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Risk Management: The Total Return Approach and Beyond

by Thomas S.Y. Ho

Risk management for insurers is quite distinct from that for the trading floors. The main differences arise from the insurer's liabilities. They are in general long dated and illiquid with no secondary markets and some of their risks cannot be replicated or hedged. As a result, the management of the liabilities tends to be based on book value. The management performance metrics are not based in on marking to market value, but on performance over a much longer time horizon. For these reasons, "enhancing the equity" based on marking to market or over a short-term horizon can no longer be used as the performance metric. VaR approach has to be extended to the management of insurance liability before it can be useful; and, to date, managing the VaR risk of the "equity" of an insurer's balance sheet is often not considered relevant in practice.[1]

This paper discusses the risk management approaches of insurers. I will describe some of the current practices of the total return approach. Then I will describe how the total return approach is used in managing risks as a process. Finally, I propose a model that takes future sales into consideration and determines the appropriate fair valuation method of an ongoing business. The methodology enables us to determine the goal of managing the risk on an enterprise level, taking other performance metrics like earnings at risk, into account.

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A. Risk Management Practice for Life Companies: the Total Return Approach

There is no one standard approach to risk management for life companies in practice. Different insurers have their methodologies and procedures in managing risk. On the one hand, there is regulation in place to ensure that insurers comply with the adequacy of their assets in supporting their liabilities. This regulation is called cash-flow testing. Such a risk management approach is confined to managing the solvency risk. How should we manage the economic value of the insurer's assets and liabilities?

The total return approach is a risk management process that can be used to measure, monitor, report and manage the assets and liabilities on an economic basis. The total return approach has been described elsewhere (see Ho, Scheitlin and Tam 1995). I will provide a brief summary here. The total return approach can be used as an extension of the cash-flow testing methods.

The approach can use the liability models developed in the cash-flow testing to determine the cash flow of each product under different scenarios. The main difference between the two analyses, cash-flow testing and total return approach, is the use of present value measures in the total return approach versus the use of cash-flow projections in cash-flow testing. By using the present value concept, the analytical results do not depend on future reinvestment strategies. This is because when assets are fairly priced, future investment strategies (buying or selling the assets) would not affect the portfolio value today. And the present value measure for the assets is the same as the market value of the assets. Therefore, the total return approach can analyze assets and liabilities in one consistent framework. The total return approach has four steps: (a) fair valuation of liabilities, (b) determination of the liability benchmark, (c) determination of the asset benchmarks and (d)

[1] *Portions of this article are taken from "The Risk Management of Insurers" by Thomas S. Y. Ho in the* Journal of Investment Management, *forthcoming.*

establish the return attribution process. We now describe them in turn.

a. Fair valuation of liabilities

Fair valuation of liabilities begins with the determination of a pricing curve. The pricing curve is the time value of money curve that is used to discount the liability cash flows. The curve can be the Treasury curve or the swap curve. The cash flows of the liabilities are discounted by this curve to determine the present value of the cash flows. In the cases where the liabilities have embedded options, we use an arbitrage-free interest rate model to determine the interest rate scenarios and we determine the present value of the cash flows. In essence, the method uses the arbitrage-free valuation approach to determine the fair value of the liabilities. As a result, the liability cash flows are valued relative to those of the capital markets. Assets and liabilities are evaluated in one consistent framework. This method has been discussed extensively in other papers. (Ho 2000; Ho, Scheitlin, Tam 1995; Ho and Lee 2003).

As I mentioned in the previous section, the liabilities have characteristics that are difficult to treat like capital market assets. For example, some liabilities have a time to termination of over 30 years, beyond most of the capital market bonds. In these cases, one approach may be to assume that the yield curve is flat beyond a certain maturity to determine the fair value of these liabilities. Therefore the assumptions of the modeling of liability have to be specified, in general.

b. Liability Benchmark

When the liability is first sold to the policyholder, a constant spread is added to the pricing curve such that the present value of the liability is assured to equal the value of the premium of the liability sold. This spread is the option-adjusted spread of the liability and this spread is called the required option-adjusted spread (see Ho, Scheitlin, and Tam 1995.) The financial model of the liability becomes a representation of the actual liability. In particular, the liability model captures the simulated projected cash flow of the liability under different market scenarios. And the market scenarios are consistent with the observed interest rate levels, the interest rate volatilities and other market parameters.

Using the liability model, we then decompose the liability to basic building blocks. For example, we can represent the liability as a portfolio of cash flows with options. These options can be caps and floors. Or they can be swaptions. Such a decomposition may allow management to manage the derivatives separately from the cash flows. This decomposition has been explained in Ho and Chen (1996). For example, Wallace (2000) describes the construction of the liability benchmark in the management of a block of business, which can be decomposed into a portfolio of cash flows and a portfolio of interest rate derivatives.

The liability benchmark captures the salient features of the liabilities in terms of their capital market risks. As a result, the method provides a systematic way to separate the market risks and the product risks, like mortality risk. The separation of these two types of risks enables us to use the capital market instruments to manage the capital market risks embedded in the liabilities and to use actuarial methods to manage the product risks. In sum, the liability benchmark may be a liability financial model or a set of financial models represented by specific cash flows and market derivatives like caps and floors. This liability benchmark replicates the liability in their projected cash flows under a broad range of scenarios. The effectiveness of the liability benchmark depends of on its ability to capture the liability cash flows under stochastic scenarios.

An insurance company may have multiple products and product segments. Therefore, the insurers may have multiple liability benchmarks. These benchmarks have to be revised periodically since the actual liabilities' characteristics may change over time and the bench-

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“In sum, the liability benchmark may be a liability financial model or a set of financial models represented by specific cash flows and market derivatives like caps and floors.”

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marks may become less accurate in replicating the behavior of the liabilities. This revision should be conducted when the liabilities undergo significant changes.

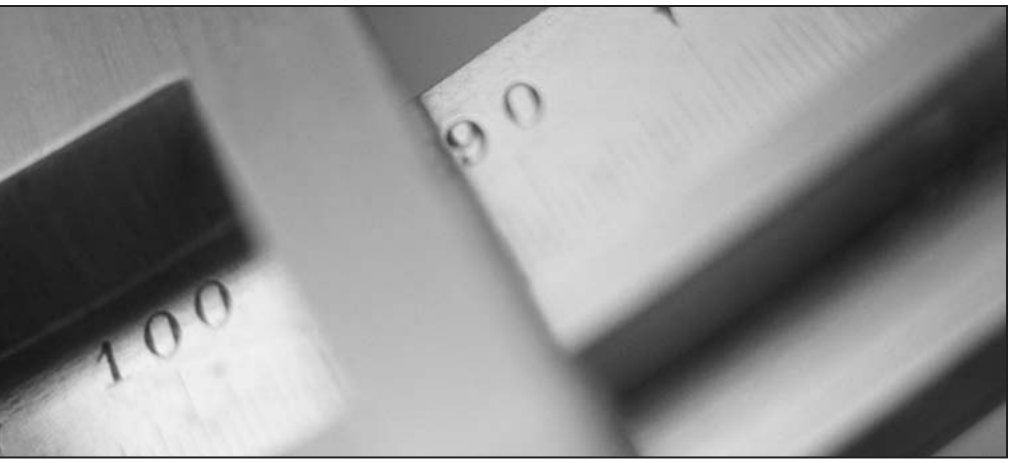
c. Asset Benchmarks

The asset benchmarks are derived from the liability benchmark. There are two types of asset benchmarks: an asset portfolio benchmark and a sector benchmark. The procedure to determine the asset benchmarks for a particular liability benchmark may follow three steps: (1) specify the investment guidelines, (2) construct the asset benchmark, (3) and construct the sector benchmarks.

1. Investment Guidelines

The procedure begins with the senior management laying out some specific guidelines about the appropriate risk that the company is willing to take. These guidelines may reflect the preferences of management and the constraints imposed on the company from outside constituents. A typical guideline may address the four characteristics of an asset portfolio.

Interest rate risk exposure limits can be set by stating the maximum allowable duration mismatch, or key rate duration mismatch, between the liability benchmark and the portfolio benchmark. Further, there may be a maximum exposure of negatively convex assets that may be allowed in the benchmark.



Credit risk exposure limits may be set by the maximum allowable percentage of assets that are categorized as high-yield assets. There can also be a minimum percentage of assets that are rated as "A" and above.

Liquidity in the asset portfolio is assured by the maximum allowable percentage of assets that are considered less liquid (or one could state them as illiquid assets). Assets that fall in this category, for example, are private placement bonds and commercial mortgages.

The senior management of some companies may also place overall broad guidelines on asset allocation—in the form of maximum or minimum allocation to certain specified classes of asset sectors.

Several other factors also affect the overall guidelines. For example, the insurance companies may incorporate the rating agencies' measures of risk, mimic the asset allocation of peer group companies, and take the desired level of capital of the company into account.

2. The Asset Benchmark

The asset benchmark consists of several sector benchmarks (which are described as follows) with appropriate weights to each asset class (which is often referred to as the asset allocation). It represents the mix of asset classes and their weights that will meet the desired needs of the liabilities while catering to the restrictions imposed by the investment guidelines.

The design takes into account the liquidity needs, the duration (or key rate durations) and convexity profile, the interest crediting strategy, minimum guarantees, required spread over the crediting rates and other product features. All of these attributes are not always identifiable

through the liability benchmarks. Therefore, it is important that the design incorporates senior management's perspective on the allowable risk that the company is willing to take. The risk is defined to include the model risks as well as the market, credit and product risks.

The portfolio managers then add specificity to the benchmark by reviewing the requirement/behavior of the liabilities, the desired minimum spread and the guidelines specified by the senior management.

The process of refining the benchmark balances the asset allocation and the duration distribution of the assets within each asset class. The latter defines the duration of the benchmark and consequentially the targeted duration mismatch between the assets and the liabilities.

Therefore, the asset benchmark is an asset portfolio that satisfies all the constraints determined from the analysis of the liability benchmark, the investment guideline and the asset portfolio management preferences.

3. The Sector Benchmark

The sector benchmark is specific to an asset sector or class of an asset (like investment-grade domestic corporate bonds, collateralized mortgage-backed securities, high-yield securities and asset-backed securities). The portfolio manager of each market sector manages the portfolio using the sector benchmark to measure the relative risks and returns of the portfolio. The manager's performances are then analyzed based on the sector benchmarks.

Thus far, we have described an asset benchmark that replicates the characteristics of the liability benchmark. However, if the asset and liability management process does not require immunizing the market risks, then the asset benchmark can be constructed with mismatching asset and liability market risks. For example, some life insurers use a mean variance framework to determine their strategic asset portfolio positions. Other insurers use the distribution of the present value of the cash flows of assets net of liabilities to determine their optimal asset portfolio.

d. Return attribution

Return attribution is concerned with calculating the total returns of the assets and the liabilities and determining the components of the returns. The purpose of breaking down the returns into its components is to detect the sources of the risks and attribute the returns to decisions made in the asset and liability management process. In identifying the impact of the decisions on the insurer's asset and liability combined total return, we have developed a procedure with a feedback effect to the management process.

The return attributions can be calculated as follows. Over a certain time horizon, say one month, we can determine the portfolio total return and the liability total return. The total return of an asset follows the conventional definition, and that is the change in the unrealized profit and loss plus the cash flow (dividends, coupons and actual gain/loss from the disposition of the assets) to the insurer's portfolio over that period. The liability total return is defined analogously. It is defined as the change in the fair value of the liability plus the cash outflows of the liability over the holding period.

Both the total returns of the assets or the liabilities can be decomposed into the basic components. These components are the risk-free returns, the option-adjusted spreads, the key rate duration returns, transactions and cheap/rich changes. Specifically, the total return of the asset portfolio is given by:

$$\Delta r_A = (r + OAS)\Delta t - \sum krd_A(i)\Delta r(i) + e_A$$

And the liability portfolio total return is given by

$$\Delta r_L = (r + ROAS)\Delta t - \sum krd_L(i)\Delta r(i) + e_L$$

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> **In identifying the impact of the decisions on the insurer's asset and liability combined total return, we have developed a procedure with a feedback effect for the management process.**

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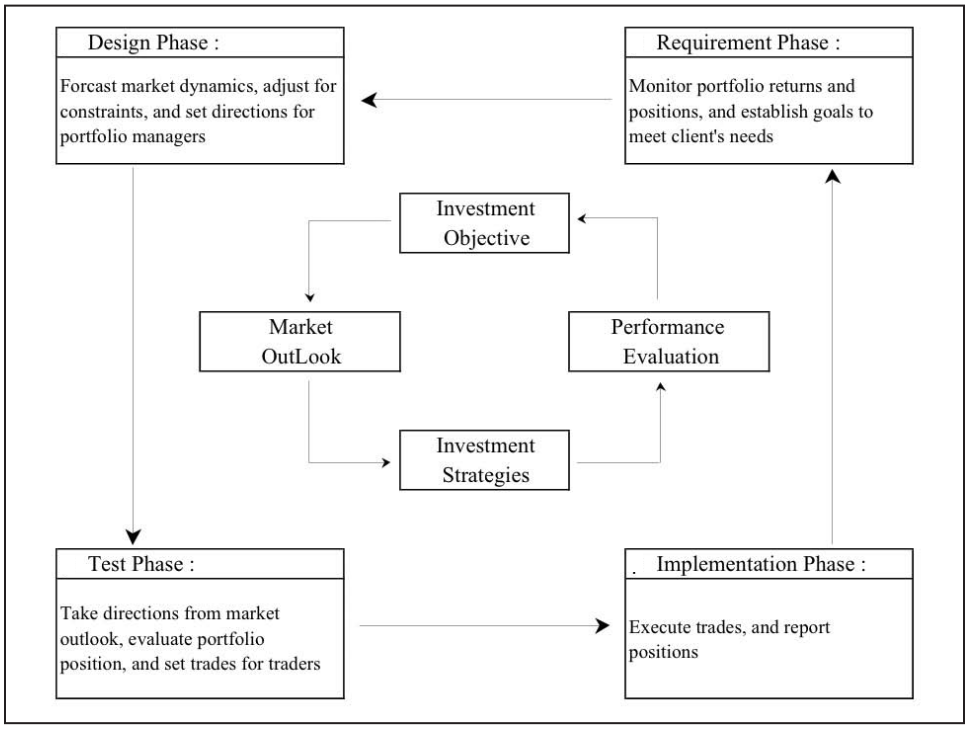
where r is the risk-free rate. OAS is the option-adjusted spread of the asset portfolio. ROAS is the required returns of the liability portfolio. $krd_A(i)$ and $krd_L(i)$ are the key rate durations of the assets and the liabilities respectively. $\Delta r(i)$ is the shift of the ith key rate relative to the forward yield curve. Finally, e_A and e_L are the residuals of the asset total returns and the liability total returns equations respectively. There may be other basic components depending on the asset and liability types. For example, there may be factors explaining the convexity effect and the product risks. For clarity of exposition, I only describe some of the components here. Details are provided in Ho, Scheitlin and Tam (1995).

Product risks are priced by the margins, which are the spreads that are part of the required option-adjusted spreads. And each product risk will be measured from historical experience. Therefore, while the asset benchmark has not incorporated the product risks explicitly, it has taken the margins for the product risks into account. The margins can then be compared with the experience of the product risks to determine the risk and return tradeoff in the pricing of the products.

Figure 1: An Investment Process



An investment cycle describes the process for making investments. There are four "phases of the investment cycle" that will oversee the milestones: the requirement phase, design phase, test phase and implementation phase. Each phase will provide the checks and balances for the following phase. The boxes for investment objective, market outlook, investment strategies and performance evaluation are indicating that they are actions to take one phase to another phase.

B. Beyond the Total Return Approach: Risk Management as a Process

The returns attribution process is becoming more important in asset management. The process relates separate departments requiring the departments to coordinate. Stabbert (1995) describes how such a coordination can be organized. Typically, return attribution, based on total return approach, is not commonly found in liability management. The lack of use of return attribution method in liability management may be explained by the slow adoption of fair value approach to analyze the liabilities. With the recent emphasis on fair value accounting to insurance companies, the return attribution approach may be adopted in the risk management practice in the future.

Risk management considers asset and liability management as a process. In this process, we then can measure the risks and the performance of each phase, and a risk/return trade-off analysis is conducted for each phase of the process. A more detailed description of an investment cycle can be found in Ho (1995) where the management of the organization is discussed.

We can construct asset and liability management as a cycle. It should be clearly organized in

order to monitor each business unit's responsibilities to determine the: asset and liability management objective, market outlook, investment strategies, product management and performance evaluation. There are four "phases of the asset and management cycle" that oversee the process: the requirement phase, design phase, test phase and implementation phase (see Figure 1). Each phase provides the direction for the following phase. The requirement phase establishes the goals to meet the client's needs. This in turn dictates the objective. The design phase sets strategies for portfolio managers, which formulates the market outlook from the investment objective. The test phase uses the market outlook to formulate investment strategies. The implementation phase executes the investment strategies that result in trades and portfolio performances, which completes the investment cycle.

Each phase can be managed separately to assure that each phase's performance ties back to the asset and liability management objectives, a process similar to quality assurance management. For example, we can decompose the risk of the process into the risks of the phases of the cycle so that each risk can be measured separately. In measuring the risk of an investment cycle, risk managers can manage all the phases of the asset and liability process.

Risk managers can implement a more complex investment cycle that will include the design phase of all the proposed business strategies to monitor and adjust the business cycle. The business cycle would enable risk managers to provide risk exposures, risk sources, risk limits and policies, etc. Implementing risk management within a business control cycle would benefit the senior management when it comes to making decisions to optimize the shareholders' value, using all the measures that impact the balance sheet's risk and profitability.

The risk management of investment using a process described above illustrates how enterprise management can be implemented by modeling the business processes of the enterprise. Now we can relate this asset and liability management process to the firm's organization.

The insurer has five departments, which are senior management, ALM Committee, portfolio management, line business and risk management. The responsibilities of each department are given as follows:

(1) Senior management is responsible for the operations of the insurer and setting the insurer's performance targets; senior management includes the management committee that represents the stakeholders' interests.
(2) ALM is responsible for determining the asset and liability structure. For the purpose of this paper, asset and liability management also coordinates with risk management.
(3) The Portfolio management is responsible for investments. Investments include asset allocation, sector rotation and securities evaluation and trading. For most insurers, portfolio management is separated into trading and other functions. The proposed methodology can be used for drilling down to such disaggregated levels.
(4) Line business is responsible for the sale of products.

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(5) Risk management, as mentioned above, is responsible for the management of the process.

The model can be used in a multi-period context. To simplify the explanation, we will present the model as a one-period model. The period refers to the reporting period, which may be one month or three months in length. The model will be used on a prospective basis when it is used for risk management. At the same time, we will also use the model on a retrospective basis when it is used for performance measures.

The model can be used on a retrospective basis for measuring the performance of each department in the process of the commercial banking business. This is accomplished by setting up asset benchmark returns (r_A^*) and liability benchmark returns (r_L^*). The benchmark returns are the returns of portfolios (loans or deposits) based on the average performance determined by senior management. For the assets, this is often accomplished by using some broad-based market index, tilted to reflect the desired risk exposure of that asset and liability management view. Similarly, the liability benchmarks are determined by the liability modeling without assuming significant superiority in knowledge and information of the line of business. The performance of the ALM department depends on the views that the ALM department takes and how their views are reflected by the benchmarks that they establish for each reporting period. Therefore, their performance is measured by the difference of the returns of the asset and liability benchmarks. Specifically, we have:

$$y(ALM)=r_A^* A-r_L^* L$$

where A is the asset value, L is the liability value and $y(ALM)$ is the performance measure. r_L^* and r_A^* are the returns of the liability and asset benchmarks respectively.

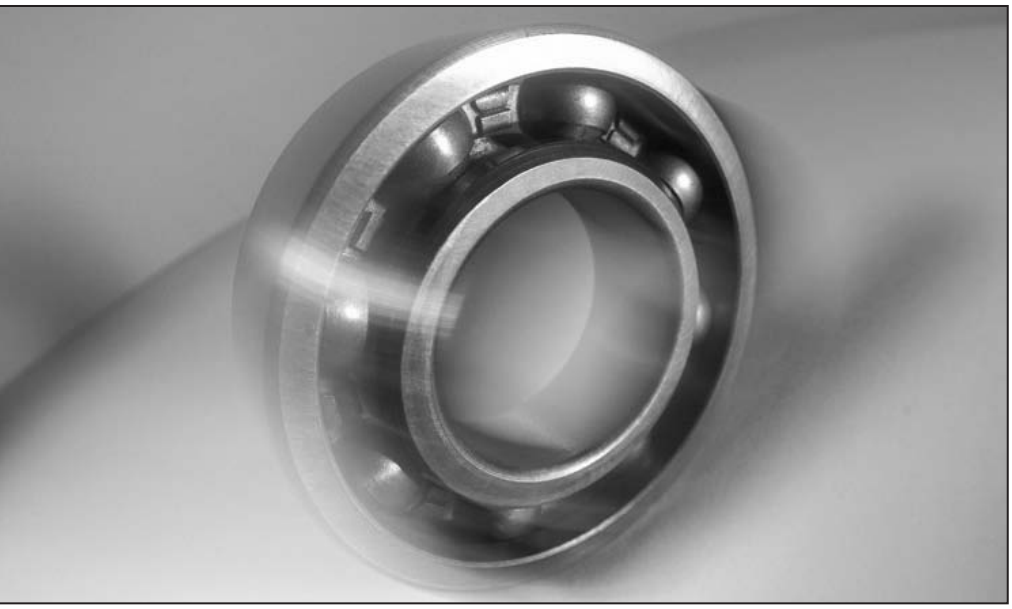
The performance of the portfolio management, $y(PM)$, is measured by the expected return of the asset portfolio net the expected returns of the benchmark on a prospective basis. For return attribution on a retrospective basis, the performance would be the realized returns of the assets r_A net the realized returns of the asset benchmark r_A. Specifically, we have:

$$y(PM)=r_A^* A-r_A^* A$$

The performance of the line business ($y(LB)$) is measured by the profits they generate from the new sales and their management of the liabilities in their performance against the benchmarks:

$$y(LB)=pv+r_L^* L-r_L L$$

where p is the profit margin and v is the sales volume.



We can now specify the corporate performance measure by noting that:

$$y=y(ALM)+y(PM)+y(LB)-FC$$

where FC is the overhead costs of the management of the business. The senior management's role is to ensure that the income y will enhance the shareholders' value by managing the process and ensuring that the net income y meets the shareholders' expectations.

It is important to note that this paper proposes a set of performance measures. It does not suggest that management compensations should be directly related to these measures, even though these measures can be part of the inputs. It also does not propose a management system to deal with human resource issues. It focuses on the process-engineering aspect of the risk transformation and control of an insurance company.

While performances in general are additive, risks are not. Indeed, not only are risks diversifiable so that they are not additive, but risks are often cross-hedged across different business lines. Therefore, risk attribution must take these issues into account to assure coherence in the analysis.

C. Beyond the Total Return Approach: The Corporate Model Approach

The total return approach focuses on managing the risks of the economic value of the in-force business. Using benchmarks in our risk management processes can assist us in managing our business, but these approaches have their limitations.

First, to manage the risk of our shareholders' value, we need to relate our models to the values of the businesses, identifying the sources of risks to our shareholders, and not only to the in-force business. There is no direct relationship between managing the total returns of the assets and liabilities to the shareholders' value.

Second, many products do not fall into the usual genre of a spread product where the total return approach is effective. These products may have significant product risk with lapse or renewal risks, more akin to a going concern business. For example, long-term health care insurance in life insurance is more like the general insurance where the potential product liability is significant and difficult to estimate.

The model that brings the two approaches together in one consistent framework is called the fair value corporate model. The corporate model is described in more detail in Ho and Lee (2004). In the corporate model approach, we determine all the assets and liabilities by arbitrage-free relative valuation models. We calibrate all the assets and liabilities to the observed securities prices.

The extension of the approach is based on incorporating the following features of modeling:

1. We specify the models of new sales. From these models, we can determine the free cash flow generated by the product sales and the asset and liability management. The present value of the free cash flow is then related to the market capitalization via relative valuation approaches.
2. We relate the economic value to the GAAP financial statements. Therefore, earnings at risk can be calculated.
3. We determine the appropriate discount rate of the business in such a way the valuation is consistent with the total return approach.
4. We determine optimal risk management to maximize the market capitalization of the insurer subject to market constraints, like the rating agencies' measure of credit risks and the stock analysts' demand on performance metrics.

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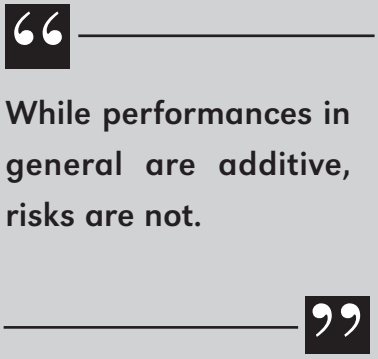

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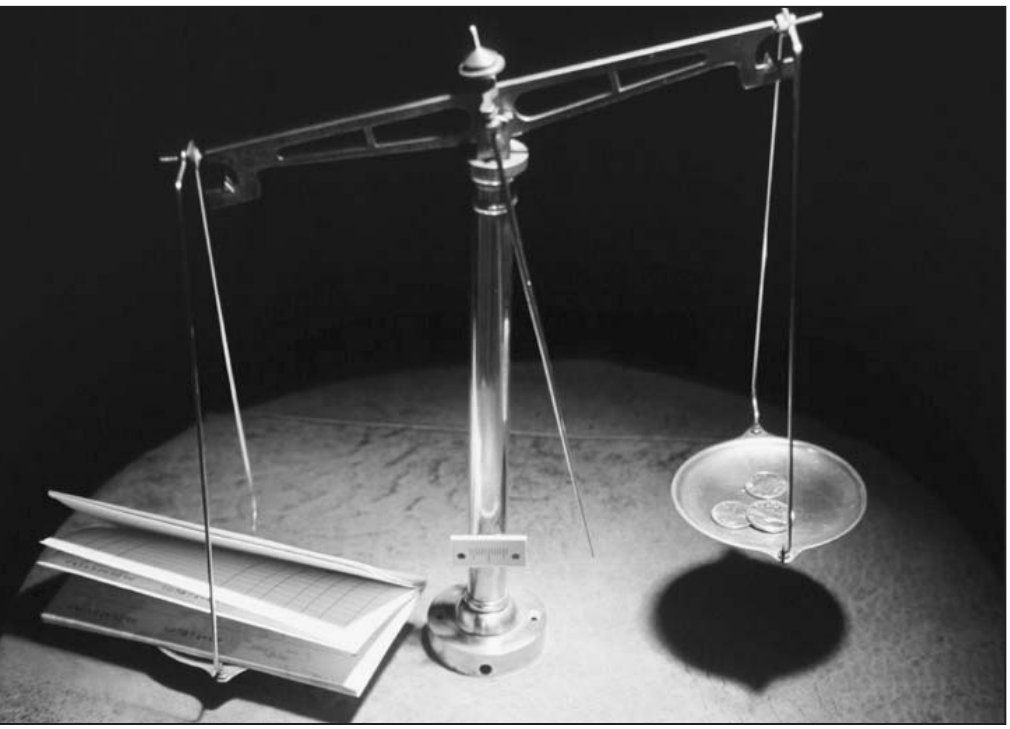
D. Conclusions

While all insurance companies are engaged in selling insurance products, they differ significantly in their approaches to managing their assets and liabilities and in managing their risks. Indeed, asset liability management and risk management in practice is quite fragmented within the industry. The methods used depend on the product within the company or depend on the business units. The approach is clearly different between one company and another.

We have shown that the life insurance company's risk management practice focuses on in-force business. They seek to manage the assets and the liabilities on their balance sheets. The fragmentation confines us in the usefulness of the asset/liability and the risk management processes. As a result, an insurer's risk management practice may be limited to determine whether a product's risk can be appropriately managed or a business unit satisfies a solvency test, but we cannot determine how each business unit should be optimally managed. Methodologies have been proposed to answer these questions.



I propose a general approach, which is to incorporate the future projected sales and the valuation of the firm in the financial modeling of the insurance company. Under a more integrated framework, we could deal with risk management in a broader context. Specifically, I propose using a corporate model that uses the arbitrage-free approach in valuing the assets and liabilities and incorporates the future sales of the products to develop a going concern approach to determine the free cash flows of the insurer. We then relate the risk management impact on the assets and liabilities to the market capitalization of the insurer and the impact of the firm's financial statements. In doing so, we can relate risk management to many performance metrics of the firm, like earnings at risk. Given this relationship, we can then develop a consistent methodology to determine the optimal risk management.

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Risk Management Working Groups (leaders)

RMTF/RM Section Groups

ERM (Jenny Bowen)
Extreme Value Models (Tom Edwalds)
Health (John Stark)
  Health RM Specialty Guide —Rajiv Dutt
  Health Solvency—Trevor Pollitt
CRO (Juan Kelly)
Policyholder Behavior in the Tails (Jim Reiskytl)
RBC Covariance (Jim Reiskytl)
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Risk Management Survey (Charles Gilbert)
Integration of Risk Models (Ken Seng Tan)

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Standard Risk & Risk Management Terms (Open)
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