \$72 million. At the beginning of 2012, out of \$250 million available capital, \$72 million is used to support existing business and \$178 million can be used to support new business activities.

²⁵ Profit margin = Underwriting profit/premium

Figure 4.2 Return and Required Capital as of Dec. 31, 2011 (USD million)

Year 2011	Premium	Required capital ²⁶	PV (required capital)	[PV (underwriting profit) + PV (invest. income on capital)] × (1-t)	RAROC
Auto liability ²⁷	10	5	10	1.8	18%
Specialty liability	15	10	20	3	15%
CAT	50	125	250	15	6%
Homeowners/farm owners	25	20	40	1.6	4%
Company	100	144	289²⁸	21.4	7.4%

Reinsurer ABC's risk appetite statement is as follows:

1. Economic capital adequacy: The company has sufficient economic capital with a probability of 99.95 percent (available economic capital is no less than the required economic capital in a 1-in-2,000-year event).
2. Economic earning volatility: Reinsurer ABC has a long-term target 10 percent RAROC (hurdle rate) over the cycle. The company does not want to see drops in earnings by more than 40 percent in a 1-in-20-year event. In other words, the company should earn at least 6 percent RAROC with a probability of 95 percent.

At the end of 2011, required capital (\$144 million) is less than available capital (\$250 million), which implies the company's capital position is consistent with risk appetite. Reinsurer ABC earns 7.4 percent in 2011, which is much less than the target of 10 percent but above the limit of 6 percent. This is something to be improved upon.

Before determining the new business mix in 2012, another important decision to be made is whether the premium rate needs to be adjusted. Premium adjustment will change the view of profitability and capital requirement. In this case study, it is assumed the company is operating close to the average level of RAROC in the industry for each individual business line. The activities with RAROC in excess of the hurdle rate create shareholder value, while those below the hurdle rate deplete shareholder value.

Comparing figures 4.1 and 4.2, another interesting finding is that the line exposed to CAT has the second lowest RAROC while its statutory profit margin is the highest. This line produces

²⁶ Required capital here is the 99.95th percentile of loss distribution, the mean loss under the economic framework. The correlation among all the product lines is assumed to be 50 percent for illustration purposes.

²⁷ The four business lines (auto liability, specialty liability, commercial multi-peril and homeowners/farm owners) are chosen to be the same as the product lines studied in Nakada, et al., "P&C RAROC: A Catalyst," 15. The industry average RAROC information (Exhibit 14, Page 15) available in the study was referred to in the case study.

²⁸ The company level PV(Required Capital) takes into account diversification benefit. Therefore the total amount is lower than the sum of line figures.

a much higher return most of the time given that catastrophe has low frequency but high severity. However, when a catastrophe event happens, the loss is significant.

As a new company, the board of directors wants to maintain a minimum 20 percent premium growth rate. The 2012 new business mix plan needs to address the following:

- The economic capital adequacy requirement needs to be met. Capital available for new business is \$178 million.
- The overall target RAROC of 10 percent needs to be met.
- Long-term client relationships need to be maintained; therefore, reducing undesired lines of business needs to be gradual.
- The new business projection should also consider the phase of cycles for different lines of business (hard market²⁹ or soft market³⁰).
- Other constraints mentioned in section 2 such as appetite for catastrophe risk and concentration risk need to be assessed.

A relative shift from CAT and homeowners/farm owners to auto and specialty liability business is planned to increase expected RAROC and efficiency in the use of capital. It is predicted that 2012 will be a soft market so there is no rate increase and a profitability increase is expected. A 45 percent increase in premium income is targeted.

Figure 4.3 2012 New Business Plan (USD million)

2012	Premium	Required capital	PV (required capital)	[PV (underwriting profit) + PV (invest. income on capital)] × (1-t)	RAROC
Auto liability	50	25.0	50.0	9.0	18%
Specialty liability	30	20.0	40.0	6.0	15%
CAT	45	112.5	225.0	13.5	6%
Homeowners/ farm owners	20	16.0	32.0	1.3	4%
Company	145	148.4	296.8³¹	29.8	10.0%

Expected RAROC is 10 percent for 2012 new business and the required capital is \$148.4 million, which is less than the available capital for new business.

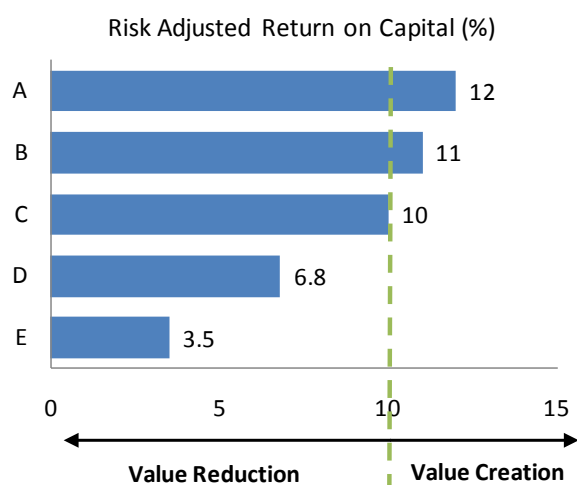
²⁹ A hard market comes after a catastrophic event when the price of insurance coverage and demand increases.

³⁰ A soft market happens several years after a big catastrophe, when the event has been gradually forgotten and competition increases. The price of insurance coverage goes down and there is less demand in the market, thus less margin.

³¹ See footnote 30.

Step 2: Total premium target of 2012 for each business unit

Figure 4.4 2011 RAROC for Each Business Unit



Business Unit	Required EC ²⁹ (\$MM)	RAROC (%)	Excess Return (%) (RAROC - hurdle rate)
A	30	12.0	2.0
B	40	11.0	1.0
C	20	10.0	0.0
D	45	6.8	-3.2
E	50	3.5	-6.5
Company	144	7.4	-2.6

Business units A and B add value to the firm. Their RAROCs of 2011 business exceed the prespecified hurdle rate of 10 percent. On the other hand, BUs D and E reduce shareholder value. BU C earns the rate at the average level in the market.

It is implied that from the perspective of capital efficiency, more capital needs to be allocated to BUs A and B relative to BUs D and E to support more business expansion.

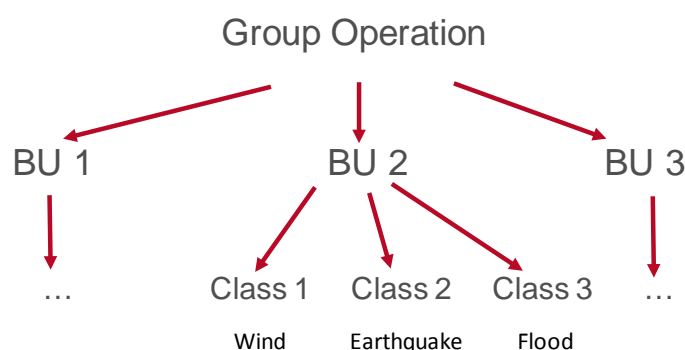
³² Required capital here is 99.95th percentile of loss distribution, the mean loss under the economic framework. The correlation among business units is assumed to be 50 percent for illustration purposes.

5 Risk Appetite and Capital Allocation

Capital available to a firm is not inexhaustible. Generally, capital should be employed to generate enough return for shareholders on a sustainable basis. The level of required return is determined by the level of risk taken. Otherwise, the share price of the firm will underperform that of competitors.

Companies need to allocate capital to different risk types, business lines and business units. Below is an example for a top-down capital allocation structure.

Figure 5.1 Capital Allocation Structure



The company has three business units and each business unit can write coverage for damages caused by wind, earthquake and flood.

In some cases, companies allocate capital based on a statutory framework or rating agencies' capital models. The appropriateness of those approaches highly depends on the regulatory rules or rating agencies' rules.

- Under a statutory framework, regulatory rules build conservatism into calculating reserves and specify the amount of required capital needed to remain solvent. Although a certain degree of the provision for adverse deviations (PAD) of reserving assumptions is used, it is hard to get a clear idea of how well the PAD can protect from the risks being taken. Regulatory required capital frameworks vary significantly across the world. Such frameworks compare businesses from different regions using the same criteria. Most statutory regulations adopt factor-based models where the factors are prescribed by the regulator. However, the lack of required granularity in those models may lead to an inaccurate estimation of the risk exposure. Those may be improved significantly after the implementation of the Solvency II framework in Europe and the adoption of more principal-based reserve methods.
- Rating agencies' models are very helpful in understanding the requirement to maintain the

target credit rating. However, like statutory frameworks, the model cannot cater to all the idiosyncratic characteristics of the business.

- Both statutory and rating agencies' capital models are prescribed and cannot reflect the view of the board of directors and senior management.

Economic capital framework was chosen by many insurance companies for efficient capital allocation after realizing the disadvantages of using the statutory capital model or rating agencies' capital model. It provides a platform to compare and select business opportunities from different business lines, risk types and geographic regions. However, relying on economic capital framework alone is not practical as the company still faces the constraints of regulators and rating agencies.

Risk appetite takes into account the specifics of the business, the investors' risk tolerance and all the constraints. It provides the guideline for capital allocation with the board's risk tolerance (CaR, economic capital adequacy and EaR). The explicit statement of the probability of loss and associated maximum loss amount facilitates capital allocation decisions.

Capital allocation is highly correlated with new business plans. A new business plan deviating from current capital allocation actually changes the future capital allocation. The example of a new business mix in section 4 also applies to capital allocation except that only new business is considered. It explains how to make decisions to meet the RAROC target (an economic measure) and have economic capital remain sufficient. The following case study, based on the one in section 4, highlights a situation where a rating agency's capital requirement constrains fast growth.

Case study

Reinsurer ABC has a target financial strength rating of AA. The rating agency's capital model shows that a 45 percent premium income growth in 2012 will make required capital at the AA rating greater than the available capital. Considering that the company needs to hold a buffer of 50 percent annual net income on top of the required capital at the AA rating, the maximum allowable premium income growth in 2012 is 30 percent. A revised new business plan including capital allocation according to required capital is given below.

Figure 5.2 Revised 2012 New Business Plan (USD million)

2012	Premium	Required capital	PV (required capital)	[PV (underwriting profit) + PV (invest. income on capital)] × (1-t)	RAROC
Auto liability	44.8	22.4	44.8	8.1	18%
Specialty liability	26.9	17.9	35.9	5.4	15%
CAT (catastrophe)	40.3	100.9	201.7	12.1	6%
Homeowners/farm owners	17.9	14.3	28.7	1.1	4%
Company	130	133.0	266.1³³	26.7	10.0%

Some of the considerations embedded in risk appetite framework are important to capital allocation too. They are necessary for aligning capital allocation with risk appetite.

Available capital versus required capital

If the total available capital is much greater than the total required capital, the company can reduce the available capital (dividend payment to shareholders or share buyback) and/or take up more business opportunities (increase the size and/or risk of the business).

If the total available capital is lower than the total required capital, the company has to take actions to increase available capital (raise additional capital from shareholders or the market, perhaps by issuing preferred stocks) and/or reduce the required capital (reduce the size or risk of the business).

The role of diversification in capital allocation

Diversification benefit happens in many places. For a given product, there is diversification between different risk categories it is exposed to, such as between insurance risk and financial risk. Within a business unit, there may be diversification among different products, such as diversification between life insurance products and annuity products regarding mortality risk and longevity risk. There also exists diversification across different types of business at a higher level, such as diversification benefits between general insurance business and financial service business.

For capital allocation, available economic capital allocated to business units should be based on the required economic capital after diversification benefits. Business units providing significant diversification benefits to the group are preferred for extra capital allocation due to the relatively lower marginal cost of capital.

³³ See footnote 30.

Capital fungibility

Capital is assumed to be freely mobile among different legal entities in the examples. If one entity has insufficient capital, the capital can be moved from other legal entities with sufficient excess capital. In the real world, it is not always true and subject to regulators' approval. Entities accumulate their retained earnings to build up the capital. The easier and normal way to transfer capital is paying the parent company in the form of dividend. If capital is not easy to transfer between entities, the diversification benefit is reduced.

6 Risk Appetite and Liquidity Management

Liquidity is "the ability to fund increases in assets and meet obligations as they come due."³⁴ Liquidity risk can be described as "the measure of probability that a company's cash resources will be insufficient to meet current or future cash needs."³⁵ When a liquidity event occurs, the loss will happen via transaction cost, interest payments on borrowings and market impact of fire sale. Bankruptcy costs may also occur when mass lapses take place together with a credit rating downgrade.

Appetite for liquidity risk defines the liquidity risk tolerance and, therefore, appropriate cash levels held in the company's asset allocation. Liquidity risk management without a clearly defined and stated guideline usually leads to oversimplified rules and/or an overconservative strategy if a prudent policy is adopted. Liquidity management policies without risk appetite consideration could include:

- Cash balance is no less than the maximum weekly cash payment in the past three months.
- Cash balance is no less than Y times the maximum daily cash payment in the past month.
- Liquid assets cannot be less than 50 percent of the total asset balance.

While these kinds of liquidity policies protect the companies to a certain extent, they come at the cost of earning a lower yield on those liquid assets. However, the underlying risks may not be identified. The risks are caused by both the liability structure and the exogenous market changes.

Appetite for liquidity risk is often stated as:

- The company maintains liquidity in a 1-in-200-year event over a time horizon of three months.
- The company maintains liquidity at the confidence level of 95 percent while the liquidity cost to meet cash payments at the confidence level of 99.5 percent (1 in 200 years) is less than 25 percent of capital.

³⁴ BCBS, "Sound Practices," 7.

³⁵ CRO Forum, "Insurance Risk Management," 12.

Those quantitative statements, of course, need a bottom-up analysis to figure out the major liquidity requirements, the risks that will increase the liquidity requirement dramatically, the market impact on available liquidity and the way to position the company.

With appetite for liquidity risk in place to protect companies from severe events like a credit crisis or credit rating downgrade, it will also constrain strategic planning in the following ways:

- When planning for new business sales, the impact on required liquidity would have to be quantified so it can be verified that the overall liquidity position remains consistent with risk appetite. This also includes identifying new factors related to the new business that might largely change the liquidity requirement.
- Strategic capital management will also be impacted as decision makers need to keep liquidity requirements in mind when allocating capital to different risks, business units and business lines.
- Strategic asset allocation should consider the liquidity of assets and the likely liquidity cost if immediate liquidation is required under stress scenarios.

Case study

In this section, we will provide an example of how the appetite for liquidity risk can be established and linked with strategic planning. Note that the bottom-up liquidity risk analysis is a critical tool and beneficial to both risk appetite setting/updating and strategic planning.

Company ABC needs to maintain a liquidity level to meet payment requirements for a 1-in-200-year event for a continuing period of three months.

Available liquidity

The company's assets are classified into three tiers with respect to liquidity risk management:

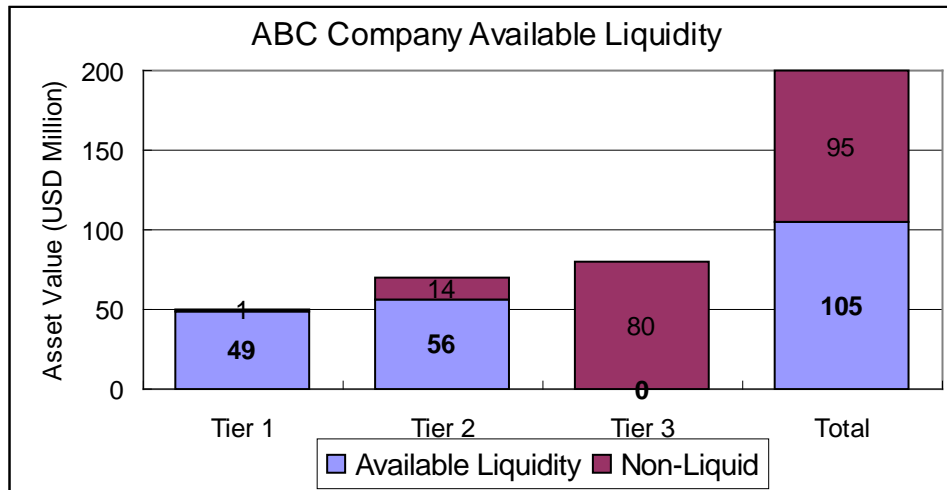
- Tier 1: highly liquid, like cash and government bonds
- Tier 2: liquid, like bond coupons and redemption, equity dividends, rental income, etc.
- Tier 3: not liquid. Selling those assets or cash flows might lead to big market impact and significant liquidity cost.

Available liquidity = 98% Tier 1 assets + 80% Tier 2 assets.

Here the haircuts on Tier 1 (2 percent) and Tier 2 (20 percent) assets are based on capital market condition.

Figure 6.1 shows ABC company's available liquidity. Out of a \$200 million asset value, there is \$105 million available liquidity.

Figure 6.1 Available Liquidity



Required liquidity

Required liquidity measures the required cash payment for a certain period (three months) in a severe event (1-in-200-year event). It is composed of, but not limited to, the following components:

- Credit rating downgrade impact: the additional cash payment requirement due to a credit rating downgrade caused by either overall market chaos or idiosyncratic reason. Insurance companies normally experience an unexpected mass lapse if downgraded. It can be estimated based on past credit crisis experience. If the company's own experience is not available, industry experience is a good source to estimate the impact.
- Normal operational cash flow volatility. Historical company data would be the most appropriate sources to use for the analysis. For example, weekly historical data of net cash flow (benefit outgo + expense – premium income for an insurance company) can be used to fit to a distribution. The 99.5th percentile can be calculated either from historical data directly or from fitted distribution. Distribution fitting may better capture tail events when the history of available experience data is not long enough.³⁶ The historical data should be adjusted to exclude the period when a credit rating downgrade occurred and/or when there was a sharp increase in the interest rate as those two factors are assessed separately from cash flow volatility.

Figures 6.2 and 6.3 provide an example of historical weekly data and some fitted distributions. To use some fat-tailed distribution types such as lognormal, the historical data are shifted to the right to be all positive, so that lognormal distribution and other fat-tailed distribution types can be used. The fitted data are then shifted back to the left.

³⁶ For example, 99.5th percentile needs at least 200 data points to have an estimate based on the worst one. If there are only 100 data points, distribution fitting would be more appropriate.

Figure 6.2 Probability Density Function
— Shifted weekly net cash flow data

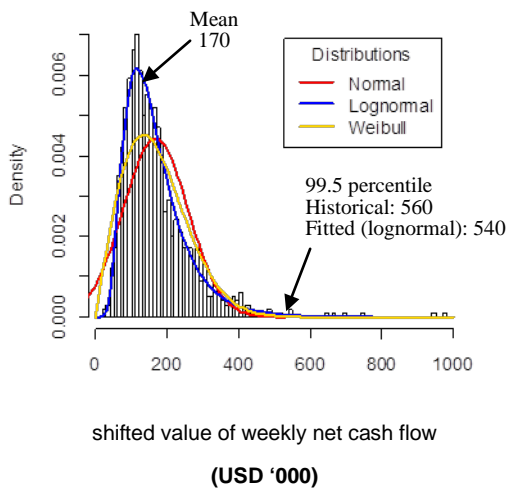
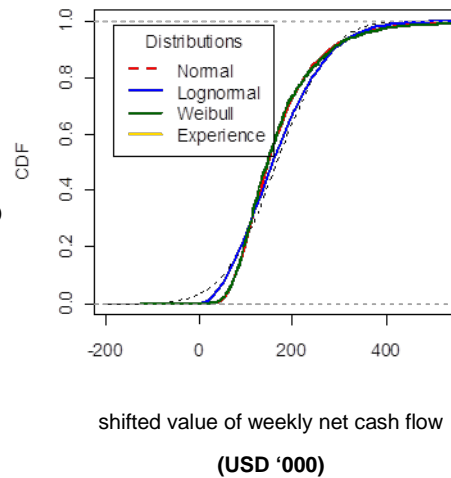


Figure 6.3 Cumulative Density Function
— Shifted weekly net cash flow data



Subtracting the mean \$170,000 from the 99.5th percentile (\$540,000 based on fitted lognormal distribution), the 1-in-200-year event will require \$370,000 extra liquidity on top of the expected value.

Weekly data analysis needs to be extended as a three-month period is being considered. Two approaches might be used to get a reasonable estimation.

- Conservative approach: $3 \times 4.345 \times \text{weekly results} = \4.82 million . Here 4.345 is the average number of weeks per month.
- Assume it follows the Wiener process (aka, Brownian motion):

$$\sqrt{3 \times 4.345} \times \text{weekly results} = \$1.34 \text{ million}.$$

- Catastrophe risk (CAT risk): Stress test the business portfolio using some extreme events that occurred before, like the 2011 Japan earthquake and the 1918 Spanish flu pandemic. Calculate the required benefit payment under those stress scenarios.
- Funding commitments such as private equity investment or real estate investment.
- Interest rate risk: Assess the impact on both the interest rate risk sensitive products and asset values when there is a significant increase in the new money rate. Normally, increased lapse activity and a drop in asset value will be seen. This can create additional liquidity requirements and realized losses due to asset liquidation at a depressed price.
- Adverse mortality and morbidity experience. Sometimes, actual claim experience may deviate a lot from pricing assumption, especially for new markets, new products and new features added to existing products. Actual claim experience is an important component of required liquidity for start-up companies that do not have much credible experience.

- Correlation among the above factors. The diversification benefit is a very important assumption in determining the appropriate required liquidity level. Being too conservative may hinder business due to the cost of maintaining a high liquidity level, such as low investment return. Being too risky may lead to a position exceeding the risk tolerance. Detailed research based on market data and reference to industry standard and peers is essential to determine the appropriate correlation assumption. Industry standards have many sources such as the CFO forum,³⁷ CRO Forum and Solvency II.

In this example, we use the following correlation matrix to calculate the diversification benefit.

Figure 6.4 Illustrative Correlation Matrix

Correlation Matrix	Downgrade Risk	Normal Net Cash Flow Volatility	Catastrophe Risk	Funding Commitment	Interest Rate Risk	Insurance Risk
Downgrade Risk	1	0.4	0.4	1	0.5	0.4
Normal Net Cash Flow Volatility	0.4	1	0.2	1	0.4	0.2
Catastrophe Risk	0.4	0.2	1	1	0.4	0.2
Funding Commitment	1	1	1	1	1	1
Interest Rate Risk	0.5	0.4	0.4	1	1	0.4
Insurance Risk	0.4	0.2	0.2	1	0.4	1

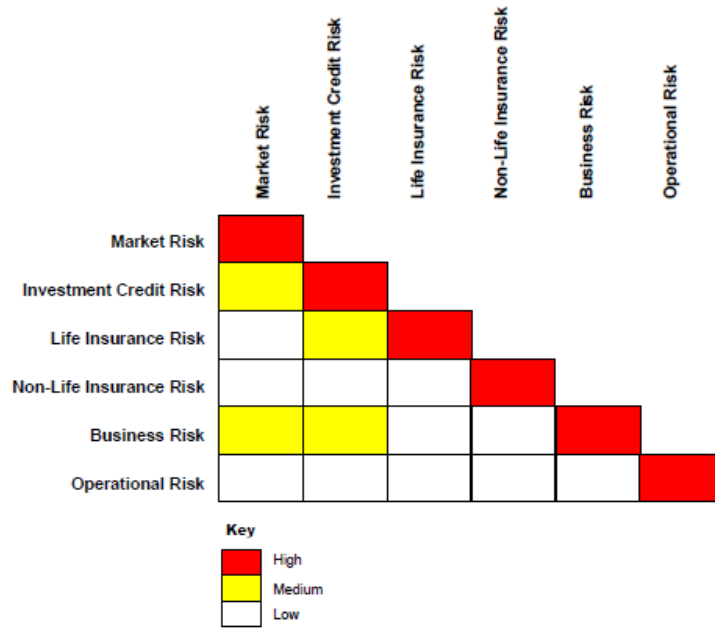
Below is a brief explanation of the correlations.

- Interest rate risk and downgrade risk have a medium correlation of 50 percent. When a downgrade happens in a credit crisis, bond yields will normally increase as the credit spread widens. A medium correlation is set to be consistent with CRO Forum recommendations, such as for portfolios with short durations (which is the more common situation), and a correlation of 0.5 seems to be appropriate; whereas for a portfolio long in duration, a correlation of 0 would be appropriate (conservative assumption).³⁸
- Insurance risk has a medium correlation with financial risks (market and credit) of 40 percent. It is at the high end of the range suggested by the CRO Forum.

³⁷ The European Insurance CFO Forum (CFO Forum) is a high-level discussion group formed and attended by the chief financial officers of major European listed, and some nonlisted, insurance companies. Its aim is to influence the development of financial reporting, value-based reporting and related regulatory developments for insurance enterprises on behalf of its members, who represent a significant part of the European insurance industry. <http://www.cfoforum.nl/index.html>.

³⁸ CRO Forum, "Calibration Recommendation," 6.

Figure 6.5 Recommended Correlation Matrix by CRO Forum



Source: The Chief Risk Officer Forum, "A Framework," 18 and 19.

Note: High correlation: 0.75~1; medium correlation: 0.40~0.75; low correlation: 0.0~0.40

- Funding commitment is an add-on item. These are scheduled events and very predictable.
- Correlation within insurance risk is as low as 20 percent. In the fifth quantitative impact study on Solvency II,³⁹ the following correlation matrix is specified for a life underwriting risk module. A general 20 percent assumption is a reasonable value compared to the one used in QIS5.

Figure 6.6 Correlation Matrix in QIS5

	Mortality	Longevity	Disability	Lapse	Expenses	Revision	CAT
Mortality	1						
Longevity	-0.25	1					
Disability	0.25	0	1				
Lapse	0	0.25	0	1			
Expenses	0.25	0.25	0.5	0.5	1		
Revision	0	0.25	0	0	0.5	1	
CAT	0.25	0	0.25	0.25	0.25	0	1

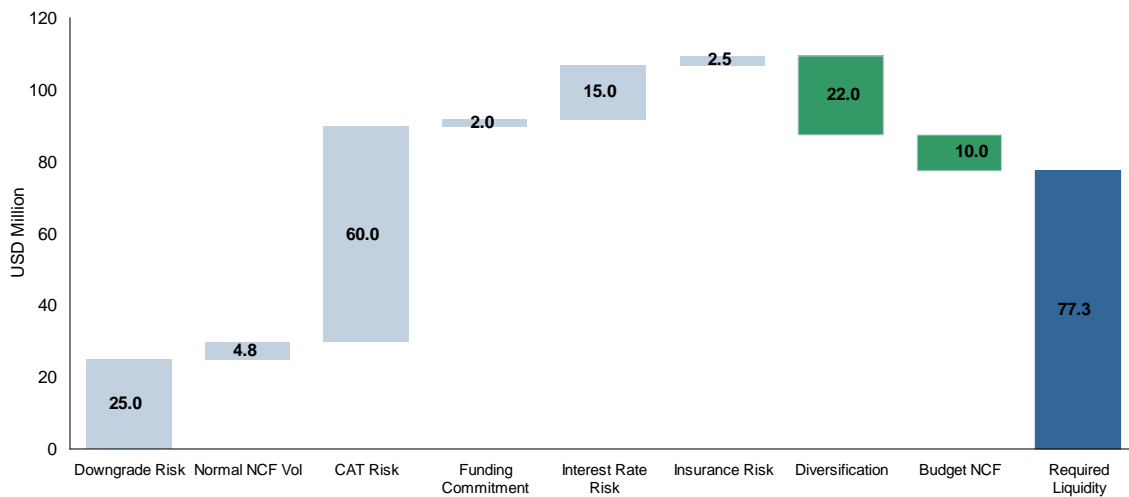
Source: CEIOPS, "QIS5 Technical Specifications," 148.

³⁹ CEIOPS, "QIS5 Technical Specifications," 148.

- Budget net cash flow (NCF) within the time horizon. This is an offset of required liquidity for a mature company unless there is significant expansion that overwhelms the contribution from in-force business.

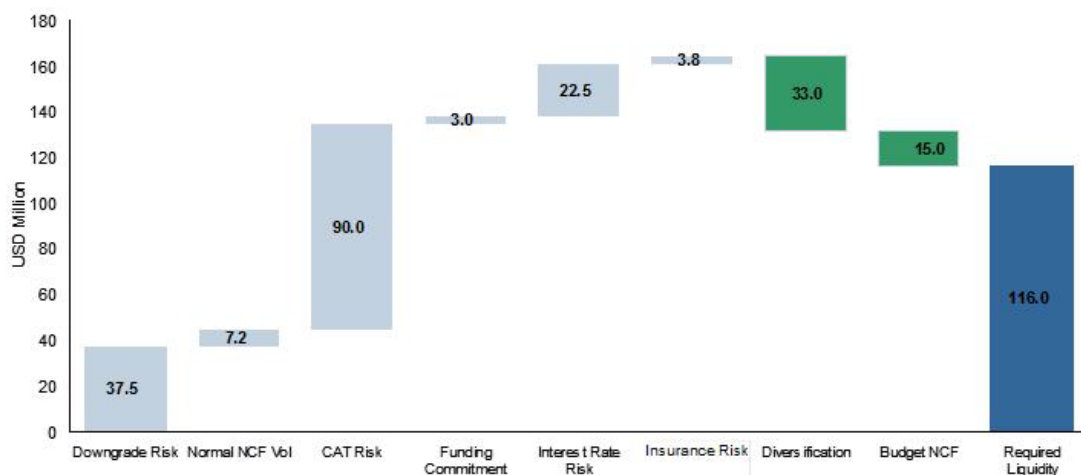
Here two scenarios of required liquidity that will help illustrate how liquidity requirements could influence strategic planning are presented.

Figure 6.7 Scenario 1: Required Liquidity



Required liquidity (\$77 million) < available liquidity (\$105 million). The current liquidity level meets the requirement of liquidity risk appetite with a margin of \$28 million. As the buffer is not trivial, switching some liquid low-yield assets to less liquid high-yield assets gradually to enhance investment income can benefit both policy- and shareholders.

Figure 6.8 Scenario 2: Required Liquidity



Scenario 2 has required liquidity before budget NCF at 50 percent more than that of scenario 1. Required liquidity (\$116 million) > available liquidity (\$105 million). Under this scenario, the current available liquidity is below the level implied by the risk tolerance. Downgrade,

interest rate and CAT risks are the candidates to reduce liquidity risk exposure. In strategic planning, we might want to:

- Reduce CAT risk by decreasing the underwriting of CAT coverage and/or have it reinsured to reduce exposure.
- Reduce downgrade risk and interest rate risk. Those risks will increase chances and impact of mass lapses. In the new business planning, policies with market value adjustment features are desired.
- Adjust strategic asset allocation to move assets with lower liquidity to assets with higher liquidity gradually.

7 Risk Appetite and Performance Measurement

A healthy risk culture is the key to successfully implementing and gaining from a risk appetite framework. A risk management mandate without the understanding and buy in of management will not create value for the company. Including appropriate key performance indicators (KPI) regarding risk appetite in managers' performance scorecards would encourage people to think in terms of both return and risk when making business decisions. Three types of performance measures can serve this purpose.

- The gap between current risk profile and risk tolerance. This is to make sure the business is safe compared to its risk tolerance. It is reflected at different levels.
 - At the top level, the current risk profile is compared with enterprise risk tolerance to identify major gaps. Group level senior management should be responsible for it.
 - At the risk category level, exposure to each risk category is checked against risk appetite for a specific risk. Risk committees should be responsible. For example, the credit risk management committee needs to evaluate the credit risk exposure. The asset liability management committee needs to be responsible for any significant deviation from the appetite for interest rate risk.
 - At risk limit, or business execution, level, risk management committees and risk-taking departments are responsible for the monitoring. For example, market risk management and the chief investment office's performance scores will be deducted if the equity VaR exceeds the limit.
- Risk-adjusted return: for example, actual risk-adjusted return on capital (RAROC) vs. expected RAROC.
- Risk-adjusted value: for example, actual economic value added vs. expected economic value added.

A few examples regarding how to set risk limits and perform risk monitoring against them were discussed in section 2.5. In the following case study, we will focus on risk-adjusted return and risk-adjusted value. The most difficult part of embedding these types of performance measurements in the management's scorecard is how the appropriate performance target can be determined and how the deviation of actual results from the target

can be explained. Management cannot control the system risk and the financial market movement. Therefore, it is not reasonable to penalize them for this. A consistent, reasonable and well-accepted performance measurement framework would have to address these issues.

In recent years, banks have increasingly adopted economic profit measures such as RAROC and economic value added (EVA). It encourages senior management to take opportunity cost of capital into consideration and maximize shareholder's value given their risk appetite.

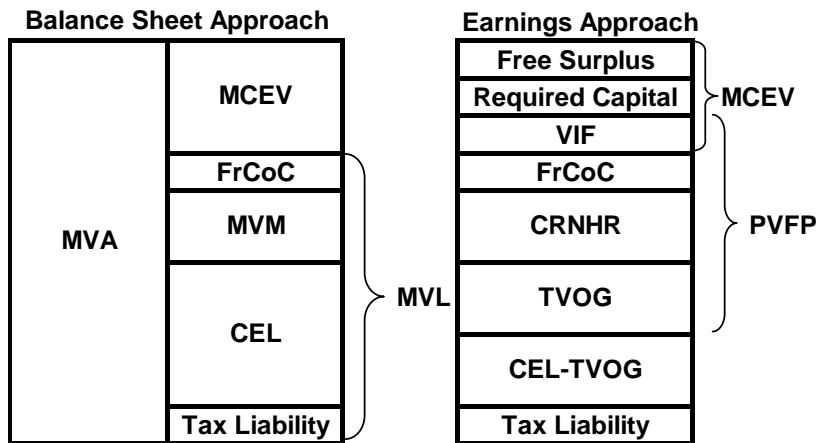
Different functions in a company are held responsible for different risk types. Investment is responsible for achieving higher returns than expected. The asset liability management (ALM) committee is responsible for minimizing the gap between asset and liability portfolios. Business management is held responsible for new business growth and gain and loss from nonfinancial risk. In the banking industry, the risk-adjusted value measure EVA is calculated as: $EVA = \text{earnings} - \text{opportunity cost} \times \text{capital allocated}$.

Life insurance companies usually require a longer period than banks before gaining profits. Ideally, the earnings measure is correlated with a value measure used in the insurance industry. MCEV is a good candidate for measuring economic value. According to the definition by CFO Forum, "MCEV represents the present value of shareholders' interests in the earnings distributable from assets allocated to the covered business after sufficient allowance for the aggregate risks in the covered business. The allowance for risk should be calibrated to match the market price for risk where reliably observable."⁴⁰ There are two approaches to calculate MCEV: balance sheet approach and earnings approach.⁴¹

⁴⁰ CRO Forum, "Market Consistent," 3.

⁴¹ More details about the calculation of MCEV and definition of its components can be found at CRO Forum, "Market Consistent."

Figure 7.1 Two Approaches of MCEV Calculation



Notes:

MVA: market value of asset

FrCoC: frictional cost of capital. It reflects the taxation and investment costs on the assets backing required capital.⁴²

MVM: market value margin

CEL: current estimate of liability

MVL: market value of liability. It is equal to CEL + Tax Liability + FrCoC + MVM.

VIF: value of in-force business. It is equal to PVFP – TVOG – FrCoC – CRNHR.

CRNHR: cost of residual nonhedgeable risks. It includes the impact of nonhedgeable, nonfinancial risks and nonhedgeable financial risks and should be presented as an equivalent average cost of capital charge.⁴³

TVOG, aka TVFOG: time value of financial option and guarantees

PVFP: present value of future profit of in-force business

Under an MCEV framework, the opportunity cost of allocated capital has been considered as cost of residual nonhedgeable risks (CRNHR) and frictional cost of capital (FrCoC) due to investment and double taxation costs. However, CRNHR and FrCoC take into consideration all future years' cost of using capital. In performance measurement, the actual earning/cost and expected earning/cost are compared over the measurement period. We can define EVA = MCEV earning – cost of capital for life insurance companies. MCEV earning refers to the change of MCEV from the beginning to the end of the measurement period.

Investment

The task is to build two benchmarks so that we can attribute EVA to different functions: investment, ALM and business management. In section 3, the concept of SAA/TAA and its relationship with risk appetite were discussed. Based on SAA, investment departments can manage an asset portfolio actively as long as the resulting portfolio does not stray outside the allowable range specified by TAA. The investment department targets extra returns by positioning the portfolio based on market movement expectations. For example, when the interest rate is expected to be going down, the investment department may decrease the

⁴² CRO Forum, "Market Consistent," 5.

⁴³ Ibid., 5 and 6.

duration of liability and increase the duration of assets. The investment department may also pick up yields by investing in lower credit rating bonds. Translating into the change of MCEV, it is obvious that an active investment department will change the present value of future benefit and cost of capital⁴⁴ as it also has an impact on required capital. EVA calculation for the investment department could be: $EVA_{inv} = \text{extra investment income over SAA} - \Delta \text{ cost of capital}$.

Business management

The business management function is supposed to focus on new business and nonfinancial risk such as insurance and operation risks. Therefore, a good benchmark should have the following properties:

1. It mimics the liability characteristics as much as possible so if there is a change in the financial market, it will change in the same way as the liability portfolio.
2. The replication is valid for a wide range of market situations.
3. Its value is easy to track.

Replicating the portfolio of liability seems to be a good choice. Sometimes, it is also called a risk-minimizing portfolio. It uses the available liquid assets in the market to replicate the value and sensitivities of liability. Under risk appetite framework, a replicating portfolio is more complicated due to the additional risk-adjusted measures. It needs to replicate the cash flows, economic value (MVL), sensitivities, and the earnings, value and capital requirement under statutory and rating agency frameworks. This is to ensure that for the major quantitative measures used in risk appetite, the replicating portfolio will not deviate from liability too much.

With the replicating portfolio, EVA contributed by in-force business for business management can be calculated as expected return on the liability replicating portfolio + experience gain/loss due to nonfinancial factors such as mortality, expense, morbidity and lapse — cost of capital. Cost of capital is calculated as the cost of capital rate times the required capital consistent with risk appetite. In other words, we take the maximum statutory-required capital, rating agency-required capital at the target credit rating and economic capital as required capital. EVA contributed by new business can be calculated as MCEV of new business at time zero. The following formula summarizes EVA for business management function:

$$EVA_{bus} = \text{MCEV of new business} + \text{expected return on replicating portfolio} + \text{experience G/L} \\ - \text{cost of capital}$$

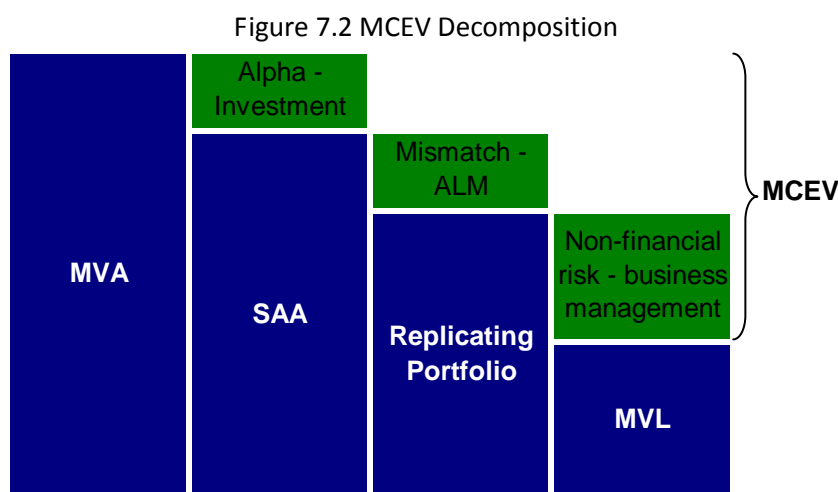
ALM

ALM performance measurement is straightforward now. The return on SAA over the return on a replicating portfolio of liability is attributed to asset liability management. The difference is caused by the mismatch between the asset and liability portfolios.

$$EVA_{ALM} = \text{return on SAA} - \text{return on replicating portfolio}$$

⁴⁴ Cost of capital includes both FrCoC and CRNHR incurred due to the cash flow in a certain period.

If the movement from MVA to MVL is decomposed, the responsibility of different functions can be summarized as below.



In the following case study, an example of how to evaluate investment function, asset liability management function and business management functions is given.

Case study

Life insurance company ABC has been calculating and testing the use of risk-adjusted values to measure the performance of different functions. As the company has a large exposure to market and insurance risks, the focus is on evaluating the investment department, ALM committee and business management. Let's illustrate the EVA calculation with a numeric example.

Figure 7.3 Asset Portfolio (USD million) — Consistent with Strategic Asset Allocation

<u>Asset Class</u>	<u>MVA</u>	<u>Duration</u>	<u>Expected Return</u>
Short-term bond	100	5	3%
Long-term bond	100	20	5%
Total	200	12.5	4%

MVL is \$160 million with a duration of 15 years. It is fully replicated with the fixed income portfolio with a duration of 15 years and value of \$160 million. The expected return of the replicating portfolio is 4 percent.

The investment department has an expectation of the bond yield curve flattening. The medium-term interest rate is expected to increase and the long-term interest rate is expected to decrease. Within the allowable range specified by tactical asset allocation, a \$10 million short-term bond is sold for long-term bond investment. During the measurement period, the five-year interest rate increases by 1 percent and 20-year interest rate decreases by 1 percent. The 15-year interest rate decreases by (1/3) percent. The expected change in asset value of the SAA portfolio is calculated as:

$$\sum_{i=1}^2 MV_i \cdot -\Delta r_i \cdot D_i = -100 \cdot 1\% \cdot 5 + 100 \cdot 1\% \cdot 20 = 15$$

MV_i : market value of asset class i

r_i : interest rate of asset class i

D_i : duration of asset class i

The actual asset value after active management using the same formula above is:

$$\sum_{i=1}^2 MV_i \cdot -\Delta r_i \cdot D_i = -90 \cdot 1\% \cdot 5 + 110 \cdot 1\% \cdot 20 = 17.5$$

After interest rate change,

$$MV_1 = 90 - 90 \cdot 1\% \cdot 5 = 85.5$$

$$MV_2 = 110 + 110 \cdot 1\% \cdot 20 = 132$$

$$MV_{total} = MV_1 + MV_2 = 217.5$$

Asset duration changes to:

$$\sum_{i=1}^2 W_i \cdot D_i = 14.1$$

W_i : weight of asset class i

$$W_1 = MV_1 / MV_{total} = 85.5 / 217.5 = 39.3\%$$

$$W_2 = MV_2 / MV_{total} = 132 / 217.5 = 60.7\%$$

This active management behavior benefits company ABC in two ways:

- Positive investment income over SAA = $17.5 - 15 = 2.5$.
- Decrease in cost of capital. Asset duration increases from 12.5 to 14.1. The duration mismatch is reduced from 2.5 years to 0.9 year. It will reduce the required capital to support asset liability mismatch risk. Assume the cost of capital rate is 4 percent and the reduction in required capital is \$20 million. The decrease in cost of capital is \$0.8 million ($4\% \cdot 20$).

$$EVA_{mv} = \text{extra investment income over SAA} - \Delta \text{ cost of capital} = 2.5 - (-0.8) = 3.3$$

As the 15-year interest rate decreases by (1/3) percent and MVL is 160, change in MVL is calculated as $(MVL)(-\text{change in interest rate})(\text{duration of liability}) = (160)((1/3)\%)(15) = \8 million. Therefore, EVA for ALM function is calculated as:

$$EVA_{ALM} = \text{return on SAA} - \text{return on replicating portfolio} = 15 - 8 = \$7 \text{ million}$$

Further assume the following experience:

- During the measurement period, the market consistent embedded value of new business underwritten is \$10 million.
- The experience of nonfinancial risk has no deviation from the best-estimate assumption.

As calculated above, return on the replicating portfolio due to the shock of the interest rate is \$8 million. However, it is 100 percent offset by the increase in MVL and should not be included in EVA for the business management function. Expected return on the replicating portfolio is the expected 15-year interest rate (4 percent) times MVL. The maximum of statutory-required capital, rating agency-required capital and required economic capital at the desired probability is assumed to be \$40 million. Cost of capital is (cost of capital rate)(required capital) = (4%)(40) = \$1.6 million. EVA for business operations is calculated as:

$$\text{EVA}_{bus} = \text{MCEV of new business} + \text{expected return on replicating portfolio} + \text{experience G/L} \\ - \text{cost of capital} = 10 + (4\%) \times (160) + 0 - 1.6 = \$14.8 \text{ million}$$

Another important step in performance measurement is to set the appropriate EVA target. This should be consistent with strategic planning. After the strategic and business plans are decided, the expected EVA can be set as the target. Realized EVA is compared with expected EVA to evaluate the performance of different functions.

At this point, a risk-adjusted value framework is established for performance measurement. However, this is the simplest part. The most difficult part of introducing a risk-adjusted measure to the performance scorecard is communication with the management team and getting their buy in and agreement on all the assumptions used in the determination of the EVA target. Interactive workshops with senior management from business units and core departments are necessary to help them understand EVA and the assumptions and calculation methods used. Without fully understanding how it is calculated, it is hard to persuade people to accept linking it with their compensation. With full understanding and buy in, management is better able to make business decisions under a risk-adjusted return/value framework. The communication is a long and lasting process. Gradually selling the idea to the management team will have a long-term and beneficial impact on business management and risk culture.

8 Conclusion

Regulators and rating agencies have been emphasizing the integration of risk appetite and business strategy for quite a few years. A disconnect between the company's risk appetite and business strategy was not uncommon, as has been seen since the financial crisis in 2008. Strategic decision making is very critical in managing and developing business. Awareness of the risks embedded in these planned business activities will improve the process as demonstrated in the paper. A risk appetite framework provides a holistic picture of the company's willingness and ability to take risk. It can improve strategic planning from two perspectives:

- It embeds the risk perspective in decision making and therefore may reduce the chance of making bad and risky strategic decisions that the company, the regulator or the market are

not ready for.

- Its analysis of the risk/reward tradeoff and quantification of their impact on capital position and earnings may make it easier for senior management to make better decisions.

Risk appetite influences business decisions almost everywhere. It also changes the way business is managed. More focus is put on the overall impact of these decisions on the company's solvency, earnings and risk-adjusted value. This is clearly demonstrated in the case studies. The examples in the case studies have a focus on quantitative analysis. When incorporating risk appetite framework in making strategic plans, qualitative perspective and quantitative perspective are equally important. Though quantitative analysis provides more detailed information, model risk and assumption setting are always a challenge.

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