RISKS and REWARDS

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The Bullet GIC as an Example

by David F. Babbel, Jeremy Gold, and Craig Merrill

There has been considerable discussion of a variety of issues related to fair value in the actuarial literature, in conferences, and among individuals interested in this topic. Unfortunately, we seem to be failing to communicate due, in part, to inconsistent use of terminology. The goal of this discussion paper is to present a few concepts that we hope will be of use in the broader discussion of fair value of liabilities.

Fair Value from the Perspective of FASB

Current practice dictates that corporate liabilities (specifically, bonds) are listed on the balance sheet on a book value basis. The liability changes only if the company actually refunds or retires the bond. FASB is moving toward a requirement that the market value of the bond be reported in place of, or in addition to, the book value of the bond. The reasons for this change are covered in some detail in document number 204-B of the Financial Accounting Series (December 14, 1999) entitled, "Preliminary views on Major Issues Related to Reporting Financial Instruments and certain related assets and liabilities at fair value."

In the preliminary views document they indicate that "fair value" should be determined based on observable market prices.

(continued on page 4)

Beyond the Bullet GIC

by Stephen J. Strommen

In a separate article in this edition of Risks and Rewards, Babbel, Gold and Merrill provide an excellent exposition of three approaches to present-valuing a series of risky cash flows and provide several insights into the way modern finance theory deals with risk. The purpose of this article is to bring these insights to the world of insurance risks and view them in relation to existing actuarial techniques.

All three of the valuation approaches presented by Babbel, Gold and Merrill involve direct discounting of liability cash flows. However, current actuarial practice for determining liability exit value (i.e. fair value) is embodied by the actuarial appraisal method, an indirect method under which the value of the liability is computed as the market value of assets supporting the liability less the present value of future distributable earnings at a hurdle rate.

Many observers feel that direct discounting and the actuarial appraisal method produce different values. However, Luke Girard demonstrated that these two methods produce identical values when identical assumptions are used. The source of confusion is that many observers find it hard to justify the assumptions that must be used under a direct discounting

(continued on page 8)

In This Issue

Editor's Column...

Investment Actuary Symposium Special Edition

by Tony Dardis

Welcome to a special edition of *Risks and Rewards* newsletter! On November 9 and 10, 2000 the Society of Actuaries' Finance Practice Area held its first Investment Actuary Symposium — a milestone event. This edition of *Risks and Rewards* celebrates the symposium by presenting a variety of articles written by speakers from the symposium.

The symposium focused on issues and matters impacting the work of actuaries working in the finance, investment, and asset-liability management related fields. With the growing importance of the position of "Investment Actuary," this looked like an opportune time to hold such a symposium.

Our feedback so far has been that the symposium was a success, and we are looking forward to repeating the event next year. Many thanks from the Investment Section and the Finance Practice Area to all speakers who contributed.

Tony Dardis

In this edition of *Risks and Rewards*, Max Rudolph gives an overview of the highlights of the symposium. Other contributors from the symposium include: Dave Ingram, who presents some ideas on investment strategy development for a life insurance company; Peter Jones, who gives some insights from the U.K. investment actuary perspective; Marc Altschull and Catherine Ehrlich, who present some thoughts on asset modeling assumptions; and Luke Girard and Greg Goulding, who discuss fair value of liabilities. In connection with the latter, this issue also carries two other perspectives on fair value of liabilities, with front page articles from David Babbel, Jeremy Gold, and Craig Merrill, and from Steve Strommen.

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Back issues of Section newsletters have been placed in the Society library.
Photocopies of back issues may be requested for a nominal fee.

Chairperson's Corner
Looking Towards 2001

by Peter D. Tilley

In my first Chairperson's Corner, let me begin by thanking last year's chairperson, Josephine Marks, for all of her contributions to the success of our Section in 2000. Under her leadership, we organized many interesting and informative sessions at the Spring and annual meetings, and stayed plugged in to the activities of the Finance Practice Area and many other specialty Sections.

I would also like to thank the two other council members whose terms expired in 2000 — Christian-Marc Panneton and Steve Craighead. Their efforts to plan and recruit for our meeting sessions will certainly be missed.

Elections were held last summer with a very strong slate of candidates. The new council members are David Ingram, Craig Fowler, Charles Gilbert, and Doug George. If Doug's name seems familiar to Council-watchers, it's because he was elected in 1999 for a one-year term and enjoyed our conference calls so much that he ran again for a full three-year term.

One of our main goals for 2001 is to continue to give our section members many opportunities to continue their investment education through current topics at SOA meetings and seminars. My personal prediction is that credit risk will be a "hot" topic (if it isn't hot enough for you already) throughout the year.

Our Section will be sponsoring a seminar (under the guidance of Rick Jackson and David Li) on this topic. There will also be a panel discussion on this topic at the Toronto Spring meeting.

Last year, Max Rudolph got the Section web page up and running. This year, Charles Gilbert will be keeping things up to date with information on the council's activities including minutes from our conference calls, council member biographies, and copies of timeless documents such as the Chairperson's Corner.

We promise you won't have to sift through banner ads to get to the good stuff, so check us out under special interest Sections on the SOA Web site.

As always, the council welcomes your input. This spring, we will be planning the sessions for this year's SOA Annual meeting. We also plan to have an extended council meeting by mid-year to discuss seminars and research funding for 2002.

Please contact any council member to give us your suggestions. Our newsletter liaison, Vic Modugno, is interested in receiving articles for this newsletter, or if you can even suggest an article topic we can work to develop it for a future issue.

"One of our main goals for 2001 is to continue to give our Section members many opportunities to continue their investment education through current topics at SOA meetings and seminars. My personal prediction is that credit risk will be a 'hot' topic throughout the year."

Peter Tilley

I have been looking forward to using this "bully pulpit" for an occasional message that doesn't necessarily relate to council business. In the past few years, I have become involved in a few of the Society's many volunteer committees. It seems that in our specialty of investments and ALM, the same names are always involved in organizing symposiums, keeping exam materials current, setting exams, developing ALM principles of practice, etc. While actuarial students may not always immediately appreciate their efforts, these volunteers help keep our profession current in the best ways to manage the risks we deal with every day. The next time you see Josephine, Christian-Marc, Charles, or any of the literally hundreds of actuaries volunteering their time for our profession, say thanks. Maybe even volunteer to help.

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The Bullet GIC as an Example

continued from page 1

In a thinly traded market, "exit value" might be used as an indicator of "fair value." In this context, exit value is "an estimate of the amount that would have been realized if the entity had sold the asset or paid if it had settled the liability on the reporting date." FASB also allows that in some cases the present value of projected liability cash flows may be used as an estimate of the fair value of liabilities. This is the current practice in the pension area. Use of the present value method is discussed in the Financial Accounting Series document FASB Concepts Statement No. 7, "Using Cash Flow Information and Present Value in Accounting Measurements."

Approaches to Valuation

There are at least three theoretically correct methods for estimating the value of a series of (potentially risky) future cash flows. One, discount the future cash flows using a discount rate that is the sum of a risk-free rate and a risk premium. Two, modify the probabilities of the risky future cash flows to account for risk and discount at risk-free interest rates. Three, modify the risky cash flows to account for risk and discount at the risk free rate. We will discuss each briefly in the form of an example. [1]

Consider a security with price S, that will pay either S_u or S_d in one year. We can apply the three methods of valuation as follows. First,

$$S = \frac{[p\,S_u + (1-p)\,S_d]}{(1+r+\lambda\sigma_S)} \qquad (1)$$

where r is the one-year risk-free rate, p is the "true" probability of the payoff being S_u, λ is the market price of risk associated with the uncertainty about the security's payoff, and σ_S is a volatility parameter associated with the uncertainty of the security's payoff. [2]

Second,

$$S = \frac{[\pi\,S_u + (1-\pi)\,S_d]}{(1+r)} \qquad (2)$$

where $$\pi = p - \lambda\sqrt{p(1-p)}$$

is the risk-neutral (martingale) probability. Or, third,

$$S = \frac{[p\,S_u + (1-p)\,S_d] - Z}{(1+r)} \qquad (3)$$

where Z is a quantity that makes the numerator of (3) equal to the certainty equivalent of the risky expected payoff in the numerator of (1).

In order to illustrate how pricing with martingale probabilities compares to pricing with the "true" probabilities or using a certainty equivalent, consider the problem of valuing a simple one-year interest rate contingent claim. This claim will pay \$110 if the short rate goes up and \$90 if the short rate goes down. This claim can be valued using the "true" probability, p = 0.51, and a risk-adjusted discount rate. The risk-adjusted discount rate is

$$r + \lambda\sigma_s = 0.0520995$$

where $\lambda = 0.02$ and $\sigma_s = 0.104979$.

Thus, this security's value is

$$[p\$110 + (1-p)\$90]/(1+r+\lambda\sigma_s) = \$95.24.$$

Similarly, this security can be valued using the martingale probability, π = 0.5, and discounting at the risk-free rate, r = 0.05.

$$[\pi\$110 + (1-\pi)\$90]/(1+r) = \$95.24$$

Finally, using the certainty equivalent approach with Z = 0.2, the value would be

$$[p\$110 + (1-p)\$90 - 0.2]/(1+r) = \$95.24$$

The conclusion is that the valuation process can account for risk, either by using the "true" probabilities and discounting by a risk-adjusted discount rate, or through converting the "true" probabilities into martingale probabilities and discounting by the risk-free rate, or by adjusting the cash flows to a certainty equivalent level and discounting at the risk-free rate.

Each of these three approaches is theoretically correct. Practical considerations dictate the choice between the three approaches. Equation (1) is the traditional discounted cash flow model. It is most often used for capital budgeting and net present value type of analysis. It is also the traditional method of choice for non-traded or thinly-traded securities. Equation (2) is a one-period lattice version of the option pricing model. The existence of the martingale probabilities arises from the ability to create a hedge portfolio in a complete market. The hedge portfolio exactly replicates the cash flows of the security under consideration. In fact, the ability to create a hedge portfolio is synonymous with markets being complete. This approach is used when pricing interest-sensitive financial instruments and other derivatives in a complete market. Equation (3), the certainty equivalent method, is not often used because the certainty equivalent adjustment, Z, is dependent on the form of a utility function. It has, however, been successfully used in capital budgeting problems.

Some Applications of the Option Pricing Model

There are examples where the option pricing model has been successfully applied to thinly traded securities.

Probably the most prominent are the mortgage-backed securities (MBS). The underlying prepayment risk was not actively traded until the creation of MBS. The uncertainty surrounding the prepayment risk was accounted for using an option-adjusted spread (OAS). The OAS was, essentially, a fudge factor added to the discount process that reconciled the models with the market. Over time as market participants understood the prepayment risk better, and active trading emerged, the OAS shrunk drastically on vanilla MBS when valued using properly calibrated, adequate models.

Another example of an application of the option pricing model to thinly traded assets is the pricing of corporate bonds. Merton, as well as Black and Scholes, suggested that corporate securities could be viewed as options on the underlying assets of the company.

The underlying assets include plant and equipment, franchise value, customer relationships, etc. These parts of the asset value are difficult to observe and price. The model has still been used successfully in pricing credit derivatives. The inability to observe the value of assets is less of a concern for insurance liabilities where the vast majority of assets are financial and easily observed.

Consider a simple company with equity holders and a single bond issuance. Note that the bondholders are entitled to the value of the assets up to the face amount of the debt and that the equity holders are entitled to the value of the assets in excess of that amount.

This means that we can view equity as a call option on the assets with a strike price equal to the face value of the debt. For a zero coupon bond, the value of equity is given by the Black-Scholes call option formula. Extensions for coupon bonds have also been derived. The value of the bond is given by subtracting the equity call option from the underlying assets.

Thus, the bondholders are described as owning the assets and selling a call option to equity holders.

Recall the Black-Scholes call option formula

$$C = AN(d_1) - Xe^{-rT}N(d_2)$$

where

$$d_1 = \frac{\ln(A/X) + (r + \sigma^2/2)/T}{\sigma\sqrt{T}}$$

$$d_2 = d_1 - \sigma\sqrt{T}$$

and where

- C = call option value = value of equity in the Merton model,
- A = current asset value of the company,
- $N(d)$ = standard normal density evaluated at d,
- X = exercise price = face value of debt,
- r = risk-free rate,
- T = time to maturity for the option,
- σ = standard deviation of the annualized continuously compounded rate of return on the assets.

Then the value of the bond is $A - C$.

There are three key observations that can be made at this point. First, the bond value converges to a risk-free bond value as the asset value of the company increases. Second, the value of the bond decreases as the volatility of assets increases. And third, the expected return on assets is not an explicit component of the value of the bond. We will comment on each point in turn.

An increase in asset value increases both the value of equity and the value of debt, up to a limit. The most that the bond can be worth at maturity is X, the face value of the debt.

As the value of assets increases, the value of the equity converges to $C = A - Xe^{-rt}$. This can be seen by observing that as A grows large relative to X, d_1 and d_2 increase and the call option (equity) value increases toward an upper limit of $C = A - Xe^{-rT}$. Then, the value of the bond is $A - C = Xe^{-rT}$. Thus, for very large asset values, the bond is risk free and the price of the bond is the promised cash flow discounted at the risk-free rate. Notice that this result holds for relatively conservative assets with a low standard deviation or for very risky assets with a large standard deviation. For any given risk level (standard deviation of assets), the bond will be risk free for a sufficiently large asset level.

The second point deals with volatility. It is a standard result in option pricing that an increase in volatility increases the value of an option. This can be seen by taking the derivative of the option pricing formula with respect to σ.

Therefore, all else being equal, the value of the bond decreases when volatility increases. This is an intuitive result. Higher volatility in the assets leads to a greater probability of the firm defaulting and the bond holders receiving the assets of the firm as partial payment of their claim. Thus, our first point does not violate the simple intuition of this second point.

Finally, many students of the mathematics of finance find it troubling that the expected return on assets is not an explicit component of the equity or bond value. While the option pricing formula involves discounting at the risk-free rate, the relationship between the martingale probabilities inherent in the option-pricing formula and the "true" probabilities depends on the risky return on assets.

Recall equation (2) above. The martingale probability, π, is a function of the "true" probability and the market price of the underlying risk.

The same intuition holds in the more complex Black-Scholes option pricing formula. The market price of the asset risk of the company enters into the relationship between the martingale measure, N(d) in the option pricing formula, and the "true" probability density.

(continued on page 6)

The Bullet GIC as an Example

continued from page 5

There is an alternative representation of the value of a corporate bond in the option pricing framework. Recall the put-call parity relationship

$$P = C + Xe^{-rT} - A$$

where P is the price of a put option written on the same assets, A, having the same strike price, X, and the same time to maturity, T, as the call option, C. The put-call parity formula can be rewritten as

$$A - C = \mathrm{X}e^{-rT} - P. \qquad (4)$$

Notice that the left hand side of (4) is the value of the bond, as described above. The right hand side of (4) is the price of a risk-free bond minus a put option. Thus, a corporate bond value can be decomposed into a risk-free bond and a put option on the assets of the firm. For convenience, we will refer to the value of the bond cash flows, discounted at risk-free Treasury rates, as the synthetic Treasury value of the bond. Thus the decomposition involves two terms: the synthetic Treasury value of the bond and the put option.[4] This is a useful decomposition, as we can now observe the relative impact of interest rate changes and credit quality changes. Interest rate changes will impact both terms, but the price of the risk-free bond will capture the pure time value of money. When the creditworthiness of the firm changes, that will be captured by the put option value.

It is important to note that the option pricing approach differs from simply discounting liability cash flows at Treasury rates and calling the resulting present value the fair value of liabilities. As has been pointed out repeatedly and forcefully, there must be some accounting for risk. The accounting for risk is done properly in our decomposition approach. Notice, though, that simply using the asset portfolio return as a discount rate would be a mistake. The asset portfolio return is not the key to the risk in the liabilities. The keys are the degree of overcapitalization ($A - X$) and the volatility of asset returns.

Fair Value from a Finance Perspective

Consider a bullet GIC as a simple insurance company liability. In its simplest form, the bullet GIC is little more than a zero-coupon bond. The fair value of the bullet GIC could be determined using any of the valuation approaches discussed above. There are several reasons, however, that we suggest it should be valued as a risk-free zero-coupon bond minus a put option. As before, no correctly implemented valuation approach is more theoretically correct than any other correctly implemented valuation approach. The choice of valuation methodology is often driven by practical considerations.

If the bullet GIC were the only type of liability issued by an insurance company, we could just calculate the market value in the most convenient way possible. We could simply look to the secondary market, thin though it might be, and price accordingly. Alternatively, we might look to the creditworthiness of the issuer and add a spread to Treasury STRIP rates to discount the promised cash flow from the bullet GIC. The liabilities of an insurer, however, are much more complex than a simple bullet GIC. It is when we turn to the more complex liabilities that the decomposition into a risk-free liability and a put option become particularly desirable.

The key benefit of the decomposition approach is that it increases transparency. Insurance liabilities are far more complex than corporate bonds. Any reasonably competent analyst, given a market price and the details of a corporate bond (coupon rate and maturity date), could use Treasury bond data to figure out the synthetic Treasury value of the corporate bond, and the value of the put option. The put option is just the difference between the synthetic Treasury value of the bond and the market price of the bond. The relative ease of this decomposition is due to the limited information required to fully describe the cash flows of a corporate bond. Thus, for a corporate bond, it is fully adequate to report only its fair value.

> *"The synthetic Treasury value of liability is like a defeasance value of the liabilities. The put option value captures the risk inherent in the company backing the liabilities."*

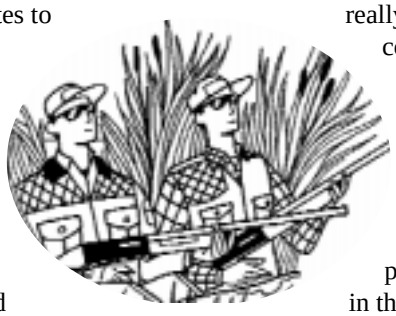
The relative impact of interest rate changes and credit quality changes is easy to discern. Similarly, for a GIC, it would likely be adequate simply to report the market (fair) value of the liability. For more complex insurance liabilities, the decomposition approach has advantages.

The increased transparency of the decomposition approach is valuable for analysts, regulators, investors, and management. Analysts would be able to compare the structure of liabilities from one company to another more easily because of the consistent use of Treasury rates in calculating the risk-free present value of liability cash flows (the synthetic Treasury value of the bond). Then, a contra-liability (the put option) would summarize the condition of the company backing the liabilities.

If the liabilities were to be transferred from one company to another, the contra-liability would change, not the present value of liability cash flows. This would aid in mergers and acquisitions analysis and decision making as well as for sales of a block of business. Regulators would also benefit from this decomposition.

The synthetic Treasury value of liabilities is like a defeasance value of the liabilities. The put option value captures the risk inherent in the company backing the liabilities. Similar reasoning applies to investors and managers who are concerned with the condition of the company.

The put option value is relatively easy to compute. The same projected cash flows that are discounted at Treasury rates to arrive at the synthetic Treasury portion of the decomposed liability value can also be discounted at risky interest rates. A spread, with appropriate maturity and risk dependencies, can be added to the Treasury interest rates to discount the projected liabilities.



The difference between the two present values is the value of the put option. While it might seem that it would be easier just to discount with a spread and call that the fair value, the decomposition is valuable for the reasons listed above.

Concluding Comments

There is a lot of work still to be done to extend the reasoning in this note to more complex liabilities. In fact, it may well be that the best we can do at this point is to estimate future possible cash flows with their interest rate contingencies and discount them by Treasury interest rate processes and then by interest rate processes that incorporate appropriate spreads. In this way, we can estimate the two pieces of the decomposed value of insurance liabilities.

It could be argued that reserves are analogous to the Treasury rate discounted insurance liabilities. If reserves are estimated according to consistent actuarial and statutory standards, it is asserted, they can be compared to fair value estimates, and out pops a default risk premium.

We think not, for two reasons. First, for more general corporate bonds, the construction of a synthetic Treasury captures properly all of the interest-sensitive elements in the bond. Stochastic interest rate valuation models then capture the option value.

In contrast, reserving methods either ignore options or render their value at the current exercise price. Either treatment greatly misvalues the option. This is particularly ironic in light of the modern trend to view the life insurance policy as a package of options.

Second, reserving methods typically are conservative and embed margins designed to provide security that insurance promises can be kept. To the financial economist, these margins are more properly considered a part of surplus, not liabilities. What is really needed by the financial community, investors, and regulators is analogous to the synthetic Treasury used to analyze corporate bonds, and this measure is not currently produced by life insurers in their financial reports.

Regarding the issue of risk-based interest rate spreads, it has been suggested that insurance liabilities be discounted by rates that reflect the "claims paying rating" spreads associated with Moody's or Standard & Poor's ratings. We have two concerns with such procedures. First, the resulting estimation could hardly be called a "market value," because a rating agency's claims paying rating is not a market rating. Second, there is far more variation within a given rating than there is across rating categories.

For instance, Moody's chief economist, Jerome Fons, demonstrated that even with bonds, where the rating agencies have decades of experience, there are large disparities in yields. He showed how on a single day you can observe bonds in the same rating category with the same maturity commanding yields that are 50 to 800 basis points apart, depending on which of the investment grade categories one is considering. By way of contrast, the variation in average yields across categories is less than one-fourth as large. Clearly, such large disparities are forcing claims paying ratings to shoulder too heavy a load when it comes to valuing insurance liabilities.

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Footnotes

1) This example is drawn from the monograph, "Valuation of Interest-Sensitive Financial Instruments." Babbel and Merrill, SOA Monograph M-FI96-1, pp. 43-44.
2) The market price of risk is the equilibrium excess reward to risk ratio,

$$\lambda = \frac{\mu_S - r}{\sigma_S}$$

where μ_S is the expected return and σ_S is the standard deviation of return for the security, *S*. In equilibrium the reward to risk ratio is constant for all securities. In a CAPM framework λ would be defined with β in the denominator. In a multi-factor setting there would be a market price of risk for each stochastic factor.
3) Other names applied to this model include the martingale measure, risk-neutral probability, or hedging model.
4) In Merton's original derivation of this model the only risk captured by the option was default risk. In an insurance liability application it would need to capture other risks such as illiquidity.
5) In this context "defeasance value" means the value of a portfolio of Treasury securities that fully funds the expected cash flows, including interest rate contingencies, of the insurance liabilities being considered.

Beyond the Bullet GIC

continued from page 1

method to arrive at the same liability value as the actuarial appraisal method. The principal areas of discomfort are the discount rate and the provision for risk.

To justify the required assumptions under direct discounting, let's decompose a liability exit transaction (i.e. assumption reinsurance) into the parts that have financial value. A liability exit transaction involves three key elements that have real financial effects.

1. The liability cash flows become the responsibility of the buyer.

2. The seller provides the buyer with cash or invested assets whose market value is equal to the fair value of the liability.

3. The buyer accepts the liability risk. To do so, the buyer commits some capital in addition to the amount provided by the seller to provide security for the liability.

When a buyer determines the amount of cash or invested assets to demand from the seller, the buyer sums the effect of all three parts of the transaction. These effects are:

1. The liability cash flows become the buyer's responsibility. This value by itself is the discounted present value of the liability cash flows at a risk-free rate. If credit standing is to be reflected, then the liability cash flows should be adjusted downward to reflect the probability of default.

2. The buyer acquires cash or invested assets that can be re-invested for the duration of the liabilities to earn a return above the risk-free rate. The possibility of earning a spread over the risk-free rate is an opportunity that has value for the buyer. This value serves to reduce the fair value of the liability.

3. The buyer's acceptance of risk requires a commitment of capital to provide security for the liability. The cost of this capital commitment increases the value of the liability.

Thus we have the following:

Liability exit value = Present value of liability cash flows at risk-free rate less Value of buyer's opportunity to re-invest plus Provision for risk

While it's clear how to calculate the present value of liability cash flows at a risk-free rate, it's not obvious how the other parts of liability exit value can be treated under a direct discounting approach. Here's how:

- **The value of the buyer's opportunity to re-invest** can be represented by an expected investment yield spread over the risk-free rate. This spread is the excess of the investment yield the buyer expects to achieve over the risk-free rate. Use of this spread when discounting liability cash flows results in a smaller present value, thereby taking into account the value of the buyer's opportunity to re-invest.

- **The cost of capital** can be computed as a dollar amount and added to liability cash flows just like any expected claim payment. When the present value of liability cash flows is computed with this amount added to cash flows, the resulting present value is larger, thereby taking into account the buyer's cost of capital. (It's also possible to express the cost of capital as a reduction to the discount rate rather than as an addition to liability cash flows.)

To summarize, direct discounting of liability cash flows will produce a liability value equal to that under the actuarial appraisal method if the following assumptions are made:

1. The discount rate includes a spread over the risk-free rate equal to what the buyer expects to earn on the invested assets.

2. The buyer's cost of capital is added to the liability cash flows being valued, or equivalently, converted to a reduction in the discount rate.

These two assumptions focus on areas of much debate: the discount rate and the provision for risk. Here are a few observations on each, taking into account both the analysis above and the discussion by Babbel, Gold, and Merrill.

The Discount Rate

As suggested above, the discount rate should include a spread over the risk-free rate. The spread should be what the buyer (not the seller) expects to achieve. Since it is the buyer's expectation in which we are interested, we can assume for the sake of discussion that the existing portfolio will be sold and re-invested as part of the exit transaction. The spread on a portfolio selected by a reasonable buyer is what we need to estimate. This could well be different from the spread on the seller's portfolio, although it may be the same.

Many observers object to including an investment spread on risky assets when determining the discount rate. In their article in this issue of *Risks and Rewards*, Babbel, Gold, and Merrill point out that the return on assets does not explicitly appear in their option-based formula for the value of a bond. However, they are careful to observe that its absence is due to the use of martingale probabilities rather than "real" probabilities. The return on risky assets is implicit in their formula because it is used when deriving martingale probabilities from "real" probabilities. Therefore the expected return on risky assets influences the value of a bond or other financial liability under both their analysis and that presented here.

The Provision for Risk

The analysis above uses the cost of capital to quantify the provision for risk. Before discussing the cost of capital, let's review the way risk should affect fair value of a financial instrument.

Risk can be accepted by either the payer of the cash flows or by the receiver of the cash flows. Risks accepted by the receiver reduce the fair value of the instrument. Risks accepted by the payer increase the fair value of the instrument.

In their discussion of bonds and mortgage-backed securities, Babbel, Gold, and Merrill dealt only with risks accepted by the receiver of the payments. The risks were default or prepayment. Both risks reduce the fair value of the instrument in question. They can be valued by including a positive spread in the discount rate, as in their method 1, or by subtracting a "certainty equivalent" from cash flows as in their method 3.

In the general insurance context, most risks are accepted by the payer, that is, the insurer. The risk is that future insurance claims could be much different than expected. This risk *increases* the fair value of insurance liabilities. The risk can be represented by including a *negative* spread in the discount rate under method 1 or *adding* a "certainty equivalent" to cash flows under method 3.

A number of methods have been proposed for quantifying the provision for risk. Babbel, Gold, and Merrill refer to methods (their method 2) that have been developed and used widely to quantify interest rate risk.

These methods rely upon the existence of a com- plete and active market from which the "market price of risk" can be determined. With the market price of risk one can in theory compute the martingale probabilities that must be used when discounting cash flows using a risk-neutral interest rate process.

The use of the martingale probabilities eliminates the need for the interest rate spread that could otherwise be used to value the risk.

Since there is no complete and active market for insurance policy risks, applying that approach isn't practical in the insurance context. The actuarial appraisal method uses a different approach. The provision for risk is the cost of capital. Insurers hold capital to make the pay-ment of claims a near certainty.

Under a direct discounting approach equivalent to the actuarial appraisal method, the cost of carrying capital is added to liability cash flows in the manner of the "certainty equivalent" under method 3 of Babbel, Gold, and Merrill.

Some observers feel that the cost of capital is difficult to estimate. Clearly there is some judgment involved. The cost of capital is the product of the amount of capital required and the excess of the required pre-tax return on that capital over the portfolio investment yield[4]. Estimates must be used for the amount of capital required and for the required return.

In the United States, it is common practice for actuaries pricing life insurance and annuity business to build the cost of capital into their calculations in exactly the terms described here.

Since it is common practice for such estimates to be made in pricing, it is hard to argue that such estimates cannot be made for valuation. Over time, either actuarial standards or pressure from auditors will push companies towards reasonable consistency in these assumptions.

It's important to realize that when the cost of capital is used to quantify the provision for risk in a multi-scenario valuation model, the real probabilities must be used rather than the martingale or risk-neutral probabilities. That's because the use of martingale probabilities makes a provision for risk. If the full cost of capital is also included, then the provision for risk is at least partly double-counted.

Some observers prefer to make the provision for risk as an adjustment to the interest rate used for valuation rather than as an addition to cash flows. It is certainly possible to do this in a manner that produces the same result as the approach given here. Arguments as to which approach is best are beyond the scope of this article.

Interaction of the Discount Rate and Provision for Risk

One way to think about Girard's transformation of the actuarial appraisal method is to consider it an indirect approach to determining the appropriate interest rate spread for use in present-valuing insurance liabilities. We start with the risk-free rate, add a spread for investment risk, and then subtract a spread for total enterprise risk. What's left is the spread for liabilities.

As we've discussed, the spread for investment risk is the spread included in the expected return on the investment portfolio. The spread for total enterprise risk is the cost of capital expressed in terms of a yield spread.

This framework explains some of the liability spreads observed in the marketplace. For example:

1. In the case of a bullet GIC, we have an illiquid financial instrument. Insurers typically invest in somewhat illiquid assets to support the GIC, and thereby earn a yield spread attributable to the liquidity risk. However, since the GIC liability's liquidity characteristics hedge the liquidity risk, the total enterprise risk is smaller than the asset risk. When the total enterprise risk spread is deducted from the investment risk spread, there is a positive remainder. So the discount rate for a GIC liability can be greater than the risk-free rate because of the market liquidity premium that is hedged by the liability.

2. In the case of some property-casualty business, there is no hedging relationship between the investment portfolio and the liabilities. The total enterprise risk is greater than the investment risk. When the spread for total enterprise risk is subtracted from the spread for

(continued on page 10)

Beyond the Bullet GIC

continued from page 9

investment risk the result is a negative net spread. So the discount rate for some property-casualty business can be less than the risk-free rate.

These examples show that the liability discount rate can be either greater or less than the risk-free rate. In general, it can only be greater than the risk-free rate when there is some sort of hedging relationship (or negative risk covariance) between the insurance policies and the investments so that the insurer does not retain the entire investment risk.

Conclusion

The purpose of this article has been to bring the insights of Babbel, Gold, and Merrill to the world of insurance risks and view them in relation to existing actuarial techniques. In doing so, we have found their insights to be entirely consistent with existing actuarial practice and helpful in confirming the appropriate assumptions for use in liability fair valuation.

Stephen J. Strommen, FSA, MAAA, is an associate actuary at Northwestern Mutual in Milwaukee, WI. He can be reached at stevestrommen@northwesternmutual.com.

Liberty Rings in 1st Annual Investment Actuary Symposium

by Max J. Rudolph

The voters of America should have visited Philadelphia to find some expert counters. While the world's focus was on Florida and "chads," the first Investment Actuary Symposium was held November 9 and 10 just up the street from Independence Hall. The seminar was held the day following one detailing the Unified Valuation System and was sponsored by the SOA, AAA, CCA, and CIA. Four of the session time slots had three different options, which allowed participants to attend topics of interest to them. The day-and-a half seminar started with an economic review by Bharat Nauriyal, Ph.D., of Nationwide. Craig Merrill Ph.D., from BYU, reported on some valuation models that are being considered by the UVS team. Alton Cogert, CFA, CPA, gave an entertaining review of current issues for investment managers, including investment performance and rating agency issues. The first breakout session featured M&A implementation issues, derivatives, and fair value of liabilities.

Peter Jones, FIA, provided an interesting comparison with UK methodologies over lunch, followed by a discussion of investment strategies, led by David Ingram, FSA, from M&R and Steven Huber, FSA, CFA, from Aeltus. The second breakout session ended the first day, with discussions covering fair value accounting, option pricing models, and liquidity.

The second day featured two breakout sessions and an opportunity to "Ask the Experts." Investor relations, risk position reports, and variable product guarantees were discussed at the first breakout session. Performance measurement, modeling assumptions, and interest rate models were the topics for the final breakout sessions. The distinguished group of experts included Peter Jones, Alton Cogert, Bob Reitano, FSA, from John Hancock and George Silos, FSA, CFA, from New York Life. The discussion ranged from UVS to embedded value and beyond.

While a brief review like this one can't give you an in-depth understanding of the topics discussed, it can give you a flavor for the direction of this recurring seminar. Hopefully, the sessions were valuable to attendees and repeat participants will value the meeting for the networking possibilities as well as the educational benefits.

Thanks to Tony Dardis, FIA, ASA, CFA, for coordinating the meeting and providing excellent kickoff and closing remarks. Many thanks also go to the planning committee, which included Tony, Syed Ali, Steve Craighead, Peter Hepokoski, and David Vanden Heuvel. If you have any ideas for topics or speakers during next year's seminar, let someone from this group or the Investment Section Council know. Please turn to page 12 to begin reading the first of a number of articles in this issue from presenters at the first Investment Actuaries Symposium.

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Redington Prize Nominations Due May 31, 2001

To promote investment research, the Investment Section sponsors a biennial prize of $2000 (U.S.) for the best paper on an investment-related topic written by a SOA member. The prize is named after F. M. Redington, the eminent British Actuary who coined the term "immunization" in a 1952 paper that was published in the *Journal of the Institute of Actuaries*. The Council has awarded five prizes since its inception and these are listed below:

1. "The Risk of Asset Default" *TSA XLI* (1989): 547-582 by Irwin T. Vanderhoof, Faye Albert, Aaron Tenenbein, and Ralph Verni.
2. "Multivariate Duration Analysis," *TSA XLIII* (1991): 335-376 by Robert R. Reitano.
3. "Multivariate Stochastic Immunization," *TSA XLV* (1993): 425-461 by Robert R. Reitano.
4. "Interest Rate Risk Management: Developments in Interest Rate Term Structure Modeling," *NAAJ Vol. 1 No. 2* (April 1997) by Andrew Ang and Michael Sherris.
5. "Quasi-Monte Carlo Methods in Numerical Finance," *Management Science* (1996) and reprinted in Chapter 24 of Monte Carlo: *Methodologies and Applications for Pricing and Risk Management* (1998) by Corwin Joy, Phelim Boyle, and Ken Seng Tan.

The Council is now seeking nominations for the next award. The criteria for selection are as follows:

Publication Years:
The paper must have been published during the calendar years 1998 or 1999.

Author:
A member of the SOA must have written the paper. In the case of a paper with multiple authors, a member of the SOA must be a major contributor to the paper.

Content:
The topic must be judged to be timely, primarily of investment nature, and of substantial value to SOA members.

Source:
The paper may appear in any recognized SOA format, including *North American Actuarial Journal, Transactions, ARCH,* study notes and Section newsletters. The paper may appear in non-actuarial journals or publications deemed to be of at least comparable quality by the Prize Committee. Such publications include, but are not limited to *The Journal of Portfolio Management, Financial Analysts Journal, Journal of Finance, and Journal of Financial and Quantitative Analysis.* If the paper is a result of a SOA seminar or colloquium, it must have been published either in a conference book available to the membership or in an acceptable journal. The journals, books, and newsletters should be published in 1998 or 1999.

Judging:
The selection criteria will include factors such as investment content, originality, practical significance, timeliness, relevancy, and educational value to the membership. A prize will be awarded only if the Prize Committee deems the best eligible work to be of sufficient merit to justify an award. The Prize Committee members are Nino Boezio, Steven Craighead, Luke Girard, Jeremy Gold, David Li, John Manistre, Robert Reitano, Michael Sherris, Elias Shiu, Ken Seng Tan, and Richard Wendt. The final decision for any award will rest with the Investment Section Council.

Submission:
The paper must be submitted prior to May 31, 2001. The submission should be sent to Luke Girard, Lincoln Investment Management, Inc., 200 East Berry Street, Fort Wayne, IN 46801-7814 or e-mailed to *lgirard@lnc.com.*

Investment Actuary Symposium

Investment Strategy Development for a Life Insurance Company

by David N. Ingram

Investment strategy development is fundamentally a communications exercise. If the investment and actuarial functions operate together as a team, the strategy development discussions can be the beginning of the long, ongoing dialog and can form the basis for that working relationship.

If the investment and actuarial functions work as separate teams, then the strategy development discussion will be a large part of the total discourse between the two areas and is therefore even more important. Investment strategy discussions should always begin with the question of risk tolerance. That is what every textbook says. However, risk tolerance is rarely known. It is sometimes hinted at. The best that can often be done is to look at various types of tea leaves to try to draw a picture of what risk tolerance may look like.

If you look at what any brokerage firm or mutual fund company uses to determine risk tolerance for individual investors, you will see that they ask about income and net worth; knowledge of investments; experience with investments; investment objectives; risk – return expectations; expected cash flow needs and investment horizon.

These are the same questions that need to be asked about an insurance company. Direct answers will be more difficult to get from an insurance company management than from an individual investor, where the answers are usually fuzzy at best.

Risk tolerance will often have to be determined largely by inference. There are two methods for indirectly determining risk tolerance: looking back and looking ahead. To look backwards, examine the past investment choices of the company. For example, take the portfolio details from the recent past and look at the C1 risk characteristics (under the current RBC rules) of the purchases compared to the portfolio at that time and compared to the current portfolio. Were the acquisitions significantly different in risk than the current portfolio?

What types of investments were chosen that have higher risk characteristics? What types of investments does the company seem to favor and avoid? From looking back like this, you can determine the answers to the questions in the preceding paragraph even if you failed with direct questioning.

Looking ahead to determine risk tolerance means taking the current choices and stating the risk characteristics of each. What is chosen then reveals the marginal risk tolerance under direct observation. There are two problems with this. The first is that to form an investment strategy, you do not want to work with just marginal risk tolerance.

The second problem is that such observed decisions sometimes reveal different and possibly significantly more conservative or more aggressive than the actual risk tolerance. One way to avoid that problem is to combine looking back with looking ahead to get a full perspective on actual risk tolerance.

There are four key questions to answer in the investment strategy discussion:

1. How are you going to make money?
2. How are you going to control earnings fluctuations?
3. How are you going to prevent catastrophic losses?
4. How are you going to choose when a new investment idea comes along?

How Are You Going to Make Money?

How you make money relates to the value that will be added in your investment selection process to do better than simply buying a basket of securities at the market. Some examples include sector rotation, credit selection, non-standard weightings in riskier investments such as junk bonds, real estate, or common stocks. This answer should be the same as the answer to the question: what are you good at?

Whatever the answer, try turning it inside out. Can this strength be applied on the sell side as well as on the buy side? Even with all of the gains in investment technology over the past 10 to 15 years, many, many insurance companies will still describe themselves as buy and hold investors.

Fifty years ago, buy and hold was a moral choice. Trading securities was thought to be improper speculation. Fifteen years ago, I encountered a situation where the portfolio managers told me that they could not trade securities because they had been told that the investment year method used to set interest rates could not handle trading. I told them that it was my job to make it work if they had a way of making more money through trading. If, for example, your investment strategy is driven by sector selection, why, if you think that you should buy the sector that has the wider spreads, do you not want to sell the sector with the narrower spreads?

When you are talking about making money, make sure that your strategy discussion includes talking about your standards for putting money to work. That may be through a maximum cash position or a time limit for purchases. Simple strategies exist for locking in a particular yield curve situation to match the time of the cashflow. If these standards are not set, then there may sometimes be a tendency to wait to find the perfect investment, losing yield or spread until perfection is found or until time runs out.

How Are You Going to Control Earnings Fluctuations?

Controlling earnings fluctuations can be a long discussion. This is where the

actuary needs to bring the investment manager into the liability side of the game. All the possible liability side sources of earnings fluctuations need to be reviewed with the portfolio manager. The actuary needs to be forthcoming in discussing the strengths and weaknesses of the liability model used to set prices and test for volatility sensitivities. Possible shortcomings in the liability model as well as possible effects of variations in economics should be reviewed. To act as a team, the portfolio manager needs to stay awake for this discussion.

A highly trained investment professional who knows little about the inner workings of insurance liabilities can be a big help in formulating the most effective strategy if they fully understand the nature of the drivers of the liabilities. On the other hand, the actuary should stay awake when the investment manager is describing the details of what can create earnings fluctuations from the asset side. It is too easy to just hear the words, write them down and want to skip to the amount without understanding why the loss occurs. Only if the actuary and investment manager understand each other's side of the business can they really form a fully effective team.

One area of caution for the control of earnings fluctuations is that diversification is the first and most important tool in moderating earnings fluctuations. Diversification is usually accomplished through constraints on maximum exposure to a "name," sector diversification, regional diversification, and instrument diversification. Make sure that your diversification constraints are meaningful in today's economy. With the globalization of most things, it is hard to be really diversified. The most recent lesson learnt in 1998 after the Russian bond crisis led to ripples throughout the global financial system. When things went wrong, everything converged. There were no inverse correlations to save things for those with too little liquidity.

How Are You Going to Prevent Catastrophic Losses?

Catastrophic losses have received much attention. In discussions of company failures, the question comes up as to whether the crisis was precipitated by a shortage of liquidity or of capital. The answer in my opinion is actually that there is little difference between the two when crunch time comes. In your investment strategy discussion about preventing catastrophic losses, take some time and talk through a simulation of one or more crisis situations. Where will you get the cash to meet the run on the company? The first instinct is to sell the highest quality, most marketable securities. In your simulation, see then what the company balance sheet looks like. What will be the market perception of your company with the balance sheet that remains? If, on the other hand, you have plans to use a line of credit in time of need, think again.

A bank may balk at extending even a fully guaranteed line of credit to a company that they perceive is in trouble. They will be weighing the expected cost of a lawsuit against the possible loss of the money extended through the line of credit. For a hair-raising story of the daily events in a failure situation, read the two books published last year about the long-term capital situation in 1998 (*Inventing Money: The Story of Long-Term Capital Management and the legends behind it* by Nicholas Dunbar and *When Genius Failed: The Rise and Fall of Long-Term Capital Management* by Roger Lowenstein).

To complete your discussion of earnings fluctuations and catastrophic losses within your investment strategy development discussion, talk about how these issues are reflected in your everyday choices in investment decision-making. Are decisions based on mean or even maximum returns? Note that for a bond, maximum return is the yield to maturity. Do you look at risk- adjusted returns? Is the impact of RBC or Target Surplus on the returns of investments a part of the evaluation process?

How Are You Going to Choose When A New Investment Idea Comes Along?

Any time that I have been involved in an asset liability team, I have noticed that investment ideas wear out. Whatever worked well last year does not work as well this year. At the same time, there are a group of investment bankers who make their living selling the "new best thing" to institutional investors like insurance companies. Every year, decisions need to be made to choose in or out of these new opportunities. The pressures are great, especially since it usually looks like it will be difficult to meet goals with the investment strategy that you used last year. What is needed is a decision-making framework for evaluating these new opportunities, or some way to stretch the existing strategy to either embrace or reject the new ideas.

The "traditional" approach is to look at the expected return on these new choices compared to the current investments. Other important considerations are "who else is doing this?" and "has anyone on the investment committee ever had a problem with this?" Tax and accounting issues are paramount, and most important, the projected impact on sales.

The "modern" approach is to compare the risk and return of the new opportunity to the appropriate class of bonds, that is, the bonds with similar risk characteristics. The most popular new investments are ones that fall between the cracks of statutory, RBC, or GAAP rules. Investments have to be matched with liabilities also.

The "New Economy" approach is that investment opportunities no longer have to fit with liabilities. Companies can trade away any aspects of either assets or liabilities that do not fit well.

In the end, almost as important as the approach you choose is that you have the discussion as a part of your investment strategy formation discussion. This part of the discussion will be especially useful in promoting rational decision making when the choices seem the most urgent.

Having the conversations, asking the questions, and honestly trying to come to agreement on answers is what the investment strategy formation discussion is all about.

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Investment Actuary Symposium

Fair Valuation of Liabilities: Theoretical Considerations

by Luke N. Girard

Is it better to be precisely wrong or approximately right? This question is at the center of the battle between historical cost and market value accounting. Current market value is highly relevant, but its accuracy is limited. Historical accounting, on the other hand, is highly accurate, but is of little relevance. The following quote is from Diana Willis at the FASB.

"The old model with its historical-price based measures provides less relevant information than today's dynamic capital markets need, and it cannot cope with today's complex financial instruments and risk-management strategies — much less tomorrow's.

It clearly indicates that the FASB has shifted toward increased relevancy. This increased emphasis does not necessarily have to come at the expense of less accuracy, since there have been advances in both valuation methodology and information technology.

The two leading methods for doing a fair valuation of liabilities are the *option pricing method* and the *actuarial appraisal method*. While they have wide acceptance, they also appear to contradict each other in many ways. A task force formed by the American Academy of Actuaries coined the term "option pricing method." This task force produced a position paper that catalogued seven possible methods, one of which was the option pricing method.

The option pricing method has also been referred to as the "direct method," since liability cash flow is discounted at the risk-free rate plus a spread. Included in liability cash flow is premium and benefit cash flow along with expenses. This valuation method is consistent with the way assets are valued in the capital markets. If cash flow is certain, the discount rates are the spot rates. If cash flow is uncertain, we need to generate interest rate scenarios, and then, to complete the valuation, we need to probability weight the path-wise present values for each scenario. The option pricing method has many advantages. The valuation method is independent of statutory accounting, risk-based capital, and taxes. It is also independent of the investment strategy that is being used to fund the liabilities. Assumptions can be objective if they are derived from the marketplace. For all these good reasons, it is preferred by accountants and corporate finance professionals.

The actuarial appraisal method has also been referred to as the *indirect method* because it is deduced indirectly from an actuarial appraisal. An actuarial appraisal is fundamentally based on discounting free cash flow. Free cash flow is discounted at the cost of capital in order to derive what is called DDE or *discounted distributable earnings*. The fair value of liabilities is deduced by deducting DDE from the market value of the assets. The actuarial appraisal method has many advantages. It is based, of course, on free cash flow, which depends on the important realities of statutory accounting, taxes, and the investment strategy. It is flexible since it can incorporate actuarial assumptions of mortality, morbidity, and lapsation. It is generally accepted as a valuation basis in the merger and acquisition marketplace.

As different as these two methods appear to be, they can be reconciled. In fact, it can be shown that they produce exactly the same result if we are careful in applying consistent assumptions in each case. This equivalence is based on pure algebra. To see this, we start with the actuarial appraisal method and define a term called *required profit*. This is the pretax profit that needs to be generated by the product in order to earn the cost of capital. If this profit is generated, the shareholders should be satisfied since the company will earn its cost of capital. Next we define a term called the *liability spread* as the asset spread minus the ratio of required profits over the fair value of liabilities, where the asset spread is the expected return of the assets over the risk-free rate. Note that because this is an actuarial appraisal, the liability spread depends on investment strategy, risk-based capital, statutory accounting, cost of capital, and taxes. If we add the liability spread to the risk-free rate and discount liability cash flow directly, we get exactly the same result as the actuarial appraisal method. No new information is being created by doing an actuarial appraisal in this way. In essence, this is a tautology.

The new information is that there is no new information. Critics of this line of reasoning have pointed to the existence of a "circularity" in the derivation of the option pricing method from the actuarial appraisal method. This circularity results from the fair value of liabilities being dependent on the required profit, which is in turn dependent on the fair value of liabilities. While it exists, it does not invalidate the conclusion, although it does make the mathematics somewhat challenging (see Girard 2000-1).

Many practitioners, in declaring that these methods are different, are not being diligent in ensuring that assumptions are being applied consistently between the two methods. Whether assumptions are derived implicitly or explicitly or whether each method uses different assumptions should not be sufficient cause to view these methods as being different. After all, within each method different methods exist for developing assumptions. If this were a sufficient argument to make the two methods different, then we would arrive at the absurd conclusion that each method would be different from itself. Thus, if

we make exactly the same assumptions in applying each method, we will get exactly the same result. This makes the two methods equivalent.

Now that we have established that the two methods are equivalent, we are ready to move to the next stage, which is the choosing of assumptions for the valuation or accounting policy. Let's assume that we have perfect markets, as Modigliani and Miller contemplated back in 1958, when they wrote their celebrated paper concerning the cost of capital (see Modigliani and Miller 1958 and 1963).

If we have perfect markets, M&M con-cluded that we must use a leverage-adjusted cost of capital when discounting free cash flow. M&M derived the leverage-adjusted cost of capital under the assumption of a steady state. This assumption is not appropriate for most fair valuation situations, since fair valuations have finite horizons and cash flow can vary for each period. However, the leverage-adjusted cost of capital can be generalized to accommodate finite horizons and varying cash flow (see Girard 2000-2).

If we assume a leverage-adjusted cost of capital, then the liability spread reduces to or converges to the debt spread. This debt spread is the funding cost for the firm in excess of the risk-free interest rate or, stated differently, the debt spread plus the risk-free rate is the market cost of debt for the firm.

There are many reasons to suggest that it is quite sensible to use a leverage-adjusted cost of capital as the policy when doing an actuarial appraisal. For example, everyone would agree that if you have a riskier investment strategy, you should be using a higher discount rate.

If the level of risk-based capital is lower, you have more leverage and this should result in a higher discount rate. Also, if the reserve basis is weak, this means higher leverage, which should translate into a higher discount rate. A leverage-adjusted cost of capital has all these desirable attributes. Furthermore, using a "risk-adjusted rate of turn" may be required under the actuarial standards of practice in order to reflect the risk of leverage. At least, appropriate disclosure may be necessary if the discount rate does not reflect all risks (see section 5.2.2 of *Actuarial Standard of Practice No. 19 – Actuarial Appraisals*).

The insurance markets are not perfect. Life insurance policies do not trade in the capital market as treasury bonds do. Therefore, it is quite natural and appropriate to critique this assumption. So, why should we make the perfect market assumption? First, it is a good idea to have an internally consistent valuation process, and the perfect market assumption helps you achieve that consistency. Second, the perfect market assumption is consistent with asset valuation.

This assumption is generally made on the asset side of the balance sheet to value similar risks such as interest rate risk and equity market risk. Third, the assumption is objective, the information used in the valuation process comes from the market and is not subjectively derived by management.

Objectivity is good because it helps to ensure comparability between companies. Finally, the perfect market assumption insures that you have a willing buyer and a willing seller, which is a generally accepted guideline in a fair valuation.

In doing an actuarial appraisal, the assumption is often made that the cost of capital is constant. A more sophisticated assumption would be to assume that the cost capital is equal to the risk-free interest rate plus a spread. These assumptions are usually made when calculating an *option adjusted value of distributable earnings* (OAVDE). The pitfall is that, if you do this, you are implicitly assuming that leverage is constant over both state and time.

However, leverage is not static. It can be quite dynamic. Leverage can be very large, it can be very small, and it can even be negative. The existence of dynamic leverage is problematic when valuing merger and acquisition transactions at one single corporate hurdle rate or at the risk-free interest rate plus a static spread. Depending on the circumstances, this practice could easily result in mispricing a transaction.

It has been said that it is not the objective of FASB to measure the distributable earnings capacity of the firm. In fact, that is exactly what we are doing when we are calculating fair values by discounting liability cash flows directly at the risk-free interest rate plus the firm's debt spread. We have also been told that when doing a fair valuation, we should not be discounting liability cash flow at the company's investment earnings rate less a profit margin. In fact, that's what we are implicitly doing when we are doing a fair valuation using the option pricing method.

In summary, we started off with the actuarial appraisal method. We reformulated the actuarial appraisal method into the option pricing method format. We then made the assumption that liabilities are freely traded in perfect markets. From all this, we concluded that liability cash flow should be discounted at the risk-free interest rate plus the firm's debt spread and then we make an adjustment for taxes.

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Investment Actuary Symposium

Risk-Neutral Pricing for Insurance Contracts

by Stephen Britt

This article discusses is about the pricing of life insurance contracts in the risk-neutral world. Specifically it deals with three aspects:

- The motivation for pricing contracts using a risk-neutral methodology in valuing life insurance contracts
- Development of some 'intuition' behind the risk-neutral valuation techniques
- Some caveats which need to be recognized before Risk-Neutral Valuation can be more widely accepted

The Motivation for Pricing Using a Risk-Neutral Methodology

Question :
How is an actuary unlike a car salesman?

Answer :
Sometimes an actuary will actually give away free options.

Life insurance contracts have always had implicit and explicit guarantees. A simple whole of life or endowment contract contains an implicit guarantee of a minimum guaranteed interest rate underlying the growth of the policy reserve. Minimum surrender values offer 'harder' and more explicit guarantees.

More recently, SPDA and variable annuity contracts have offered explicit guarantees to what would otherwise be investment products.

If it is true that these guarantees have always existed in these products, it is equally true that their existence has not always been accepted in general by the actuarial community, and even now, it is by no means common to see these guarantees explicitly costed in the product development stage.

Risk-neutral pricing allows the pricing actuary to develop a relative pricing strategy, in that the price is calculated relative to similar traded instruments like swaps and options. It also opens the opportunity that these products may be hedged using these instruments.

Risk-Neutral Valuation Techniques

In this section, we investigate cases whether knowing the probability of an adverse event does not assist in pricing it.

We consider the case of a bookmaker offering odds on a horse race. There are two horses, and the chance of each winning is 50%. Due to some popular sentiment on the part of the crowd, the current bets are not split evenly. Scenario 1 shows the outcome, should the bookmaker offer even money odds on the part of both horses.

Scenario 1: Bookmaker offers the probabilities

						Expected
	Bets	Odds	Payoff	Profit/Loss	Probability	P/L
A Wins	10,000	one to one	20,000	-5,000	0.5	-2,500
B Wins	5,000	one to one	10,000	5,000	0.5	2,500
	15,000					0

Under this scenario the bookmaker expects to neither win nor lose money, but may be down $2,500 if A wins.

Consider the next scenario, Scenario 2, where the bookmaker offers a different set of odds, with different implied probabilities.

Scenario 2: Bookmaker follows the money

						Expected
	Bets	Odds	Payoff	Profit/Loss	Probability	P/L
A Wins	10,000	one to one	15,000	0	0.5	0
B Wins	5,000	two to one	15,000	0	0.5	0
	15,000					0

In this case, the bookmaker is in the pleasant situation of not caring which horse wins the race; they are fully hedged in either case.

The applications to both pricing and hedging in finance are clear — if it is possible to completely hedge a claim, then the price of the claim must be equal to the initial cost of the hedge.

Consider a simple case where the hedge portfolio is set at the start of the period and remains unchanged. This is a simple forward contract. An example would be to receive an amount X and pay $1 times the value of the DOW index (currently at 10,000) in three months time. We assume the risk-free rate is 6% per annum.

The approach is to:

- Borrow $10,000
- Invest the proceeds in the DOW

The replicating strategy is then:

- $10,000 the cash bond
- $10,000 long the DOW

On expiry, we can sell our DOW and receive X. We need to repay the loan, now standing at $10,150. For this replicating portfolio to have same value as the forward, we need to receive exactly $10,150 — the cost of the claim.

Applications to Insurance

The examples given are relatively simple and give no hint as to whether a replicating strategy exists to allow pricing of insurance products products. The good news is:

- There is a financial theory which provides a methodology for this valuation process; and
- There is a market for liquid securities, which are 'similar' to interest rate sensitive life products in many ways.

The theory goes by the grand title 'Fundamental Theorem of Asset Pricing.' Stripped of detail, the relevant part is that where a claim can be replicated, it can be valued as the expected value using a set of 'risk-neutral' probabilities.

The market which shows similar risk patterns to interest rate-sensitive life products is the mortgage backed security market.

The Mortgage-Backed Security Market

The MBS market is similar to the life market in several ways:

- Both deal in long-term financial instruments
- Both deal in cash flows emanating from the same group of consumers — policyholders also hold mortgages
- These policyholders do not always behave in a way which is completely 'rational' in the economic sense of the word — their reaction to changes in interest rates etc. needs to be estimated

There are also some salient differences:

- The MBS market is one of the largest and liquid physical markets in the world
- Mortgage-backed security holders are not subject to risk from expense overruns etc. — these are borne by Fannie Mae, etc. who administer the securities
- The MBS market is not subject to event risk of wholesale surrender by mortgage holders — the event of adverse publicity, as may happen to an insurance company.

With these caveats, risk-neutral valuation has been successfully used in pricing MBS securities for many years now. The market has developed a mechanism for dealing with the approximations needed to cope with mortgage holder behavior (Option Adjusted Spread), and while not perfect, these valuation tools are proving their worth.

Interest Rate Models

The academic literature on interest rate models is enormous, as is the amount of money spent by investment banks and others to implement models. The ability to better price a security is key to the solvency of these institutions.

Unfortunately, no single interest rate model serves all needs for all investors, and it would not be uncommon for some investment banks to use different interest rate models to value different instruments. Interest rate models are usually judged on their ease of use and, most importantly, on their ability to accurately price the relevant financial instruments.

This creates a chicken and egg situation for life companies. The way to test an interest rate model is to test how well it matches observed prices of life insurance products. As there is no liquid secondary market for life products, we must rely on our interest rate models to value the models.

More Research is Needed

Risk-neutral valuation opens up opportunities for actuaries to determine a market price, and in some instances to hedge the interest rate and other financial risks in their portfolios. However, there is still a need for some additional research.

There is a need for additional research on interest rate models. It is fairly certain that simple interest rate models (so-called one factor models such as the extended Vasicek model) will not make the grade — the spread seems to influence policyholder behavior, so at least two factors are preferred. Statistical analysis suggests that three or four factors are required, but these models have proven quite cumbersome to derive and manipulate in the past.

Finally, even the best interest rate models should not be expected to deal with all sources of risk perfectly. There will be a need to adjust the values to adjust for these risk factors — something akin to the option adjusted spread in the mortgage market.

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Investment Actuary Symposium

Modeling Credit Risks

by Marc N. Altschull

A major component in most asset/liability models is the projection of the credit risk. This risk is typically defined as the risk that the issuer defaults and is therefore unable to make timely principal and interest payments. Credit risk is gauged by quality ratings, which are assigned by commercial rating companies (e.g., Moody's, S&P, etc.).

When considering credit risk, we are also concerned with changes in the perceived credit risk in addition to the actual event of default.

Credit risk reduces the market price for an asset versus comparable US Treasury securities, which are assumed to be free of credit risk. Alternatively, the credit risk necessitates a yield spread to Treasuries called the credit spread. Note that this spread over Treasuries is not entirely attributable to the credit risk but also incorporates the liquidity spread. Note also that the credit spread is not directly linked to actual levels of default, but expresses the market's expectations of, and appetite for, the default risk.

In an asset model, the credit spread assumption is used for the following purposes:

- To determine the prices/yields paid on assets purchased in the future
- To determine the market value in the case of asset sales and
- To affect call and put option rates.

When developing the credit spread assumption, we can begin by looking at the current average credit spreads varying by credit rating and the term to maturity. For example, the current average spreads of corporate bonds as of November 27, 2000, are presented in Exhibit 1.

Exhibit 1
Current Average Credit Spreads as of 11/27/2000 (bps)

	Maturity (years)							
Rating	**1**	**2**	**3**	**5**	**7**	**10**	**30**	**Total**
AAA	64.2	73.6	79.6	98.6	113.4	135.0	152.2	102.4
AA	81.6	90.4	97.8	124.7	142.0	163.5	186.5	126.6
A	93.8	106.3	112.8	146.8	167.3	197.3	220.7	149.3
BBB	126.0	138.1	149.9	184.4	208.2	241.9	268.6	188.1
BB	264.0	284.3	300.9	330.7	371.7	431.0	473.3	350.8
B	483.0	513.7	541.0	582.0	658.0	756.2	804.3	619.7
CCC	597.0	630.0	682.0	723.0	820.0	900.0	966.0	759.7

Arithmetic averages are taken over all industries and rating agencies included in the data.
Source: RiskMetrics' 11/27/2000 Corporate Bond Spreads Dataset (www.riskmetrics.com/products/data/datasets)

An obvious observation from Exhibit 1 is that the credit spreads trend upward with decreasing credit rating and increasing maturity.

With an initial credit spread assumption selected, we then consider the progression of credit spreads in the future. We begin with the following decision process:

- Should we grade to an assumed set of ultimate spreads or not?
- If so, over what period of time should this grading take place?
- Also if so, what should the ultimate spreads be?
- Or, should the model use stochastic spreads?

In making these decisions, we need to consider how significant this assumption is for the purposes of the model. Furthermore, we need to consider how far off we think the current spreads are from the ultimate spreads. Finally, we should also consider how much weight to give to the historical past and which period of time is the most significant for our purposes and most applicable to the period being projected. The graph in Exhibit 2 displays the volatility of credit spreads by credit rating historically since late 1998.

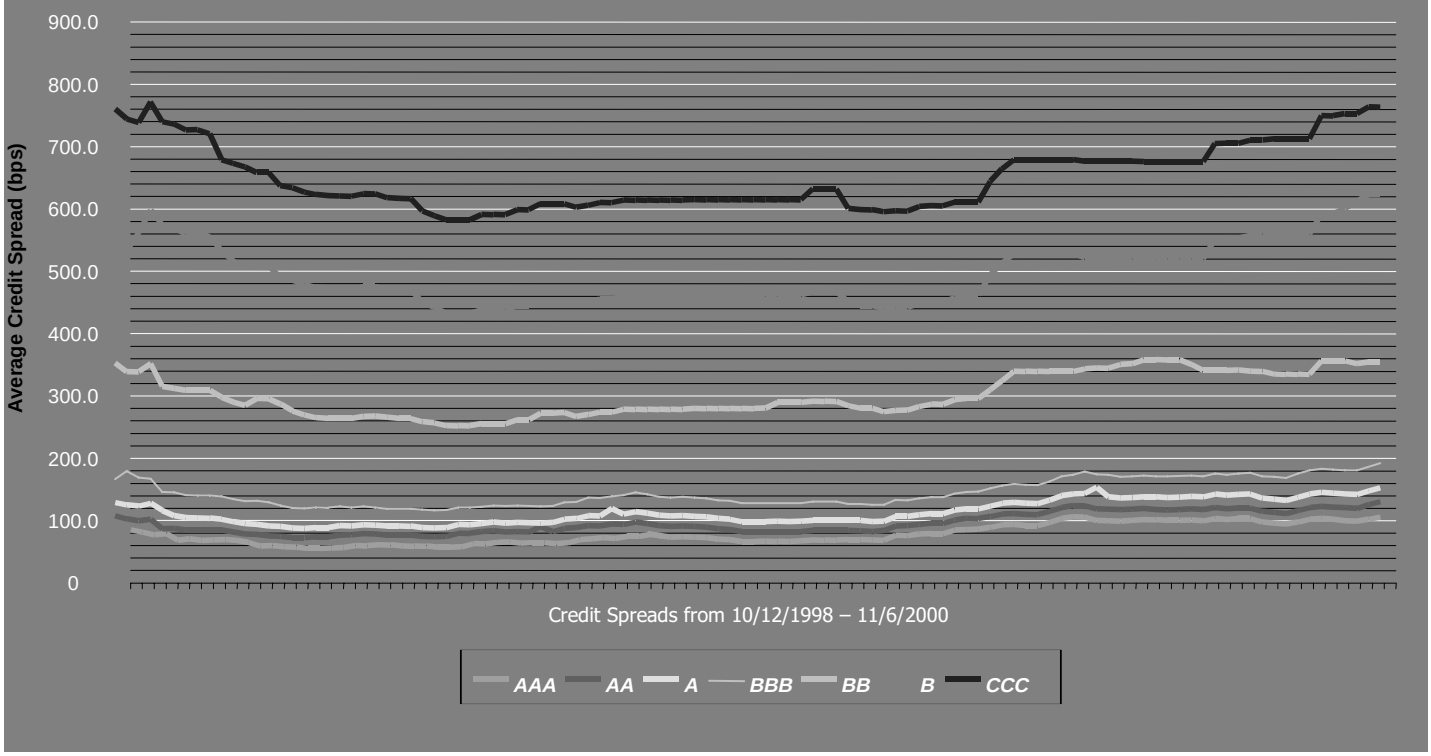
The other major assumption in an asset model that is closely related to the credit risk is the default cost assumption. Average default costs can be calculated based on historical default rates and recovery rates.

Since defaults reduce the coupon payments and par value payments received at the time of default and in the future, the default cost assumption is used to reflect the impact of defaults on future asset cash flows.

A significant consideration in determining the default assumption is whether to model rating class changes. Specifically, as a bond gets downgraded, the probability of default increases. If rating class changes are not being modeled, the default rate is inflated for the original rate class. Likewise, default rate deflation occurs in the case of rating class upgrades. The tradeoff for the increased precision of modeling rating class changes is increased model complexity.

Another consideration is the source of the information used to determine the historical default costs. There are a variety of studies available, each with a different time period in addition to a unique methodology.

Exhibit 2
Weekly Average Credit Spreads



(continued on page 20)

Investment Actuary Symposium: Modeling Credit Risks

continued from page 19

The determination of a default cost assumption begins with an analysis of cumulative default rates from a variety of sources. Again, consideration of the source is the key here. For high quality corporate bonds, there have not been very many defaults, and a seemingly inoccuous methodology difference such as weighting by dollar amounts versus weighting by number of issuers can significantly affect results.

Average default rates can then be developed by duration since a rating was determined. For high quality bonds, default rates tend to be low initially after a rating is identified because issues do not typically default straight away. However, over time, a credit rating may deteriorate and, ultimately, defaults occur. For lower rated bonds, the opposite effect occurs — the bonds that do not default may upgrade, and the aggregate default rate improves.

Exhibit 3 illustrates the pattern of expected defaults. This exhibit was calculated using data from two sources (Moody's Investor's Service report "Historical Default Rates of Corporate Bond Insurers, 1920-1998" and Standard & Poors *Credit Week* of January 26, 2000)

After determining a default rate assumption, a recovery rate assumption must be developed. The recovery rate determines how much of the bond value is recovered upon default. Historically, this percentage has decreased as the credit rating decreases, perhaps because of the greater securitization of higher rated debt. For corporate bonds the assumed recovery percentage might range from 70% for a AAA bond, to 50% for a BBB bond, to 40% for lower rated bonds.

Finally, combining the recovery rates and the default rates, we arrive at a default cost table showing the amount that will be lost upon default by duration.

The credit spread assumption in conjunction with the default cost assumption account for the credit risk inherent in corporate bonds. Appropriate analysis of the data in-hand and consideration of your modeling purpose are required when developing these critical asset assumptions.

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Exhibit 3
Default Rates

	Annual Rate by Year Since Rating				
Rating	1	2	3 to 5	6 to 10	11 to 20
AAA	0.00%	0.00%	0.05%	0.12%	0.13%
AA	0.02%	0.02%	0.10%	0.12%	0.13%
A	0.02%	0.06%	0.13%	0.21%	0.30%
BBB	0.16%	0.27%	0.44%	0.47%	0.70%
BB	1.10%	2.13%	2.38%	1.74%	2.28%
B	5.82%	6.39%	4.97%	3.15%	1.73%

Investment Actuary Symposium

The Investment Actuary in the United Kingdom

by Peter D. Jones

This article presents some thoughts on the role of the investment actuary in the United Kingdom. It is a topical subject and one that has involved a good deal of soul searching on the other side of the Atlantic Ocean, prompted by a feeling that the U.K. profession is not fulfilling its potential in this specialty.

The menu for this article has three main themes, but this is more in the way of a "ramble" than a journey through the investment countryside.

a) Some historical perspective.

b) What the professional actuary uniquely has to offer the investment marketplace.

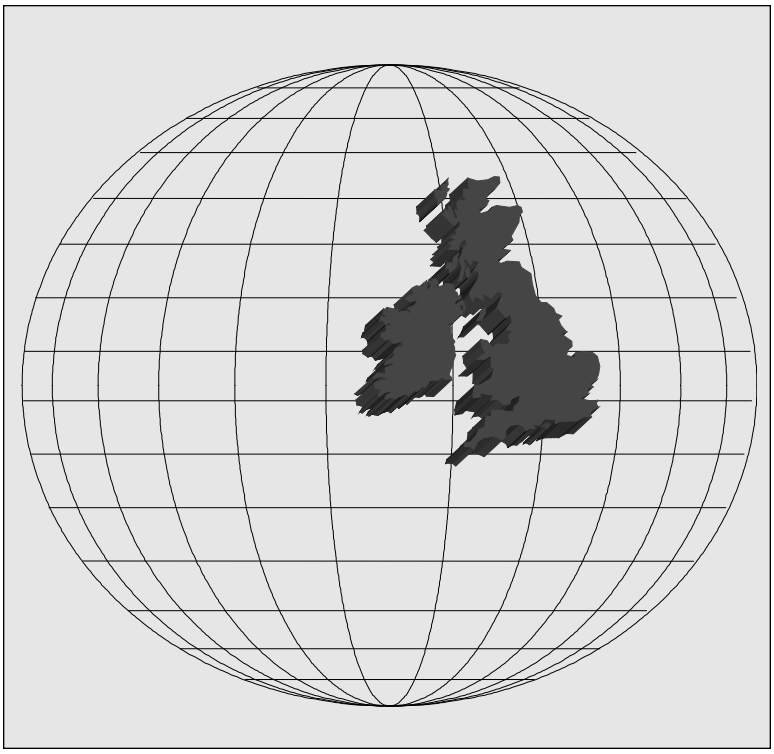
c) What the consulting actuaries in the U.K. currently offer their clients.

My own career may be instructive, because I started it in 1961 as an actuarial student. I began in the actuarial department, but the practice at the time was to rotate trainees through various departments. My next stop in 1962 was the investment department. In a sense, I never left that department. My entire career has been in investment. In what sense then, am I an actuary?

Well, I completed the examinations, and I have served the Institute in a wide range of posts — including 10 years as a member of the governing body. That though, does not make me an investment actuary.

Perceptions are of course all important in business. My ambitions always did lie in the investment field. But why did I choose to align my ambition with a course of examinations, which is far from easy? Two reasons come to mind.

Firstly, the actuarial profession in the U.K. was held in high esteem and had a reputation in the investment area. In the 1960s, the major pools of investment funds were life funds. Pension funds were growing quickly, but had not yet reached the pre-eminence that they have today. Investment departments of the life companies often had actuaries at their heads. Most life company chief executives were also actuaries, often having spent some part of their career in investment.



Secondly, the actuarial profession provided the only examination course in investment matters. The Institute had pioneered this in 1910.

A third factor would have influenced me, except I was too soon! Namely, the association of the Institute with the U.K. investment indices. The FT Actuaries Indices have been published daily since 1962 and have undoubtedly raised the profession's awareness with key opinion formers and the public at large. Indeed, the profession has been involved with investment indices since the 1930s when there was a fascinating paper in the *Journal of the Faculty of Actuaries*. And it was the president of the Institute (in 1923 I believe) who defined the standard for calculating gross redemption yields on British Government Stock.

And I, for some 30 years, have been heavily involved in design and management of the investment indices, the FT Actuaries Indices, a joint venture initially between the profession and the Financial Times newspaper, later joined by the London Stock Exchange.

The Institute of Actuaries dates back to 1848. The first Institute paper on an investment topic was in 1858. Over the next 40 years, there were at least half a dozen papers on investment topics. Some were of a technical nature, for example, one on "Debentures for life funds" and another providing a statistical summary of Investment of British and American Life Offices in the years 1880 to 1902.

But as early as 1862, before the names Gettysburg and Robert E. Lee took on the connotations that they have today, there was a paper by A.H. Bailey entitled "Principles on which the Funds of Life Assurance Societies should be invested."

(continued on page 22)

Investment Actuary Symposium: The Investment Actuary in the United Kingdom

continued from page 21

Bailey was a prolific contributor to the actuarial journals and became president of the Institute in 1880. All his other papers have a distinctly actuarial slant. He was the Actuary of London Life. His paper laid out five principles, interestingly enough with a preamble which emphasized the long-term nature of the liabilities against which the assets were to be invested.

His principles (this was 1862) were:

1. Security of capital is paramount.

2. Maximize income subject to the first principle.

3. Keep a small amount in cash to meet claims and contingencies.

4. The balance of the fund (the vast proportion of it) to be invested for the long term in securities not readily convertible (which in parlance I think means readily realizable)

5. Investments should "aid" the company's life business.

Apart from the fifth rather curious point, the first four are easily recognizable today. In those days, the funds were almost entirely invested in three types of securities:

- Government stock (25%)

- Mortgages and real estate (as much as 50%)

- Debentures, especially of Railways

In the text of his paper, Bailey says, "ordinary shares are not eligible as being too speculative."

I have focused on this paper of 1862 for a purpose. It contains the key element which differentiates the investment actuary from any other skilled investment professional: "That an understanding of the liabilities brings a greater awareness to the investment of the assets."

This was an essential element in the growing importance of actuaries on the U.K. investment scene. "With-profits" is a concept which does not really exist in the United States, but is common in Anglo-Saxon countries.

With-profits is an arrangement whereby actuarial surplus is determined periodically by the actuary and allocated as a reversionary bonus to ranking policyholders. The periods of review have become progressively shorter and are now invariably one year.

Once allotted, reversionary bonuses are contractual, but before allocation, they merely represent policyholders' "reasonable expectations" to use the term of phrase. No guarantees!

No modern insurance company would have designed this concept because of its lack of openness, its reliance on actuarial interpretation, and its weak contractual policy terms. So how did the concept come about?

I suppose its origins lie in the views of the Actuary of the Equitable (the first mutual life office), William Morgan, in the 1760s. He set premiums on endowment policies at a high level to provide a cushion against adverse mortality and investment experience.

At each review, he reduced premiums. This soon became unwieldy and hence an alternative model was used, in effect to increase the sum assured.

The sum of the sum assured and reversionary bonus increased at each actuarial review and became the eventual maturity value.

This system worked well but required good judgements, especially as offices progressively invested in equities. As we have seen, they did not do this in the 19th century, but did increasingly, especially after the Second World War. The movement of actuaries into the investment field in significant numbers seems to have begun at this time, provoked by two things:

a) An awareness of how important investment returns were to policy holder value.

b) The need to understand the durability of equity stock market values in relation to the actuarial distribution of surplus.

And possibly by a third:

c) Inflation, which rose rapidly after the Korean War

It was not until 1959 that the income return on equities fell beneath the yield on British Government Securities, indicating wider acceptance of equities as an investment medium.

Today about 8% of U.K. Fellows are involved in the investment field in one way or another.

There are around 4,000 Fellows in the U.K. (Institute and Faculty).

45% in Consulting Practice

40% in Insurance Companies

15% elsewhere

About 300 state that their work is predominantly in finance and investment. While this number may be at an all time peak absolutely, I suspect it shows a decline:

a) Relatively

b) In stature and influence in the community

Now is perhaps not the time for a long discussion as to why. It has to do with the demise of with-profits (and its replacement by unitized products) and to the increasing numbers of well-educated entrants into the investment banks and asset management companies, i.e. the growth of Fidelity relative to Prudential (both the United Kingdom and the United States).

So what investment services should the actuarial profession be providing today? As I said earlier, a rethink is underway in the United Kingdom. In his address to the Faculty of Actuaries in October, David Kingston listed the following six topics:

a) Asset liability modeling

b) Risk management

c) Futures/derivatives

d) Managing investment managers

e) Product development

f) Investment strategy and communication

"I see less opportunity in areas like derivatives where I believe the investment banks will be able to recruit and remunerate the specialist talent that is needed..."

This, of course, is a list for the U.K. profession to address (for example, in terms of education). But in practice, it is one that the consulting firms will focus on most closely.

In preparing for this article, I consulted with a number of my contemporaries. They confirm that consultants in the U.K. did little or no investment work until the 1970s.

Performance measurement calculations began almost by accident. One very large pension fund in the late 1960s asked its pensions valuation actuary for help in measuring the performance of its investment managers on an objective basis, using the FT Actuaries All Share indices as a benchmark. About the same time a large stockbroking firm, Wood McKenzie, started doing similar calculations as a service to their clients. That business today trades under the name, the "WM Company." Immediately, we can see a topic where the actuarial profession cannot claim either a monopoly or indeed any special insights.

I am not proposing here to discuss these six items in detail. However, I hope the U.K. profession, and the consulting community in particular, will focus its attention in areas where:

1. It has a unique contribution to make (e.g. asset liability modeling).

2. It is close to the assets involved, e.g., pension assets and hence, pension fund manager selection and pension fund strategy

I see less opportunity in areas like derivatives where I believe the investment banks will be able to recruit and remunerate the specialist talent that is needed and may well be closer to the assets involved than the actuarial profession (unless, of course, they are life or pension assets).

That is my ramble through the U.K.'s investment countryside. I hope I have generated some interest.

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Investment Actuary Symposium

Modeling Assumptions

by Catherine E. Ehrlich

This article focuses on one fundamental modeling assumption — the choice of a benchmark rate or risk-free rate.

This assumption did not require much analysis when I first began learning about the bond market. The yield curve derived from the Treasury market had all the characteristics that one would want.

The market was large — no one investor's buy or sell decisions influenced prices.

The market was liquid — traders could easily establish and liquidate positions, and there were no difficulties in determining market prices for various issues.

Finally, the securities are generally considered not to be at risk of default due to the reputation and financial health of the U.S. government.

Treasuries have been an accurate barometer of the bond market for almost a century. However, fundamental changes in the economy are currently making Treasuries a less than perfect reference rate.

This article re-examines this one assumption, not because it is the most exciting thing to happen to the bond market or because it is a new kind of risk, but rather to use it as a case study of how one needs to monitor fundamental market changes for their impact on assumptions.

Treasuries have been used for a lot of different things in their role as benchmarks. Most discussions of interest rate dynamics rely on a risk-free rate based off a class of securities whose market is large enough not to be impacted by any one trader, liquid and default-free.

While the "default-free" nature of Treasuries is still unquestioned, the size and liquidity of the Treasury market has been declining.

Treasury Curve Dynamics

The yield curve went from being a nice normal positively shaped curve at the end of 1999 to a humped curve by the end of January. The long end of the curve continued to fall, and by the end of August, there had been over a 100 basis point decrease in slope.

Interest rate theory has hypothesized three fundamental influences on yield curvature.

These are:

- **Pure Expectations Theory**
  All government bonds theoretically have the same near term expected return. A positively sloped yield curve is consistent with market expectations for an increase in rates, since the higher yields earned by long-term investors will be offset by capital losses. If investors expect that their long-term bonds will lose value from an increase in rates, they will demand higher initial yields as compensation. Using this theory you can derive a forward curve, which is the market's expectation of future rates.

- **Risk Premium**
  A bond's risk premium is the difference between that long or intermediate term bond's expected one period return and the short-term risk-free return. The different forms of this theory vary by whether that premium is sometimes or always positive and why. The liquidity premium theory is based on the assumption that most investors dislike price volatility and, therefore, long-term investors must be compensated for the extra price volatility that long-term bonds have relative to short term bonds. The preferred habitat theory argues that there are different markets for short term and long-term bonds.

- **Convexity Bias**
  Bonds with positive convexity will perform better when interest rates change than similar bonds with zero or negative convexity. Therefore, if investors expect interest rate volatility, they will give up yield to get convexity.

Generally, all three influences are at work in any given economic situation. All reflect investors' expectations, risk aversion, and market forces for the bond market in general. The influences that were causing contortions in the shape of the Treasury curve this year did not appear to be present for other segments of the fixed income market. While some of the curve inversion may, in fact, be due to investors' expectations of rate decreases, given the economic environment and other indicators, it more likely reflects supply concerns. The continuing decrease in the amount of outstanding Treasuries combined with an announced plan of buybacks caused bond traders to grow concerned about the future supply of long-term Treasuries. This decoupling of the Treasury market from the other fixed income markets has had unforeseen impacts on pricing and modeling.

Treasury supply decreased from mid-1996 to mid-2000. In mid-1996, there were outstanding Treasuries maturing in each of the next thirty years. By mid-2000, there are fewer outstanding bonds at each point, and no maturities between 10 and 15 years. This is primarily the result of bond calls and also of buy backs. Obviously, it is incredibly hard to construct a curve when you have no data points.

During this period, as supply at the long end was decreasing, there became an increasing discrepancy between on-the-run and off-the-run Treasuries.

On- the-runs have lower yields than off-the-runs, due to their liquidity. Prior to September 1998, i.e., the market disruption caused by Long-Term Capital

Management, this liquidity spread was stable at about 4-5 basis points. Afterwards, it has been as much as 25 basis points. While it has retreated somewhat from the highs immediately following the crisis, it has never settled down to its earlier level. Typically the on-the-run curve has been more volatile — buffeted by auctions. This has made the off-the-run curve a better pricing benchmark. However, the paucity of supply for maturities longer than 10 years out coupled with the need to remove on-the-run issues makes this a difficult curve to plot.

The Treasury is committed to maintaining the liquidity of the Treasury market to minimize borrowing costs. By issuing laddered maturities, its borrowing costs are more predictable. This also increases the popularity of Treasuries to investors.

The Treasury also announced a series of buybacks of longer maturity off-the-run issues. This caused the long end of the curve to become expensive for investors, as noted earlier.

Impact on Modeling Assumptions

Why does this matter beyond Treasury arbitrage opportunities? There are an overwhelming number of issues in the U.S. taxable fixed income market — over 70,000 issues excluding pools. Most of these bonds don't trade every day. Therefore, bond market practitioners are forced to manufacture prices. Most pricing systems depend on matrix pricing of varying degrees of sophistication. The underlying premise of this methodology is that a single OAS curve can be determined for certain bonds that share common characteristics. For instance, all bonds with observed or broker prices in the same sector and with the same quality may be grouped together to calculate the average OAS. This will generally vary by duration. Then, any bond in this sector and quality group can be priced using this OAS for its own duration. In practice, it is not always possible to obtain prices on a large enough universe of bonds in any one group to generate an entire OAS curve. Various smoothing and extrapolation techniques must be employed. When the Treasury curve changes shape differently from the rest of the bond market, these techniques become flawed, and the result can be bad pricing.

Simulations generally assume constant spreads to manufacture prices throughout time. Increasing spread volatility calls this assumption into question.

Benchmark Alternatives

What can we use for a benchmark curve? There are four alternatives:

- **On-the-Run Curve**
  As we know, the OTR curve has many missing points and has had volatility associated with auctions that the rest of the market doesn't experience.

- **All Treasury Curve**
  A smoothed all Treasury curve does have new (since 1998) volatility, and is also subject to supply problems.

- **Agency benchmarks**
  In 1998, FNMA began a benchmark notes program, and other agencies have followed. These programs make the issue and maturity structure of Agencies more predictable. These securities do trade with some credit risk, and the issues are much smaller than Treasuries. Under some projections, the size of this market could surpass Treasuries in the next 10 years. Issue-specific differences could become important. The major drawbacks to using agencies are the illiquidity of many issues, and the callable features contained in many issues. This market is also subject to supply problems that currently plague the Treasury market.

- **Swap Curve**
  The swap market is not risk-free, but is a reasonable indicator of systematic risk conditions. This is a very active market with narrow bid-ask spreads. Turnover is considerable higher than coupon agencies, but is less than Treasuries. Liquidity has been somewhat hindered by counterparty credit risk. The absence of an underlying fundamental asset is an advantage — no supply limit. Since corporations can use a combination of bank lending and the swap market as an alternative to debt issue, this market is highly correlated with other spread products. Therefore, this market has potential to be a better hedge than Treasuries. In fact, its major drawback has been a lack of familiarity. Bond markets in other countries have followed the swap curve when their sovereigns experienced similar supply problems.

Market and Modeling Implications

LIBOR OAS has exhibited more stability than Treasury curve OAS. Market pricing is increasingly being quoted off of LIBOR. Also, it is easier to manage basis risk by hedging with LIBOR swaps than Treasury-based instruments.

While these are all attractive advantages for market participants, existing systems and assumptions will need to be modified and/or monitored, if a different benchmark is used. Historical spread data is relative to Treasuries and will need to be adjusted. The volatility parameters of the new term structure will need to be calculated and analyzed. Research will need to be done on the appropriate reference rates for other cash flow models, such as mortgage prepayments.

The impact of changing economic conditions on modeling assumptions will always need to be monitored. Generally, new assumptions or methodologies need to be implemented quickly in response to market changes. However, since so much in fixed income analytics is built upon this one assumption, care should be taken in order to avoid unforeseen discrepancies.

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Investment Actuary Symposium

The Cost of Capital Assumption in Actuarial Appraisals: An Application of Fair Value of Liability Concepts

by Gregory Goulding

A critical assumption in actuarial appraisals is the rate at which free statutory cash flows are discounted, a rate referred to as the cost of capital. The cost of capital in part reflects the risk inherent in the deal, but there are many considerations in setting the assumption, and there is no consensus about what theory to use. Reflecting this lack of consensus, appraisal values are typically calculated for a range of assumptions (e.g. 10% to 14%). However, negotiations seldom center on the cost of capital as an input to the valuation. Rather, the cost of capital usually serves only as a way of quoting the appraisal value that a particular counterparty to the transaction has arrived at through other considerations.

In his pivotal paper, "Market Value of Insurance Liabilities: Reconciling the Actuarial Appraisal and Option Pricing Methods," Luke Girard demonstrates an algebraic connection between the cost of capital used in actuarial appraisals and the degree of leverage implied by the valuation of asset and liability cash flows using the option pricing method (OPM). His work provides us with an intriguing theory for setting the cost of capital assumption. Further, the theory ties into the leverage equations familiar in finance from the work of Modigliani and Miller.

In the following, we explore the implications of Luke's work in setting the cost of capital assumption in actuarial appraisals. Of course, the process of appraising value will continue to involve many considerations, but any theory that helps pin down the cost of capital assumption could potentially become a useful negotiating tool.

The Case Ignoring Taxes

The theory presented in Luke's paper is easiest to grasp when taxes are ignored. When taxes are introduced, results are similar, but adjustments are required. It is also easier for this discussion to think of all cash flows as static, but this assumption may also be relaxed.

If taxes are ignored, the following equation expresses the relationship that should hold between the valuation of distributable earnings and the valuation of the asset and liability cash flows underlying those earnings:

$$1) \qquad DDE \equiv RS + MVA - MVL$$

In (1), "DDE" is the discounted value of distributable earnings, "RS" is required surplus, "MVA" is the market value of assets backing operations, and "MVL" is the fair value of liabilities. (The separation of assets into those backing operations and those comprising required surplus is only a convenience.)

Luke's paper presents algebra that allows us to work this equation in two ways. On the one hand, we can start with a given cost of capital assumption that produces a value for DDE. We can then derive implied liability discount rates which give us a value of MVL fitting the equation. On the other hand, we can start with the liability valuation and back into a cost of capital assumption that produces a value for DDE fitting the equation[1].

Pursuing the second approach mentioned above, Luke shows that if $\{j^t\}$ are the discount rates that apply in deriving RS, $\{i^t\}$ are rates that apply to asset cash flows, and $\{d^t\}$ are rates that apply to liability cash flows, the cost of capital assumptions that fit the equation are as follows:

$$2) \qquad k^t = \frac{j^t RS_t + i^t MVA_t - d^t MVL_t}{RS_t + MVA_t - MVL_t}$$

The $\{d^t\}$ used in discounting liability cash flows would be derived per OPM, viewing the liabilities as if they were debt cash flows. Note that the cost of capital changes with duration t as the relationship between RS_t, MVA_t and MVL_t changes.

We recognize that the cost of capital rate in (2) is just the weighted average of the asset and liability discount rates. In other words, the cost of capital assumption that ensures consistent valuation of assets, liabilities, and free cash flows is an asset-based rate levered by the liabilities. Dropping subscripts and pooling RS and MVA, (2) is closely related to Modigliani and Miller's proposition II for leverage adjusted capital:

$$3) \qquad k^L = \frac{kA - dD}{A - D}$$

In (3), "A" are the assets of the a firm, "D" the firm debt, "k" the unlevered cost of capital, "d" the cost of debt, and "k^L" the levered cost of capital of the firm. Luke has applied the same concept in the appraisal context. Liabilities play the role of "D," and the asset rate plays the role of "k."

Implications

Equation (2) gives us the following algorithm for backing into a cost of capital rate:

1. Value the liability streams per OPM, obtaining discount rates $\{d^t\}$ and liability market values $\{MVL^t\}$ for each duration

2. Derive $\{k^t\}$ and equivalent level k using equation (2)

The resulting cost of capital assumption reflects the degree to which the appraised entity's assets are levered by liabilities. If, for example, statutory reserves plus required surplus for the entity is conservative relative to expected liability cash flows, RS + MVA will exceed MVL by a large margin, and leverage will be minimal. The cost of capital will be closer to the asset rate (i.e. at the low end of the range)[2]. If reserves are weak relative to liability cash flows, MVL will approach RS + MVA. Leverage and the cost of capital rate will be high and DDE small.

An interesting secondary impact of the theory arises when performing sensitivity tests. Suppose that one counter-party to the transaction believes that expenses are understated and wishes to re-value DDE with higher expenses. The new DDE will be lower, or, equivalently, MVL will be higher. But there is an additional effect according to Luke's equations; leverage has increased, and the cost of capital rate should be higher. Additional value is lost because of the increased risk.

"Luke's paper presents algebra that allows us to work this equation two ways. On the one hand, we can start with a given cost of capital assumption that produces a value for DDE....On the other hand, we can start with the liability valuation and back into a cost of capital assumption that produces a value for DDE fitting the equation."

Taxes

When taxes are introduced, the basic character of the conclusions discussed above does not change. However, the formulas are more complex, and space does not permit discussing the necessary adjustments here. The "With Taxes" case is discussed in a second paper by Luke Girard, "Market Value of Insurance Liabilities and the Assumption of Perfect Markets in Valuation." Help is also available in the form of spreadsheets posted on actuarially-oriented internet sites.

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Footnotes

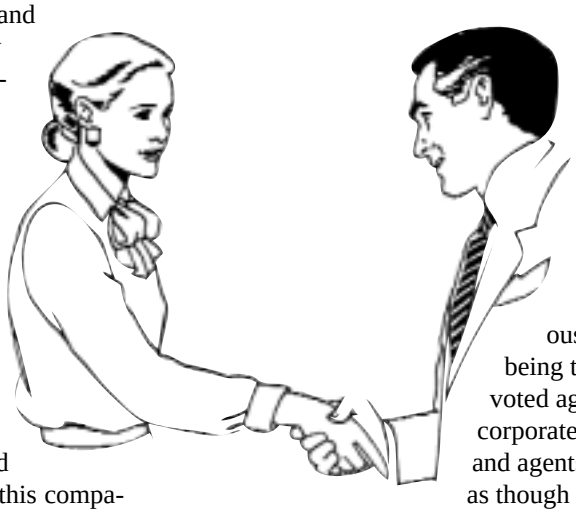
1) It should be noted at this point that Luke's formulas require discount rates that vary with the projection year.

2) Note the extreme case in which there are no liabilities. In that case, only a block of assets is being traded, and the cost of capital would equal the asset rate.

My Experience With a Shady IPO

by Nino Boezio

A number of years ago, I was asked by a personal friend to attend a shareholder meeting by proxy for a stock his brother owned. Since I worked in the area where the meeting was to be held anyway, in downtown Toronto (and wanted some experience in attending such meetings), I agreed to devote part of the day to sit in on this forum regarding the company's past performance and find out about any emerging new corporate activities that could turn this company around. Apparently the company had gone to market as an IPO a few years earlier, had performed poorly ever since, and it now was very hard to assess whether this company was a write-off or most nearly so, or whether there was still some life in the organization.



What made matters even more uncertain was the fact that this IPO was no longer traded (at least to my knowledge) for lack of investor interest. I had pored over the financial statements to understand what had been transpiring over the past several years and tried to identify the source of its losses.

The meeting was to be held at the boardroom of the solicitor who had promoted the stock years earlier. I entered the legal offices and boardroom and was quite impressed by the rather glitzy and well-to-do appearance of the surroundings.

It gave me the impression that at least we had the elements of success behind the scenes (i.e. if the place looked run down, I would figure that we were dealing with a shabby fly-by-night operation. I guess I was measuring success by outward appearances). I sat down and waited for other shareholders to appear.

As time passed and the meeting was about to start, I found that very few new people entered the room. Except for a few corporate officers and the legal team, I was only part of a handful of shareholders. The meeting proceeded, and I found that I was generally the only one asking questions.

When various items were being tabled, and I voted against them, the corporate representatives and agents looked at me as though I was a troublemaker (at least that is how I felt). Of course, they soon reviewed how few shares I actually represented, and then quickly judged me to be some sort of clown relative to the other shareholders. Unfortunately, the really big shareholders must have given up on the stock, for they relegated their vote to the officers. I was quickly shot down on any dissensions, even though my adversarial vote was noted in the corporate minutes.

The company was basically going to go where it wanted, and neither I nor anyone else was going to derail its plans. I also certainly realized the great impact peer pressure has on people, since we all like sheep, want to go with the majority — it is hard to fight the tide by dissension when the prevailing direction of the meeting and the company is strong.

After the meeting ended, I asked some simple questions about what the company did and where it intended to go from there. Apparently it had entered into a number of product lines which did not work.

I was also intrigued by the fact that the products they entered into were unrelated. When I asked about future prospects, it was suggested that they were thinking of a new product to push ("any product" in their words), and in the process, they would have to go out for more seed money in order to get any new idea launched. They said they were looking to latch onto any idea that would make them money, but currently had none.

There was no special insight or expertise in this company. The head of the company would not look me straight in the eye, but only out of the window (perhaps he was embarrassed or felt someone might take him to task on the company performance). I was quickly getting the picture. One would be better off going to Vegas — the odds are much better. The company was set up without any real focus in mind, had some product ideas which were rather ill-defined, and perhaps hoped to hit it big with other peoples' money.

If the company was not successful, then no personal loss would be sustained, and in the process the officers of the company would still get paid until the company ran out of cash and folded. If the company failed, then set up a new company with a new name and new set of brochures and prospectus and start the process all over again.

The focus here was to set up a company, then worry about the idea later, not the other way around. This was not the way it was supposed to work.

I began to realize some truth in what my Depression-raised parents always cautioned about getting into stocks — that frequently there are agendas in play that are only intended to make the proponents rich and rarely for the benefit of the little people. Since then, I tend to focus my attention on well-established companies or companies which I thoroughly understand.

The reason I bring up this story is that it should hopefully shed some light on what, in part, happened with the Internet and technology IPOs.

There is always a great desire to get something cheap and the internal hope that we could have the next Microsoft, Cisco or America Online in our pocket (at least when they reached their heyday-perhaps not today). Humanity, at least when dealing with stocks in a booming equity market, is very much inclined to be overly optimistic about corporate prospects and is willing to ignore any negative vibes.

"The reason I bring up this story is that it should hopefully shed some light on what, in part, happened with the Internet and technology IPOs. There is always a great desire to get something cheap and the internal hope that we could have the next Microsoft, Cisco, or America Online in our pocket."

All a company needs is a reasonably convincing story on what it plans to do and have some promoters buy into the smooth talk (and often the matter is not whether the stock is any good, but whether it can sell on the street).

There is also often too strong a human tendency to believe in the honesty and integrity of the promoters. In the end, some little people win and probably big, but the majority will get hit. Then a generation or so will have to pass (until people have forgotten about the past), and then a whole new breed of unsuspecting investors will rise up all over again.

I had heard about internet IPO promotions where the public response was astronomical, which made me sure that there were plums ripe for the plucking, if the promoters and corporate strategists were willing to take advantage of it (and I am sure there were those that did).

It often boils down in many instances to a simple case of supply and demand, and if there is insufficient good supply, we will bring in the second or third string issues to meet the demand.

It would not surprise me at all, if those I mentioned above that peddled that shady IPO selling faulty products, eventually peddled some sort of Internet 'idea' thereafter.

Don't get me wrong — I have some very positive feelings about the Internet and its prospects for companies, technology, and other types of IPOs. But I also know that the success of the early entrants into Internet and technological related services had set up the public to be in a buying mood for almost anything that hits the street.

Some were honest and fair players, while others were just trying to ride the wave and become rich with no sound idea in mind. I know that if I had come up with almost any idea, I could have probably got it launched.

Unfortunately, I had too much of a conscience. And if I thought my idea was quite good, I would be more tempted to borrow the money, rather than use the money of shareholders (unless I really needed a lot of capital), and thereby keep more of the profits for myself.

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Index Separate Accounts

by Vic Modugno

Starting from the 1970s, the popularity of index investment funds has grown in recent years, especially among pension plans. As fiduciaries, plan sponsors measure equity performance against the S&P 500 Index — so investing in low cost funds that replicate that index was natural. Some pension funds were so large that they felt they had no choice but to "buy the market." The vast majority of investment managers underperformed the index, furthering this trend, which started to spill over into the retail market. As more money poured into S&P 500 funds, this trend became self-reinforcing.

Today 70% to 75% of pension plan assets are indexed. Earlier this year, the Vanguard Index 500 Fund with assets exceeding $100 billion passed Fidelity Magellan as the largest mutual fund signifying the triumph of indexing over active management in the retail market.

There is a proliferation of indexes currently in use covering broader or special segments of the equity market; there are many fixed income indexes as well as international stock indexes. There are exchange-traded securities that represent indexes. There are a number of investment managers offering enhanced index fund management to institutional investors, designed to provide higher return than the index with only a small risk of underperformance.

While some insurers offered separate accounts for pension clients designed to replicate the S&P 500 Index in the 1970s, the first guaranteed index separate account was introduced in 1987. Under this account, the insurer guaranteed the performance of the Lehman Government/ Corporate Index for funds on deposit for one year. The pension plan could withdraw funds from the separate account and receive the index performance on any contract anniversary with 30 days notice. Any overperformance was to belong to the insurer.

However, state regulators required a fee for this account, and so a fee of 3% per annum was deducted (due to the performance guarantee, the actual fee would be less). If the overperformance for the year exceeded 3%, it would belong to the contract holder — but there was little chance of this happening. The Lehman Government/ Corporate Index consists of medium-term U.S. government and very high-quality corporate bonds.

The insurer had developed a proprietary, computer-tested strategy involving longer-term lower quality bonds that should outperform the index 9 years out of 10, with small underperformance in the losing year. The lower quality bonds had higher yields, but were less interest-sensitive than the bonds in the index.

A couple of years later, another insurer introduced an S&P 500 Index guaranteed separate account that paid a .15% annual enhancement over the index.

The fee of .85% allowed for participation by the policyholder in overperformance. This was also based upon a proprietary, computer-generated strategy developed by a college professor where 200 of the 500 stocks are selected from the Index. Back testing demonstrated that this strategy is profitable in over 90% of scenarios, with minimal losses in the down scenarios.

Later, other insurers introduced S&P 500 Index guaranteed separate accounts that used S&P 500 futures with LIBOR-based investment strategies. These could be debt securities or market neutral strategies such as index arbitrage, convertible bond arbitrage, GNMA rolls, and others that produce returns that benchmark to LIBOR.

Each strategy has different non-correlated risks. The use of futures to replicate the index has roll risk, but over time should be cheaper than using swaps. The contracts usually have three to five year tenures, but may provide for early withdrawal with penalty.

The first definition of an Index Separate Account appears in California Insurance Code Section 10506.4(3), which was part of a law enacted in 1994 to give insurers authority to issue guaranteed separate accounts.

The Model Regulation for guaranteed separate accounts, which was drafted a few years later, follows the California definition: "Index Contract means a contract under which contract benefits shall be based upon a publicly available interest rate series or an index of aggregate market value of a group of publicly traded financial instruments, either of which is specified in the contract and that do not provide a guarantee of some or all of the consideration received plus earnings at a fixed rate specified in advance and that does not provide any secondary guarantees on elective benefits or maturity values."

The part about not guaranteeing consideration and interest and secondary guarantees, which is not in the California code, was added to exclude protected equity accounts — where the insurer pays a percentage of upside of the index only and may guarantee principal or some percent of principal plus interest and certain other separate accounts used in the individual annuity market.

The NAIC RBC instructions also define index separate accounts as follows: "Index Separate Accounts are invested to mirror an established securities index that is the basis of the guarantee. Consequently, indexed separate accounts are relatively low risk; the risk-based capital factor is the same as class 1 bonds."

In setting these risked-based capital requirements, the NAIC recognized that the factors for the general account, where principal is guaranteed and assets held at book value, are not appropriate. In an S&P index contract, if the index returns a negative 30%, the policyholder gets his guaranteed value decreased by 30%. So holding stocks to back this guarantee

should not require the 30% RBC factor for common stocks held in the general account.

Both the Model Regulation and California Bulletin 95-8 require, inter alia, a plan of operation where there is a demonstration that investment strategy supports the index guaranteed. Under the Model, the actuary can propose an Asset Maintenance Requirement, which acts as a haircut to the market value of the assets in determining non-insulated deficiency reserves, to cover basis risk between the investment strategy and the index. California appears to be on a pass/fail basis when it comes to basis risk between the investment strategy and the index.

Statutory accounting will follow the Model Regulation, which is part of the codification, to go into effect in 2001. For GAAP and tax accounting, these accounts could be treated as managed funds with operating income equal to the fee withdrawn. Comprehensive income would include changes in market value of the assets relative to the liabilities. In order to smooth out GAAP operating income, it may be possible to use a formula that amortizes the withdrawal of overperformance or to set aside part of fee income in asset impairment reserves.

The primary market for index separate accounts are defined benefit pension plans, where these contracts are used as part of the core index fund. A typical contract might have a three-year tenure and have a .25% non-participating enhancement over the index.

The separate account is exempt from registration under 3(a) 2 for qualified pension plans. This is fairly expensive funding for LIBOR contracts. An alternative would be to issue a contract paying LIBOR to a money market or other short-term investment fund. These funds cannot hold investments with maturities over one year and so the best liability that could be written would be a perpetual contract with a 12-month put. Since these are not qualified funds, a private placement exemption must be used to avoid registration. There are numerous requirements, such as a private placement memorandum and marketing through broker dealers, that must be met under this exemption.

The index separate account offers life insurers a capital-efficient structure for certain investment strategies and assets compared to funding in the general account, which could result in a higher return on capital.

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Pension Forecasts, Part One: Some Questions

by Lawrence N. Bader

Note: This article will be presented in two parts. The first part, appearing below, describes a simplified problem in pension plan financing and presents two questions about how that pension plan can be modeled. We hope that readers will ponder these questions and perhaps be moved to respond. The second part of the article, in the next issue of this newsletter, will discuss the answers to the questions raised below and their implications for traditional actuarial models.

Consider this simplified pension plan and funding system. The liabilities consist of a single known benefit payment to be made 20 years from today. That benefit payment can be matched in timing and amount by a portfolio of 20-year zero-coupon Treasury bonds with a market value of $1 million.

The plan assets also equal $1 million. The company will make no interim contributions to or withdrawals from the plan. At the end of year 20, the company will wind up the plan by withdrawing the surplus or contributing to cover the deficit. (We ignore taxes.)

The corporate sponsor of this plan asks for your help. The assets are currently invested in the matching Treasury portfolio, which will ensure full funding of the plan with a company cost of zero. The sponsor believes that, over a 20-year horizon, equity investments would give rise to potential withdrawals that greatly outweigh the potential contributions, in both probability and magnitude. So he asks you **Question #1:** *Ignoring taxes, how would shifting the $1 million from Treasuries into equities affect shareholder value?*

You decide to use a pension forecasting model. You prepare a series of 20-year simulations that show a range of terminal company contributions or withdrawals. To provide a single answer to Question #1, you need to discount each of these terminal payments to a present value. This presents **Question #2:** *What discount rate should you use — the Treasury yield, the expected return on the plan assets, the company's borrowing rate, the company's weighted average cost of capital, or some other rate?*

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Investment Journal Reviews

by Edwin Martin and Will Babock

"Value at Risk" by Thomas J. Linsmeier and Neil D. Pearson, *Financial Analysts Journal*, March/April 2000.

This article accurately bills itself as "a self-contained introduction to the concept and methodology of value at risk." It includes examples of how VaR works and a discussion of the pluses and minuses of different methods for computing VaR. This would be a good article for those who have heard about VaR and would like a compact overview of the subject.

* * *

"Stocks versus Bonds: Explaining the Equity Risk Premium," by Clifford S. Asness, *Financial Analysts Journal*, March/April 2000.

Actuaries who are interested in the long-term behavior of stocks and bonds will find this article interesting. The author shows how the dividend yield and earnings yield on stocks (earnings yield is the reciprocal of the more widely followed P/E ratio) is explained by past volatility of stocks and bonds as well as the yield on bonds. Predictive ability of these ratios is also studied. This is an insightful analysis of how risk tolerance of investments is formed by past market volatility.

* * *

"Estimating and Pricing Credit Risk: An Overview,"by Duen-Li Kao and "Corporate Credit-Risk Dynamics," by Lea Carty, *Financial Analysts Journal*, July/August 2000.

These two articles discuss credit modeling, which has received a lot of attention recently. The first examines the relationship of credit spreads to several economic variables including the level of interest rates, the shape of the yield curve and equity returns. It ends with a good discussion of credit risk modeling methods and uses for credit models. The second article uses a number of economic variables to calculate parameters for a default hazard rate model using Moody's Investors Service's extensive database of credit information. Different quality ratings and industries were analyzed along with the impact of economic variables like tenure in the market, GDP growth, real interest rates and S&P 500 growth.

* * *

"Meeting the Highly Effective Expectation Criterion for Hedge Accounting" by Ira G. Kawaller and Paul D. Koch, *The Journal of Derivatives*, Summer 2000.

This timely paper on the very challenging FAS 133, derivative accounting, provides several non-regression based methodologies to obtain the "highly effective" prequalifying condition for derivatives. Additionally, the pitfalls of utilizing regression analysis are also explored. For actuaries working with derivatives, FAS 133, or considering derivatives, this paper provides relevant and highly practical information.

* * *

"Better Risk Management" by Jarrod W. Wilcox, *The Journal of Portfolio Management*, Summer 2000.

In this paper, the author combines many theoretical risk management topics into a single framework, which maximizes expected compound return of discretionary wealth. The paper demonstrates that this framework can be applied to three important areas: sustainable investment policies over multiple periods, better risk performance policies, and capturing the risk impact of dynamic policies. ALM actuaries may find this paper useful.

* * *

"Semiannual Seasonality in High-Yield Bond Returns" by Martin S. Fridson, *The Journal of Portfolio Management*, Summer 2000.

For those interested in marketing efficiently or performing data mining on the markets, this paper may be an interesting read. Using historical data, the author demonstrates that there existed exploitable seasonal patterns in high-yield bond returns from 1989 through 1998. The author gives some reasons for the patterns and methods to exploit these patterns in the paper.

* * *

"Patent Power: Who Owns the Ideas That Drive Derivatives?" by William Falloon, Risk, December 1999 and "Columbia Patents VAR Methodology," *Risk*, June 2000.

Using low-discrepancy sequences in Monte Carlo simulation has shown promise in reducing the amount of computational effort required to complete asset/liability simulations. Columbia University's patent on these methods has generated controversy within the derivatives industry. Actuaries are featured in the December 1999 article, while the June 2000 article is a brief follow up.

* * *

"The Credit Rating Challenge" by Ebo Coleman and Pascale Viala and "Synthetic Structures Drive Innovation" by Ganesh Rajendra, Alexander Batchvarov, and Brian McManus, *Risk*, June 2000.

These two articles are part of a "CDO Special" that discusses collateralized debt obligations. The first is by authors from Moody's Investors Service which describes how Moody's goes about rating and analyzing the risk of a CDO. The second discusses the evolution of CDOs and goes into depth on synthetic CDOs.

Irwin T. Vanderhoof

(December 4, 1927 - September 24, 2000)

PhD, CPA, FLMI, CFA, CLU, ACAS (1964), AIA (1972), FSA (1957), MAAA (1965)

by Sarah Christiansen

The actuarial profession lost one of its brightest lights when Irwin Vanderhoof passed away on September 24 following several months of serious illness. Irwin was a very intelligent, friendly, and highly educated family man, who always had a smile on his face and was interested in everything. He was creative and forward thinking, and he used his intelligence and connections to help lead the actuarial profession into new areas of intellectual inquiry.

I first met Irwin at the May 1995 Spring SOA meeting in New York, where he had arranged a session at New York University's Stern School of Business on quasi-Monte Carlo methods and Low Discrepancy Sequences (LDS). Irwin's description in the Record of the Marco Island meeting on how he came to be involved in LDS is illustrative of his personality.

Irwin had first learned about LDS in 1992 from an article in Science News and called to discuss this theory many times with Joseph F. Traub and H. Wozniakowski of Columbia University's Computer Science Department. After giving the idea much thought, he told them that their technique should be very efficient for valuing assets. They sent him a PhD student who was the first to use LDS to value a collateralized mortgage obligation (CMO). First it was used on a sample CMO that Irwin created and then later on a real one at Goldman Sachs. Irwin then claimed that an actuary was the first one to use LDS to value assets. Irwin felt that both individuals and academic institutions should be well rewarded financially for their research efforts. In response to IBM's attempt to charge a million dollars for the coding which would implement LDS on various machines, Irwin and the Computer Science Department at Columbia developed software that would not only generate LDS, but also interact with actuarial and other software. They then jointly patented and licensed the software, charging an annual license fee. However, the software was free to academic researchers.

My first contact with Irwin's work was when I took over as chair of the V-480 exam. He had written a short study note entitled "Stochastic Calculus without Tears." The title was evidence of Irwin's sense of humor. Another place that Irwin's sense of humor often surfaced was in his column "Through an Actuarial Looking Glass" for *Contingencies* magazine.

Irwin's contributions to the profession were many and varied. He served on many industry committees over the years, including the Committee on Valuation and Related Areas (COVARA), which instituted the use of the C-1 though C-4 notation for the various risks. Irwin chaired the subcommittee that studied asset defaults. Irwin was also involved with the E&E committee structure, serving on the committee that created the syllabus for the core exam 220, covering basic finance and investment topics. He was one of the original organizers of the Reinsurance Section, and served on the Education and Research Section Council from 1996 through 1998, serving as chair during 1998. His research reflected his varied interests and related committee work. He wrote many joint papers on a variety of subjects including mortality studies of reinsured business, forecasting changes in mortality, Lyme disease, and asset loss and bond default. Irwin's interest in Lyme disease stemmed from his personal experience. His daughter became infected when she was pregnant, resulting in the death of his grandson at a young age.

Among the professional research conferences that Irwin helped to arrange were two relating to the relationship between actuarial science and accounting. The first conference was in 1995 on the Fair Value of Liabilities and the second was in March of 1999 on the Fair Value of Insurance Business. Irwin arranged for both conferences to be held at the Salomon Center of the Stern School of Business at NYU and used his connections to obtain sponsorships from major accounting firms. As a result, the conference attendance was a mix of actuaries, accountants, and other professionals. The sponsorships provided for publication of a book containing the papers presented at each conference. He edited both books jointly with Edward Altman.

Irwin was always ready to help out, often being recruited as a speaker at SOA sponsored meetings. Irwin was able to balance his dedication to the actuarial profession with his love and devotion to his family.

He was a good friend and mentor, and I shall miss him.

Investment Section Meets in Chicago at the Annual Meeting

The Investment Section Council taking a break from Planning the Section's 2001 activities during the Chicago Annual Meeting:

Standing - L to R: *Max Rudolph, Charles Gilbert, Rick Jackson, and Doug George.*

Sitting - L to R: *Peter Tilley (2000-2001 Chairperson), Josephine Marks (1999-2000 Chairperson), and Victor Modugno.*

Missing council members: Craig Fowler, David Ingram (participated by phone), David Li, and Christian-Marc Panneton.

Peter Tilley, incoming chair of the Investment Section, presenting Josephine Marks, retiring chair, a gift of the Section's appreciation during the Section breakfast at the Annual Meeting in Chicago.

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