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Fair Valuation of
Insurance Liabilities:
Principles and Methods



AMERICAN ACADEMY *of* ACTUARIES

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Table of Contents

Introduction	1
1. Valuation Principles for Financial Instruments	2
The JWG Hierarchy of Valuation Methods	2
<i>Method 1: Use market value when available</i>	2
<i>Method 2: Use the market value of similar instruments, adjusted as necessary</i>	3
<i>Method 3: If no market value is available, use a present value of future cash flows</i>	3
Valuation Principles.....	4
<i>Principle 1: If there is no risk, discount the cash flows at the risk-free rate</i>	4
<i>Principle 2: If there is risk in the cash flows, the present value estimate should include a risk adjustment to reflect the market price of risk</i>	4
<i>Principle 3: Include all Cash Flows</i>	5
Application of the Principles to Insurance	6
<i>Application of Principles 1 and 2</i>	6
<i>Application of Principle 3</i>	6
2. Theoretical Background for Market Calibration of Risk Adjustments	7
The Cost-of-capital Approach	7
<i>The Role of Taxes</i>	9
<i>Practical Considerations</i>	10
The Option-pricing Approach	10
<i>Practical Considerations</i>	11
Other approaches.....	12
3. Example Valuation Techniques	12
Interest Rate Spreads: The Guaranteed Interest Contract	12
Option Pricing: Interest-sensitive Liabilities.....	13
Adjusted Cash Flows: Property / Casualty Insurance.....	15
Adjusted Cash Flows: Participating Business	17
4. Other Issues	19
Fair Value versus Entity-Specific Value	19
Credit Standing	20
Emergence of Earnings	22
<i>When All Assumptions Are Realized</i>	22
<i>When Interest Rates Change</i>	26
<i>When Market Value Margins (MVMs) Change</i>	27
<i>When Estimates of Future Claims Change</i>	28
<i>Other Issues Associated with Earnings Emergence</i>	29
Imperfect Markets	30
The Risk-Free Rate	31
Bibliography	34
Endnotes	36

Introduction

This paper has been prepared by the Fair Value Task Force of the American Academy of Actuaries to discuss the application of fair value accounting principles to the liabilities associated with insurance contracts.

The actuarial and accounting literature abounds with different theories, approaches, and techniques for fair valuation of insurance liabilities. Often, however, such approaches and techniques have been presented in isolation. The core principles that underlie all such techniques are not often discussed.

One purpose of this paper is to provide a framework of principles and basic approaches that apply to fair valuation of all financial instruments, including insurance contracts.¹

A second purpose of the paper is to present several specific valuation techniques. The techniques presented here may be helpful in expanding the toolbox of some readers. However, each one is presented as a variation on the aforementioned framework of principles and basic approaches.

This paper is divided into four main parts. Part One outlines the hierarchy of valuation methods proposed by the Joint Working Group of Standard Setters (the JWG)² and discusses the principles and basic approaches that are used to apply them to the valuation of insurance contract liabilities. Part Two covers some theoretical background for calibrating risk adjustments to measures of the market price for risk, with examples. Part Three presents several examples of valuation techniques, each of which is shown to be a variation on the theme of one or more of the basic approaches. Part Four discusses several issues that have been topics of considerable debate.

The Insurance Steering Committee (ISC) of the International Accounting Standards Board (IASB)³ has defined the fair value of a liability as:

the amount for which ... a liability [could be] settled between knowledgeable, willing parties in an arm's length transaction. In particular, the fair value of a liability is the amount that the enterprise would have to pay a third party at the balance sheet date to take over the liability.

An alternate measurement objective proposed by the ISC is "entity-specific value" measurement, defined as follows:

Entity-specific value represents the value of an asset or liability to the enterprise that holds it, and may reflect factors that are not available (or not relevant) to other market participants. In particular, the entity-specific value of a liability is the present value of the costs that the enterprise will incur in settling the liability with policyholders or other beneficiaries in an orderly fashion over the life of the liability.

The discussion in this paper is directed at a fair value measurement objective rather than an entity-specific measurement objective. The differences between the two measurement objectives as generally understood at this time are discussed in Part Four. However, the definitions of these two objectives are still being debated as this is being written. The reader should be aware that both the words and the understanding of the measurement objective may change over time.

Each of the proposed measurement objectives represents a major change from existing U.S. generally accepted accounting principles (GAAP). The areas of significant change are different for life insurance versus property/casualty insurance.

For life insurance contracts, the measurement objectives are fully prospective, whereas U.S. GAAP uses primarily a historical cost approach to accounting for life insurance contracts. U.S. GAAP capitalizes deferrable acquisition costs and amortizes them over the period during which revenues are recognized.

Fair Valuation of Insurance Liabilities: Principles and Methods

There is no place for such capitalization and amortization in a fully prospective system. For business under SFAS 60, U.S. GAAP liability valuation assumptions are locked in at issue and changed only when loss recognition is necessary. Under fair value, all valuation assumptions are unlocked and potentially change on every valuation date.

For property/casualty business, current U.S. GAAP assumptions concerning the amount of future claim payments are already unlocked on each valuation date but are generally not discounted for interest.⁴ Under fair value, both the level of interest rates and the timing of future cash flows influence the valuation of property/casualty insurance liabilities.

Because liability fair values will be highly sensitive to the assumptions used, great care should be taken to develop a consistent, disciplined approach for setting those assumptions. Developing such an approach will be a challenge.

When evaluating the dependence of published results on various assumptions, the accounting standard setters will frame much of their discussion in terms of relevance versus reliability. These two, frequently conflicting, accounting goals are discussed in more detail later in this paper.

As of this writing, the current proposal for an international accounting standard is contained in the Draft Statement of Principles (the DSOP) issued by the IASB. This document consists of several chapters that were released at various times during late 2001 and early 2002. Readers with an interest in all aspects of the proposed standard are encouraged to refer directly to the DSOP. Discussion in this paper is limited to liability valuation.

1. Valuation Principles for Financial Instruments

A hierarchy of methods for determining fair value of financial instruments has been proposed by the JWG. Since many insurance contracts are included within its definition of financial instruments, this hierarchy presumably would apply to insurance liabilities. A number of valuation principles come into play when applying this hierarchy to insurance liabilities. The following sections first review the hierarchy, then discuss the principles to be applied.

The JWG Hierarchy of Valuation Methods

The JWG hierarchy⁵ of methods for fair valuation is:

1. Use market value when available.
2. When no market value is available for the exact same instrument, use the market value of similar instruments, adjusted for differences between the instrument to be valued and the similar instruments.
3. If no market value is available and no suitable similar instruments are available, use a present value estimate of future cash flows. This present value should include an adjustment for risk.⁶

Each of these methods is discussed below in some detail.

Method 1: Use market value when available.

Whenever it is possible to dispose of a financial instrument through exchange for cash in a deep, wide, and open market, then the market price is the fair value.

In some situations a market may exist, but the market price might not be a fair value. Such situations include the following:

1. The market may not be deep, wide, and open, or each trade may take place under special conditions or involve unique considerations. For example, the volume of trading activity might be small relative to the holdings of major players in the market. If so, the market price could be heavily influenced by supply and demand fluctuations unique to the day of trading and not representative of ongoing market conditions.
2. There may be restrictions on market trades that make it impossible to complete an arm's length exchange. For example, a U.S. insurance company cannot completely exit liability under its contracts for payment of cash to a reinsurer. Under U.S. laws, the original writing insurer is liable for future claims whether or not the reinsurer meets its obligations to reimburse the ceding company for claim costs. Since the original writing insurer is not fully relieved of risk in such a reinsurance transaction, the price of the transaction is not the fair value of the risk. However, the price of reinsurance transactions may provide some guidance as to fair value as long as the remaining risks are taken into account.
3. In rare cases, there can be special considerations due to the size of the financial instrument. For example, a large block of stock that represents a controlling interest in a company may have a fair value larger than the product of the number of shares and the market price per share. In effect, a controlling interest has value that is separate from the value of the individual shares traded in the market.

When a market price exists, it should not be ignored. Even if it cannot be used directly as the fair value, it may provide some guidance, and the difference between any reported fair value and the market price of a similar instrument should be explainable in direction and, preferably, also in amount.

Method 2: Use the market value of similar instruments, adjusted as necessary.

Some products offered by insurance companies closely resemble other financial instruments offered by noninsurance companies. Deferred annuities with minimal insurance risk are one example. With some such products it is possible to construct a portfolio of publicly traded securities that behaves much the same way as the insurance contract liabilities and contains most of the same risks. In such situations the value of the portfolio of publicly traded securities can serve as a reasonable estimate of the value of the insurance contract liabilities.⁷ The portfolio of publicly traded securities may be called a "measurement portfolio" because it is used as a guide in measuring the value of liabilities. Many believe it is incorrect to refer to such a portfolio as a "replicating portfolio" unless it exactly matches the cash flows of the liabilities in every possible scenario, including scenarios involving credit default.

Whenever insurance risks such as mortality, morbidity, or property damage are involved, replicating portfolios do not exist in current investment markets. However, in some situations, insurance risks are very small in relation to the value of the financial instrument. In those cases, the value of a similar portfolio of publicly traded securities can provide some guidance as to the value of insurance contract liabilities, but adjustment must be made to reflect the insurance risk.

Method 3: If no market value is available, use a present value of future cash flows.

When market value is not available (or, due to considerations mentioned above, does not represent fair value), fair value should be computed as a present value of future cash flows.

The present value approach is a reasonable approximation of market value if properly implemented. This is particularly true for financial instruments, where it is generally possible to estimate the future cash flows associated with the instrument.⁸

The present value model is very flexible. In particular, it can be adapted to reflect the value of risk and uncertainty. This is important because many financial instruments involve cash flows that are uncertain.

Fair Valuation of Insurance Liabilities: Principles and Methods

Examples include equity interests, derivative investments, and insurance contracts. The principles discussed below address the treatment of risk and uncertainty.

Valuation Principles

When applying this hierarchy to insurance contract liabilities, one often finds method 3 most applicable. Therefore, it is worth reviewing the principles commonly applied when computing present values and making risk adjustments for financial instruments.⁹

Principle 1: If there is no risk, discount the cash flows at the risk-free rate.

A major issue in the use of present values is determination of the discount rate. The market for newly issued financial instruments includes a variety of instruments that offer a variety of interest rates. So what interest rate should be used for fair valuation?

It is generally accepted that the degree of risk affects the interest rate. Higher interest rates are associated with greater risk to the holder of a security. That suggests, of course, that there is a market-determined interest rate that is associated with zero risk. Such an interest rate is called the “risk-free rate.” The risk-free rate should be used in a present value calculation for cash flows that involve zero risk.

To be technically correct, the term “risk-free rate” must really refer to the risk-free spot rate curve, because the risk-free rate depends on the length of time before payment. Whenever the term “risk-free rate” is used in this paper, it is to be understood as a reference to the risk-free spot rate curve.

Several issues surround the practical determination of the risk-free rate. These are discussed in Part Four of this paper. For the time being, accept the premise that a “risk-free rate” exists. In this context, the term “risk-free” typically means “default risk-free” and nominally certain, but may retain other risks such as inflation and opportunity cost risks.

Due to the difficulty in practical determination of the risk-free rate and due to the rarity (or nonexistence) of cash flows that are truly risk-free, a present value taken at the risk-free rate is useful more as a dividing line than as a final result. The fair value of any financial instrument will diverge from the present value at the risk-free rate due to the market pricing of the risks involved in the instrument. Principle 2 deals with the effect of risk on fair value.

Principle 2: If there is risk in the cash flows, the present value estimate should include a risk adjustment to reflect the market price of risk.

Both financial theory and observable market pricing indicate that the presence of risk affects fair value. Generally, risks to the payer of cash flows increase the fair value of a financial instrument while risks to the receiver decrease the fair value.¹⁰

When no market value is available for the financial instrument itself or suitably similar instruments, the JWG hierarchy requires use of a present value technique. There are three general approaches to including a risk adjustment in a discounted present value calculation:¹¹

1. *Adjust the discount rate.*

Use of a discount rate above the risk-free rate leads to a negative risk adjustment. This is commonly observed in the bond market, where bonds with greater default risk carry higher yields and lower prices. Use of a discount rate below the risk-free rate leads to a positive risk adjustment. This can be observed in the price of many insurance contracts, since the price can exceed the present value of expected claims and expenses at the risk-free rate.

2. *Use option-pricing techniques to weight the results under various scenarios.*

Option-pricing techniques are commonly used to provide an adjustment for interest-rate risk. The

discounted present value of future cash flows is determined under a large number of scenarios for future interest rates and the results are weighted using derived probabilities¹² that differ from their real probability of occurrence. Similar techniques can sometimes be used for risks other than interest-rate risk, depending on the available data.

3. *Adjust the cash flows being discounted.*

A risk adjustment can be included by using cash flows other than the average expected cash flows. For example, insurance contracts often involve payment of highly uncertain cash flows. A risk adjustment can be introduced by adding some amount to the expected value of the cash flows and present-valuing the adjusted cash flows.¹³

When a financial instrument involves more than one kind of risk, each risk can be reflected using a different technique. Different combinations of risks and risk adjustment techniques lead to a wide variety of methods for valuation of financial instruments. However, all such methods adhere to the principles outlined here.

It is worth noting that the DSOP expresses a preference for the third method, adjustment of cash flows. The term MVM (market value margin) has been developed to refer to risk adjustments of this nature. Specifically, this term refers to adjustments for insurance-related risks such as mortality and morbidity that create uncertainty in liability cash flows. The term is meant to encompass any nondiversifiable risk from insurance-related factors as well as any diversifiable risk that is currently being priced for due to inefficient market conditions. If other risks are present (e.g., interest-rate risk), the risk adjustment will have to include an amount for these as well. However, any value included in the risk adjustment for these other risks is not considered part of the MVM.

Any risk adjustment technique must involve some element of calibration to a market price for risk. There are many ways to accomplish this, and in most cases some judgment is required. Nevertheless, some connection to a reasonable model for the market price of risk is a necessary part of applying any risk adjustment technique.

Principle 3: Include all cash flows.

The cash flows being valued should include all cash flows associated with the financial instrument being valued, including:

- Future cash flows that could occur under the contract that defines the financial instrument. This would include both contractual obligations and constructive obligations such as dividends and non-guaranteed interest credits.
- Costs to be incurred in carrying out obligations under the instrument.¹⁴

Some would argue that there are situations where the value to be reported for accounting purposes should ignore certain cash flows, or should only reflect one of several possible future outcomes. Such arguments amount to suggesting that the value for accounting purposes should be something other than fair value or market value in specific circumstances. As such, these restrictions could result in misleading valuations and financial reports. When faced with an accounting restriction that has caused a valuation significantly different from a fair or market value, disclosure of the situation might be beneficial, in order to prevent misuse or misinterpretation of the resulting valuation.

For example, a rise in interest rates could cause the fair value of a fully guaranteed life insurance contract to fall below its cash surrender value. If few policyowners were expected to surrender their contract for cash, then other patterns of cash flow under the contract would be more likely, and the present value of those cash flows might be less than the surrender value. If the liability value were not allowed to be less than the surrender value, then disclosure of the more likely value may be appropriate.

Application of the Principles to Insurance

The principles discussed above come into play only when market values are unavailable for the instrument being valued or for similar financial instruments. With regard to insurance liabilities it is generally accepted that there is no deep and wide market, and in most cases no suitably similar instruments exist that do have market values. This leads to the use of present value estimates adjusted for the market price of risk. Application of the principles discussed above to insurance liabilities provides valuable insight.

Application of Principles 1 and 2

Insurance contracts by definition involve some risk to the insurer, at least at issuance. Therefore, according to Principle 2, the present value of expected cash flows at a risk-free rate is not normally an accurate estimate of the fair value of a contract involving insurance risks. A risk adjustment needs to be included in the fair value to reflect market pricing for insurance risk.

If one starts from a value equal to the present value of cash flows at a risk-free rate, then the risk adjustment can be positive (increasing the value) or negative (decreasing the value), depending on the kind of risk in the contract. For example, a pure casualty insurance contract involves mainly risk to the insurer, so there should be a positive risk adjustment. Alternately, an investment contract where actual investment performance is passed to the policyowner involves risk to the policyowner, so there should be a negative adjustment for this risk.¹⁵ A participating whole life insurance contract includes both mortality risk to the insurer and the risk of uncertain dividends to the policyowner, so both positive and negative risk adjustments come into play. It is common for some insurance contracts to involve risks to both parties, so both positive and negative risk adjustments must be determined.

Application of Principle 3

Principle 3 can be used to resolve issues related to items such as renewal premiums, nonguaranteed policyholder dividends, and a deposit floor.

If all cash flows under the financial instrument should be included when calculating fair value, then it is clear that renewal premiums that are either required or allowed under the existing contract should be included. The length of the contract is the key consideration in this regard.

In property/casualty insurance in the U.S., it is common for the insurance contract to run for a period of one year or less. In such a case, renewal premiums after the expiration of the contract are not part of the contract and should not be included in the fair value of the financial instrument.

In life insurance, it is common for the contract to run for a period of decades or for the lifetime of the policyowner. In such a case, renewal premiums should be included in the determination of fair value because they are part of the contract. This is true even if the contract does not require renewal premiums but does allow them, as long as it is common for such premiums to be paid.¹⁶

Many insurance contracts offer the policyowner options regarding premium payment, benefit patterns, and policy loans. This flexibility means that many different patterns of future cash flow could arise under the contract. In such cases, the fair value of the contract can be estimated by weighting the present value of each pattern of cash flows with its likelihood of occurrence.

The weighting of different possible outcomes, if accepted as a principle, resolves the question of whether the fair value can be less than the deposit floor. If there are other patterns of cash flows that are likely to occur under the contract (other than immediate full cash withdrawal) and those other cash flow patterns have a discounted present value less than the deposit floor, then the fair value of the contract can be less than the deposit floor.

There can be a variety of reasons why patterns of cash flow other than immediate full cash withdrawal are likely to occur under a contract even when the fair value of the contract is less than the amount available on surrender for cash. In the life insurance context, for example, the contract owner gives up future

guaranteed insurability if the contract is surrendered for cash. In the bank deposit context, the contract owner (depositor) gives up the convenience and safety of a bank account. Considerations such as these give the appearance of inefficient exercise of options for full cash withdrawal. The fact that an option to surrender a financial instrument for cash is not always exercised means that the fair value can be less than the cash surrender value.

2. Theoretical Background for Market Calibration of Risk Adjustments

A variety of valuation techniques fall within the basic approaches discussed above for calculation of a risk-adjusted present value. The main difficulty is to make reasonable adjustment for risk. To be reasonable, an adjustment for risk must reflect a market price for risk in some fashion. Therefore, the following sections provide some theoretical background for calibration of risk adjustments to measures of the market price for risk, and then apply that theory in several examples.

Two approaches to measuring a market price for risk are discussed here: the-cost-of capital approach and the option-pricing approach. This is not meant to be a complete list of calibration techniques, but an illustrative sampling.

The Cost-of-Capital Approach

Insurers require capital in order to operate, and providers of capital require compensation for any risk to their capital. The greater the risk, the greater the compensation demanded. The relationship between the return on capital and the level of risk can be used to determine the risk-adjusted value of a liability. This section uses this relationship to determine an interest rate for present-valuing liability cash flows that is consistent with their level of risk and with market demands for return on risk.

Some terms for use in defining mathematical relationships:¹⁷

- A = Company total assets at fair value
- L = Company total liabilities at fair value
- E = Company equity on a fair-value financial statement.
- $E = A - L$
- r_f = the risk-free interest rate

This analysis will focus on the changes in the balance sheet quantities during one reporting period, that is, ΔA , ΔL , and ΔE . It will assume there is no capital flowing to or from owners during the period and there are no taxes,¹⁸ so ΔE represents net earnings for the period. The return on equity is $\Delta E \div E$.

The following is a very simple case. There are no liabilities, and all assets are invested in risk-free securities. Also assume there is no change in interest rates. $E = A$, and $\Delta E = \Delta A = A \times r_f$. The return on equity is the risk-free rate r_f . This is consistent with basic economic theory, because owners take no risk.

Next, add some liabilities, but make them fixed and certain liabilities that involve no risk.¹⁹ The fair value of such a liability is its present value at the risk-free rate. For simplicity, assume that no liability cash flows occur during the first accounting period and no change in interest rates occurs, so $\Delta L = L \times r_f$. That is, the change in liabilities is just the unwind of discount on the beginning liability value.

Fair Valuation of Insurance Liabilities: Principles and Methods

The return on equity in this case can be determined as follows:

$$\begin{aligned}\Delta E &= \Delta A - \Delta L \\ &= (A \times r_f) - (L \times r_f) \\ &= (A - L) \times r_f \\ &= E \times r_f\end{aligned}$$

The return on equity of $\Delta E \div E$ is equal to r_f , the risk-free rate. This is again consistent with basic economic theory, because owners take no risk.

Now assume that the liabilities involve some risk to the insurer. To accept that risk, the owners demand a return on equity of r_E , where $r_E > r_f$. Also, the fair value of the liability should be greater than the present value of its expected cash flows at the risk-free rate. Assume the liability value is determined by taking the present value of its expected cash flows at a rate of r_L , where $r_L < r_f$. How can this information be used in determining r_L ?

Start with the basic identity:	ΔE	$= \Delta A - \Delta L$
Use known growth rates r_E , r_f , and r_L	$(E \times r_E)$	$= (A \times r_f) - (L \times r_L)$
Substitute for $A = E + L$	$(E \times r_E)$	$= ((E+L) \times r_f) - (L \times r_L)$
Collect terms in E on the left	$E \times (r_E - r_f)$	$= L \times (r_f - r_L)$
Divide both sides by L, define $e = E \div L$	$e \times (r_E - r_f)$	$= (r_f - r_L)$
Solve for r_L	r_L	$= r_f - (e \times (r_E - r_f))$

Thus, r_L is less than the risk-free rate by a spread that depends on both e and r_E ; that is, the ratio of capital to liabilities and the market's required return on capital. If one can observe values of e and r_E for market participants holding similar assets and liabilities, one can use that information to determine a market-based discount rate for determining the risk-adjusted value of the liabilities. If a company is in a unique position, observed values of e and r_E for other companies can theoretically be adjusted to reflect the differences between those companies and the company whose liabilities are to be valued.

A significant practical problem with this approach, as developed so far, is that the asset portfolio is assumed to be composed of risk-free investments. Few if any market participants hold risk-free investment portfolios. To the degree that they take investment risk, owners expect an additional return to compensate for that risk. Therefore, the levels of e and r_E observed in the marketplace are not consistent with a risk-free return on assets. They are more consistent with a risky asset portfolio.

This approach can be adapted for use with risky assets. Assume for the moment that the return on assets²⁰ is r_A instead of r_f . If the equations above are solved for r_L the result is the following:²¹

$$r_L = r_A - (e \times (r_E - r_A))$$

The values of e and r_E in this equation are those observed for market participants with risky assets having a total return of r_A and holding liabilities similar to those we wish to value.²²

It is worth noting that typical relationships between e , r_E, r_A and are such that many combinations of these values can give the same liability return r_L . For example, consider the following combinations of values that might be observed for a hypothetical line of insurance. All of them are consistent with $r_L = 5.74\%$.

Set 1: (high-grade bond assets)	$r_A = 6.5\%$	$r_E = 15\%$	$e = 9\%$
Set 2: (risky assets, high equity)	$r_A = 7.0\%$	$r_E = 15\%$	$e = 15.8\%$
Set 3: (risky assets, high ROE)	$r_A = 7.0\%$	$r_E = 21\%$	$e = 9\%$

The point here is that the formula $r_L = r_A - (e \times (r_E - r_A))$ appears to make the liability valuation rate (and therefore the liability value) dependent on asset portfolio returns. However, the examples above show that, as a practical matter, liability value is not dependent on the investment return as long as any change in investment return is assumed to be offset by changes in the level of equity or the return on equity. The investment return appears in the formula instead of the risk-free rate to be consistent with values of e and r_E observed for companies with risky investment portfolios.

The Role of Taxes

So far, there has been no discussion of taxes. However, the rate r_E has been defined as the return on equity, which implicitly means the after-tax return on equity. The pre-tax return on equity could be defined as $r'_E = r_E \div (1 - t)$, where t is the tax rate. Pre-tax income would then be $E \times r'_E$, and tax would be $E \times r'_E \times t$ under the simplifying assumption that tax and fair values are equal. Adapting the previous equation to include a tax payment at the end of the period produces the following:

$$\Delta E = \Delta A - \Delta L - \text{Tax} \quad (\text{here, } e \Delta A \text{ and } \Delta L \text{ are calculated as above, before tax})$$

$$E \times r_E = (A \times r_A) - (L \times r_L) - (E \times r'_E \times t)$$

$$\text{Solving for } r_L \text{ gives } r_L = r_A - (e \times (r'_E - r_A))$$

$$\text{or equivalently } r_L = r_A - \left(e \times \left(\frac{r_E}{(1 - t)} - r_A \right) \right)$$

From this it is clear that an increase in the tax rate t results in a decrease in the liability valuation rate and, therefore, an increase in liability fair value, holding everything else constant.

When using valuation interest rate r_L , no amount of taxes is included in the cash flows being discounted. Taxes are provided for implicitly through the valuation interest rate. (The higher the tax rate, the lower the valuation interest rate.) It is also possible to treat taxes explicitly. In this case, one could add the amount of taxes $E \times r'_E \times t$ to the cash flows being discounted. When taxes are included in the cash flows being discounted, the appropriate valuation interest rate is higher than r_L .

The discussion of taxes presented here is simplified because taxable income is assumed equal to income reported on a fair value accounting basis. In reality, taxable income is defined differently, and this can change both the timing and amount of taxes. A more complete treatment of taxes with regard to liability

Fair Valuation of Insurance Liabilities: Principles and Methods

fair value can be found in a 2000 paper by Luke Girard, “Market Value of Insurance Liabilities: Reconciling the Actuarial Appraisal and Option-Pricing Methods.”²³

Practical Considerations

The formula for r_L depends on observed values of r_E , e , and r_A . A host of practical issues arise in obtaining usable observed values. These include the following:

- Most insurers write a variety of types of insurance coverage, and each type potentially involves a different level of risk. Observed values of r_E , e , and r_A for multi-line insurers blend all these risks together so they don't provide clear guidance to market pricing for each type of risk in isolation.
- The total return on assets r_A is currently not a reported figure²⁴ and in many cases cannot be exactly determined. Generally the value of r_A is an estimate. Especially when private equity or real estate investments are involved, the total return must be estimated.
- Credit standing can affect the observed relationships between r_E , e , and r_A and therefore can affect r_L . Observations need to be categorized so that companies of comparable credit standing are grouped together.²⁵ This decreases the number of available observations in any group.
- There is significant variance in the values of r_E and e between insurers and between time periods for any one insurer. Even when controlling for credit standing, mix of business, and investment strategy, observed values of r_E and e may lie in a wide range.
- For some types of long-term insurance contracts, the level of risk changes over time. Consider the value of monthly disability payments to an insured payable until the earlier of recovery or age 65. The uncertainty (risk) in that value is considerably greater when the disabled person is age 30 than when he or she is age 64. It may be appropriate to use values of r_L that change over time based on changes in liability risk levels.
- Franchise value, or the value of future new business, may affect observed relationships between e , r_E , and r_A . Franchise value is an intangible that is often not recognized on the financial statements.²⁶ However, a strong franchise value may allow a company to charge higher premiums and earn a higher return relative to its reported equity. Observed values of r_E may vary widely due to the effect of franchise value.

While there are practical difficulties in obtaining observed values for the market as a whole, it is worth noting that company-specific values for e , r_E , and r_A are routinely used in pricing by many companies in the United States. When the values used in pricing are within the range of observed values in the market, it may be reasonable to use the company-specific values as reasonable estimates in calibrating risk adjustments.

The discussion above is not meant to imply that risk adjustments should always be implemented by adjusting the discount rate. The intent of the formula for the discount rate r_L is to help calibrate risk adjustments; that is, to help determine whether they are realistic in relation to one measure of the market price for risk. The discounted value of expected cash flows at rate r_L provides a convenient reasonableness check on risk adjustments made using other methods. Other risk adjustment approaches, such as adding a market value margin to expected claims, are equally valid when applied in a manner consistent with the valuation principles outlined above.

The Option-Pricing Approach

The cost-of-capital approach treats all risks at once. That is, it leads to a single comprehensive adjustment for all risks involved in a liability. The option-pricing approach, on the other hand, is more typically

applied to specific individual risks. Option-pricing techniques often allow calibration to a wider set of observations for the market price of risk, thereby narrowing the range of reasonable risk adjustments. This is especially true when applied to interest-rate risks that are widely traded in financial markets.

This section focuses on option-pricing approaches that could just as well be termed “multi-scenario” approaches. Their common characteristic is that the present value of future cash flows is determined under many alternate future scenarios and the results are averaged in some way to arrive at a single estimate of the value. The exact description of such techniques is beyond the scope of this paper. However, it is important to understand how risk adjustments arise under such techniques, and how such risk adjustment methodologies can be combined with other approaches.

There are two main reasons why a multi-scenario approach may arrive at a different value than a single-scenario deterministic valuation.

- Some scenarios with small probability of occurrence may involve very adverse outcomes. Including such scenarios in a simple average may increase the average value of the liability over the value based on the single most likely scenario. The increase in value is based on the probability of the adverse outcomes.
- Either the scenario construction method or the weights applied to the scenarios may be calibrated to the market in a manner that results in a risk-adjusted value.

It is important to recognize that a multi-scenario approach does not automatically result in a risk-adjusted valuation. If various equally likely scenarios are simply averaged, one simply obtains a better estimate of the present value of the liability, taking into account various possible outcomes without including any adjustment for risk.

An adjustment for risk is only included in a multi-scenario approach when either the scenario construction method or the weights applied to the scenarios are calibrated to the market using some risk-adjustment technique.

For example, multi-scenario approaches are commonly applied to interest-rate risks, such as the risk that a minimum interest-rate guarantee will come into play on the cash accumulation portion of a life insurance or annuity contract. When valuing liabilities with such guarantees, it is common to use stochastically generated scenarios of future interest rates. Stochastic scenario generators use probabilities to determine the distribution of interest-rate changes from one period to the next.

An adjustment for risk may or may not be included in a valuation using such techniques, depending on how the scenario generator’s probabilities are set. If the probabilities are realistic estimates, then there is no adjustment for risk. If, however, the probabilities (and perhaps other parameters of the scenario generator) are calibrated using the current market yield curve, then an adjustment for interest-rate risk is included in the valuation.

When a multi-scenario approach is used with realistic probability weighting of outcomes, risk adjustments can be included using other means. For example, a risk adjustment under the cost-of-capital method could be built into each scenario before the values under all scenarios were averaged.

However, when a multi-scenario approach includes an adjustment for one risk such as interest-rate risk, it is important that other risk adjustments be determined in a way that avoids counting the adjustment for interest-rate risk twice.

Practical Considerations

Multi-scenario option-pricing techniques tend to be theoretically complex and computationally demanding. This leads to some significant practical considerations.

Fair Valuation of Insurance Liabilities: Principles and Methods

- Even with modern computers, the volume of computations can be prohibitive when applied to millions of individual insurance contracts within a company. To overcome this, it can be expected that similar contracts will be grouped together and modeled as if they were identical for valuation purposes. This adds an additional source of approximation error to any valuation.
- Many insurers do not yet have systems set up to routinely carry out such valuation techniques on all of their insurance business.
- Calibration and use of these techniques requires specialized expertise. The number of professionals with the requisite training may be insufficient to support use of these methods for worldwide financial reporting at this time.
- Calibration of these techniques requires extensive market data. While extensive data exists for some risks, such as interest-rate risk, it does not always exist for certain kinds of options contained in insurance contracts.

Other approaches

Many other approaches to risk adjustment have been developed. Calibration to a market price of risk is always an issue, and this paper has focused on two techniques for which calibration methods are well known. However, other approaches exist.

In reviewing the wide assortment of available methods, one should keep in mind the hierarchy of valuation approaches defined by the JWG, and the valuation principles presented earlier in this paper. In general, most liability valuation methods should fall within that framework.

The following papers present alternative liability valuation approaches: CAS Task Force on Fair Value Liabilities, “White Paper on Fair Valuing Property/Casualty Insurance Liabilities,” 2000; Michael Abbink and Matt Saker, “Getting to Grips with Fair Value,” 2002; IAA Comments to the IASC Insurance Issues Paper, “Valuation of Risk-Adjusted Cash Flows and the Setting of Discount Rates,” 2000. Some of these papers include calibration techniques; others leave that issue as one requiring further study. The American Academy of Actuaries has neither reviewed nor expressed any opinion on the approaches presented in these papers. The references are provided simply for the convenience of the reader.

3. Example Valuation Techniques

Interest-Rate Spreads: The Guaranteed Interest Contract

A guaranteed interest contract is a promise to pay a given maturity value on a given date. The maturity value is equal to the amount originally deposited, accumulated at a guaranteed interest rate, hence the name “guaranteed interest contract.”²⁷

How could one determine the fair value of the liability to pay the maturity value? As discussed above, the fair value is equal to the present value taken at the risk-adjusted discount rate

$$r_L = r_A - \left(e \times \left(\frac{r_E}{(1-t)} - r_A \right) \right).$$

Use the following assumptions, for discussion purposes:

- r_E = return on equity for GIC business = 9%
- e = ratio of equity to liabilities for GIC business = 8%

- r_A = total return on assets = 6%
- r_f = the risk-free rate = 5%
- t = the tax rate = 35%
- The maturity value is \$1,000 and is due at the end of two years.
- There are no expenses.

Under these assumptions, the discount rate $r_L = 5.37\%$ and the fair value is

$$\$1,000.00 \times (1.0537)^{-2} = \$900.63$$

Some might suggest that the fair value of this liability should be determined by discounting at the risk-free interest rate, since there is no risk to the insured other than default risk. Two issues come into play when determining which discount rate is appropriate.

The first issue is credit risk. Use of the risk-free rate is based on the idea that credit risk should be ignored. Ignoring credit risk is consistent with “entity-specific value” as defined by the ISC, rather than “fair value.” In the case of this kind of liability, the difference between the liability valuation rate and the risk-free rate implicitly includes an adjustment for credit risk. (This is discussed further in the sections on credit risk and on entity-specific value versus fair value.)

The second issue is liquidity and its connection to the definition of the risk-free rate. A guaranteed interest contract held as an asset is typically not a liquid asset, and there can be restrictions on transfers or early settlement. Therefore, the liability valuation rate should be consistent with investments of limited liquidity. As is discussed later, the risk-free rate should also be consistent with investments of limited liquidity; the risk-free rate should be interpreted as a default-free rate on securities with fixed and certain cash flows. If the risk-free rate were based on U.S. Treasuries (which are very liquid), it would not be the appropriate discount rate for a non-liquid liability, even for computation of entity-specific value.

In the example above, if the risk-free rate shown as 5.0% were a rate based on U.S. Treasuries, the difference between r_L and the risk-free rate would include an adjustment for a liquidity premium in addition to an adjustment for credit risk. It would not be clear from the information at hand whether an r_L of 5.37% was greater than or equal to the risk-free rate for investments of limited liquidity. In practice it may also be difficult to make this determination.

Option Pricing: Interest-Sensitive Liabilities

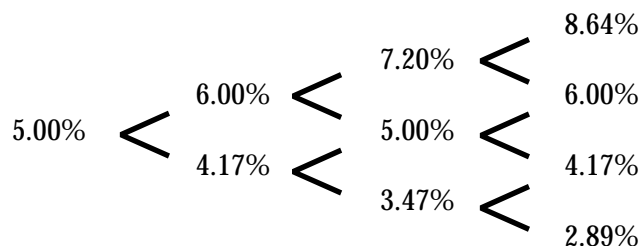
Interest-sensitive liabilities involve cash flows that depend in some way on the future level of interest rates. The next example focuses on a simple four-year deferred annuity with surrender rates that are interest sensitive.

In this example, the contract has a current cash value of \$1,000. Interest is guaranteed at a rate of 5.00%, and the contract matures in four years for \$1,215.51. Cash surrender values are available in the interim and include all accrued interest with no surrender charge. At maturity the contract either pays out its accumulated cash value or can be converted to a life income at then-current rates.

This contract may not fill the definition of insurance, but the valuation treatment of interest-sensitive surrenders shown here is very much analogous to the treatment for more complex contracts that involve an investment element.

Fair Valuation of Insurance Liabilities: Principles and Methods

The example assumes that short-term interest rates are currently 5.0%, and that a lognormal interest-rate model with volatility of 20% represents the current yield curve. That is, the following recombining binary tree has been calibrated to reproduce the current risk-free yield curve.



During each year, interest rates can either increase by 20% or decrease by 16.67% ($.1667 = (1/1.2) - 1$). In calibrating the binary tree to the current yield curve, the probabilities of increase or decrease turn out to be exactly 50% each at every time period, for the purposes of this example. There are eight possible paths through the binary tree, each with probability 0.125.²⁸

If one assumes lapse rates are insensitive to interest rates and are 10% of remaining contracts at the end of each year, one can compute the cash flows at the end of each year and discount them using the path of short-term rates along each path of the tree. The expected cash flows are:

End of year	Portion in force before terminations	x Termination rate	= Portion terminating	x Contract cash value	= Cash flow
1	100%	10%	10.0%	\$1,050.00	\$ 105.00
2	90%	10%	9.0%	\$1,102.50	\$ 99.23
3	81%	10%	8.1%	\$1,157.63	\$ 93.77
4	72.9%	100%	72.9%	\$1,215.51	\$ 886.10
			100.0%		

Discounting this stream of cash flows through each path of the binary tree, and averaging the results, leads to a value of \$996.85.

Now suppose that lapse rates are assumed to be sensitive to the level of interest rates. In particular, if interest rates are high, more policyowners will surrender for cash, and vice versa. Instead of level 10% lapses under all conditions, lapse rates depend on the level of short-term interest rates according to the following table:²⁹

Interest rate	Lapse rate
8.64%	23.25%
7.20%	14.84%
6.00%	11.00%
5.00%	10.00%
4.17%	9.31%
3.47%	7.67%
2.89%	5.56%

With this pattern of lapse rates, a different pattern of cash flows occurs for every path through the binary tree. The resulting patterns of cash flow are shown in the table below.

Interest rate path	Cash flows at end of year			
	Year 1	Year 2	Year 3	Year 4
up, up, up	\$ 115.50	\$ 145.61	\$ 203.99	\$ 707.07
up, up, down	\$ 115.50	\$ 145.61	\$ 96.51	\$ 819.92
up, down, up	\$ 115.50	\$ 98.12	\$ 102.00	\$ 866.52
up, down, down	\$ 115.50	\$ 98.12	\$ 86.29	\$ 883.02
down, up, up	\$ 97.71	\$ 99.99	\$ 103.94	\$ 883.02
down, up, down	\$ 97.71	\$ 99.99	\$ 87.93	\$ 899.83
down, down, up	\$ 97.71	\$ 76.65	\$ 90.21	\$ 923.17
down, down, down	\$ 97.71	\$ 76.65	\$ 53.93	\$ 961.27

When the cash flows along each path are discounted using the short-term rates along each path, the resulting probability-weighted value is \$998.17. That represents an increase of \$1.32 attributable to the risk of interest-sensitive cash flows.

This example does not include any adjustment for risks other than the interest sensitivity of the cash flows. Our purpose has been to illustrate the adjustment for interest sensitivity alone. In computing fair value or entity-specific value, one would normally include an adjustment for other risks in the contract, typically by adding a risk adjustment to the cash flows under every interest-rate path or by adding a spread to the path-specific interest rates used for discounting. In calibrating the adjustment for other risks, care would be needed to avoid double-counting the adjustment for interest-sensitivity risk.

Adjusted Cash Flows: Property/Casualty Insurance

Consider the valuation of insurance contract liabilities under a one-year property/casualty insurance policy immediately after the annual premium is paid. Assume all related payments will be made at the end of the year, and that the expected value of those payments and associated expenses is \$525. What, then, is the fair value of the liability?

Since the amount of actual claim payments is uncertain, an adjustment is needed for the risk of insurance claims differing from the expected amount. This is a risk to the insurer and justifies some positive risk adjustment; that is, an increase in the fair value of the liability over the present value of benefits and expenses at the risk-free rate. This example applies the cost-of-capital method, assuming that the practical limitations of that method can be overcome.

The following assumptions are made:

- r_E = return on equity for this example = 12%
- e = ratio of equity to liabilities = 25%
- r_A = total return on assets = 6%
- r_f = the risk-free rate = 5%
- t = the tax rate = 35%

Fair Valuation of Insurance Liabilities: Principles and Methods

Based on the theoretical background presented earlier, the fair value of the liability is the present value of cash flows (excluding tax) discounted at rate:

$$r_L = r_A - \left(e \times \left(\frac{r_E}{(1-t)} - r_A \right) \right) = 2.885\%.$$

Discounting the expected year-end cash flow of \$525 at rate r_L gives a liability fair value of \$510.28.

Suppose, however, that one wishes to make the risk adjustment by adding an amount to cash flows rather than by adjusting the discount rate. The DSOP expresses preference for discounting at the risk-free rate and adjusting for risk by adding an MVM (market value margin) to cash flows. How can an appropriate level of MVM be determined?

This problem can be expressed mathematically. Define C as the end-of-year expected cash flow (\$525 in this example). The liability fair value has already been calculated as:

$$\frac{C}{1+r_L} = \frac{525}{1.02885} = \$510.28.$$

One wishes to obtain the same fair value while discounting at the risk-free rate and adding MVM to the cash flow.

That is:
$$\frac{C + MVM}{1+r_f} = \frac{C}{1+r_L}.$$

Solving this for MVM gives
$$MVM = C \times \frac{r_f - r_L}{1+r_f} = 525 \times \frac{0.05 - 0.02885}{1.02885} = 10.79.$$

This example involves cash flows at only one point in time, but the same technique can be applied to calculate MVMs for multi-period insurance contracts. First, the following terms are defined:

C_t = cash flow at end of period t

MVM_t = market value margin for period t

L_t = liability fair value at end of period t , or beginning of period $t + 1$

If the insurance contract being valued involves cash flows for n periods, the calculation proceeds as follows.

1. Begin by calculating the final period MVM:

$$MVM_n = C_n \times \frac{r_f - r_L}{1+r_f}.$$

2. Find the fair value at the beginning of the final period:

$$L_{n-1} = \frac{(C_n + MVM_n)}{1+r_f}.$$

3. Go to the previous period ($n-1$). Compute the MVM:

$$MVM_{n-1} = (L_{n-1} + C_{n-1}) \times \frac{r_f - r_L}{1 + r_f}.$$

4. Find the fair value at the beginning of the period:

$$L_{n-2} = \frac{(L_{n-1} + C_{n-1} + MVM_{n-1})}{1 + r_f}.$$

5. Go back to step 3 for the next prior period ($n - 2$). Repeat steps 3 through 5 as many times as needed.

So far, this analysis has focused on the cash flow adjustments that are consistent with discounting at the risk-free rate. This analysis can be extended to determine the cash flow adjustments that are consistent with any choice of discount rate. Since risk adjustments can be made through either the discount rate or the cash flows, it is intuitive to expect that when a larger risk adjustment is made to the discount rate, a smaller risk adjustment will be needed in the cash flows. As we've seen, when the entire risk adjustment is made in the interest rate (so we discount at rate r_L), then the cash flow adjustment is zero. But what if the discount rate is other than either r_f or r_L ?

One can show that a simpler formula for the cash flow adjustment derived above for use with the risk-free discount rate is:

$$MVM_t = L_{t-1} \times (r_f - r_L).$$

An analogous formula provides the cash flow adjustment consistent with a generalized discount rate of $r_{discount}$. The formula is:

$$Adjustment_t = L_{t-1} \times (r_{discount} - r_L).$$

When $r_{discount} = r_f$ this is the formula for the MVM show above, and when $r_{discount} = r_L$ the cash flow adjustment is zero, as it should be. This provides some intuitive support for the correctness of the formula. An algebraic proof is left to the reader.³⁰

Adjusted Cash Flows: Participating Business

Several types of insurance contracts allow the insured to share to some degree in the profits of the insurer. This section focuses on traditional participating permanent life insurance contracts as issued by mutual insurers in the United States. Such contracts can be described as follows:

- Premiums are fixed and payable for life or for a limited number of years.
- Death benefits and cash surrender values are fixed and guaranteed. There is no unit-linking with an investment fund.
- Dividends are paid annually at the discretion of the insurer's board and are based on any excess of company earnings over amounts the board deems necessary to retain for solvency or other reasons. Dividends can be paid in cash or applied to purchase additional insurance and increase cash values within the policy.

Fair Valuation of Insurance Liabilities: Principles and Methods

The key feature here is dividends that are paid at the discretion of the board. There is no preset formula for their determination. For example, there is no requirement that 90% of earnings be distributed to policyowners and 10% retained. Also, there is no dedicated investment fund. The assets supporting these contracts are part of the pooled general account assets of the insurer and are not separately dedicated to these contracts.³¹

Dividends are often very significant and therefore must be considered in valuation of the liability. Often there is past practice that can be used as a basis for projecting future dividends, including changes in dividends in response to changes in the market environment.

Assuming reliable estimates of future dividends can be made, one approach to valuation of this kind of participating business is as follows:³²

- First estimate all future cash flows, and include in the cash flows the future dividends to be paid if assumptions are realized.
- Take the present value of the cash flows, including an adjustment for risk. This can be done using an adaptation of the cost-of-capital method similar to that discussed in the property/casualty example above. Risk adjustment is accomplished in two parts: an adjustment to cash flows and an adjustment to the discount rate.

1. The discount rate is set equal to the asset total return.³³ This makes the discount rate consistent with the asset returns anticipated in the projection of dividends. Consistency between projected dividends and the assumed asset total return is important because dividend payments often depend in some way on the level of investment returns. Consistency does not mean that the interest rate credited to policyowners must equal the asset total return. Rather, consistency means that dividends are projected based on the assumption that the company will earn the assumed asset total return on its investments and distribute part or all of that return to policyowners through dividend payments in accordance with established or expected practice.

2. Cash flows are adjusted by adding an amount³⁴ to adjust for the risk retained by the company. The cash flow adjustment can be calibrated to market compensation for risk by setting it equal to

$$L_{t-1} \times e \times \left(\frac{r_E}{1-t} - r_A \right)$$

where the symbols have the same meaning as in examples presented above.

Some explanation is needed for the formula for the cash flow adjustment shown above. Recall that, under the cost-of-capital method, the cash flow adjustment and the discount rate are related to one another by the formula

$$\text{Adjustment}_t = L_{t-1} \times (r_{\text{discount}} - r_L).$$

In this case, the discount rate is set to the asset total return r_A , so

$$\text{Adjustment}_t = L_{t-1} \times (r_A - r_L).$$

If one then substitutes for r_L using the formula

$$r_L = r_A - \left(e \times \left(\frac{r_E}{(1-t)} - r_A \right) \right)$$

the formula for cash flow adjustment shown above is obtained.

As mentioned above, one reason for using the asset total return as the discount rate is for consistency with the projection of dividends. Another reason for using the asset total return is to avoid the use of negative cash flow adjustments or MVMs in valuation. When significant investment risk is passed on to the policyowner, as it often is with participating life insurance, the liability valuation rate r_L increases to adjust for that risk transfer. As a result, r_L can exceed the risk-free rate. The formula for cash flow adjustments shown above produces negative values if the discount rate is r_f , and one has

$$r_f - r_L < 0$$

An issue arises if one needs to report a liability value for participating business excluding risk adjustments. The non-guaranteed nature of dividends represents a risk to the policyowner, and dividends are arguably higher than guaranteed payments would be because of the risk taken by the policyowner. There is no direct way to discount future cash flows that include dividends and arrive at a value excluding risk adjustments. Simply excluding dividends altogether may result in too low a value, while including full projected dividends results in too high a value.

Similar issues arise with respect to certain nonparticipating life insurance and annuity contracts in the United States. Contracts issued by stock companies often include non-guaranteed payments whose magnitude is at the sole discretion of the insurer. For example, “universal life” contracts that are not variable or unit-linked often involve non-guaranteed interest credits; that is, interest in excess of the guaranteed minimum rate is credited to cash values at the discretion of the insurer. Such non-guaranteed interest credits need to be estimated for valuation purposes in much the same way as dividends on participating contracts.

The problem with determining liability value excluding risk adjustments arises any time the cash flows of an insurance contract include some compensation to the policyowner for bearing risk. To compute a value excluding risk adjustments, that compensation would need to be estimated and removed from the cash flows to be used in the present value calculation.

4. Other Issues

Fair Value Versus Entity-Specific Value

Fair value and entity-specific value are two alternate measures proposed in the DSOP for valuation of insurance liabilities. (Both are defined in the introduction to this paper.)

The proposed measures have much in common. For example, both involve use of the JWG hierarchy of valuation methods discussed earlier. For insurance liabilities, both generally involve estimation using present value techniques. And both anticipate update of valuation assumptions on every valuation date.

However, the DSOP indicates that the measures differ in the ways assumptions are to be determined, and in the treatment of an insurer’s credit standing. The table below illustrates the treatment according to the DSOP:

Fair Valuation of Insurance Liabilities: Principles and Methods

Measure	Rationale	Assumptions	Credit Standing
Fair value	Exit value, or immediate settlement value	Market-based, e.g., market average expenses	Reflected ³⁵
Entity-specific value	Orderly settlement over life of the liability	Specific to the entity	Not reflected

These measures are still evolving, and alternatives beyond those shown above are possible. For example, some have suggested that valuation should involve use of entity-specific assumptions combined with full reflection of credit standing.

Credit Standing

There are several schools of thought regarding whether and to what degree credit standing should be reflected in the valuation of an entity's liabilities. A full discussion of the issues could fill a small book. Rather than attempt a full discussion here, we only note the basic rationale behind a reflection of credit standing in fair value estimates, present some counter-arguments, and list some references where a more thorough discussion of the issue can be found.

The basic rationale behind the reflection of an entity's credit standing in the fair value of its liabilities is as follows:³⁶

- The liability of a company is someone else's asset. From the perspective of the asset purchaser, the fair value of the asset is reduced by the risk that the company backing the asset will default, so the credit standing of the asset backer is reflected in the price. Looking at the same situation another way, the asset backer holds a liability for the obligation to back the asset. The asset backer can extinguish its liability by paying an amount to the asset holder. The amount it must pay should be the same as any other third party would pay for the asset. Since the price of the asset reflects the credit standing of the asset backer, the cost to the asset backer of exiting its liability reflects its own credit standing.
- The largest category of financial liabilities in many industries is publicly issued debt. For many companies there is a market for this debt, and the price for such debt reflects the credit standing of the issuer. Conceivably, a company could buy back its debt or issue more debt at this market value. Therefore, unless the fair value for its debt was set at its market value (which reflects its credit standing), a company could manipulate its earnings by trading in its own debt.³⁷
- There is no compelling reason why other financial liabilities should be treated any differently than publicly issued debt. Hence all other financial liabilities should have their fair value reflect their own credit standing.
- The fair value of a firm from the owner's perspective will reflect the fact that the owner can always walk away from the (stock) investment. Therefore, the fair value of the liabilities (from the owner's perspective) can never be greater than the assets. This requires the fair value of the liabilities to reflect the credit standing of the firm.

Some of the principal arguments against the reflection of credit standing in insurance liabilities include the following:

- If the liability value reflects the firm's credit standing, then the firm's earnings can go up when its credit standing goes down. This is counterintuitive, and provides less useful (i.e., less relevant) information to the users of its financial statements.
- The arguments for reflection of credit standing in liabilities are based on the valuation of assets. Assets are traded, and asset valuations do reflect credit standing. But liabilities, especially insurance liabilities, are not traded. Hence, there is no market value for liabilities, and asset valuation models do not necessarily apply to the valuation of insurance liabilities.
- Even if reflection of credit standing makes sense for some financial liabilities, insurance liabilities are different. Insurers cannot exit their liabilities except through settlement with the policyholder/claimant³⁸. If they try to do so in a manner that reflects their credit standing, then they violate state laws that cover unfair trade practices. Therefore, the actual exit price for an insurer's liabilities cannot in practice reflect its credit standing.
- The existence of guarantee funds, the priority status of policyholders/claimants in the event of an insurer insolvency, and the existence of other co-guarantors in some cases makes any effect of credit standing on insurance liabilities immaterial.
- Liability values that are not adjusted to reflect credit standing are more useful to financial statement users, including creditors and potential buyers of the firm. For example, the value of a liability of a party that assumes responsibility for payment of the liability would be independent of the credit standing of the original party responsible for meeting the obligation.

Additional discussion of this issue can be found in:

- "Understanding the Issues –Credit Standing and Liability Measurement"
June 2001–Volume 4, Series 1, FASB, available from
http://www.fasb.org/articles&reports/vol4_series1.shtml
- Casualty Actuarial Society – "White Paper on Fair Valuing Property/Casualty Insurance Liabilities",
Section H – Credit Standing and Fair Value, available at:
<http://www.casact.org/research/tffvl/index.htm>
- Girard, Luke, 2002. "An approach to Fair Valuation of Insurance Liabilities Using the Firm's Cost of Capital", *North American Actuarial Journal*, Vol. 4.

The credit standing issue has special significance for those involved with guaranteed investment contracts and annuity products with minimal insurance risk. For many of these products the market value of liabilities (based on those portfolio sales that have occurred) reflects discounting of future cash flows at rates in excess of the risk free rate. Some believe that this is due to the reflection of credit standing in the fair valuation of the liability cash flows. Others have suggested that this is instead due to anticipation of investment yields higher than the risk-free rate, even after adjustment for increased investment risk. If fair value for accounting purposes reflects neither credit standing nor future investment margins³⁹, then such products can create an operating loss upon issue, because the initial premium (the market price) is lower than the initial reported liability.

Actuaries should be aware that some liability valuation methods may reflect the credit standing of the liability holder implicitly, even when there is no explicit assumption regarding credit standing or the likelihood of default. For example, one can argue that the cost of capital method outlined in this paper reflects

Fair Valuation of Insurance Liabilities: Principles and Methods

credit standing implicitly. To understand how credit standing may be reflected, consider the effect of either increasing investment risk or decreasing the level of capital.

- An increase in investment risk leads to an increase in the investment return r_A . This in turn increases the liability valuation rate r_L and decreases the value of the liability.
- A decrease in the capital ratio e also increases the liability valuation rate r_L and decreases the value of the liability.

Therefore assumption changes that are consistent with increased credit risk lead to decreases in liability value when using the cost of capital method, even though there is no explicit assumption concerning default.

Emergence of Earnings

Under a fair value paradigm the focus is on the balance sheet. Assets and liabilities are defined without consideration of income statement effects. Nevertheless, there is much interest in patterns of earnings emergence that will result from a fair value approach to asset and liability measurement. And there have been many mistaken first impressions as to how earnings will emerge under the fair value approach.

Some have noted that acquisition costs are charged off in the period incurred, rather than amortized as under existing U.S. GAAP. They conclude that this will create an initial loss on sale of new business. This is not necessarily true, however, because fair value at time of sale of a new contract includes the value of acquisition costs along with all other future costs. The fair value of any liabilities under that contract is reduced by the amount of these costs when they are paid. It is not necessary to cover these expenses through amortization because there is a release of liability value in each period (similar to a reserve release) that provides for the payment of expenses.

Some have noted that liability fair value is a present value of all future cash flows and have concluded that all expected future profits would therefore be recognized at time of sale. This impression is generally incorrect because the initial contract liability is to be risk-adjusted. Risk adjustment means the liability is increased to reflect the risk involved in providing insurance coverage in the future. The provision for risk included in the liability tends to reduce or eliminate any initial recognition of future profits and results in the release of profits over time.

It turns out that the provision for risk in liability valuation is the key to the gain on sale and emergence of earnings under a fair value regime. The larger the provision for risk, the smaller the gain on sale. The smaller the provision for risk, the larger the gain on sale. Under the cost-of-capital approach outlined in this paper, there is typically no initial gain or loss, and earnings emerge as a level return on equity if all assumptions are realized.

The following examples show the emergence of earnings for a single policy. Additional issues arise under fair value accounting for ongoing operations, including questions about how to present the effect of changes in estimates regarding blocks of previously written policies. Such issues are beyond the scope of this paper.

When All Assumptions Are Realized

This section illustrates the emergence of earnings for a simple five-year term life insurance contract when all assumptions are realized and no changes occur during the life of the contract. Two examples are shown, using two different levels of adjustment for risk in the liability valuation.

The expected cash flows under the contract are shown in Exhibit 1. The contract involves a single up-front premium payment for the full five years of coverage. Expected death benefit payments increase each

year as a result of increasing mortality with age. Expenses are particularly heavy in the first year, due to sales and underwriting costs.

For purposes of the example, assume the contract is issued on the last day of the year. In addition, all claims are assumed paid at the end of each policy year, as are all expenses other than the initial expenses at time of issue.

Besides the liability cash flows, several additional assumptions are needed in order to illustrate financial results under fair value accounting. Assume the following:

$r_E = 10\%$ (hypothetical normal return on equity for this sort of product)

$e = 12\%$ (benchmark equity capital as a percent of the liability)

$r_A = 7\%$ (return on assets)

$t = 35\%$ (tax rate on income)

With these assumptions, the risk-adjusted liability valuation interest rate can be computed.

$$r_L = r_A - \left(e \times \left(\frac{r_E}{(1-t)} - r_A \right) \right) = 5.99\%$$

There are now enough assumptions to compute all of the items shown in Exhibit 1.

- **Liability at fair value.** This is the present value of future liability cash flows at the risk-adjusted liability valuation interest rate.⁴⁰
- **Benchmark capital.** This is the assumed percentage e of the liability fair value.
- **Total assets.** For the balance sheet to balance, total assets must equal the sum of liabilities and benchmark capital. For purposes of this example, assume all assets are invested assets.
- **Investment income.** This is the assumed investment return multiplied by invested assets at the beginning of the year.
- **Gain from operations before tax.** This is the net of premium income plus investment earnings, less claims, expenses, and the increase in liabilities.
- **Income tax.** For purposes of this illustration, taxes are estimated as the assumed tax rate t times the operating gain before tax.
- **Net release of capital.** In order for total assets to accumulate to the amount calculated earlier, some capital must be committed at time of issue. Some of this capital is released each year thereafter. The amount committed or released each year is equal to the increase in benchmark capital less the net operating gain after tax.
- **Internal rate of return on release of capital.** This is the internal rate of return on the pattern of cash flows represented by the net release of capital. This is the return on equity that will be earned over time if all assumptions are realized.

Fair Valuation of Insurance Liabilities: Principles and Methods

Exhibit 1						
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Liability cash flows						
Premium	310.37	-	-	-	-	-
Expense	35.00	5.00	5.50	6.00	6.50	7.00
Death claims	-	50.00	55.00	60.00	65.00	70.00
Net liability cash flows	275.37	(55.00)	(60.50)	(66.00)	(71.50)	(77.00)
Liability at fair value	275.37	236.87	190.57	135.99	72.65	0.00
Benchmark capital	33.04	28.42	22.87	16.32	8.72	0.00
Total assets	308.41	265.30	213.44	152.31	81.36	0.00
Investment income	0.00	21.59	18.57	14.94	10.66	5.70
Gain from operations before tax	0.00	5.08	4.37	3.52	2.51	1.34
Income tax	0.00	1.78	1.53	1.23	0.88	0.47
Net release of capital	(33.04)	7.92	8.40	8.84	9.23	9.59
Internal rate of return on net release of capital: 10.00%						
Operating statement	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Premium income	310.37	-	-	-	-	-
Investment income	-	21.59	18.57	14.94	10.66	5.70
Total income	310.37	21.59	18.57	14.94	10.66	5.70
Claims	-	50.00	55.00	60.00	65.00	70.00
Expenses	35.00	5.00	5.50	6.00	6.50	7.00
Increase in liability	275.37	(38.49)	(46.30)	(54.58)	(63.35)	(72.65)
Total disbursements	310.37	16.51	14.20	11.42	8.15	4.35
Gain before tax	0.00	5.08	4.37	3.52	2.51	1.34
Tax	0.00	1.78	1.53	1.23	0.88	0.47
Net operating gain	0.00	3.30	2.84	2.29	1.63	0.87
Return on equity		10.0%	10.0%	10.0%	10.0%	10.0%
Balance sheet	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Assets	308.41	265.30	213.44	152.31	81.36	-
Liabilities	275.37	236.87	190.57	135.99	72.65	-
Surplus	33.04	28.42	22.87	16.32	8.72	-
Total liabilities and surplus	308.41	265.30	213.44	152.31	81.36	-

The internal rate of return on net release of capital turns out to be 10% in this example. The product's premium rate was set to obtain this result. It is important to note that the return on equity based on the financial statements also turns out to be 10% in every year. That is, the net operating gain after tax is exactly 10% of prior year-end surplus. Earnings emerge as a level return on equity when the liability valuation is risk-adjusted using assumptions consistent with product pricing.

What happens, though, when the risk adjustment is reduced? Exhibit 2 shows the same product as Exhibit 1, but in this case the valuation is done assuming the hypothetical normal return on equity for this sort of product is 8% instead of 10%. Under this assumption, the risk-adjusted liability valuation interest rate is:

$$r_L = r_A - \left(e \times \left(\frac{r_E}{(1-t)} - r_A \right) \right) = 6.36\%.$$

A higher valuation interest rate leads to a lower value for the liability. And that in turn leads to a different pattern of operating gains. Exhibit 2 shows the financial statements in the same format as the bottom of Exhibit 1, but with results adjusted for this change in liability valuation. The resulting pattern of earnings includes a first-year operating gain; that is, a gain on sale. Future year gains are smaller in Exhibit 2 than in Exhibit 1.

Exhibit 2						
<u>Operating statement</u>	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>	<u>Year 6</u>
Premium income	310.37	-	-	-	-	-
Investment income	-	21.36	18.41	14.84	10.61	5.68
Total income	310.37	21.36	18.41	14.84	10.61	5.68
Claims	-	50.00	55.00	60.00	65.00	70.00
Expenses	35.00	5.00	5.50	6.00	6.50	7.00
Increase in liability	272.47	(37.66)	(45.56)	(53.96)	(62.89)	(72.39)
Total disbursements	307.47	17.34	14.94	12.04	8.61	4.61
Gain before tax	2.90	4.02	3.47	2.79	2.00	1.07
Tax	1.02	1.41	1.21	0.98	0.70	0.37
Net operating gain	1.89	2.62	2.25	1.82	1.30	0.69
Return on equity		8.0%	8.0%	8.0%	8.0%	8.0%
<u>Balance sheet</u>	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>	<u>Year 6</u>
Assets	305.16	262.98	211.95	151.52	81.08	-
Liabilities	272.47	234.80	189.24	135.29	72.39	-
Surplus	32.70	28.18	22.71	16.23	8.69	-
Total liabilities and surplus	305.16	262.98	211.95	151.52	81.08	-

It is important to note that the return on equity based on the financial statements in Exhibit 2 is 8% in years 2 through 6. That is lower than the 10% return on equity shown in Exhibit 1, even though both

Fair Valuation of Insurance Liabilities: Principles and Methods

examples deal with exactly the same product. The only difference is the liability valuation. The 8% return on equity, of course, ignores the gain on sale. If the company were to issue more new business in years 2 through 6, the gains on sale would add to the reported return on equity. Depending on the level of new business, the reported return on equity could rise to 10% or more. In any case, the return on equity would become much more sensitive to the level of new business under these assumptions.

Some general observations can be made about the gain on sale under fair value accounting.

- In many cases, contracts priced “at the market” generate neither a gain nor a loss on sale. This is the situation in Exhibit 1.
- Contracts that are expected to be unusually profitable due to special circumstances generate a gain on sale. This is the situation in Exhibit 2. If products with similar levels of risk typically achieve an 8% return on equity, yet this product is priced to achieve a higher return, the extra profitability is recognized at time of sale.
- Contracts that are loss leaders, or are expected to generate lower returns than usual for products of similar risk, generate a loss on sale.
- It is often the case that a product will be priced “at the market” with the anticipation that sales of the product will cover a certain amount of fixed costs or overhead. If the level of sales is lower than expected, then the premiums will not help cover as much fixed cost or overhead as anticipated. When this happens, an initial loss equal to the unrecovered fixed costs may result. On the other hand, if sales turn out to be greater than expected, then an initial gain can result.

When Interest Rates Change

Review what happens to the example in Exhibit 1 if interest rates change at the end of year 4. Assume that investment returns increase from 7% to 8%. It is also reasonable to assume that the expected return on equity for this business will increase from 10% to 11%, an increase comparable to the increase in other investment returns.

If interest rates change at the end of year 4, then the value of the liability changes as well. Under conditions at the end of year 4, the liability valuation rate r_L is increased to 6.93% from 5.99%. Using the new r_L leads to a liability fair value of \$134.21 instead of \$135.99, a decrease of \$1.78 or 1.31%.

The value of assets also changes when interest rates change. For example, assume that assets are well matched to liabilities, and that their value declines by exactly 1.31%, the same as the decline in the liabilities. This means the value of assets changes to \$150.32 from \$152.31, a decline in value of \$2.01.

Under fair value accounting, the decline in value of both assets and liabilities is reflected in income in the current period. Before-tax income is increased by \$1.78 due to the decline in liability value, and is decreased by \$2.01 due to the decline in asset value. Net income before tax declines by \$0.23. The after-tax effect is \$0.14 in this example. Exhibit 3 shows the resulting financial statements.

The decline in reported income due to the interest-rate change may come as a surprise, especially given the assumption that the value of assets and liabilities changed by the same percentage due to good asset/liability matching. The decline in reported income is due to the change in value of the assets supporting surplus. Any change in value of those assets runs through income in the current period and is not offset by any change in liability value. This is a source of volatility in reported earnings that arises under fair value accounting and was not captured under previous accounting regimes that emphasized deferral and matching.

Looking past year 4, if the new assumptions remain unchanged and experience matches them, then the reported return on equity will be 11% in years 5 and 6. This represents an increase from the 10% expected before interest rates changed, and reflects mainly the higher level of investment income reported in the future.

Exhibit 3						
Change in Interest Rates						
<u>Operating statement</u>	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>	<u>Year 6</u>
Premium income	310.37	-	-	-	-	-
Investment income	-	21.59	18.57	12.94	12.03	6.45
Total income	310.37	21.59	18.57	12.94	12.03	6.45
Claims	-	50.00	55.00	60.00	65.00	70.00
Expenses	35.00	5.00	5.50	6.00	6.50	7.00
Increase in liability	275.37	(38.49)	(46.30)	(56.36)	(62.20)	(72.01)
Total disbursements	310.37	16.51	14.20	9.64	9.30	4.99
Gain before tax	0.00	5.08	4.37	3.30	2.73	1.46
Tax	0.00	1.78	1.53	1.16	0.95	0.51
Net operating gain	0.00	3.30	2.84	2.15	1.77	0.95
Return on equity		10.0%	10.0%	9.4%	11.0%	11.0%
<u>Balance sheet</u>	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>	<u>Year 6</u>
Assets	308.41	265.30	213.44	150.32	80.65	-
Liabilities	275.37	236.87	190.57	134.21	72.01	-
Surplus	33.04	28.42	22.87	16.11	8.64	-
Total liabilities and surplus	308.41	265.30	213.44	150.32	80.65	-

When Market Value Margins Change

As noted above, market value margins are an adjustment for risk due to uncertainty in the liability cash flows from insurance-related sources such as mortality, morbidity, and so on. What happens to the example in Exhibit 1 when market value margins change at the end of year 4? For the sake of discussion, assume that a new incurable disease has been discovered. While it has not infected large populations, there is fear that it could do so. This raises the perceived risk to life insurance companies and raises their expected return on equity from 10% to 12%. The market price of life insurance company shares falls due to this extra perceived risk.

If the risk adjustment changes at the end of year 4, then the value of the liability changes as well. Under conditions at the end of year 4, the liability valuation rate r_L is decreased to 5.62% from 5.99%. Using the new r_L leads to a liability fair value of \$136.71 instead of \$135.99, an increase of \$0.72.

Under fair value accounting the increase in value of liabilities is reflected in income in the current period. Before-tax income is decreased by \$0.72 due to the increase in liability value. The after-tax effect is \$0.47 in this example. Exhibit 4 shows the resulting financial statements.

Fair Valuation of Insurance Liabilities: Principles and Methods

Exhibit 4						
Change in Market Value Margins						
<u>Operating statement</u>	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Premium income	310.37	-	-	-	-	-
Investment income	-	21.59	18.57	14.94	10.72	5.72
Total income	310.37	21.59	18.57	14.94	10.72	5.72
Claims	-	50.00	55.00	60.00	65.00	70.00
Expenses	35.00	5.00	5.50	6.00	6.50	7.00
Increase in liability	275.37	(38.49)	(46.30)	(53.86)	(63.81)	(72.90)
Total disbursements	310.37	16.51	14.20	12.14	7.69	4.10
Gain before tax	0.00	5.08	4.37	2.80	3.03	1.62
Tax	0.00	1.78	1.53	0.98	1.06	0.57
Net operating gain	0.00	3.30	2.84	1.82	1.97	1.05
Return on equity		10.0%	10.0%	8.0%	12.0%	12.0%
<u>Balance sheet</u>	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Assets	308.41	265.30	213.44	153.12	81.65	-
Liabilities	275.37	236.87	190.57	136.71	72.90	-
Surplus	33.04	28.42	22.87	16.41	8.75	-
Total liabilities and surplus	308.41	265.30	213.44	153.12	81.65	-

Looking past year 4, if experience continues to match assumptions, then the reported return on equity will be 12% in years 5 and 6. This represents an increase from the 10% expected before MVMs changed, and reflects mainly the release of higher risk margins in the future.

In this example, only the MVMs changed. The premiums, expected benefits, and expenses directly associated with the contract did not change. This suggests that the company's total earnings over the life of the contract should not have changed from those in Exhibit 1. And indeed they would not change, if it were not for the change in the amount of assets and investment income. In this example, the amount of assets supporting the liabilities at the end of year 4 is \$153.12, an increase of \$1.19 from the \$152.31 in Exhibit 1. The increase in assets is due to the higher liability being held and to the assumption that the company always holds capital equal to 12% of liabilities. If the assets had remained exactly equal to those in Exhibit 1, then the total earnings over the life of the contract would have been exactly equal to those in Exhibit 1. A change in MVMs does not affect total earnings over the life of a block of business unless some other change (such as a change in dedicated assets) occurs as a result.

When Estimates of Future Claims Change

What happens to the example in Exhibit 1 when estimates of future claims change at the end of year 4? For the sake of discussion, assume the same scenario as in Exhibit 4. A new incurable disease has been discovered. While it has not infected large populations, there is fear that it could do so. This time, instead of

raising the MVM, the expected level of future claims is raised by \$1 per year, and a corresponding increase in estimated future expenses is made. Assume that the estimate of higher future claims and expenses turns out to be correct.

If assumed future claims change at the end of year 4, then the value of the liability changes as well. In this example, the liability valuation rate of 5.99% does not change, but the projected cash flows change. The increase in estimated claims leads to a liability fair value of \$138.01 instead of \$135.99, an increase of \$2.02.

Under fair value accounting, the increase in value of liabilities is reflected in income in the current period. Before-tax income is decreased by \$2.02 due to the increase in liability value. The after-tax effect is \$1.31 in this example. Exhibit 5 shows the resulting financial statements.

Exhibit 5						
Change in Estimated Claims						
<u>Operating statement</u>	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>	<u>Year 6</u>
Premium income	310.37	-	-	-	-	-
Investment income	-	21.59	18.57	14.94	10.82	5.78
Total income	310.37	21.59	18.57	14.94	10.82	5.78
Claims	-	50.00	55.00	60.00	66.00	71.00
Expenses	35.00	5.00	5.50	6.00	6.60	7.10
Increase in liability	275.37	(38.49)	(46.30)	(52.56)	(64.33)	(73.68)
Total disbursements	310.37	16.51	14.20	13.44	8.27	4.42
Gain before tax	0.00	5.08	4.37	1.50	2.55	1.36
Tax	0.00	1.78	1.53	0.53	0.89	0.48
Net operating gain	0.00	3.30	2.84	0.98	1.66	0.88
Return on equity		10.0%	10.0%	4.3%	10.0%	10.0%
<u>Balance sheet</u>	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>	<u>Year 6</u>
Assets	308.41	265.30	213.44	154.57	82.53	-
Liabilities	275.37	236.87	190.57	138.01	73.68	-
Surplus	33.04	28.42	22.87	16.56	8.84	-
Total liabilities and surplus	308.41	265.30	213.44	154.57	82.53	-

Looking past year 4, if experience matches the new assumptions, then the reported return on equity will be 10% in years 5 and 6. The entire effect of the increase in all future claims is reported in year 4, resulting in a return on equity of just 4.3% for that year.

Other Issues Associated with Earnings Emergence

The previous discussion focused on the timing of earnings emergence. A simple and stable product was used to avoid complicating the issues under discussion. Other concerns have been raised regarding earn-

Fair Valuation of Insurance Liabilities: Principles and Methods

ings and income statement presentation under a fair value system, but these are beyond the scope of this paper. Such concerns include the following:

- **Volatility of earnings.** Reported earnings may be more volatile under a fair value system due to frequent changes in financial market values (such as interest rates) and values other than financial market values (such as inflation and other model estimation parameters). The concern often expressed in this area is over the usefulness of reported results, given that random fluctuations may reverse themselves before a contract runs off.
- **Presentation of earnings by component.** There is concern over the extent to which components of earnings can or should be reported. For example, should the change in a fair valued liability be reported as a single item, or should the following components be separately reported or disclosed?
 - The change due to interest rates
 - The change due to revision of past insurance loss estimates
 - The impact of new business versus changes in estimates for prior business

The concern is that some knowledge of the components of earnings may be needed for the reported earnings to be useful, but it is not clear that these components can be determined in a reliable, consistent manner. In addition, would the costs involved in such reporting be worth the benefits?

Imperfect Markets

When calculating the fair value of insurance liabilities, one of the most difficult tasks is determining an appropriate risk adjustment. In the absence of a market, there is no direct way to determine the market price for insurance risk. It would be ideal if there were a theory to apply that would specify a market price for the risks of insurance liabilities without resort to the cost-of-capital approach, thereby avoiding the empirical approximations that are necessary under that approach.

One might search the field of financial economics for such a theory. After all, financial economics provides excellent techniques for dealing with interest-rate risk and for pricing all sorts of options that contain risk. Perhaps similar techniques could be applied to insurance contracts.

As is discussed in the remainder of this section, this approach runs into some difficulty. Financial economic theory starts from an assumption of perfect markets, where all financial instruments are infinitely divisible and fully liquid, transaction costs are immaterial, and all market participants have the same risk/return profile. Risk adjustments based on the theory of perfect markets are a good fit for interest-rate risks, but are at odds with observed market prices for insurance risks. That real markets are imperfect should surprise no one; however, this means that theories based on perfect markets provide no purely objective way to set risk adjustments that are consistent with pricing in imperfect markets.

The remainder of this section discusses the treatment that financial economics gives to pure insurance risks under the assumption of perfect markets. The difference between the observed market risk adjustment and the adjustment suggested by economic theory is described, and an explanation of market imperfections that cause the difference is proposed.

Treatment of Insurance Claims Risk

The unknown level of future insurance claims presents a risk to insurers. That risk can be divided into two parts:

- a) Risk of deviation from the true expected claims
- b) Risk due to the unknown level of the true expected claims

The risk of deviation from the true expected claims can be reduced by taking on a large number of independent claim exposures. For example, a company can insure a large number of policyowners.

The risk due to the unknown level of true expected claims can be reduced by writing a variety of different types of insurance coverage.

So, at least in theory, both of these risks are diversifiable. The term “diversifiable” has a special meaning in Capital Asset Pricing Model (CAPM) theory, and it adds a dimension to this discussion.

Under CAPM theory, the market price of a risk is a linear function of its correlation with financial markets (i.e., proportional to its beta). Insurance risks such as hurricanes, earthquakes, and the general level of mortality are generally uncorrelated with financial markets. Therefore, they have zero beta. Under CAPM theory, anything with a zero beta is “diversifiable” by definition. CAPM concludes that the market prices zero beta contracts as if they had zero risk, that is, there is no risk adjustment in their market value.

Therefore, economic theory concludes that the risk adjustment for insurance risks should be zero. Yet, in the real world, the risk adjustment is not zero. Both retail prices and wholesale (reinsurance) prices of insurance contracts are at levels that can only be explained by the inclusion of some risk adjustment.

An explanation for the nonzero price of insurance risk lies in violation of the assumptions underlying perfect markets. Assumptions that may not hold in the real world include the following:

- The risks may not be diversifiable. The risk due to the unknown level of true expected claims can be especially hard to diversify. Financial instruments that allow easy and inexpensive trading of such risks do not exist in most cases.
- The risks may have highly skewed distributions. There may be a very small probability of an extremely large loss. Such risks are especially difficult to reduce through diversification.
- The theory depends on a well-defined *market portfolio*. World financial markets have not converged to the point where such a market portfolio can be clearly defined and its covariance matrix determined.
- The theory depends on *costless bankruptcy*, which means that all assets of a failed entity are available to settle its liabilities. In reality, there are substantial legal costs that reduce the amount of assets available to settle liabilities of a failed entity.

If market imperfections are the explanation for a nonzero price of insurance risk, then determining the market price of insurance risk is especially difficult. Economic theories based on perfect markets don't help quantify the risk adjustment because these theories say the adjustment should be zero. Yet, consistency with a sparse set of observed prices suggests a nonzero adjustment. Hence, the risk adjustment associated with insurance risk must be empirical and approximate.

The Risk-Free Rate

In the United States, it is often assumed that the risk-free rate is the same as the interest rate on U.S. Treasury securities. There are at least two reasons why U.S. Treasuries are not the risk-free rate needed for fair valuation.

1. U.S. Treasuries are not really risk-free because they are denominated in dollars. The uncertain future level of inflation introduces some risk to any security measured in dollars that have uncertain future buying power. However, for the purposes of fair valuation, one is interested in a default-free security with cash flows that are certain, not a truly risk-free security.
2. Liquidity is not a requirement of a default-free security with cash flows that are certain. U.S. Treasuries are very liquid, thereby implicitly including an option to sell at current market value before

Fair Valuation of Insurance Liabilities: Principles and Methods

maturity. If this option has value, then a pure default-free security with cash flows that are certain has lower value and higher yield than U.S. Treasuries.

It has been suggested that the risk-free rate can be measured by adjusting the market return on high-grade noncallable corporate bonds downward to remove expected defaults. However, this approach ignores the risk adjustment that is included in corporate bond yields due to the risk of default. To arrive at the risk-free rate, one would need to remove the risk premium for defaults as well as the expected defaults.

Another way to estimate the risk-free rate is to start with the Treasury rate and adjust upward to remove the liquidity premium included in the price of Treasury bonds. Estimation of the liquidity premium presents some difficulty, however.

We are left in a situation where the risk-free rate cannot be exactly determined. The return on U.S. Treasuries is probably too low, due to their liquidity characteristics. And the return on high-grade noncallable corporate bonds adjusted for defaults is too high because it includes a difficult-to-estimate risk premium. However, it may be possible to arrive at an estimate of the appropriate risk-free rate by approaching this problem from both directions. On one hand, we adjust the Treasury rates to reflect the impact of liquidity. On the other hand, we make an effort to remove both the expected value of defaults and the risk premium for defaults from the market return on high-grade noncallable corporate bonds. Two estimates are then obtained, both of which should be in the vicinity of the risk-free rate. Some sort of blending of those two estimates could provide a single risk-free rate for use in valuation.

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american academy of actuaries

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Endnotes

¹ The American Academy of Actuaries has taken no position on whether insurance contracts should fall within the definition of financial instruments. For purposes of this paper, the task force uses definitions currently proposed by accounting standard setters, under which many insurance contracts are treated as a type of financial instrument.

² The Joint Working Group of standard setters (JWG) was formed in 1997 for the purpose of developing a coherent framework for accounting for financial instruments measured at fair value. The JWG consists of nominees of accounting standard setters or other professional organizations in Australia, Canada, France, Germany, Japan, New Zealand, five Nordic countries, the United Kingdom, and the United States, as well as the International Accounting Standards Board. In December 2000, it issued a draft standard for financial instruments and similar items that focused on fair value accounting. (FASB news release, "FASB Publishes Special Report of the Joint Working Group of Standard Setters on Financial Instruments," Jan. 5, 2001.)

³ "The International Accounting Standards Board is an independent, privately funded accounting standard setter based in London, U.K. Board members come from nine countries and have a variety of functional backgrounds. The Board is committed to developing, in the public interest, a single set of high quality, understandable and enforceable global accounting standards that require transparent and comparable information in general purpose financial statements. In addition, the Board cooperates with national accounting standard setters to achieve convergence in accounting standards around the world." (IASB website, (<http://www.iasb.org.uk/cmt/0001.asp>, March 8, 2002.)

⁴ Principal exceptions are structured settlements and workers' compensation lifetime indemnity (i.e., wage loss) claims, with some additional exceptions by state. In most cases, the allowable discount rate is locked in at a conservative level, and does not vary with general market interest rates. Throughout much of the world, property/casualty insurance (a.k.a. general insurance) claim liabilities are not allowed to be discounted for interest.

⁵ This hierarchy is described in the JWG December 2000 Draft Standard and Basis for Conclusions – Financial Instruments and Similar Items, page iii (top of page) and paragraphs 77 and 104, with clarifying discussion in paragraphs 77-121.

⁶ Paragraph 116 of the JWG December 2000 Draft Standard and Basis for Conclusions – Financial Instruments and Similar Items states:

An enterprise should reflect the following information in the fair value estimate, either as a part of the present value computation or as an adjustment of the result:

- a) the price market participants are able to receive for bearing the uncertainty inherent in the financial instrument (the risk premium); and
- b) other factors market participants would be expected to consider in setting prices, including marketability and profit margins expected by market participants.

⁷ This assumes that such a contract would still have sufficient insurance risk to be labeled an insurance contract. The definition of an insurance contract put forward by the JWG is as follows: "An insurance contract is a contract under which one party (the insurer) accepts an insurance risk by agreeing with another party (the policyholder) to make payment if a specified uncertain future event occurs (other than an event that is only a change in a specified interest rate, security price, commodity price, foreign exchange rate, index of prices or rates, a credit rating or credit index or similar variable)."

⁸ For insurance liabilities that involve delivery of goods and services, the costs of those goods and services can be determined and used in place of the cash flows to be discounted.

⁹ These principles may be superseded by explicit guidance in an accounting standard. If that happens, then the accounting standard will take precedence for valuations under that standard.

¹⁰ There are exceptions to this general rule. For example, a financial instrument involving risks that are negatively correlated with other market risks can have a risk adjustment in a direction opposite from the general rule because of the negative correlation. In the stock markets, this can be observed for stocks with negative “beta.”

¹¹ The three risk-adjustment approaches outlined here are taken from a paper by David Babbel, Jeremy Gold, and Craig Merrill, “Fair Value of Liabilities: The Financial Economics Perspective,” 2002.

¹² Derivation of the probabilities is based on market prices for certain kinds of instruments.

¹³ Alternatively, a risk adjustment can be accomplished by accelerating the expected timing of cash flows whose timing is uncertain. This is sometimes done when payments are to be made after insured damages accumulate to a predetermined level. While one can think of this risk adjustment technique as an adjustment of expected cash flows, it is also a simplified way of adjusting the weights applied to various possible outcomes, as is done in option pricing. In this case, one assigns 100% weight to an outcome more adverse than the average. Whichever way one thinks about it, this technique can be classified under one of the three risk adjustment approaches described here.

¹⁴ Note that taxes are part of the costs mentioned here. There are proposals that certain taxes, such as the insurer’s income taxes, should not be recognized in liability valuation. Such a restriction violates this principle. In the methods shown in this paper, insurer income taxes are considered when determining the appropriate pretax adjustment for risk.

¹⁵ The fair value of a pure investment contract where all investment results are passed to the contract owner should be equal to the market value of the assets held under the contract. In this context, if the assets held under the contract are expected to earn a return in excess of the risk-free rate, then the discounted value of the future cash flows at a risk-free rate would exceed the current market value of the assets. A negative risk adjustment is needed to get from the discounted value at a risk-free rate down to the market value of the assets, which is the appropriate fair value. In situations like this, shortcut approaches that avoid a discounted present value calculation altogether can lead to an appropriate fair valuation. Note, however, that such shortcuts still adhere to the general valuation principles discussed above.

¹⁶ A gray area exists with regard to automatically renewable contracts, where each side has the right to unilaterally cancel. Examples include some pro-rata reinsurance contracts for property/casualty, where the contract is automatically renewed each year unless one side provides written notice otherwise within a fixed number of days before renewal date. It is expected that this issue will be decided by whatever accounting standard is finally produced.

¹⁷ The relation $E=A - L$, as used here, is based on the no-arbitrage principle. To see this, one must make a distinction between accounting and valuation. When accountants see this equation, its meaning is simply “count the values of all the assets, count the values of all the liabilities and the difference is the value of the equity in the firm.” E is, by definition, $A - L$. When it comes to valuation from an economics standpoint, one cannot take this relation for granted or assume it is what it is by definition. In economic terms, one must think of E , A , and L as separate securities that trade in capital markets. In this sense, E may not always equal $A - L$. It will only be so if the markets are perfect and one invokes the no-arbitrage assumption. By invoking this assumption, one can derive the value of L using economic valuation principles. Such valuation will ensure that L is valued consistently with how A and E are valued. This consistency ensures the integrity of the financial reporting process. The expression $A = L + E$ is also known as Modigliani and Miller Proposition 1, derived in their seminal 1958 paper on the value of the firm. Modigliani and Miller did not establish this relation by simple definition. It was proven using no-arbitrage arguments.

¹⁸ Taxes will be considered in the next section, after some basic relationships have been developed.

¹⁹ Also assume asset/liability mismatch risk is not introduced.

Fair Valuation of Insurance Liabilities: Principles and Methods

²⁰ As elsewhere in this paper, the reference to a single interest rate is meant to imply a full spot rate curve. This is done to simplify the exposition and is not intended to imply that the shape of the yield curve can be ignored.

²¹ If this equation is reformulated as follows $r_E = r_A + ((1/e) \times (r_A - r_L))$, one has Modigliani and Miller Proposition 2. This is the formula for the leverage-adjusted cost of capital, which is derived from Proposition 1.

²² Note that since r_A includes default risk on the assets, r_L includes default risk on the liabilities.

²³ In a 2000 paper, "Market Value of Insurance Liabilities: Reconciling the Actuarial Appraisal and Option-Pricing Methods," Girard extends an analysis originally formulated by Modigliani and Miller in 1958 regarding the effect of capital structure on the value of the firm.

²⁴ The total return on assets for valuation purposes is a prospective figure. It may be possible to determine a retrospective value (that is, the total return on invested assets in the most recent reporting period) from financial statements. But that is not the return used for valuation at the end of the period.

²⁵ If one targets "entity-specific value" instead of "fair value," then observations of r , e , and a must be limited to companies with top credit standing. Under the definitions used in the DSOP, entity-specific value does not include recognition of company credit standing, but fair value does. Under entity-specific value there can be no discount for a likelihood of default. Limiting observation to companies with top credit standing is a way to minimize any implied adjustment for default included in the observed values.

²⁶ Franchise value may be recognized as goodwill when a company is acquired.

²⁷ While typically sold by insurance companies, GICs generally do not meet the definition of insurance contracts (see footnote 7). They do meet the definition of financial instruments.

²⁸ In practice, a more complex interest-rate model typically would be used, and the calibrated probabilities would not come out to exactly 50%.

²⁹ The lapse rates in the table are based on the lapse rate function $0.1 \pm 100(\text{rate} - 0.05)^2$, where the plus/minus depends on whether rate is greater or less than 0.05.

³⁰ An astute reader will notice that the simpler formula discussed in this paragraph is circular. The cash flow adjustment for a time period depends on the beginning fair value, while the beginning fair value depends on the cash flow adjustment. Due to this circularity, iterative techniques are needed to reach a solution. For example, begin by making a reasonable estimate of the fair value L at each duration. Use this estimate to compute the cash flow adjustments at each duration and then use those cash flow adjustments to re-estimate L . Repeat this process until L converges. Very few iterations are typically required for convergence.

³¹ Recently some large mutual companies have demutualized and set up a "closed block" for the participating business in force as of the demutualization date. Such a closed block includes assets that serve as an investment fund backing the participating business. In general, 100% of the results of assets in a "closed block" are to be ultimately distributed to policyowners. This situation in a demutualized company is different from that in a mutual company, where there often is no separately dedicated investment fund.

³² This valuation approach is derived in detail in Luke Girard's "Market Value of Insurance Liabilities: Reconciling the Actuarial Appraisal and Option-Pricing Methods," 2000.

³³ The total return on assets is a prospective measure that includes current income net of expected defaults plus any expected change in market value. It is the rate of interest that will discount all expected future asset cash flows to the current market value.

³⁴ Strictly speaking, only part of this cash flow adjustment is an MVM. The adjustment provides for all risks retained by the company, while an MVM is defined to apply only to insurance risks such as the uncertainty in the level of future claims.

³⁵ Technically, the DSOP does not take a position on whether fair value should reflect credit standing, cit-

ing practical issues that must be addressed. However, it clearly says that in theory fair value would reflect credit standing. All other definitions of fair value have also included reflection of credit standing.

³⁶ The argument in the first three bullets below is essentially the same as that found in FASB's Concept Statement 7 – Using Cash Flow Information and Present Value in Accounting Measurements – Paragraphs 78-85.

³⁷ There are additional arguments for and against this position with regard to public debt. FASB has published discussions that address the financial statement of issuing debt if credit standing is or is not reflected, concluding that the fair value of debt should reflect credit standing. Others have argued that the “trading in one’s own debt” concern is overblown, due to legal constrictions against such actions for most publicly traded firms.

³⁸ Except in certain cases (such as assumption reinsurance), reinsurance contracts do not result in an exit from the policy obligation. Instead, reinsurance results in an asset that offsets the financial impact of the liability, except when the reinsurer defaults.

³⁹ Investment margin as used here is defined to mean the investment returns over risk-free rates.

⁴⁰ There are many ways to compute the risk-adjusted fair value of liabilities. The fact that one particular approach is used in these examples is not meant to imply it is the only correct method. For example, one could take the approach used in the example for participating life insurance, where liability cash flows plus a cash flow adjustment are discounted using the return on assets (7.0% in this example). The amounts added to liability cash flows under that approach would be as follows: for year 2—\$2.77; year 3— \$2.38; year 4—\$1.92; year 5—\$1.39; year 6—\$0.94. Calculating liability fair value that way gives exactly the same values as are shown in Exhibit 1. Other valuation methods with calibrated risk adjustments should provide similar liability values.

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