2004 Valuation Actuary Symposium*

Boston, MA
September 20–21, 2004

Session 15PD
Embedded Value, Fair Value and the Move to Principles-Based Measurement Systems

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Panelists: Duncan Briggs
Steeve Jean
Maria Torres-Jorda

Summary: The International Accounting Standards Board is well on its way to adoption of fair-value standards for reporting insurance company liabilities. In the United States and elsewhere, accounting standards boards appear committed to moving away from rules-based to principles-based accounting systems. Insurance companies struggle with determining which basis of measurement provides the most meaningful information. Panelists in this session discuss current embedded-value and fair-value practices;similarities and differences between embedded value and fair value; andbenefits and drawbacks of embedded value, fair value and other measurement systems for internal management purposes.

MR. DUNCAN BRIGGS: This session is on embedded-value (EV) and fair-value reporting. I am the moderator and also the third of the three panelists. The focus of my presentation is going to be on discount rates. I am a consultant with Tillinghast, and over the last several years, I have advised quite a few companies on various aspects of value-based reporting, both in the United Kingdom and for the last eight years or so in the United States.

I am joined on the panel by Maria Torres-Jorda and Steeve Jean. Maria is a consultant with Ernst & Young. She has experience both as a chief actuary and as a consultant in a wide range of subject areas, including economic value frameworks and fair-value reporting. Maria is also a member of the SOA Task Force on

Note: The chart(s) referred to in the text can be found at the end of the manuscript.

International Financial Reporting Standards. She will focus her presentation on a comparison between the EV and fair-value methods. Steeve is an assistant vice president of Old Mutual U.S. In addition to his valuation EV and financial reporting responsibilities, Steeve is involved in various projects such as economic capital and international accounting standards and, Old Mutual being a multinational company, actually reports on an EV basis. Steeve has the enviable task of being responsible for the U.S. calculations on EV. Maria will begin the presentation.

MS. MARIE TORRES JORDA: Lately there has been a lot of activity around fair-value reporting. We developed the International and Financial Reporting Standards (IFRS). First I will cover what the Insurance Standards Board (ISB) has proposed for fair-value reporting, then I will compare IFRS to EV, and finally I will show the property mergers in both frameworks with a case study.

The ISB originally envisioned a fair value for insurance liabilities. However, owing to the lack of time and a position in the insurance industry, the standard is not going to be ready for 2005. Therefore, the ISB has decided to follow a two-phase implementation for insurance. Phase 1 will have premiums implemented by 2005, and insurance contracts will have to be accounted on the IFSR 4, which is basically using existing account involved. Investment contracts will be accounted under Insurance Accounting Standard 39. For phase 2, the summary is not yet defined, and as I said before, the original intent was to have a fair-value framework. What I will cover is all related to phase 2, and it is based on the tentative conclusions that the ISB included in IFSR 4.

The scope of phase 2 covers all insurance contracts, including life and property/casualty. However, the ISB has said that the inclusion of future investments or capitalization of future investment spreads in the liability valuation is not allowed. Therefore, you cannot use EV as a basis for fair-value reporting. The intention is to have an insurance standard that is consistent with the financial standard, which is Insurance Accounting Standard (IAS) 39.

Since there is no active market for the insurance liabilities, I am sure that if I asked all the actuaries in this room how to perform a fair valuation, I would get as many responses as actuaries in this session. Next, we are going to cover what the ISB has proposed for fair value. This has been described in the draft statement of principle that was published in 2001, and also in the conclusions included in IFRS 4.

Let us go through the basics. The fair-value reserve is basically the expected present value of future liability cash flows. Liability cash flows should be discounted using the risk-based discount rate. However, we need to include adjustments for risk and uncertainty. Both documents can be included either in the cash flow or in the discount rate.

Actuaries usually refer to these reasons for risk of an uncertainty as market value

margins. The key challenge here is to calibrate these market value margins as kind of a market measure. You also have to take into account the insurer's own credit standing, which is usually taken into account by adjusting the discount rate. Then, economic assumptions about these interest rates and equity scenarios should be consistent with the market. For interest rates, you should use the rates as of the day of valuation.
For economic assumptions such as mortality, lapses or expenses, there is usually no market data available. In those situations, it is appropriate to use entity-specific data.

Finally, all options and guarantees should be valued using the option pricing techniques, but you do not necessarily have to separate them and identify them separately. Other fair-value issues are related to future premiums, and future premiums should only be included when uncontrollable renewable rights constrain the insurer's ability to reprice, and the rights lapse if the policyholder ceases to pay premiums.

This is an area that was very controversial. We have been struggling to come up with a definition of the renewal premiums, because we wanted to have a definition that applies to life insurance, to property/casualty, and also to other items such as credit card receivables. These are the latest definitions, but they have changed along the way. Actuaries are hoping that in the end, definitions will feed better into best-estimates assumptions such as what we do for EV.

Finally, the ISB said that no gain at issue is allowed. You have a gain at issue, and you have to adjust your provisions for reasons of uncertainty, so as to break even at issue. However, losses on the other side should be recognized. This is quite surprising, because most of the people would say that, if you are doing something like this, you can really argue that you are not doing a fair valuation.

As I said before, these are the tentative conclusions that were included in IFRS 4. They are also in a phase 2 draft statement of principle that was issued some time ago, but the ISB is restarting the phase 2 discussions by late 2004. Really, the final direction and the framework are at this point quite uncertain.

Next I will cover a comparison between EV and fair value, but before I get into that comparison, we have to think of EV a bit differently than the way you are accustomed. If we do not do this, then full comparison is very difficult to do. We can think of the EV as the difference between the invested assets that are equal to the target surplus, plus the statutory reserves, less the EV of the liabilities. The EV of the liabilities consists of the present value of their best-estimate projections of liability cash flows, discounted at the asset rate earned on the asset stock and the liabilities, less a provision for risk and uncertainty, which is defined like this: The hurdle rate less the asset rate times the EV.

Here is a very simple example to give you an idea of why this method that I just

described and that we tend to call the EV indirect approach is your traditional EV calculations, which is just the present value of distributable earnings.

This example is very simple.. The premiums are $1 million. The company is earning 6 percent on the assets, and surplus and the assets backing the reserves.The reserves are equal to the account value. Target surplus is 3 percent of reserves and then the discount rate for EV purposes is 8 percent. We can see that the value of the EV, which is just the present value of the distributable earnings at end of year 1, if calculated at 8 percent, is $38,704.

How does the EV indirect approach work? As I said before, the EV indirect approach is equal to the invested assets, which in this example are just the reserves plus the target surplus, less the EV liability. To compute the EV liability, we said that we have to compute the present value of the future liability cash flow, plus the provision for risk and uncertainty. Our liability cash flows are the premium, with interest credited, which is 5 percent. Our provision for risk and uncertainty is the difference between the hurdle rate, less the asset rate, times the EV. Then if we do standard liability cash flow plus the provision for risk and uncertainty with the asset rate, which is 6 percent, we get an EV liability of $991,296. If we then do the invested assets, less the EV liability, we get EV, which is exactly the same number that we were getting before with the traditional EV calculation.

After these reformulations of the EV calculation, we can do a matched, more meaningful comparison between IFRS and EV. On the asset side, IFRS has a mix of market value and amortized cost. Whether you use market value or amortized cost depends on your asset classification. To give you an idea, the asset classification of the asset categories under IFRS are very similar to what you have in Financial Accounting Standard 115.

For EV, assets are valued at market value or book value, and the practice varies by country. On the liability side, for noneconomic cash-flow assumptions, we use best estimates in both frameworks. For future renewals, we said before that IFRS said you can include future renewals, but only when there are uncontrollable rates, renewal rates, and it is really subject to the company's ability to reprice.

Under EV, we include renewal on our best-estimated basis. For the liability discount rate, we said for IFRS we use the risk-free rate, but we have to adjust it using the company's credit risk or claims-paying ability. Under EV, we use the rate earned on the assets. Because these companies tend to leverage their grade standing by investing in riskier assets, the discount rate and your EV will tend to be higher.

Let us address the provision for risk and uncertainty. Under IFRS, we have to use what we tend to call market value margins. There is no clear guidance on how to compute these margins, but they are not going to be similar to the EV provisions for risk and uncertainty. The ISB has stated that you cannot take into consideration the asset returns at all when you are valuing your liabilities, and on the other hand,

these market value margins should not consider regulatory requirements.

With options and guarantees, on a fair-value basis, when you are doing a fair valuation, you have to use option pricing techniques. For EV, some companies value the options and guarantees embedding their products. Some of the companies do a very simplified approach using a number of scenarios, and some companies ignore it completely. We will see afterward that in Europe, there is a lot of activity around this issue. Most of the companies are trying to capture the optionality in their product, in their EV-reported results.

With profit and loss at issue, we saw before that under IFRS, if there is a gain at issue, the ISB tells you that you have to set market value margins to break even, although you still recognize losses. Under EV, there is no break-even requirement.

I want to briefly give you another view of some of the activities of the CFO Forum in Europe related to EV. The chief financial officers of the leading insurers in Europe recognized the need for international guidance on public EV reporting. They want to improve the transparency and consistency of the EV results around Europe, so they put together some principles. These principles encourage companies to set the discount rate at the product level.

They also specified that the assumptions should be defined so that shifting investments between asset classes does not have a direct impact on EV. The definition of cost of solvency capital has also been widened. You have to consider for your EV calculation all of the assets in excess of your liabilities whose distributions to shareholders is restricted. For example, the company manages its business using capital calculations based on an economic measure, then you have to incorporate the cost of the capital based on that measure in your EV result.

The time value for financial options and guarantees should also be considered, and companies are currently being very proactive on this issue. An allowance must be made for holding-company operating expenses, and service companies should be reported on a "look through" basis. There are also a lot of new requirements for disclosures, and companies should highlight any area of noncompliance with the CFO Forum embedded value principles. The company members of this firm had agreed to disclose supplementary EV results consistent with these principles year-end 2005.

I hope that this case study will help clarify what we have discussed so far. It will cover a single-premium deferred annuity. We have the basic assumptions. We have a single premium of $1 million. The company is rated AA. The account value is equal to the single premium plus credited interest, which is discretionary, subject to a minimum guaranteed rate of 3 percent. The surrender charges vary by year, starting at 7 percent in the first year and going to 0 percent in year seven. The lapse rate in year six bounces up to 20 percent, when the surrender charge expires, whereas we have interest-sensitive lapses when the product is not competitive.

In the base example, we will see the future interest rate follow the forward rates, and that the company investment strategy is a mix of one-, five- and seven-year, A-rated corporate bonds, and it passes the book yield on those assets to the policyholder, less the spread of 132 basis points.

Chart 1shows a comparison of the profit margins and of fair value and EV. The first bar is the fair-value results. The second bar is the EV results. We can see that at issue, as suspected, the profit and their EV are much higher. The reasons for this are, first, the company is leveraging its credit standing by investing in single-A assets, and second, an EV framework allows you to capitalize at inception the excess of the interest rate earned on the assets, over the interest credit to the policyholders. Those are the reasons why EV results are higher than the fair-value results at issue.

In Chart 2, we see what happens when you have an interest rate shock. We will assume that interest rates go up by 300 basis points at the end of year three. The first bar illustrates the fair-value results. We can see that in year four, we had a significant loss. The reason for this loss is that on the asset side, since interest rates go up, the market value of our assets will go down. On the liability side, the same thing would happen.Therefore, the company will start experiencing higher interest-sensitive lapses. The liabilities will go down, but not as much as the assets do, which is the main cause of this significant loss when interest rates go up by 300 basis points.

Other than fair value, we can see in the second bar that these are a bit depressed, but not as much as the fair-value sample, and in the third bar, the company is merely increasing the hurdle rate by 300 basis points. We can see that even in that situation, losses are much worse in the fair-value sample.

To summarize what we have discussed today, we have seen that the fair-value framework is disconnected for pricing or EV techniques. We saw in the case study that the EV for new business will tend to be higher, especially for investment-oriented products. We have also seen that large swings in interest rates and equity markets will cause substantial net income volatility, which tends to be much more significant in the fair-value framework.

One key consideration for a fair-value framework is the disclosures and external relations. Companies will really have to do a good job in explaining volatility. When interest rates change, you can have a situation where your financials change from the date of valuations to the date of filings to the date of the shareholders' meeting. Therefore it will be key to include these detailed disclosures, summarizing the key assumptions, and how the company set up the provisions for risk and uncertainty.

I will now pass it over to Steeve, who will discuss the practical aspects of EV reporting.

MR. STEEVE JEAN: Thank you, Maria. Let me start with a show of hands of people

who work for a company that does EV. That is pretty good. What about companies who publish EV or do EV only once a year? What about more than once a year? There are a couple. What about companies who produce EV within 30 days? I see one person. Thirty to 60 days? Sixty to 90 days? What about more than 90 days? When I was first asked to speak about practical aspects of EV, I went the route of addressing practical aspects of producing and reporting EV, and that was covered in a previous presentation. You have probably heard or seen most of those issues already.

At present, we are all faced with the evolution of EV. Another challenge we are facing is how to integrate EV with new requirements in projects such as international accounting standards, economic capital and risk-based capital (RBC).

We will cover the overall process of generating EV results, which will include asset modeling, liability modeling, bringing everything together, and producing and explaining results in variances. We will also go over different users of EV and the upcoming changes to EV and how they are affected by IAS and economic capital projects.

The overall process consists of modeling your existing assets and liabilities using different assumptions. Usually the different assumptions mean they could be different from your cash-flow testing, your RBC or your business plan assumptions. One of the critical or key assumptions you need to set is the discount rate. You will need to validate results and explain movement in variances from prior periods, and usually that is a pretty significant effort. Finally, you will need to measure the value of new business.

The modeling of existing assets, depending on whether you use independent asset models or you use the actuarial models to model the existing assets, can come out of either nonactuarial models or actuarial models. For example, when we use models with most of the assets, and we bring those projections in to test, that means we have to run multiple scenarios, and it adds to the level of manual effort that is required.

You will need to set your economic scenarios, and that will include reinvestment spreads, asset default rates, etc., and determine your reinvestment and disinvestment strategies. You will notice that the modeling of cash and the asset mix that you choose may have significant effects on your EV results.

On the liability side, there are all the usual issues of building and running liability models, and you hope that you can leverage off the cash-flow testing in RBC models. These issues—and I am sure you are familiar with all of them—include data quality, static and dynamic validation, maintenance of the models, including new products, repricing and system upgrades. If you run most of those scenarios, obviously your run time is always an issue, or at least a consideration.

You need to measure in value. Validate the value of new business. Our pricing department calculates and reports values in business every month. When we create our year-end EV models, we have to validate our EV models for new business, the pricing models. That is another fun thing to do.

Finding appropriate liability aggregation is always important. You will usually want to analyze variances at a fairly detailed level, such as at a product level, but the results may not always make sense. The assets need to be modeled against all the corresponding liabilities to avoid generating undesired reinvestment and disinvestment activity. At Old Mutual, we do not segment asset filing of business. We have one pool of assets that runs against all lines and all liabilities. This can generate some pretty interesting results when you try to analyze your results at the line-of-business level, which should be a fairly common way of looking at your EV results.

Nonmodel items include miscellaneous reserves, nonmodel reserves, protecting the surplus rate treaties and making adjustments for items such as letters of credit that back some of our liability.

Test of solvency capital is projected at a legal entity level, and we usually do not reallocate it back down to avoid having to allocate the covariance adjustment down to the line-of-business or product level. Depending on your current and future tax status, the modeling of taxes may be more or less complex. Complexity will be added if you have non-U.S. operations. For example, Old Mutual U.S. has operations in Bermuda and Ireland, and all of these different tax models have to be brought in together when generating EV results.

Different aggregations of results are often required for publication versus internal management. Line of business and legal entity are the most common. However, others such as distribution channel may require allocation of investment income, cost of capital and taxes.

Communicating and explaining results of senior management can be a challenge. You need to reconcile a movement of value for your in-force between actual and expected, and this difference between actual and expected is usually made of currency variances, a change in future assumptions and a change in the discount rates. The current period variances can be investment related, related to your liabilities, lapses, mortality expenses or changes to RBC and taxes. Senior management would also be interested in looking at sensitivity analysis around the key assumptions.

What does it mean? After you produce all these very nice numbers, how does it compare and reconcile to GAAP earnings or GAAP equity? You start with a lot of numbers floating around, the ROE and the ROI, and now somebody came up with return on EV, which we defined as the change in EV, the net of capital infusion. The return on EV is basically a measure of growth as opposed to profitability.

What do you use EV for? The analysts usually focus on results and sensitivities. Our asset managers are compensated on their contributions to EV. We measure their contributions by results in excess of a benchmark, and the benchmark already includes a provision for mismatch, the benefit from mismatch between the assets and the liabilities.

Senior management incentive compensation is based on EV results. It is an adjusted EV number that eliminates the effect of good will and the change in the discount rate. Now there are new EV flavors just to add to the excitement. Recent allotments to the EV world are trying to allow for better measurement of grids within an EV framework.

Under the market-consistent EV, option and guarantees are valued using option-pricing techniques, including stochastic simulations. Other cash flows are valued using the discount rate that reflects the risk associated with each cash flow, so we are looking at multiple discount rates. We already have trouble agreeing on one, so imagine multiple rates.

On the reporting front, market-consistent EV wants to separate entrance and investment results and to measure and report them separately. The interest profits are measured against the portfolio of assets that matches the liability, so you have assets and liabilities being matched, and then you measure your entrance profits from that. This works similarly for value in business. Your investment results are measured against the matching portfolio, so any return in excess of the matching portfolio represents your investment profit.

Again, this may require additional modeling.

I did not show stochastic EV and EV at risk. Use a CT approach in measuring risk, so they're going to look in detail under multiple scenarios. The new European EV principles are currently deadlocked with a target implementation for the end of 2005. These principles are still trying to address the evaluation of options and guarantees and the setting of discount rates.

One of the principles requires that options and guarantees devalue using stochastic techniques. The discount rate would be set equal to a risk-free rate risk margin, and the risk margin may vary between products and entities within the group. Again, we are looking at multiple discount rates.

A very interesting alternative that is being explored would be to send the required capital equal to the economic capital as opposed to the statutory capital. This captures economic capital, world cash capture and most of the risk, including the value of options and guarantees. Using economic capital, you could then use a weighted average cost of capital as a discount rate. That is one idea that was thrown out there, and I think there is a company in Europe that actually uses that

approach.

In addition to all of these very nice new flavors, we have competitors. We are currently working on an economic capital project that requires valuing options and guarantees on a market-consistent basis. We recently got to the IAS, and because entrance contracts are currently reported under the local GAAP basis, on page 1 of IAS, some of the options and guarantees are currently measured under Standard of Practice 03-1. This is not to mention RBC, which uses the CT approach on phase 1 and the upcoming phase 2.

As you can see, all of these different frameworks, the original, the deterministic EV, going to market consistent and now European EV, EV at risk, stochastic EV, fair value, and the upcoming phase 2 of IAS all generate these multiple measures of basically the same risk and the same options and guarantees. Once all these numbers become available, I guarantee you will have a fun time explaining what they mean and helping senior management make the appropriate decisions based on those.

There will be significant challenges in coordinating all these projects. We are also trying to limit or leverage off these projects as much as we can. Otherwise, you will duplicate work. There are different groups of people working on the EV, economic capital and IAS, and there is no coordination between these groups. You will end up making multiple efforts to generate the required values.

Challenges will be around consistency under these different frameworks. Management of resources, obviously, is always very tight, or is in my case anyway, and understanding and communicating those various messages that come out of those different frameworks will be important. Duncan, I will pass it on to you.

MR. BRIGGS: One topic gets discussed more or gets questioned more in value-based reporting—the choice or selection of the discount rates used in the calculations. Even changing the discount rate by the rule of 50 basis points can have a very significant impact on the results, particularly if we are looking at the value of new business. If you look at what is done in practice by companies that publish embedded values, there really does not seem to be a lot of time behind the selection of the discount rate. In fact, if you look at published EV discount rates, there tends to be quite a narrow range of rates that are used by companies. Even if you consider the risk profiles of different companies, there really are significant differences. In theory, these should lead to quite wide differences in the discount rate for the use.

There really is not a link between changes a company might make to its structure or its operations and the impact that should have on the discount rate. For example, if you think about a company for annuity business that is investing in single-A assets, if it makes the decision to change to triple B, has it really created any value for shareholders? I would argue that at the point in time that it makes

that decision, it has not created any value.

There is value added as those changes take effect, but at the point that the decision is made, no change to value has occurred. However, on the traditional EV, unless you make an offset change to the discount rate, the EV is going to go up at the point that that decision is made.

I will cover a couple of things in my presentation. First is the theory and practice behind traditional EV discount rate. What does the theory tell us, as far as how we should set the discount rate and what a company actually does in practice? That traditional EV has come under a fair bit of criticism in the last few years, particularly in Europe. Some of you are probably familiar with many of the big European companies that have had significant asset liability mismatches going back in history. They have invested heavily in common stock assets, even though the underlying liabilities are fixed in nature. What happened when the markets went down in 2000 and 2001 is that these companies made significant losses, and this risk that the companies were taking was not something that was picked up by traditional EV.. In the second part of my presentation, I will cover some of the market-consistent techniques that are now being used to address the criticisms of EV. I think ultimately these techniques may form the basis of the fair-value reporting.

The theory begins with a basic principle that investors require higher expected returns in return for accepting nondiversifiable risk. We can illustrate this using a simple example. In the top part ofChart 3, an investor is investing in a risk-free bond, and so it expects over one year to earn 5 percent. If you discount the expected proceeds of 105 at the risk-free rate, you get back to the current market price of 100. If another investor decides to take on some risk and invests in a bond that has a default probability of 1 percent, but the bond does not default, then the investor is going to receive a return of 1.07 in a year's time. We can easily work out the expected return to the investor to be 105.93. To get back to the current market price for 100, we need to discount expected proceeds back to 5.93 percent to get back to 100. We are saying that for investing in this more risky asset class, the investors require an additional expected return of 93 basis points. The principle here is that the more volatility we have in cash flow, than the higher the risk premium that will be commanded by investors.

We can see this in practice if we look at historic returns from various different aspect classes. We can see a clear correlation between average return and volatility. On the left side of Chart 4, we have some more stable asset classes such as cash, which offer the lowest average return, but at the same time have the lowest volatility. On the right side, we have the more risky stock asset classes, which have the higher established return, but also have the highest volatility.

The theory behind EV discount rates first sees the EV as the present value of expected future distributable profits that will emerge to the shareholders of the

business, and they relate just to the in-force business at the time of the valuation. The discounting is done at the company's weighted-average cost of capital, which is a weighted average of the cost of debt and is not the tax cost of debt, and then the cost of equity.

Let us look at the financials of this simple company. I have looked at how the return to the equity investors performed under various market scenarios, and not surprisingly, because of the way I structured the example, the return to the equity investors is identical to the return on the overall market. If things go as expected, and the equity market returns 10 percent, then the investors in this company are also going to receive 10 percent. The conclusion is that the company-specific cost of equity in this case is 10 percent. If we discount the expected cash flow of 11, at this rate of 10 percent, you get back a 10, which is just the initial capital that the investors are putting in.

Now we will make the example a bit more complicated and introduce some leverage. I am changing the capital structure here to 75 percent equity and 25 percent debt. Debt interest rate is 5 percent, and we actually have two different approaches that can be used to calculate EV in a leveraged situation. The first approach is to take the present value of the expected pre-debt cash flow, and then subtract the market value of the debt. The second approach just takes the present value of the expected post-debt cash flow. Intuitively, at time zero, the EV of this operation must be called the initial equity capital that the investors are putting in, so the question then is, what discount rate do we need to use under each of these at the base about this. You can look at the reinsurance market, you can look at the market for M&A, and you can point to cases where companies clearly are demanding a risk premium for mortality risk and other risks. There is still a lot of research and debate going on at this point, but the pure financial economic theory would consider that is the most risk-free.

FROM THE FLOOR: Duncan, under your market-consistent EV approach, if you were valuing an insurance process, significant market-related risk such as a variable annuity, you mentioned that it is appropriate to use a stochastic technique and that those scenarios would be risk neutral. Can you elaborate on the appropriate risk discount rate, and should it be using risk premium or not?

MR. BRIGGS: First off, if we ignore the options and guarantees and just look at the straight variable annuity, I think what you would do is almost pull it apart into two streams of cash flow. Then you would have your top-line revenue, which is just your fund management charges, multiplied by your account value progression. With that stream of cash flows, you would project them at an equity market return rate, discount them at an equity market return rate, and then your other cash flows are some fixed costs. The company is clearly going to have some fixed expenses that will not vary with the funds. You would discount those at the risk-free rate, because those are more certain in characteristics. I think you get leverage there if you were just to use a single discount rate.

On the second part of your question, we have significant optionality. The theory says you need to do maybe a thousand stochastic scenarios. Those are risk-neutral scenarios, which means that they are correlated to market prices for options and guarantees. Under each of those scenarios, you effectively discount along a path of risk-free interest rates. Each of those thousand scenarios has a unique path of risk-free rates, and that is effectively what you use for the discounting. Are there other questions? Thank you.

Chart 1

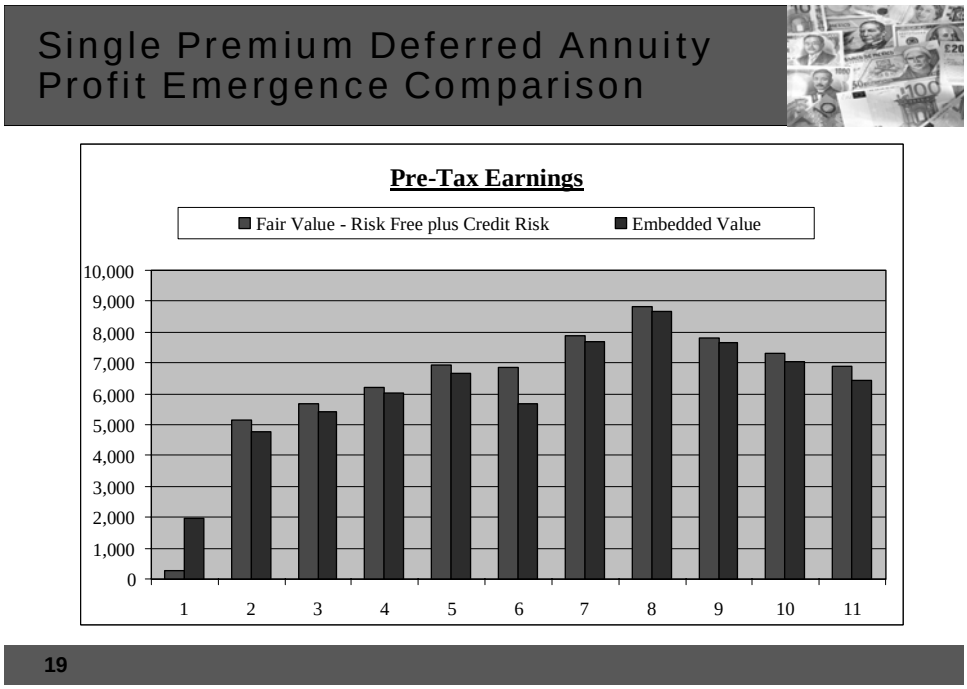

Chart 2

Single Premium Deferred Annuity Interest Rate Shock

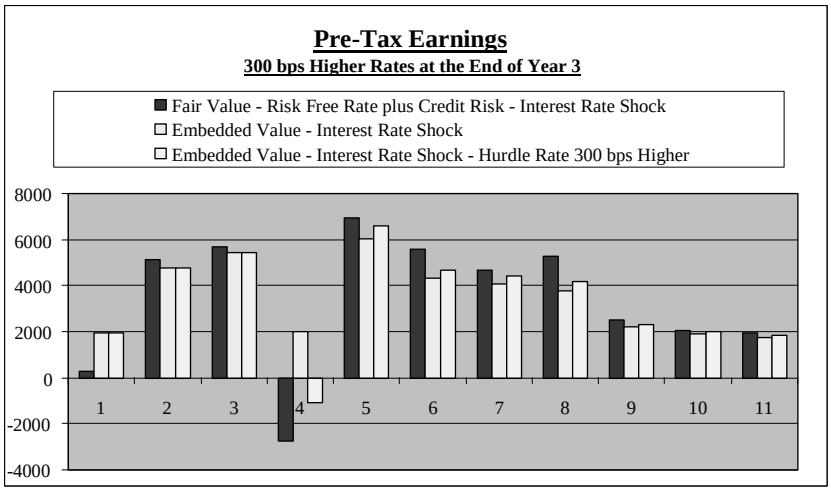

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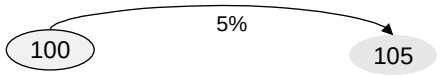
Chart 3

Investors require higher expected returns for accepting non-diversifiable risk

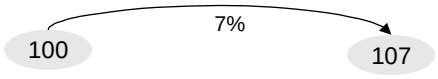
Example: one-year bullet bond

Risk-free



- Discount expected cash flow at market risk-free rate to obtain current market price

Corporate
Default Prob. = 0.01



- Expected cash flow = 0.99 x 107 + 0.01 x 0 = 105.93
- Discount expected cash flow at 5.93% to obtain current market price
- Risk premium = 0.93%

More volatility in cash flow → higher risk premium

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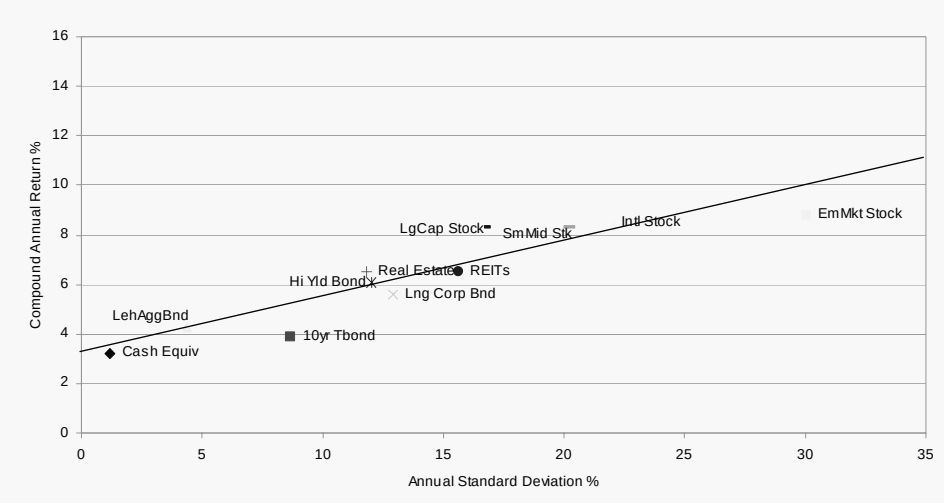
Chart 4

Risk and Return



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