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**ASSET/LIABILITY PERFORMANCE MEASUREMENT
FOR LIFE INSURANCE AND ANNUITY PRODUCTS**

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Recorder: JOSEPH J. BUFF

- Performance measurement in a risk/return context
- Incentive compensation as a tool for achieving effective performance
- Return attribution using liability-based performance indices

MR. JOSEPH J. BUFF: The insurance industry has become increasingly interested in matters of asset/liability management and good investment performance. In the last couple of years, certainly enough good and bad things have happened at different companies. Asset/liability modeling issues, risk control, and optimized business-management strategies are more than a purely academic issue; they really do matter to our jobs and to the security and success of our companies.

After substantial evolution in the last 10 or 15 years, more and more attention is paid to the volatility of the insurance markets and the capital markets and what they do to the bottom line. A new kind of paradigm has emerged in the last few years, recognizing that for most of the major decisions we make, a number of different risk-return trade-offs have to be made. Each of our three panelists is going to be talking about some of those risk-return trade-offs. The paradigm amounts to starting at the top with the overall goals for the insurance enterprise (and the objectives and financial targets for the lines of business), factoring in the various constraints of a cultural, organizational, or regulatory nature, identifying the various strategy choices that can be made, and then examining the strengths and weaknesses of each of those choices. Building a consensus on which decision is "right" is essential to success. Sometimes there's an 80/20 rule where you only need agreement on 20% of the outstanding issues to make 80% of the progress.

Garth Bernard is the director for product development at Capital Holding's retail annuity products in Louisville. In addition to product development, he has had several years of experience in the area of asset/liability management and risk analysis. Garth is a Fellow of the Society of Actuaries and he's been an active participant in many professional activities in the Society and the industry. He participated as a member of the Project Oversight Group (POG) for Interest-Sensitive Cash-Flows, which recently produced the single-premium deferred annuity persistency report. He's also a member of the advisory committee to revise the nonforfeiture law for annuities. He has served on several Society of Actuaries committees and he's been a speaker at SOA seminars, panel discussions, and workshops.

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MR. GARTH A. BERNARD, SR.: I've worked in the asset/liability management arena for about five years now, and in my opinion there appear to be two primary obstacles in measuring asset/liability performance. The first obstacle appears to involve or be centered around definitional issues. The second obstacle relates to process or structural issues. My presentation will focus on these two issues. In other words, how do we ensure that we're asking the right question and answering the right question?

I'll introduce a concept entitled the "capital efficient frontier," and I'll illustrate it with a simple single-premium deferred annuity (SPDA) study. I'll then share with you some of my thoughts on the attributes that are necessary to have a successful process to measure performance in this context.

So how do we ensure that we're asking the right question and that the question is understood? First of all, what performance are we talking about here? In the asset/liability context, a new element that has been added is the element of risk. So obviously the very first thing that you will need is an appropriate risk measure. You will also need a framework for evaluating risk-return trade-off, and that framework should be integrated into corporate goals. This will ensure an alignment of your reward systems and reward strategies with the corporate goals.

Performance cannot necessarily be measured in the absolute. It must be measured relative to something. So what should performance be appropriately measured against? What is an appropriate benchmark?

Finally, one way to demonstrate a true understanding of the right question by the functions that are accountable for managing asset/liability performance is that they must also be able to answer the related question, how do my actions affect performance? In other words, if I'm off track on performance, how do I get back on target?

The capital efficient frontier is a framework that will help solidify the issue of definition. There are three elements in its framework. There's a risk measure, a return measure, and a utility function. Now, I use the word *utility* very loosely, only in the sense that it reflects the ability to evaluate preferences. These measures can be derived from a set of stochastically generated interest rate or economic scenarios. The return measure will be the mean or expected profit of the distribution. Now, to the extent that the interest rate options in the assets and liabilities are going to be triggered by these economic scenarios, the return measure is going to be an option-adjusted measure. But, it's not risk adjusted, at least not as yet.

Next, you must have what I call a true risk measure, and there are two attributes of a true measure. First of all, a true risk measure must incorporate the magnitude of loss, and it must also incorporate the probability of loss. That's my understanding of a true risk measure. Now, there are other risk measures that can be used, and I refer to these as pseudo risk measures, in the sense that they may be indirectly related to these attributes.

In the context of the capital efficient frontier, the risk measure is a function of the maximum cumulative loss distribution. The next step that I take in deriving the utility

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measure is a unique step. You set the capital requirement for the product to be a function of this risk measure.

In this case, I'm going to use the function of identity. The utility measure simply drops out of the framework as the return on capital. In other words, the capital efficient frontier is the locus of risk-return combinations, which have equal return on capital. It sounds simple enough.

Now, let me try to illustrate this with a simple diagram (Chart 1). On the vertical axis is my return measure and on the horizontal axis is my risk measure. I have three alternative risk-return combinations: A, B, and C. It is almost immediately clear that point A is preferable to point B, because there is low risk and high return. But, it's not immediately clear that point C is preferable to either points A or B, and the question then becomes, how do I make that relative performance evaluation?

CHART 1
Risk/Return Profile

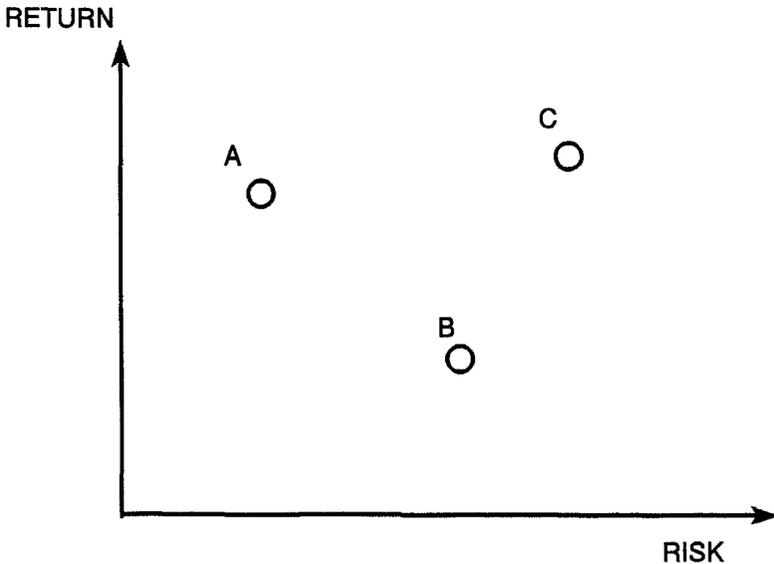
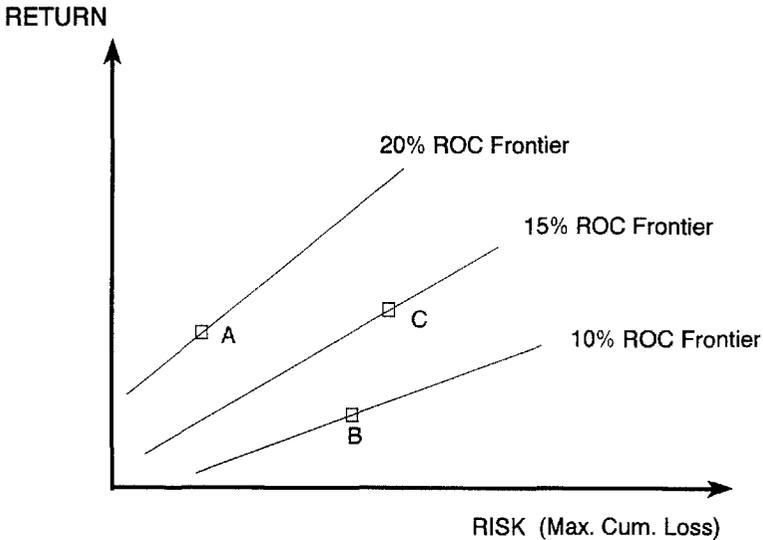


Chart 2 illustrates the capital efficient frontier. I've shown the efficient frontiers that these various points lie on, and the conclusion to which you would come, based on this example, is that point A is preferable to point C because it lies on a higher capital efficient frontier, and similarly, C is preferable to B.

Now, let's illustrate the practical application of the capital efficient frontier with a very simple example. I'm looking at an SPDA. We're trying to evaluate three investment strategy alternatives, and I've made some underlying assumptions. First, there are no surrender charges, expenses, or taxes. I've defined the competitor rate to be the five-year Treasury. My crediting strategy is to pay the competitor rate with an annual reset to the competitor rate. But I impose a spread constraint that says that I never

want to earn a negative spread on my assets. I've introduced a lapse assumption that is sensitive to the interest rate environment. Suffice it to say that if you're paying an uncompetitive rate, you will expect to see some excess lapses.

CHART 2
Capital Efficient Frontier



Now, the three investment-strategy alternatives that we will examine here are strategies A, B, and C. Strategy A is to invest all of the cash flows in five-year A-rated corporate bonds. Strategy B has a slightly different twist; invest initial premium in five-year bonds, but all subsequent positive cash flows would be reinvested in one-year A-rated corporate bonds. Strategy C is to invest all cash flows in one-year corporate bonds. I've intentionally put strategy C in as an example of what some of you would think as being a closer duration match.

The only other assumption that I've made is that single-A spreads over Treasuries are 70 basis points. I'm using 200 interest rate scenarios in this example, and let's now look at the elements that arise in the context of the capital efficient frontier.

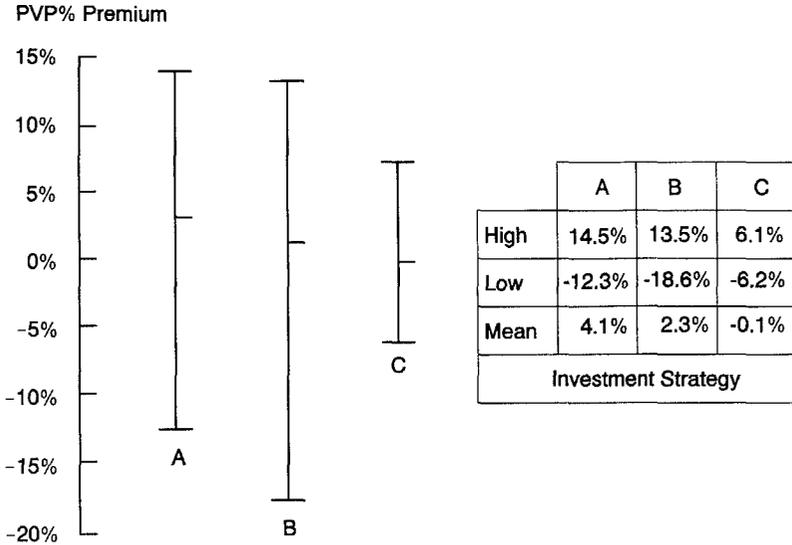
Chart 3 illustrates the profit distributions of the three investment strategy alternatives A, B, and C. The vertical axis is the profit measure – present value of profits as a percentage of present value of the premiums. You only have the initial premium, so we're talking about a percentage of the initial premium. The lines represent the distribution of profits, and the dash toward the middle of the line is the expected profit or the mean profit of those distributions. So that's my return measure. Again, it's an option-adjusted measure. It's not risk-adjusted yet.

Now, let's look at the development of the risk measure. On the vertical axis is the present value of maximum cumulative losses as a percentage of the initial premium.

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(See Chart 4.) The ticks in the center of the lines represent the 95th and 96th percentiles of that distribution. Notice that some of them have somewhat long tails, because these are all unhedged strategies in this very simple example. Nevertheless, I will use the 96th percentile of that distribution as my risk measure. Again, I refer to the earlier point that I made, this risk measure incorporates both the magnitude of loss as well as the probability of loss. So, I call it a true risk measure.

CHART 3
SPDA Case Study/Profit Distribution



Before we develop the utility measure, let's look at what we have so far. Again, on the vertical axis (Chart 5) is the return measure, and on the horizontal axis is the risk measure. As you can see, it is not possible to tell whether point A is preferable to point B, or whether point B is preferable to point C. The issue here is that, for example, if you compare A to B, you have higher risk, but you also have higher return. The question then becomes, is the incremental return commensurate with the incremental risk that you're taking?

To develop the utility measure, here is a brief overview of how to derive the actual return-on-capital measure. This is a very simple example and I'm primarily illustrating the C-3 component risk here -- I'm ignoring C-1, C-2, and C-4 risks for simplicity -- the development of the return-on-capital measure would work as follows: For each of the investment strategies, A, B, and C, and for each scenario, look at the distributable statutory earnings after tax -- the point where you introduce your tax assumptions -- and after your risk charge. Your risk measure was already defined and already determined from the maximum cumulative loss distribution. The annual risk charge is simply the increase in the risk premiums (percentage of reserves) as you move through time. This is how you risk adjust your profit streams.

CHART 4
SPDA Case Study/Maximum Cumulative Loss

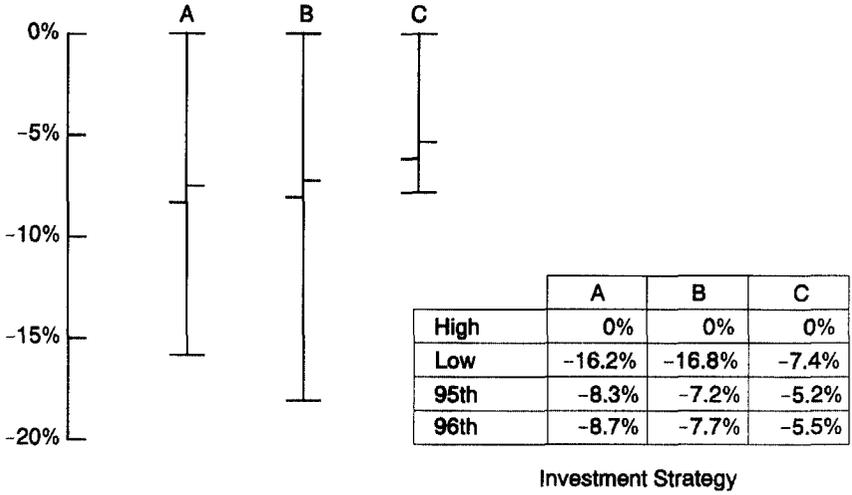
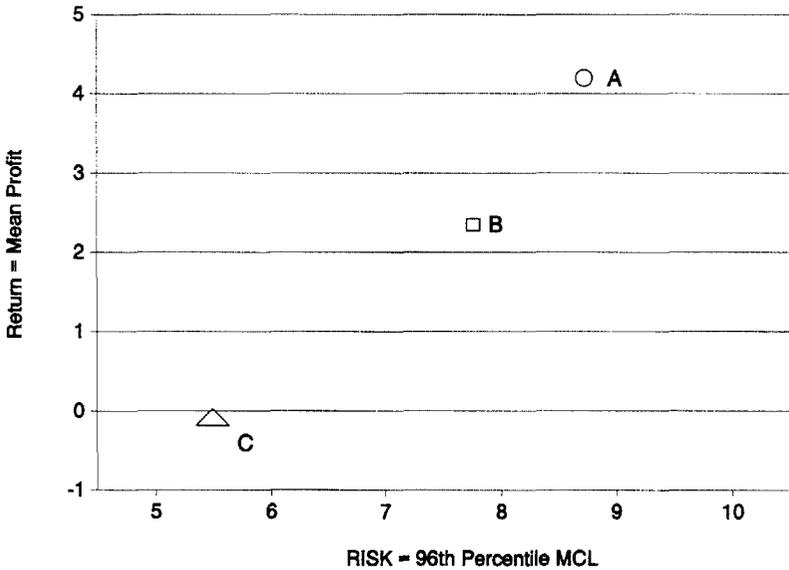


CHART 5
SPDA Case Study/Risk-Return Profiles

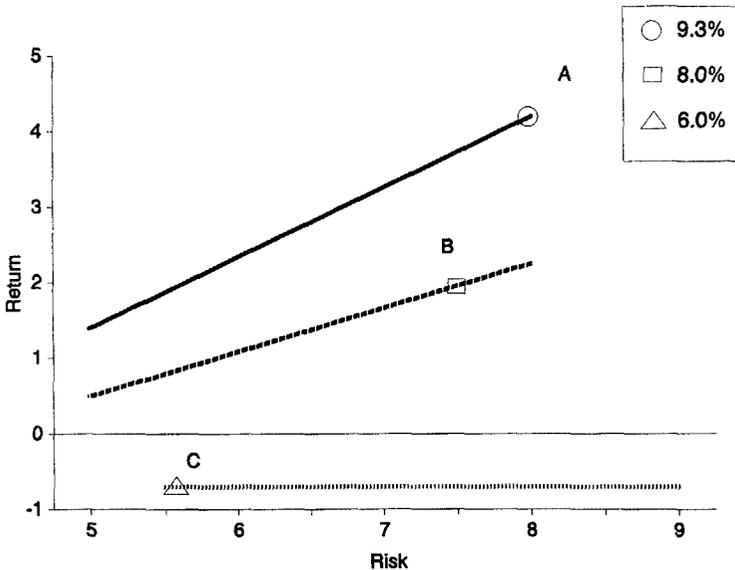


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An initial investment is equal to the statutory strain that you incurred in writing the product, as well as the initial risk premium. You have subsequent flows of after-tax, risk-adjusted earnings. The return-on-capital measure is simply the internal rate of return on that pattern of "cash" flows. The results I've calculated in this example would indicate that point A return on capital (ROC = 9.3%) is preferable to point B (ROC = 8%), is preferable to point C (ROC = 6%). So, you would choose strategy A over B and C. You would want to reject all of them, however, if they are less than your corporate targets for return on capital.

Let me illustrate the point with the capital efficient frontiers and how those would look if it were possible to track the locus of points that each of the strategies A, B, and C lie on. Chart 6 is what it would look like. You can see that point A lies on a higher capital efficient frontier than point B and so on.

CHART 6
SPDA Case Study/Capital Efficient Frontiers



This is a very simple example. But in real life, you won't necessarily make the decision to select strategy A. The fact is that you may impose some additional constraints on your decision-making framework. For example, you may have a constraint that says to not write a product that requires this much of a capital commitment. Similarly, on the return side, you may have commitments to shareholders or corporate management to earn a certain minimum dollar amount of earnings. So, you may actually have a constraint that says to not select a point that lies below a certain return level on that framework. So, there are other considerations that go into making these decisions.

I believe we've clarified the definition of performance, but we still haven't answered the question about the performance standard and what that should be. In other

words, what should performance be measured against? Now, I've observed that there is a tendency in the asset/liability management arena to want to measure and manage asset/liability performance of the investment function relative to the liabilities (we use the liabilities as a benchmark). I believe that there is a fundamental flaw in this approach. Now, it's not a theoretical flaw by any means. I believe it's a practical flaw and here's why. The nature of the liability cash flows reflects the underlying behavior of consumers. The nature of the asset cash flows reflect primarily underlying investor behavior. In my experience, investment professionals tend to be very uncomfortable, and quite rightly so, with that distinction. That is because consumer behavior has strong elements of noneconomic factors, whereas investor behavior tends to be purely economic in nature.

So, I think the ideal in terms of a performance standard for an investment function is to have a benchmark asset portfolio rather than trying to measure performance against liabilities.

I've shown how the capital efficient frontier framework can be used to derive the best "notional" investment strategy that defines that benchmark portfolio, what that portfolio should be. (In other words, the capital efficient frontier produced a "liability-based benchmark" that describes not what the investment department should invest in, but rather what the investments should be measured against.)

Our models should dictate what actual investment strategy should be. Otherwise, why do you need the investment department? Just run your models and go invest. The point that I'm trying to make is that the investment function brings a certain ability to the table that your models cannot necessarily address. So, this concept of a "notional" investment strategy is easier to communicate to the investment department. In this way, you'll be able to use traditional asset-side concepts that the investment professionals are extremely more comfortable with; for example, total return measures. "Here's a benchmark asset portfolio against which you're going to be measured. Your job is to outperform this benchmark on a total return basis." This gives the investment function a degree of latitude and flexibility that is necessary for the investment department to get its job done. In other words, it is able to make tactical investment decisions that don't appear to be restricted by "Well, you said the investment strategy should be 100% five-year bonds, so, can't I buy four-year bonds?" You have these tactical decisions that need to be made on a real-time basis.

Now that we've taken care of definition, let me say a few words about the management process and what I believe it takes to be successful there. First of all, the asset/liability performance goals must be consistent, or at least integrated with other corporate goals. The capital efficient frontier can be used to accomplish this integration, and the utility function is the piece of the framework that ties into the corporate goals.

The performance goals and measures must be understood, and they must be agreed upon first. Then you need clear accountabilities and roles. An appropriate management structure will make this happen. A review process needs to readjust the performance standards. As you accumulate a block of business, keep looking back at the emerging experience and how it relates to the assumptions used in coming up with the benchmark portfolio. That review process will allow you to readjust the

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standard of measurement. Communicate that to the people who are going to be measured against it, so they understand that process as well.

One of the most daunting tasks in having these performance measures actually work in practice, is that you have to have the financial and accounting systems in place to continuously track, measure, and report on the performance. Ideally a real-time measurement system would form the basis so that whoever is accountable for performance would see the impact of decisions on performance to get back on track or outperform the standards. Also don't exclude the liabilities from the entire process. Focus on the context of measuring asset/liability performance, having as efficient and understandable a system as possible for the people who will be accountable for that performance.

Communication must be at the level of integration. It's not sufficient to simply talk to your investment department or to have the investment department just talk to product development, corporate actuarial, etc. Talk is not enough. The investment department needs to be fully conversant with your asset projection systems, your liability projection systems, your frameworks, your measures, and so on, and buy into them. You need to be fully conversant with the investment professional's frame of reference and tools and so on. That to me represents integrated communication. It is not an easy thing to achieve in practice. It takes working together and having shared objectives for which you are equally responsible and accountable.

At Capital Holding, for example, we have worked together directly on projects and have had the investment folks actually sit down with the asset/liability models and run them. Apply some of the traditional techniques and measures on the asset side to those models and get them to have a comfort level with your systems, measures, and so on. Show them that it works.

In summary, there are two primary obstacles to measuring performance in the asset/liability management context. The first obstacle relates to definition, the second to procedural or structural issues. The capital efficient frontier decision-making framework will facilitate the process and derive measures that are understandable and with which the investment function feels comfortable. Finally, I've said what it takes to have a successful process for measuring and thereby managing asset/liability performance.

MR. BUFF: Tom Ho is the president of Global Advanced Technology (GAT). Tom was a tenured professor of finance at New York University for a number of years. About five years ago, he founded his own firm, GAT, which subsequently has grown to employ about 50 people based out of New York. Tom has written about investments and asset/liability modeling (ALM) topics. He's done a lot of very respected research on option pricing and risk-return trade-offs.

MR. THOMAS S. Y. HO: My presentation deals with the total return approach to asset and liability management. It's a presentation based on the paper I coauthored with Kin Tam and Alex Scheitlin from Metropolitan Life.

Asset and liability management has become very important. But what does it really mean? It could mean managing the whole asset side and liability side of the entire

insurer portfolios. Or, for the line of business, how do you manage asset investments backing the block of business? Or, in pricing, when issuing a new product, how do you price it in such a way that it is consistent with the return from the asset side?

All these issues are related to asset and liability management, and all of them are important. Therefore, it's no surprise that finding an appropriate performance measure is also becoming important. What is performance measurement? It's something that tells us about the profit and the risk we're taking. But, unfortunately, profit and risk exposure is no longer a very simple concept. You have probably heard of all these prepayments in our collateralized mortgage obligation (CMO) market. In March 1992, the prepayment rate grew three or four times higher than any historical rate. Prepayment speeds are actually running at 1,000 PSA (10 times the Public Security Association model), and they used to be only at 200 PSA. This month, once again, prepayments are at 1,000 PSA. So, Planned Amortized Class (PAC) interest-only's (IOs) that people bought in 1989 now have yields 15% or higher. In 1989, we were told that there was no embedded option value in these bonds. Now these bonds are trading with 100 basis points on just option cost alone.

How you match your risk and return? Not long ago we had simple assets and liabilities, and we put them together. There was no need to measure the risk exposure or the profits.

The traditional concepts of book value to measure performance are no longer applicable, simply because both our assets and liabilities are so much more complicated now. What measure reflects the risk to an insurer presently and in the future, and looks backward and sees what has happened?

Performance measure is a management tool. We're not saying that we need measurements to report to our shareholders or other boards of directors. We need measurements so that we can do our daily business.

So far we have discussed the basics. What do we have that's new? Actually doing what I will suggest is nontrivial; putting everything, assets and liabilities, in one consistent framework is a grandiose task.

How do records of performance in the past help project your future? I'm sure that in the back of your mind you're thinking, "Wow, we're holding an SPDA. It's kind of complicated. It's not a bond, so how can we do performance measurements?" Or, you are holding all these liabilities that you've already sold and there's no market for them. How can you capture all these nuances?

Dealing with these issues is something new. What this paper is about is providing a recipe from A to Z; how all the steps can be put together in one consistent framework to do the job. While the concept is simple, going from A to Z is difficult. Only recently have we developed all the financial technologies, all the modeling, and all the systems that can be put together to make this work.

I'll give a very quick outline of our paper of over 40 pages. I will present the total return approach. What other performance measures do we have? I will give an example of how we will price a liability and how we build option models on liability

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products. I'll give some SPDA examples to show how we can measure performance, and various applications.

Presently the accounting system and book-value approach do not capture the risk that we just talked about (PAC interest-only bonds and prepayment risk and so on). We use a portfolio rate relative to credited rate. This rate is only at the margin. The rates that you're selling and these rates do not capture the embedded option risk.

Spread over Treasuries is used as measure of performance. As a start, we're now bringing the market Treasury rates into account to set up the spread on the product lines. Once again, we have not incorporated the call risk into measuring performance accordingly. Finally, many firms use market benchmarks, like Shearson Lehman and S&P's, but these benchmarks do not reflect the liability returns, so they would not be able to tell you how profitable your firm is.

What performance measure should management use? Some kind of measurement needs to help with our investment decisions; not just sector rotations to decide where we put money, in mortgage-backed securities, or Treasuries, etc., but we need to know down to the tactical level. You might want to increase portfolio duration by one year. Why? How does the duration of your assets compare with that of your liabilities? When selling a new product line, it helps to know at what price the public market will support it.

For these reasons, our performance measure needs to satisfy four criteria. First, it has to be accurate. We just can't wave our hands saying that our mortgage market is now trading 80 basis points off Treasuries and therefore we can sell products at a higher premium. This has no meaning. The spread depends on which kind of mortgage product we are talking about and what maturity will give us that return. The mortgage market can change within six months. We have to revise our decisions. So, we have to have the information fast enough so that we can revise a strategic decision.

Some people often talk about performance as a type of report card that affects our bonuses. That is not an important part of the issue. More important is that the performance measure has to help us do our job in the future. We need some type of retrospective measure. The same measure could be used for our prospective strategy.

Many decisions are being made at the same time we manage assets and liabilities together. There has to be some way of breaking down the total profit number into attributes. Whose decision has resulted in this profit? With this information, we can revise our decisions. Through return attribution, we can see whether we have a pricing problem, or if we have taken too much interest rate risk or credit risk. Somehow we have to know where the return number comes from, and that number has to be broken down into its component parts.

In the total return approach, we break down this return attribution into three steps. We have to first have some measure or market value of assets and liabilities. I think market valuation of assets is clear to all of us. Treasury bonds have relatively good price quotes. But many assets are not traded. This means that many bonds in your

portfolio are not priced daily. A way of pricing these securities is by making a relative comparison to securities with known valuation. The modern theory in financial research calls this approach relative valuation. There is also a way of relative pricing the commercial mortgages in your asset portfolio to all the other bonds that are traded in the market, reflecting the market's sentiments.

Then extend this concept of relative value to liabilities. Liabilities can never be priced simply, like assets. The point I am making is the need to extend that concept to liabilities. Do this by means of a required option-adjusted spread. It's just a spread. Option-adjusted spread is by now a very standard methodology in pricing many option-embedded bonds in the security markets. We can extend that concept to liabilities and argue that, in fact, the concept can be used to determine the market value of liabilities.

The third part is the return attribution. The model is only the tool. More important is how you use it. One way of using models is to simulate exactly how your positions affect the profit and therefore attribute your impact on the firm.

What are the required option-adjusted spreads? When we first sell a liability, we have a premium or a price of the liability. On any future date, the price of the liability can always be the book value. But that would not reflect the market changes. Interest rates changes have some impact on the present value of our liability. Without taking interest rate changes into account, we really cannot manage assets and liabilities together. If our asset portfolio value changes drastically, how can we still keep the value of our liability at book? We really need to discount the cash flow of our liability by the Treasury curve, the spot curve, just like what we would do on the asset side.

Now, there's a problem with that approach: at the time we sell the liability, we discount the cash flow by the spot curve, and the price may not equal the book value. It will usually be quite different. Sometimes we have big losses or big gains right at issuance. Now, that makes no sense. We just sold a product, how can we quickly book a profit or loss right there? What we need to do is add a spread on top of the Treasury curve. So, let's say we take 50 basis points and find a spread off the curve such that when we discount the cash flow, the present value is exactly equal to the price at which we sold the liability.

So having determined this spread off the curve, we keep it, saving it somewhere for the life of the liability. The price of the liability is the present value of the liability cash flow, discounted along the spot curve with the required option-adjusted spread. The required (option-adjusted) spread, say 50 basis points, is the spread we need for the investment managers to outperform the Treasury market to pay for our product.

Now the liability value not only agrees with the price it was first sold at but it also coincides with the value at the end of the product life. This is a very valuable piece of information for the asset managers. The asset managers have to look for securities to beat out the Treasury market by this much every period.

Now, the common question I hear is, "Well, just a minute, my firm is a single-A company; shouldn't the spread be changing with the market along with the corporate single-A spreads?" No. When we talk about the market value of a liability, we are

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not talking about liquidation value of a liability. We are talking about the value for asset/liability management. We are talking about what spread you need on the asset side to pay for the premium you sold on the product. We're only interested in capturing the market value through the present value of cash flow. Therefore, the spot-curve changes are important. This spread is the obligation. It is our own obligation that we have to pay off through our investment. So, we still want to keep the spread through the life of the product.

Now, we could have misestimated a lapse rate or a crediting rate. At some point, we might like to change this required spread because the model has changed or because our perception of the future has changed. That's okay. A new required spread over the life is something the ALM committee and so on can decide.

So, let's look at a simple example here. Our liability cash flow is \$100 two years from now, and it sold at \$80. What does that mean? That means we have to discount this two-year payment off the Treasury curve plus a spread, and that spread could be, as I said, 50 basis points. That means the asset side will have to make 50 basis points every year, and if it can outperform the 50 basis points every year, then it is profitable. If it underperforms the 50 basis points every year, then it would not be supporting the product.

Now, this sounds simple. The whole problem is that if we have an SPDA, we have an option-embedded liability. We don't even know how long we would amortize this gain or loss up front or for how many years, because we don't even know the life of the liability.

We have to create a pricing model of our liability. The option-adjusted spread allows us to add a spread on each interest rate scenario into the future and discount it. If our liability model is in an arbitrage-free consistent framework, then the asset/liability management procedure can be extended to option-embedded liabilities. That is, if we have the required option-adjusted spread of 50 basis points, we can still tell the investment manager that we need the 50 basis points. We don't have to tell the investment manager how complicated our liability is. The model, the building of that model, the construction of the model, allows us to say that.

Now, building an option model and so on in the consistent framework -- consistent with the asset models and liability models -- is a very complicated issue. In the required option-adjusted-spread approach, the benefit is that it allows us to be sensitive to the market environment. If we have changes in our liability value, we will change the price according to this fixed option-adjusted spread and because it now can register the change in liability value over this period. Therefore, we have some idea whether we made money or lost money on the liability side.

Now we have some kind of total-return concept. It is objective because we have sold the product and told the investment managers what kind of spread it requires. Well, how is the spread decided? We have the market to decide what spread we need. It is very objective. We only really see two prices. When we first sold the product, we had one price. At the end of the product's life is one last payment. The required option-adjusted spread ensures the pricing procedure is consistent with these two prices.

Using these two pieces of information allows us to interpolate all the other values during the life of the product. So, one thing we want to emphasize, therefore, is that this fair price of a liability, once again, is not a price we would quote the market to sell our product. It's not a price for secondary market pricing, like an asset. It's simply a way of deciding how much we need on the asset side to cover the value of the liability.

Having discussed the required option-adjusted-spread approach, we can now talk about how to price a liability. In this case, the first step is to think of a liability like an asset. Although a liability is nothing like an asset, it does have some kind of cash flow.

Once we have the cash flow, we can apply the same method of discounts on the asset to the liability. So, that's why we are talking about a spot curve. We can use the Treasury bond market to filter out all the coupon effects to find out the proper way to discount a single payment from zero years all the way out to 30 years or 40 years. We can establish some benchmark that's consistent with the Treasury market to discount liability cash flows.

Then we add onto all the features of a liability; for example, the lapse function. I often hear that the lapse function can never be estimated, because there are changes in the consumer's behavior. But, my argument is this: what's the alternative? Just because something is difficult doesn't mean we shouldn't try to take a few steps to deal with the overall problem. Modeling is not the final answer. A model is not a black box. It will not tell us, just by pushing a button, how to invest and how to sell. I know how to overcharge or I know how to make money. That's not the point. Modeling is a way to learn about what's really driving the market. Remember the mortgage-backed markets? We saw the beginnings of prepayment models with very scant information ten years ago.

Over the years, by using the prepayment models, we've learned more and more about how people behave. Now in the mortgage market, almost everyone who trades mortgages has to have some kind of model. With lapse functions the situation is similar. It's a procedure. It's a learning process of defining what assumptions we make about our decisions.

Building models in performance measurements is all a procedure of keeping track of all the assumptions we make and making sure there's a feedback effect, so that over time, we can only improve. So, it is with liability modeling, a crucial process.

Finally, liabilities management is managing a business. Take the cost into account. We have cost structure or the sales commission, administrative costs, investment costs – all this has to be built into the model. Once there's a model, then we can apply the theorem. The theorem says that on the left-hand side, you observe the assets that made a 10% return. In fact, the theory says that you can break that 10% number into components. The first component is the holding-period return; if you hold this bond for one week, just use the one week interest rates. The second term is the option-adjusted spread. When we buy a mortgage-backed security we are making 80 basis points. If we sold an SPDA, the required option spread is 50 basis

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points. But this spread can change. So the change of this spread affects the bond price for the third term.

The fourth term, which is most important to most assets and liabilities, is the yield-curve movement. Here, I don't mean interest rates going up or down. I really mean that yield-curve twists and turns would affect our portfolio dramatically. To evaluate these effects, we use the key-rate duration approach. We want to find out exactly how our asset portfolios and our liability portfolios are changing in value by each small change in the key rates. When we add them all up, we'll actually find out that the total return of the assets or liabilities comes from the twists and turns of the yield curve.

Then, the asset managers buy cheap bonds and sell them when the bonds become rich. So, we keep track of all the cheap and rich values. Finally, we can have trading. Here we look at a very simplified version of it. Actually, when we do a return attribution, we will be taking prepayment risk into account or revising our lapse function. Or perhaps we have decided that the required option just for our product has changed during this period. So, that too can be captured.

What I'm saying is that theoretically, in fact, we can break down a total return number that all asset managers use into each component and that, in fact, we can measure each of these. So, that's the return breakdown. For example, if in one week, the yield curve moved a lot, the fourth term would become very big. So, we know exactly what the impact of interest rate changes are on our portfolio returns. For example, we may have told the investment managers to immunize or not take any C-3 risk. That means our fourth term will be zero all the time. Now, if we happen to see that the fourth term keeps fluctuating up and down and so on, we can tell these managers that they are not doing their job, even though they might be making money and taking interest rate bets. Well, our job is to immunize and this is the power of return attribution. We can actually verify what we're supposed to be doing.

Now, this equation, as I said, applies to liabilities. So, once we have a liability model, the liability total return can be broken down. We now have a new concept of total return on our liability. In managing the liability total return, we don't want the return to be high. That's the whole point. We want to minimize the cost, and the return on liability should be low; whereas, our asset total return should be high and cover the cost. Now we can monitor this total return of asset and liabilities over time and find out exactly what happened.

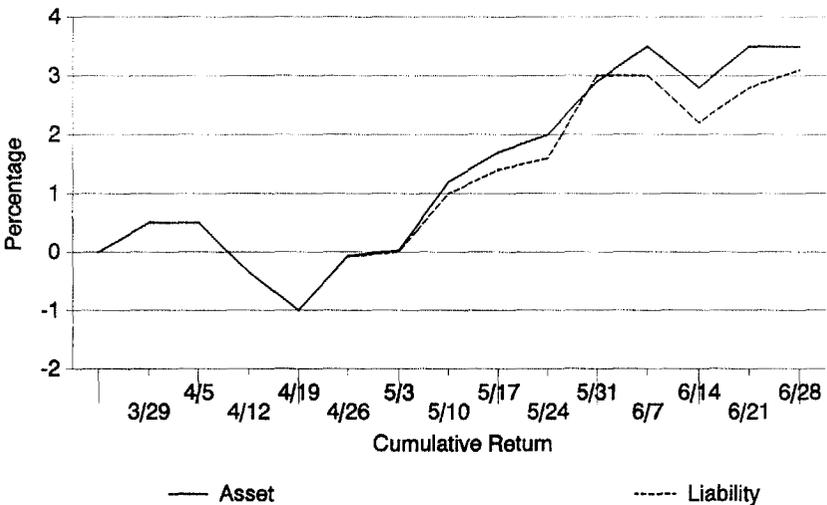
We now want to create a liability so that our required return is small. If in the equation there is a proportionate change in the fair price of liability, plus, all the expenses, and if every period our asset portfolio can outperform that number, that means over its life, the product is profitable. The converse is also true. If cumulatively, our return on assets is always underperforming the proportional change in the liability, plus all the expenses, then we're in trouble. So, therefore, we must follow the whole life cycle of the product on a continuous basis to monitor our performance.

The implication is that we can look at an SPDA product and we can develop an asset/liability management strategy. This SPDA product has a three-year fixed rate

and we adjust it every year. Now we have an asset portfolio. It has a very similar duration and we then follow it over time. We can see the return of that asset versus that of the liability over its life, and whether you can outperform it. What we did is look at the durations; are they closely matched? We also looked at the total return of the assets. Are we under- or overperforming the liability return, and can we actually find out if we underperform it? What attributes to it? Is it our pricing, or is it too much risk we're taking?

On Chart 7, the dashed line is the liability values; specifically, the cumulative return. The solid line is the asset values. So, in this case, during this period on a weekly basis, you can actually see that at the beginning, the asset is similar to the liability. But our asset gradually outperforms the liability. So this is good news.

CHART 7
Cumulative Return of Asset and Liability



But the one issue is that the outperformance may be just sheer luck. In fact, when we break down the return of each week, we find that one week, there's a big trading profit and therefore, the return is high. Now, is that good or bad? That is the performance measurement we are talking about. Maybe you don't want the investment managers to take so much risk. It just so happened that we were lucky this one week. We can always ask what happened if we're not lucky the next week. By being able to follow the performance on a regular basis we can now mix statistical inference.

Performance cannot be judged by a very short period, like one month, two months, and so on. It must be measured over a longer period, so we can see where the profits cumulatively come from. Are the asset managers taking too much risk? Are we always on the winning side or not on the winning side? Now we can break all this up.

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Table 1 is a pricing model of an SPDA. We can actually find out all the details about the SPDA. When I say "normal" that means using a normal lapse function. Sensitive means that I increase the lapse rate 150% more. Insensitive means 50% less and then we give them that kind of spread. We calculate the price and from the price we calculate a required option, just a spread. In this case, the option spread is 77 basis points. So that means our asset portfolio has to outperform the Treasury by 77 basis points to pay for this SPDA over time. Effective duration means the price sensitivity of the SPDA shows 2.59 years, in the middle of it, in the first block. What it means is that if our asset portfolio's effective duration is 2.59 years, then we're quite matched against the interest rate shifts.

TABLE 1
Analytical Pricing of SPDA Pricing

SPDA	Lapse Speed	Price per 100 Premium	Effective Duration (years)	Convexity	OAS Duration (Years)	Investor's Option Value (\$)	OAS (bp)	Index Spread Sensitivity
Rate Responsive Crediting Strategy SPDA (alpha = 0.7)								
Rate Sensitive	150	97.05	2.51	0.09	7.52	0.00	76.79	4.68
Normal	100	97.77	2.59	0.10	9.10	0.00	77.37	6.08
Rate Insensitive	50	98.62	2.65	0.11	11.05	0.00	77.39	7.95
Stable Crediting Strategy SPDA (alpha = 0.2)								
Rate Sensitive	150	96.06	4.13	0.28	7.18	0.19	64.86	2.81
Normal	100	96.58	4.56	0.32	9.11	0.23	64.32	4.08
Rate Insensitive	50	97.08	5.08	0.36	10.71	0.23	64.62	5.30

We look at the top table and use an alpha of 0.7. That means we allow our crediting rate to catch up with the market rate 70% every year. It's not immediately matched to the market rate; it gradually catches up with it. With this cost adjustment, we can see that the convexity and option costs are much less. If we gradually catch up to the market, then the convexity and the option cost will be higher. So, this is intuitive to most of us; if we always tack onto the market, it's much less risk. The whole point is, we don't want to tack onto it; but then what kind of risk are we taking?

By developing a model, we can quantify these risks exactly. But what I emphasize here is more than that. Just knowing these numbers is not enough. You know how to manage these risks: by breaking down risk into these components, by actually constructing an asset portfolio to do that, and finally monitoring over time what happens.

Thus we can consider our liability as an index and we compare our asset portfolio with this index. With the liability, we can find exactly how much we will beat a liability index by taking an interest rate risk, by trading, or by taking sector rotations. Then summarize these results cumulatively over the period and then pick up per week what actions we took.

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In summary, we need a performance measurement, a managing tool. Once we create this management tool, we have all the information together, not only for a prospective basis, that is, how to formulate strategy, but for the feedback effect. We'll want information on whatever happened previously, so that we can adjust our strategies and then develop new approaches. The implication of this performance measurement can be very broad. It allows us to manage assets and liabilities with the market-value concept so that the asset/portfolio strategies can be made consistent with how we manage our block of business.

MR. BUFF: Dick Furniss, a guest, is one of my colleagues at Towers Perrin in New York. Dick runs the compensation practice for Towers Perrin in North America, with respect to the insurance industry. He is an expert on executive compensation. He has done quite a lot of work for insurance companies, investment banks, and asset-management firms. He provides help on a critical element of this overall management paradigm which is how to pay people and what the best reward system is to influence human behavior. The pay plan provides incentives that ultimately lead to the good results needed to support the overall corporate goals. Dick has been with Towers Perrin since 1978. Before he became involved in executive compensation about five years ago, he was also heavily involved in other kinds of consulting, including acquisitions and strategies. He has an MBA from the Wharton School that was awarded to him in 1962. He received an undergraduate degree in engineering in 1960.

MR. RICHARD A. FURNISS: I'm going to talk briefly about compensation. Basically, compensation consultants help companies and help managers to accomplish some things for the good of the company. Compensation only helps do these things. Management has to do them. People will call us in and say their compensation plan is broken because their performance is lousy. Usually compensation being broken is a symptom. It's usually not the cause of anything. But a good pay plan can help you accomplish what you want to do and make the management job easier. It can help you hire talented staff. It can help you shift the mix of your staff to the new kinds of professionals you need. It can help you keep people from going to a competitor or changing careers. It can communicate the company's objectives. It's a very important communications device. Very often, it's not how much you pay people, it's what you pay them for that is the value to the company. People realize that if it's driving pay, it must be important to somebody in the company and therefore, these measures take on a new emphasis to the people who are getting paid to do this or that. But the people who work for them and with them can also be affected by an incentive plan.

It can change behavior. Really, the purpose of an incentive plan, if you look at it in the basic psychological context, is that it changes behavior.

The insurance industry is a strange one in the sense that the home office typically is the least indented industry, and the field is the most indented. The basic model for all incentive plans is the salesperson out in the field who gets nothing if nothing is sold and who gets twice as much if two things are sold.

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In the home office, incentives traditionally have been less important, but this is changing. An incentive plan should pay you for doing the right things, and it should not pay you for doing the wrong things. That's the basis of an incentive plan.

We remind all of our clients that creation of value is the basic purpose of a business. Whether this value is for the shareholder, the policyholder, the public, or anybody, value creation is supposed to drive an incentive plan.

Total compensation goes beyond pay. It's salary and bonus. It's what you see in your W-2, of course. It's the value of your stock options. But total compensation is not the entire job content. There is also everything that goes into the work day or the work week. It's the kind of company you work for. I could make a lot more money if I'd join another company, but I couldn't work with guys like Joe, and I wouldn't have actuaries as my partners. Those kinds of benefits aren't quantifiable, but they sure make life more fun. So, the noncash component of pay is a very important one: the lack of pressure, the presence of pressure, interaction.

The mix also is important. The mix is changing to a much greater emphasis on variable pay. *Variable pay should be based on measures under control.* An effective incentive plan means that if you do something, there has to be an impact on the pay. When we look at an incentive plan, we ask if they know what to do to change their pay. The answer, unfortunately, in many cases is no. Without that link between pay and behavior, you don't have an incentive plan. You have a pay-delivery mechanism, but you don't have a behavior changer.

The pay system should tell you what you have to do. The stock-option program is a very powerful pay-delivery mechanism for most of us who get stock options. It is not a behavior changer for most of us, because it doesn't say what has to be done to make the stock go up, and most of us don't have any control over it anyway. So, the stock option is very good for the president of the company. But, it is not a particularly powerful motivator below that level.

The objectives ought to be achievable, which is a difficult issue in many companies whose performance and structure is simply below par. Do you set an objective that is necessary, or do you set one that's achievable? It's a dilemma for many companies and, unfortunately, for many companies in the insurance industry that are not earning an economic return on their capital over time. If you set the requirement at that economic return, you wouldn't have an incentive plan, because the goal is not achievable in the near term.

Then it has to be clearly communicated. People have to know what they have to do to get paid and how it's going to work. Finally, it's got to be flexible. I think the first two speakers had a good flavor of the change that's necessary as your product, your liability mix is changing. The pay system has to also be able to change to accommodate unforeseen events.

I have several clients in real estate investment departments who manage real estate portfolios, and they can't remember the last loan they made. They've all become work-out experts. Unfortunately, more often than not, their pay system is paying

them for a new money yield, and there isn't any yield and there isn't any new money.

The role of the investment professional has changed a lot. Pay systems are especially sluggish in most companies, and they're typically sluggish in the insurance industry. The traditional investment manager position was not a high-pressure job. The investment department was not critical to success of the company. Insurance companies competed on the basis of their sales force and their product design, but not necessarily vigorously on the basis of the investment returns. There was a fairly narrow range of product requirements, and liability requirements, and there was a pervasive buy-and-hold strategy throughout the industry.

Presently, however, there's a lot going on. There's a very mixed set of signals coming down from the marketing people, regarding the risk and return. Marketing wants high quality and low risk, but on the other hand, they want high returns. So, what's the poor investment manager to do? Is he or she a buy-and-hold investor? Is he or she a total-return investor? What is to be done about mark-to-market requirements? The one thing that's clear is that the whole investment environment has changed and requires a much more active posture to match the returns with the requirements of the liability side. It's complex and it's changing. It is critical to company performance. Companies will have to compete on return. They can't simply compete in the old way.

Then comes the last factor that is really upsetting pay practices. Insurance companies have discovered the last of the great golden geese and that's managing other people's money. This is a no-risk business. It's a very high-pay business. It's a simple business. The profits equal the fees, minus the expenses, and that's all there is to it. It is not your own money there. You often don't even have to be any good. You just have to get money in house and keep it there. But many in-house investment managers are demanding to get paid as if they are managing outside money and that does affect the pay system.

The compensation surveys all conveniently include the people who manage outside money along with those who manage inside money. So, it's getting hard to separate the two. But pay is going up, and that's as it should be, as their importance goes up. Variable pay is increasing. We always try to insist that our clients adjust to the market increases via the variable component, rather than ratcheting up salaries, and most people are doing that. There is a new focus on investment results, measuring performance at the investment department level, rather than at the company level.

The goal of the compensation planners is to pay for value created. You can't, unfortunately, use the model of the independent manager for people running the company's assets. The economics of running other people's money is quite different from running your own money. It's a fee business. You have no assets. You have no capital. Your profits are your revenue minus your expenses, and revenue is based directly on your ability to attract and retain client assets.

Insurance investing is different from other kinds of investing. You have a much more complex set of cash-flow and return requirements. You have a very bizarre set of accounting systems. The more I learn about insurance accounting, the less I know

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about it. But, I'm fairly sure they didn't teach me anything at Wharton that has anything to do with the way you run your business. I know that all of you know that neither one of your basic systems is right. I guess that's why the insurance industry is reluctant to pay big incentives based on accounting systems that have major flaws. But in any event, the poor investment people have to live with these systems not only as they are, but as they keep changing.

The investment people have to work with other departments, certainly the marketing and the product design people who are not directly within their control, but who are dumping in money and pulling out money and setting product standards that they have to live with.

Then you're subject to demands that aren't economic. If your rating is in danger, that can have a major impact on the posture of the investment department. It'll come down from upstairs that there will be no more double Bs in the portfolio, and that's all there is to it. This may or may not be an economic decision, but it certainly affects the life of the investor.

We use a set of guidelines; when we examine an incentive plan to see how it can be changed to make it more effective. We don't usually get to design the performance measures. That's not our job. It's the job of the client or of our colleagues from Tillinghast or other firms who can help design the performance measures. What we try to do is make the compensation system track these measures, so that it has some impact on behavior.

Everybody always wants teamwork. Presidents of companies love the word *teamwork*. They say that if we're all in this together, then we'll all make the company do well. One thing I've noticed about teamwork is that it usually only works on the downside. We often will see incentive plans that will suddenly stop when the company has a bad year, and the president says that's as it should be. I ask when the last time was everybody's pay was raised because the company had a good year, and it's usually never. Teamwork is great when it's feasible. Teamwork is not caused by a pay plan, however. Putting everybody in an option plan doesn't cause teamwork usually, unless it's a very small company. But what teamwork can do is support an organization that's oriented to teamwork, one where departments talk to each other, where their bosses talk to each other. I bet there's more than one of you who work where the insurance department and the investment department leaders are rivals for the top job and may not necessarily cooperate all that well. But, do you have the lines of communication set up, and do you have actual formal programs to work together? You can build in some compensation devices to support it. You have shared responsibility for product profitability. If you do, then the teamwork orientation can be built into your pay plan.

Many investment departments have total department incentive plans, but there's no linkage for anybody in the department to talk to each other if they're different portfolio managers. Does the real estate person have anything at all to do with the listed equity department? Maybe or maybe not, but usually not. So, why put them in the same pool?

Fewer measures are better. I can always spot a plan designed by an actuary. It has no fewer than 10 measures and they're all extremely precise. The easiest way to simplify a plan is to take the number of measures and cut them in half. Fewer is better and that's almost always true. You never need more than three or four measures.

Incentives in investment departments and insurance companies are typically 20%, 30%, or 40% of salary. If you take the typical 8 or 10 measures and divide that into the 20% or 30% of salary, you realize very quickly that you're talking about performance measures that have an impact on 2% or 3% of salary. They get lost. People don't pay any attention to them. It's too much trouble to figure out what to do. So they ignore them all. That's what happens. The plans appear complex and a complex plan will definitely be ignored. So combine most measures into one: total return.

Use the appropriate external index. That is what the first two speakers have been talking about; typically, the S&P's and the Shearson Lehman are not appropriate.

If you can find other companies that have fairly similar investment requirements, that's a really good way to do it. That is something that we're trying to get started.

Value creation is what pay is all about. Keep that in mind. If the company's value isn't being enhanced by the activities of the investment department, then the money is wasted.

Insurance objectives ought to be included. This is probably the biggest change. The investment department people are getting together with the insurance people and product actuaries are having a real influence on the design of pay plans and the actual pay of people. The investment departments are becoming responsive to the insurance needs, because it's driving their pay, not only in setting the performance measures, but in writing report cards, that sort of thing.

Unforeseen events will occur, of that I'm sure. You can bet on that. There will be unforeseen events related to the company, to the investment market, to anything. The plan has to be able to deal with that, or you will have a plan that's likely to break in February and then there will be no incentives the rest of the year.

The investment measures must be controllable. The overall profits of the company are not viewed as controllable by most of us. They're certainly not in my company. If I were an investment manager, I would want to get paid for what I can control. That's my portfolio and the relationship I have with the product design people.

Individual performance is the best way to drive incentive pay, but that tends to break down teamwork. So, what do you do? Well, you could measure the company, but that has no effect on behavior. So, it's somewhere in the middle.

Judgment is almost always a requirement in investment incentives. If you tie somebody to the numbers, you won't be able to incorporate risk as you should, or teamwork, or cooperation, or unforeseen events. So, we always like to build judgment into the plans.

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Be careful that you avoid unintended behavior. For example, a plan that gives you a higher incentive -- the higher the return -- may cause you to take too much risk.

Another important point is that all you have to do is pay directionally correctly. You don't need to set up a system that you can use to price products or report to your accountants to determine pay. If the pay system is not the management system, then there's something wrong. In more than one case, I've seen pay systems that are more complicated than the system that's used to run the business. It isn't necessary. If the department is doing well, management knows it, and you can pay for it. If it isn't doing well, you don't pay for it. But you don't need to be as precise as many people think you do to derive pay systems. Pay directionally correct for good performance, but don't worry about being precise.

Looking forward, what will happen to investment department pay and everybody else's pay? There will be more long-term plans for mutuals and better plans for stock companies. There will be more variable pay for everybody, greater opportunities for everybody, much more differentiation among people at the same level, and much more pay tied to your performance.

MR. ROBERT R. REITANO: In Garth Bernard's paradigm, I agree with the idea of splitting responsibilities with the investment department people and giving them a more general bogey for beating performance. In your model, you assume five-year maturities, but you give them the objective of beating five-year investments. If they decide to buy threes, fives, and sevens, that isn't an issue, but they might decide to take a yield-curve position. For example, invest in 20-year bonds, thinking that with today's yield-curve shape that's a good bet. But that fundamentally changed the risk profile in the underlying analysis. So, do you have any formal mechanism whereby you change the requisite return to the extent they take a risk profile fundamentally different than what you have in your model?

MR. BERNARD: In response, first, I talked about the communication at the integrated level. It's absolutely necessary that the investment department be fully cognizant and in tune with your models, your measures, your results, and how things work. Therefore they're closely involved in the process. They should know that if I'm going to take a yield-curve bet like this, I could be impacting the risk profile very significantly.

Second, to the extent that they do make that bet, you do have this performance standard and you're going to penalize them if it doesn't work. But again, they're the ones who are making the judgments. Whether or not it works, you still have to, on a go-forward basis, take into account what's actually happening with the assets, reevaluate the benchmark or performance standard that had been constructed at issue, and revise it appropriately and make sure that you can get back on track.

MR. THOMAS G. KABELE: Is there any minimum interest rate for crediting the SPDA, say like minus 2% or zero? Someone said that maybe the regulations on annuities seem to apply a 3% rate.

MR. BERNARD: I believe the interpretation that the state departments have with respect to the standard nonforfeiture law is that you can't credit less than 3%. In

respect to revising the nonforfeiture laws, rates have come down dramatically over the last couple months. The 3% is starting to get a little bit close. Now, that's not to say that everyone has 3% keys in their contract. Some companies use much higher guarantees like 5.5%, during the surrender-charge period. I think at this point we've almost reached that level. The nonforfeiture working group may consider a more flexible minimum or something that changes as interest rates do.

MR. EDWARD L. ASTRACHAN: Here's a question for both Tom and Garth. Tom, I assume that in the pricing mechanism you use for your option-adjusted liability pricing, usually you would use an arbitrage-free set of interest rate paths; whereas, Garth, I would assume when you define your 200 scenarios, you would have a set of interest paths that would reflect expectations that might not be arbitrage free. To what extent can that create distortions and how careful do you have to be as a matter of practice?

MR. HO: The major purpose of the arbitrage-free pricing model is to decide how all the options should be priced under a consistent framework. Therefore, you should not build in your expectations to price the bond. Some of the option pricing seems nonintuitive, but in fact, that is the correct way of relatively pricing the bonds.

MR. BERNARD: Although my examples were very simple, I believe the process is more complex. For example, in terms of what rates to use to discount when coming up with the present value of profit measures that I showed in my case study there, we use arbitrage-free scenarios, as Thomas was pointing out, to come up with the appropriate discounting rates. But, then in terms of the risk-return trade-offs among the different investment alternatives, use interest rate scenarios that are not arbitrage free or are adjusted for arbitrage. Then, to the extent that it includes some biases or expectations as to where you think interest rates are going, in terms of the process, you must have some way, of having that continuous review. In other words, pricing must become almost continuous. You have to look at not only the situation at issue, but to the extent that you're accumulating a portfolio of liabilities, you have to do the in-force pricing going forward as well. That's the only way to make it consistent and manageable.

MR. BUFF: I'd just like to throw in a couple of comments on that. There are really two underlying financial modeling issues. One of them is simulation or projection, and the other is valuation or pricing. There are really both these two elements in the things that the panelists have talked about.

Simulation is used in making a strategy decision. However you exactly do it, you make a decision of a strategy, and that's the strategy you want to follow. Then you need to do performance analysis and performance attribution. How well have you done relative to the choice of that strategy? Was that a good strategy or not? In choosing a strategy, you're probably most concerned about the real-world effect on financial results over time, like the financial reporting systems that you work under. That being the case, many people in the industry believe -- Tom Ho and I in previous discussions have also felt this way -- that in using scenarios to pick strategies, you probably should use those that you believe are most like the real world. There are some models that are not arbitrage free, but still have a lot of credibility and support in the profession.

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On the other hand, when you're doing an analysis of valuation where you're trying to determine the exact price for something at an instant in time, then this is definitely a different process than simulation. You need to determine theoretically correct prices, and here *arbitrage-free processes* come into play.

