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Session 37PD
Does An Actuarial Bias Lead To Equity Investment?

Track: Education & Research/Pension/Investments

Moderator: ETHAN E. KRA
Panel: ZVI BODIE†
JEREMY GOLD

Summary: A controversial alternative to ERISA/FASB actuarial cost methods and assumptions is presented as a challenge from the discipline of financial economics.

1. *It is argued that economic assumptions prescribed by ERISA and the FASB are financially biased in a fashion that favors equity investments. This is detrimental to shareholders, risky to the PBGC, and of ambiguous benefit to plan participants. A comparison is made between existing methods/assumptions and alternatives that are, in the language of finance, "transparent." FASB's current "fair value" paradigm follows the transparent financial model.*

2. *The combination of transparent actuarial cost methods, unbiased actuarial economic assumptions and the Internal Revenue Code Imply that, in the future, U.S.-defined benefit plans will be invested entirely in fixed income. This will reduce the risk exposure of the PBGC, provide tax benefits to shareholders, and provide participants with a more certain measure of their benefit security.*

MR. KRA: Welcome to Session 37. It is called a panel discussion, but it is really more of a presentation of a student's work. The topic is, "Does an Actuarial Bias Lead to Equity Investments?" With me this afternoon, we are pleased to have, on my far right Jeremy Gold, who was a consulting actuary for some large employee benefits consulting firms until he decided that he would rather seek the better truth and go to graduate school. He received his doctorate in applied economics from the Wharton School. Directly to my right, in the middle is Zvi Bodie, Professor of Finance at Boston University, and co-author of the textbook *Investments*.

My name is Ethan Kra. I am with William Mercer in New York. With that, I will turn it over to Jeremy.

†Mr. Bodie, not a member of the sponsoring organizations, is a Professor of Finance at Boston University School of Management in Boston, MA.

MR. GOLD: Thank you, Ethan. I want to note that I left the consulting firm world not to go to Wharton and spend money, but rather to go to Morgan Stanley and earn it. After a few years of that, I was able to afford to go into "phased retirement" and get the Ph.D.

There is a relatively small, although growing, number of actuaries who have worked on Wall Street. Total immersion in a trading environment very quickly changes perceptions of value and the role of current market price. Traders are willing to "make a market."

Within months, one questions most of what one has learned as an actuary. Pension actuaries make 30-year estimates; one year later we replace that with an estimate extending to the 31st year. Because that is so radically different from trading desk behavior, I began to question what I had learned as a pension actuary. Among actuaries who take Wall Street jobs, my experience is the rule, not the exception.

In 1996, I went to Wharton because I had some concerns about pension actuarial methods and assumptions from a financial economics perspective. I believed I should strengthen my understanding of formal modern finance. Today's presentation is based on my working paper, *Accounting/Actuarial Bias Enables Equity Investment by Defined Benefit Pension Plans* (Gold, 2000), which you may download at the Pension Research Council at Wharton: http://prc.wharton.upenn.edu/prc/PRC/WP/wp2001-5.pdf.

This session is sponsored by the Education and Research Section, the Pension Section and the Investment Section. I am also presenting a paper tomorrow on cash balance plan design. How can anyone have enough breadth of knowledge to be expert in all those subjects? The answer is: I am a liar. No matter what subject I seem to be speaking about, I am actually speaking about subverting pension actuarial science as you know it. That is my goal.

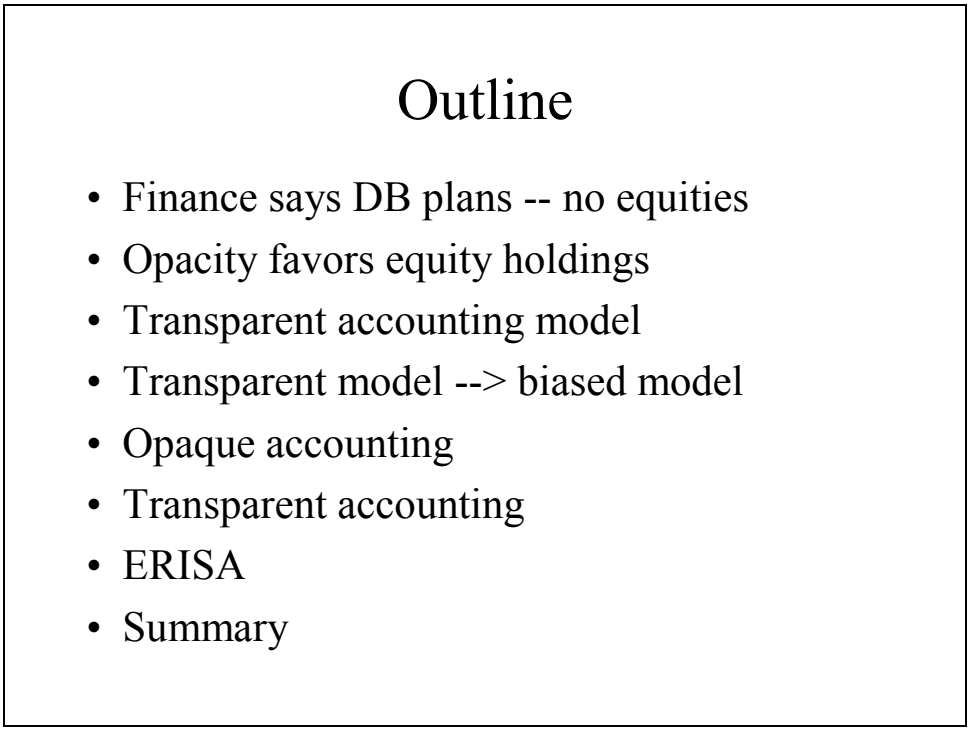
The subjects I seem to be addressing are examples of potentially fatal errors in what we all have learned as "pension actuarial science." In honor of the acquisition of all this knowledge on my part, my enrollment as an Enrolled Actuary (EA) ended a year and a half ago when I failed to meet the continuing education requirements.

MR. KRA: Was that failure to get core credit? Because you certainly had enough non-core.

MR. GOLD: I had 4,000 hours at Wharton in just the insurance and benefits side, not to mention the finance, and the Joint Board said "yes, that *might* cover the eighteen hours of non-core, *maybe*, if you will submit some more documentation." I tried to get this session classified as core. An unfortunate fact of EA continuing education is that core sessions get much better attendance to the detriment of non-core presenters and to the greater detriment of attendees who must elect core sessions. I felt that this session deserved core credit because I am challenging

pension actuarial science at a fundamental level. A level at least as basic as that underlying ERISA. A session as basic as ERISA implies core credit to me. I am alone in that view. This is not a core session. Those of you who are looking for core credits may leave.

Slide 1



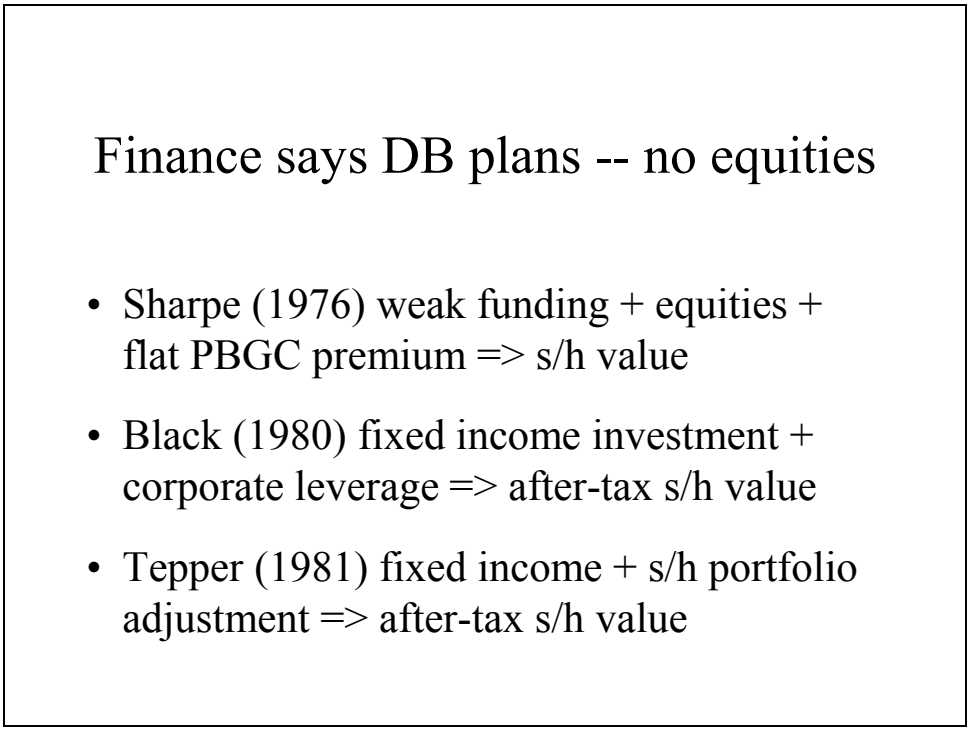
Slide 1 outlines today's presentation. A lesson of modern finance is that Defined Benefit (DB) plans should not invest in equity assets (Black, 1980; Tepper, 1981). DB Plans should be entirely invested in very taxable things such as fixed income. This lesson has had no practical impact (Bodie, Light, Morck and Taggart, 1987).

Tomorrow, in Session 98, part 3 of the Cash Balance Pension Plans Symposium, I will present the derivation of the Tepper-Black conclusion. Today's session explains why Tepper-Black has had so little impact. The pension finance literature does not tell us why. My answer is that the actuarial process defeats an otherwise optimal investment strategy. Opacity, the absence of transparency, encourages equity holdings. The primary cause of opacity is pension actuarial science, its methods and assumptions and ASOP 27 in particular. Others have made their little contributions to opacity as well: congress, accountants, attorneys, money managers.

Next I present a transparent accounting model for DB plans. This will "morph by math" into what I call a biased model, which I trust you will recognize to be FAS 87. Then we will measure the bias and we will see its great magnitude relative to plan assets. The bias leads to an overstatement of shareholder value that is exacerbated by equity investments. I will address the implications of that, then the implications

of transparent accounting and, in a last ditch effort to get some core credit, I will show that ERISA is wrong, too. Then I will repeat everything I said and call it a summary.

Slide 2



Slide 2 begins a brief history of the world of pension finance. The history is about six or seven theoretical papers, followed by empirical papers which I will not review. The empirical tests indicate that none of these theories are being exhibited in the real world.

The first paper (Sharpe, 1976) analyzes the implications of the newly formed PBGC. He observed that the PBGC was providing an option that would allow plan sponsors to put the assets of the plan and the liabilities of the plan to the PBGC. For the sponsor of a poorly funded plan, that put option would be very valuable. Most observers understood that. Sharpe's next point, which came from the then brand new option model (Black-Scholes, 1973), was that in order to maximize the shareholder value generated by that put, pension plans should strive to be underfunded and substantially invested in risky assets. Finance tells us that increasing the asset volatility increases the value of options; in this case the put option.

MR. KRA: Should we draw any conclusions from some of these authors in light of more recent experience in their other activities?

MR. GOLD: I suppose that you are referring to Long Term Capital Management. I prefer to note that their ideas won Nobel Prizes rather than be reminded that they could gamble and lose. With respect to Sharpe's PBGC put option, it is important to note that the PBGC recognized it was valuable and acted to protect itself. The PBGC has made major efforts to prevent discretionary behavior by plan sponsors (e.g., SEPPAA '86 defined the circumstances under which the sponsor termination put could be exercised). While Sharpe's paper is still an important piece of history, it is virtually obsolete.

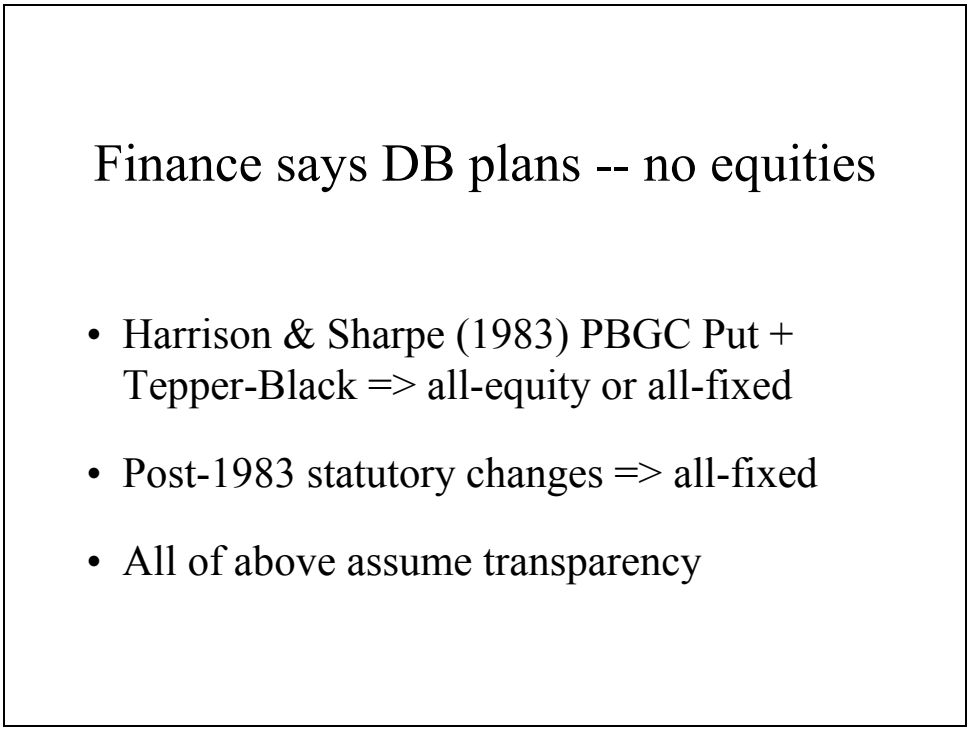
In 1980, Fischer Black, writing in the *Financial Analysts Journal* offered a model which I have extended to cash balance plans (Gold 1999, 2001). Black suggested that after-tax risk-adjusted shareholder value could be enhanced by:

- Selling any equities held by the DB plan and buying bonds instead, and
- Issuing sponsor debt in order to repurchase outstanding sponsor shares.

This is the essence of the paper that everyone has ignored for the last 20 years. My research task was to explain why. Why, when in fact the paper is quite readable and intelligible and when it was read by actuaries and pension managers? Why was none of it implemented?

In 1981, in a more rigorous form, Irwin Tepper carried the same reasoning through the corporate balance sheet into the hands of shareholders. He said, even if the corporation does not change its assets and liabilities, shareholders will be able to rearrange their own portfolios. For example, if the pension plan sells its equity and buys fixed income instruments, the shareholders will recognize they now have less equity exposure in their personal portfolios. Therefore, they will go out and buy more equity. Equity is not taxed as highly as fixed income. Some of you may know the classic financial planner advice: put your sheltered assets in fixed income and enjoy the capital gains advantages of equity outside of your shelter. Well, what Tepper did was to stretch that so as to connect all the way through the corporation to the corporation’s pension plan on behalf of the shareholders.

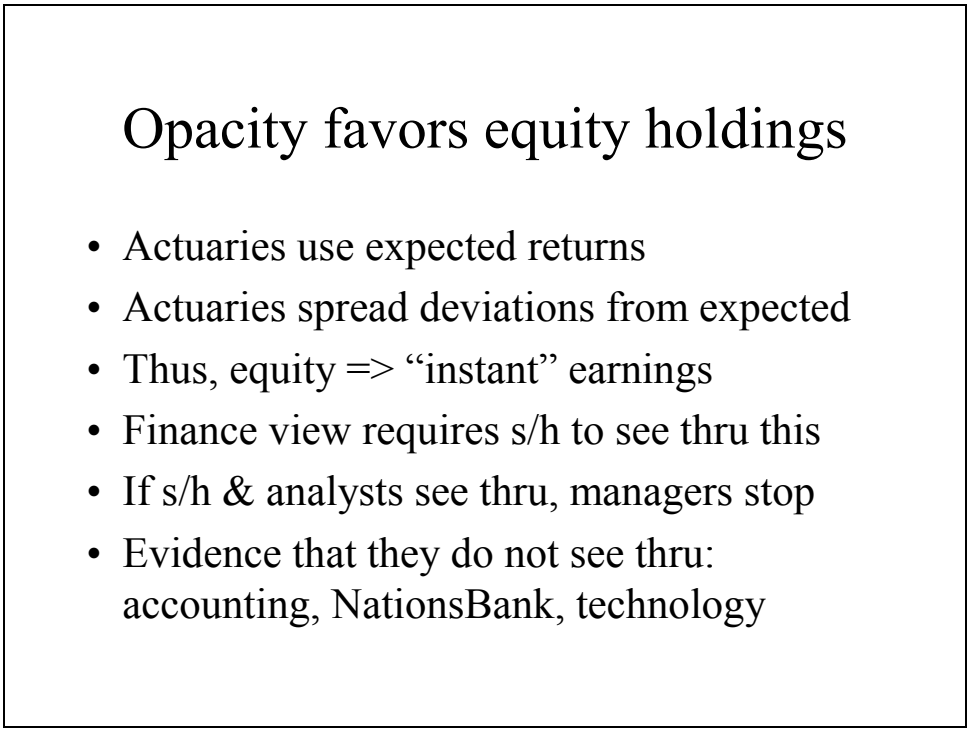
Slide 3



Harrison and Sharpe (1983), following Sharpe and Tepper and Black, incorporated the Sharpe PBGC put and the Tepper-Black tax arbitrage in a single model. Harrison and Sharpe concluded that there were two reasonable allocation/funding strategies for DB plan sponsors. You could fund the plan poorly and invest 100% in equities because you were probably not a very taxable company, or you could fund the plan very well and invest 100% in fixed income to maximize the tax advantages. It is a rather formal proof and, once again, one leg of it is obsolete because the PBGC protected itself.

That is why I say, post-1983, virtually all the statutory changes have reinforced the idea that only one of the two corner solutions in Harrison and Sharpe is applicable and that is the fixed income corner. Why is this not done? My answer is that in every one of these papers, the author saw through the accounting. He just looked at what was. He said, "I can see everything, I can see what the manager is doing, I can see what the pension planner is doing, I can see what the liabilities look like." That seeing-through concept is called transparency. It is more easily done in theory than in practice. It turns out that the practice is so opaque that the accounting and the other reporting, both pre- and post-FAS 87, has made managers and some financial analysts very happy with equity in pension plans.

Slide 4



Slide 4 highlights the root cause of pension opacity. Actuaries do two things which are inconsistent with modern finance:

- First we use expected returns. I was taught this as part of actuarial science. A fair estimate of something will be neither high nor low on average. The discipline stresses that the only really good actuarial answer is the center (particularly for symmetric uncertainty).

  The center of a mortality distribution may be financially unbiased, but the center of an equity risk, the expected return, is not financially unbiased. If you anticipate returns from equities, as all actuaries do under ERISA and under FAS87 and in compliance with ASOP 27, you are doing what the capital markets do not. When you buy an S&P future, the future price will be nothing but today's price, plus the one year risk-free rate adjusted for anticipated dividends. *Expectation is an insufficient measure of the value of risky assets.*

- Second, actuaries smooth variations over time. If you were deciding how to pay for a pension plan in the 1950s when interest rates were stable, few plans invested in equities and insurance companies provided pre-packaged pension plans, it was very nice that you could budget and pay on a very smooth basis. And if there were little bumps, we actuaries could smooth them out. This approach was valuable in a cash management sense in a world that no longer exists. We stand in danger of being buried by our own history.

In the 1960s, pension plans unbundled. They left the insurance companies and employed independent trustees, independent actuaries and independent asset managers. Sponsors wanted the *expected* high equity returns *and* smooth contributions. Actuaries in the 1960s made this possible, creatively defining and employing asset value averaging methods, implicit assumptions and amortizations of actuarial gains and losses. Because the subject was contribution budgeting, this was reasonable and rational.

Simultaneously, the accountants said, "This is small stuff; this is fringe benefits; this is marginal material; this is not the biggest thing on the balance sheet; let us not work too hard." The accountants enacted Accounting Principles Board Statement 8 (APB 8), which says the corporate expense for the pension plan is equal to the actual contributions made, subject to loose constraints. The sophistication level of APB 8 approximated: "What did you put in this year? O.K., that is the expense."

MR. KRA: That's for those of you who are old enough to remember APB 8. Remember, Jeremy, there are some people in the audience who became actuaries after FAS 87.

MR. GOLD: Thank you, Ethan. When we moved from the world of cash contributions to a world of financial reporting, the combined effect of expected equity returns and expense smoothing allowed actuaries to perform magic. When the plan asset allocation is shifted from fixed income to equities — and before any risk has been taken — earnings are increased. Think about how FAS 87 works, how it tells you to behave. ERISA tells you very similar things. The actuary is directed to take into account the future asset allocation in developing the expected long-term return on assets. When you know that the client has committed to invest for the long run in equities, you raise the expected return on assets (or the discount rate under ERISA) and you lower the expenses, thereby raising earnings.

You get this amazing phenomenon. A plan takes $100 out of bonds and puts it into stocks and the sponsoring company, on the day this is done, is instantly a more valuable company. Does that sound right? Is $100 of equity more valuable than $100 of debt? We all know that future values of $100 of equity may very well be higher and, as Zvi will point out, may also be lower. Bond and equity traders are exchanging $100 of bonds for $100 of equity this very day. You really have to be audacious to claim that you know a better value than do the bond traders and equity traders. Yet, that is what we actuaries have made possible.

The finance view requires the shareholder to see through all this. If the shareholders and the analysts were able to do so, the asset allocations of pension plans would be radically altered.

I want to identify evidence that analysts and shareholders are generally unable to see past the reported earnings to the financial reality. One example comes from the accounting literature. When I was writing my dissertation, I tried to see how aware

the finance and accounting literature was about the issue of pension bias induced by FAS 87. I searched AB/Inform, which is a database of academic papers. I searched for papers that had the word "accounting" in the title or in the abstract. 43,494 papers met that search. How many mention the word "pension"? 19,435. Pensions and accounting are certainly not ignored. How about the word "bias"? 5,041 articles mention the word bias. The intersection of these three words? Not a single paper. There are some lesser intersections. When you put pensions and accounting together, you get 1,077 articles, none of which point out this bias. When you put accounting and bias together you get 206 articles dealing primarily with how to manipulate the earnings unrelated to pensions. So that has been studied fairly well. When you put pensions and bias together you only get 49 articles, and none of them address the issues we are discussing. These articles address the biases that are induced by the benefit promises (gender, race, blue versus white collar); nothing to do with financial or accounting bias.

NationsBank has done a transaction that provides further evidence that corporate managers believe that analysts are driven by reported earnings. NationsBank allowed its 401(k) plan participants optionally to join a simulated 401(k) plan inside a cash balance plan. NationsBank can then take additional equity risks that their employees would not. Lo and behold! Their earnings increase immediately while the economic value of shareholder wealth is immediately diminished, but that latter point may only be discerned in a transparent setting.

Finally, technology. There are a lot of people who maybe even should know better, who are doing forecast valuations of various sorts.

Slide 5

Transparent accounting model

- Based on Treynor financial subsidiary model
- Operating expense of pensions:

$$X^{f}_{B,t} = SC_t$$

- Financial subsidiary accounting:

$$X^{f}_{P,t} = \left(L_{P,t} + P_t - SC_t - L_{P,t-1}\right) - \left(A_{P,t} + P_t - C_t - A_{P,t-1}\right)$$

Beginning with slide 5, I am going to start to get a bit more technical and mathematical, but not terribly. Jack Treynor, who played an important role in the history of CAPM and the Black-Scholes option formula, co-authored a book called *The Financial Reality of Pension Funding Under ERISA* in 1976. Actuaries who read it in 1977 or 1978 were outraged. Treynor's outrageous idea was that a pension plan is a financial subsidiary of an operating company. Even though ERISA (and earlier statutes and regulations) separated these two entities — the plan and its parent, the financial risks really need to be looked at together. Ignoring some of the legal limitations, Treynor built a very simple model in which the corporation and, ultimately, its shareholders own the assets of the pension plan and owe the promises of the pension plan. That does not seem all that outrageous. It is the transparent model that integrates pension and corporate finance.

The second and third bullet points on slide 5 make a distinction between the operating costs associated with pension promises and the financial results of the pension subsidiary. Patricia McConnell (McConnell and Reese, 2000), from Bear Stearns, who spoke at the Conference of Consulting Actuaries annual meeting last year makes this same distinction. Her expertise is the intersection of accounting and Wall Street analysts. I think she is among the most astute accounting writers on Wall Street.

The second bullet recognizes that the operating company's major pension financial activity is promising the benefit. If we look at one year or at one accounting period,

that promise is the benefit assigned to the accounting period; its value may be called the Service Cost[1]. The company may or may not contribute that same amount to the pension plan.

The third bullet turns our attention to the operation of the pension financial subsidiary, as Treynor described it. In a transparent model, we mark this to market. It is really a lot easier to mark the financial subsidiary to market than it is the operating company. The liabilities are cash flows. The assets are market assets. It's not hard to mark to market. This equation reconciles the beginning and ending position of the pension plan.

A comment on my notation. **X** is the expense. I use $\mathbf{X_{B,t}}$ to signify the operating or **B**usiness expense. I use $\mathbf{X_{P,t}}$ to signify the profit or loss on the **P**ension financial subsidiary. **t** is the year for which we are doing the expense; it includes the period **t-1** through **t**. Finally, the superscript **f** here identifies this equation as a **F**inancial valuation. I will later use superscript **a** for the **A**ctuarial value, distinguishing it from the financial. After marking the beginning and ending assets and liabilities to market, the financial subsidiary expense equals the increase in the liabilities adjusted for benefits paid, minus the new liabilities (**SC** = **s**ervice **c**ost) that are accounted for in the operating company, minus the increase in the assets adjusted for benefits paid and contributions received.

Slide 6

Transparent model morphs into biased model

- Define:

r = short rate (e.g., year bill)

$\tilde{r}$ = stochastic liability return

$\bar{r}$ = expected liability return (e.g., settlement rate)

α = fraction of assets in equity

$\tilde{q}$ = stochastic equity return

$\tilde{e} = \alpha\tilde{q} + (1-\alpha)r$ = stochastic asset return

$\bar{e}$ = expected asset return

[1] Service Cost is computed on a PBO basis. A better financial measure would use the ABO.

Before I can turn this model into FAS 87, I need to define a few market concepts, which I am sure will be familiar to you. The first definition on slide 6 is called the "short rate", which I symbolize by **r**, and because we are working one year at a time, just think of it as a one year T-bill return. The next, **r-tilde**, is the stochastic liability return. What I mean by the stochastic liability return is simply the total return on a liability matching bond portfolio for the year. It includes both the interest on, and the change in the market value of, the liability. Next is **r-bar**. Bar means expected. **R-bar** is the expected liability return — without getting too technical about whether or not that is the short rate or what interest rate model I am using, I am using it here to mean the settlement rate. If your liabilities were to be matched by a bond portfolio, this would be its internal rate of return and that is the settlement rate.

Here is your asset allocation reduced to one letter, α, which is always between zero and one and herein represents the equity allocation fraction. Then we have the stochastic return on equities, **q-tilde**. Then the stochastic asset return is **e-tilde**. Finally, there is an expected asset return, **e-bar**, which is an α-weighted mix of **q-bar** and **r**.

Slide 7

Transparent model morphs into biased model

$$X^{f}_{P,t} = \left(L_{P,t} + P_t - SC_t - L_{P,t-1}\right) - \left(A_{P,t} + P_t - C_t - A_{P,t-1}\right)$$

$$= \tilde{r} L_{P,t-1} - \tilde{e} A_{P,t-1}$$

$$\hat{=}\ r L_{P,t-1} - r A_{P,t-1} = -r E_{P,t-1}$$

$$\neq X^{a}_{P,t}$$

$\hat{=}$ over equals sign means risk-adjusted (financial) equality.

The first line of slide 7 is the portion of financially valued pension expense associated with the pension subsidiary; it is duplicated from slide 5. With slide 6 notation, we can equate this with the second line, the stochastic liability return

minus the stochastic asset return.

On the third line, I introduce my nonstandard own symbol which we can call "**equal-hat**." I define **equal-hat** to mean that the two expressions that it joins have the same ex-ante financial value. The short rate, **r**, applied to the liabilities is financially equivalent (because it is hedge-able) to the stochastic return on the liabilities, and similarly, the short rate is financially equivalent to **e-tilde** applied to the assets. You may suspect there is a bigger law at play here. That bigger law is that all actively traded **tildes** (stochastic returns) are financially equivalent to **r**. This may be seen in the pricing of financial futures contracts where the future price is computed as today's price brought forward at the riskless rate. In our equations, the end result is equal to **r** times the equity (surplus) in the pension subsidiary ($\mathbf{E_{P,t-1}}$ = market value of plan surplus at **t-1**). The expense measured at the beginning of the year is equal to minus **r** times the surplus.

The last line on slide 7 is an inequality between the financially valued and the actuarially valued expense.

Slide 8

Transparent model morphs into biased model

$$X^{a}_{P,t} = \bar{r} L_{P,t-1} - \bar{e} A_{P,t-1}$$

$$\hat{=} \bar{r} L_{P,t-1} + AMT_{t} - \bar{e} A_{P,t-1}$$

$$\hat{=} \bar{r} L_{P,t-1} + AMT_{t} - \bar{e} MRV_{P,t-1}$$

$$= iPBO_{t-1} + AMT_{t} - jMRV_{t-1}$$

I am now going to morph the financial value into the actuarial value. We start with the first equation on slide 8, which looks very similar to the financial value which it does not equal. Because actuaries use expectations, **r** has been replaced by **r-bar** on the liabilities and **e-bar** on the assets. Think of **r-bar** as the settlement rate and **e-bar** as the expected long term return on assets. The second equation inserts

$\mathbf{AMT_t}$ into the equation with no change in the financial value. I am using $\mathbf{AMT_t}$ to represent the current year's amortization of previous gains and losses (deviations from assumptions). Why may I say that $\mathbf{AMT_t}$ is financially valueless? I am taking an unconditional expectation long in advance, and to the extent that we were starting the accounting, we really do not know, and there is no inherent financial bias in $\mathbf{AMT_t}$ for some number of years in the future. In financial terms, $\mathbf{AMT_t}$ is a mean-zero, beta-zero variable. Pretty much anything which is both mean-zero and beta-zero has a financial worth equal to zero in anticipation. Expenses for the year under FAS 87 are always computed as of the beginning of the year.

On the third line of slide 8, I substitute the market related value ($\mathbf{MRV_{P,t-1}}$) for the market value of assets ($\mathbf{A_{P,t-1}}$). I contend that this is a financially valueless substitution. As before, with an unconditional expectation, the difference between $\mathbf{MRV_{P,t-1}}$ and $\mathbf{A_{P,t-1}}$ is both zero-beta and zero-mean. On the last line, with the equality sign, I make cosmetic notational changes. I now call the liability the **PBO**. I call $\mathbf{AMT_t}$ the amortization and I call the expected long-term return on assets **j** and the settlement rate **i**. The result is the FAS 87 expense equation except for the service cost which I have assigned to the operating company.

Slide 9

Transparent model morphs into biased model

- Consolidating the operating company and the financial subsidiary, we get FAS 87 expense:

$$X_t^a = iPBO_{t-1} + SC_t + AMT_t - jMRV_{t-1}$$

- And we can identify the bias:

$$\text{bias} = \Delta X_t = X_t^a - X_t^f = (\bar{r} - r)L_{P,t-1} - (\bar{e} - r)A_{P,t-1}$$

On slide 9, I consolidate the financial subsidiary and the parent in order to develop the actuarial version of the total cost, $\mathbf{X_t^a}$. Here is the total FAS 87 expense for the corporation consolidated with its pension subsidiary.

If you look back and collect the differences associated with the change from the financial to the actuarial value, we can compute the amount of the actuarial bias as shown at the bottom of slide 9. Financially, the return on liabilities is **r**, actuarially it is the settlement rate, **r-bar**. Financially, the return on assets is **r**, actuarially it is the long term return on assets, **e-bar**. This is what I have identified as the bias and I assert that it does not have a zero value, nor is it the kind of measure that washes out in the long run. It is a financially valuable bias and it consists of two parts shown on slide 10.

Slide 10

Transparent model morphs into biased model

- An overstatement of:

$$(\bar{r} - r)L_{P,t-1}$$

  which we ignore because it is easily hedged by dollar-duration matching.

- And an understatement (the equity enabling bias):

$$-(\bar{e} - r)A_{P,t-1}$$

The first part is a liability overstatement, typically an overstatement of the expected settlement rate versus the short rate primarily due to the observed difference between long-term bonds and short-term bonds. Generally that is a positive number. I am just going to drop that out of my issues here, because in fact we could hedge our way out of this very easily. You can execute this hedge by simply putting the assets into long-term bonds to dollar duration match the liabilities. This would equalize the asset and liability biases, and the net effect would be zero. I do not want to make a big deal of it, I just want to get rid of it, because I want to focus on the bias generated by the asset allocation and the use of **e-bar**.

As actuaries, by anticipating and smoothing, we have understated the financial value of the pension expense. We have allowed the plan sponsor to "earn" the equity return with none of the equity volatility. In fact, if you look strictly one year at a time, we have given sponsors the anticipated equity return in a zero-beta

security. Zero-beta securities are only entitled to a return (or discount) of **r**. **e-bar** is not pure equity, it is an asset mix. Recall that I defined **q-bar** as the 100% equity expected return. The typical value of (**e-bar** minus **r**) is a big number, say 3, 4, or 5%. It is a function of α; it gets bigger when the plan is allocated more to equity.

Slide 11

Implications of opaque accounting

- The annual equity-enabled earnings bias:

$$(\bar{e} - r)A_{P,t-1} = \alpha(\bar{q} - r)A_{P,t-1}$$

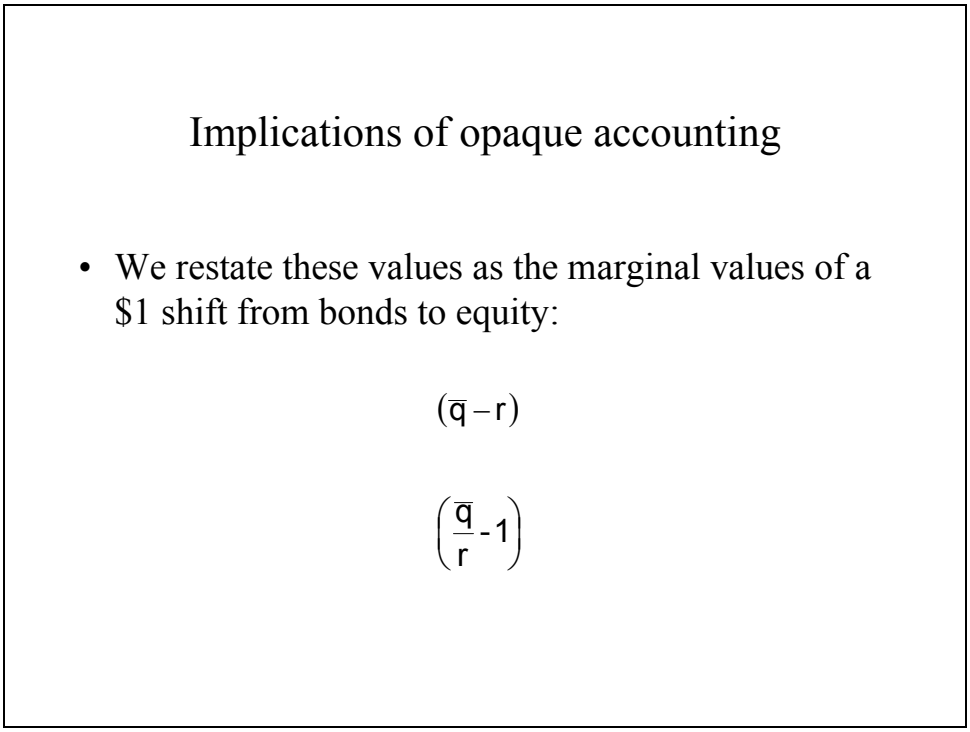
may be restated at its perpetuity value:

$$\alpha\left(\frac{\bar{q} - r}{r}\right)A_{P,t-1} = \alpha\left(\frac{\bar{q}}{r} - 1\right)A_{P,t-1}$$

The first expression on slide 11 just repeats the previous asset bias value. I have restated it as a function of α and **q-bar**.

The second expression is the present (perpetuity) value of the actuarial bias. We treat the value as a perpetuity because the bias is repeated in all future years. Is that a big number or a small number? Is this even worth talking about? We have a couple different rates of return. Let us see.

Slide 12



We can look at one dollar being shifted. Using the earlier equations, I am going to shift one dollar of my assets from bonds to equity which, ignoring taxes[2], is a transaction which does not add financial value.

The first line on slide 12 is the change in the annual value. The annual misstatement is whatever this amounts to, say 3% to 5% depending on the asset allocation. This analysis shows that $40 million of the earnings on a billion dollar plan are nothing but actuarial bias, and in the lower equation this is expressed in the perpetuity form. What is the implied value to shareholders or management of shifting a dollar from bonds to equity? I will stop at this point and ask if you have questions, because I have made a number of claims on the recent slides.

MR. SEAN SULLIVAN: I'm with Dean & Company. From the perspective of someone with a bunch of new concepts thrown at me, and as I try to follow what you are saying, I am going back. It seemed that a lot of this is based on the fact that, although we look at different asset classes as having different *expected* rates of return, on a risk-adjusted basis, all the different assets have the same basic return. I am sitting here trying to follow you and thinking that if we shift from fixed income to equity, but keep our assumptions the same…

[2] When taxes are taken into account, the financial value of shifting pension assets from bonds to equities is sharply negative for shareholders of the sponsor. Gold (1999, 2001)

MR. GOLD: What do you mean by the same?

MR. SULLIVAN: Well, suppose the plan is all in fixed income and we had a certain assumption with which we were comfortable. We shift some over to equity, but recognizing a risk-adjusted return has not changed, we leave our assumptions the same.

MR. GOLD: Yes. You understand that correctly.

MR. SULLIVAN: Then I am thinking with equities, at least we are taught to believe that the portion of the risk involved in equities is the volatility. In fact, we are led to believe it is a significant portion to that overall time horizon you end up with a greater return.

MR. GOLD: Zvi is going to want to talk about that as soon as I finally shut up and sit down. One way to make this point (i.e., that on a risk adjusted basis, future equity returns and future T-bill returns are equivalent) is that in the real world you can exchange these returns every day. What if you were to enter a swap contract, say $100 million?

MR. SULLIVAN: In the real world, I do not do that.

MR. GOLD: A swap contract: Suppose that you run a pension fund that is invested in equities but wants to earn a T-bill return. I have a pension fund that is invested in T-bills, but I want to earn equity returns. Both of us have a billion dollars in assets. But you do not want to have to sell your equities and I do not want to have to buy them, because there are lots of transaction costs associated with actually trading. Instead of that, we enter into a swap contract that says that you will pay me or I will pay you (depending on whether the difference is positive or negative) the difference between the rate of return on the stock portfolio and the T-bill return, multiplied by $100 million. As a result of that swap contract, even though you are still holding the equities and I am still holding the T-bills, effectively I am earning the return on equities for better or worse and you are earning the return on T-bills. Is that clear?

MR. SULLIVAN: Yes.

MR. GOLD: Okay. Now, how much should you pay me or should I pay you when we sign that contract? The answer is zero. So then how could either of us have increased value at the moment that we entered into the contract. All we have done is taken a different risk position.

MR. SULLIVAN: Here is where my question comes in. Suppose I am the pension actuary for a sponsor that is fully invested in fixed income and they decide that they want to shift 50% of it into equities.

MR. GOLD: Having attended this session, you might say you do not want to introduce any actuarial bias and so you are going to keep your same assumption.

MR. SULLIVAN: Then I am wondering if ten years down the road after we have gone through our market cycles and some of our volatility has come out, that if the plan might not be in a better position financially for having done that equity shifting.

MR. GOLD: Let us assume you are right. When will you recognize it? I want to recognize it as it happens. The existing framework calls for zero expected gain or loss. This is flawed. Better practice, within a modern finance framework, would call for gains and losses to emerge as they do in the capital markets.

MR. SULLIVAN: I understand your concept about that and I was with you right up to there, but maybe I am getting ahead of myself, but I am trying to jump ahead to your admonition "do not ever invest in equities."

MR. GOLD: There is an unrelated reason for that and that is the tax issue. It is disguised by the present system but it is a direct implication of transparent accounting and arbitrage. (Black, 1980; Tepper, 1981).

The issue for this session is that return anticipation is the problem, because anticipation creates earnings. This anticipation is aided and abetted by amortizations and other smoothing devices.

An interesting aspect of the financial subsidiary's earnings that I would like to note is that these earnings are investment earnings and, according to Pat McConnell at Bear Stearns; investment earnings, after properly adjusting for taxes, add to shareholder value, but do not imply an earnings multiple (PE ratio) as do operating earnings. That is part of the problem. One of the things that FAS 87 did was attempt to attach a financial subsidiary to an operating company. But the shareholder value from a pure financial transaction is one dollar for each dollar earned. When a shareholder wins a one dollar bet, the shareholder value is plus one dollar. When, instead, the shareholder finds a franchise value in a corporation that will generate a dollar per year, that might be worth ten dollars. That is the difference between a PE ratio of 10:1 and the simple 1:1 addition that applies to investment returns. In other words, investment earnings are not multiplied. Instead the earnings add to the net value (surplus) of the pension plan. The net value is added to the value of the sponsor.

Slide 13

Implications of opaque accounting

- Suppose q = 12%, r = 6% and a 35% annual corporate tax rate. Then $1 shift equity appears to add $.65 to shareholder value
- Alternatively, suppose P/E = 20:1. Then $1 shift implies apparent shareholder value of (.12-.06)(20)(.65) = $.78.

Let me move ahead so that you can hear from Zvi. Just to put a number on that last part. I just filled in some numbers on slide 13. The gist of it is that the shifting of a dollar from bonds to stocks seems to add $.65 to shareholder equity using the second formula on slide 12. Alternatively, we could use the first formula on slide 12 and a 20:1 PE ratio, approximately the same thing. I multiply the annual difference, 12% minus 6%, times a PE of 20, 65% is one minus the tax rate. If you move a dollar inside the pension plan from bonds to stocks, it looks like you have added $.78 to after tax shareholder worth. That is more than a brand new dollar in the pension plan is worth. A new dollar in the pension plan is worth $.65 in shareholder value, and you get that and even more just by changing the investment of one old dollar. This demonstrates the magnitude of the bias. It is mitigated because financial analysts seem to be a little suspicious of these earnings and do not necessarily give them these full multiples.

Slide 14

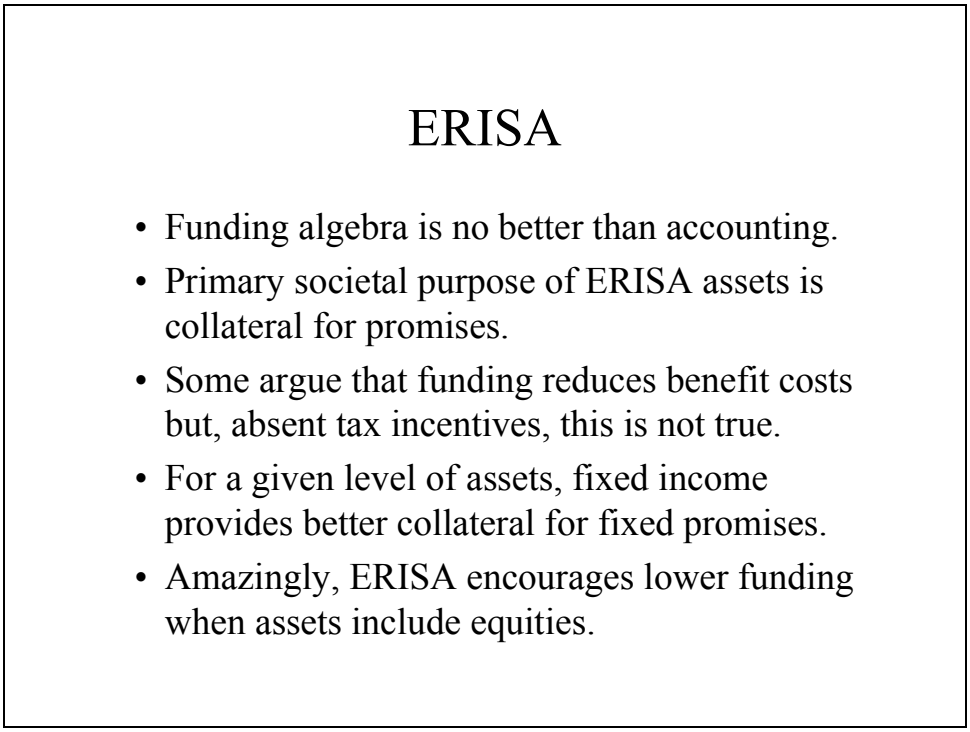
Transparent accounting implications

- After accounting for taxes, the value of $1 of plan surplus is $1 as it should be for any marketable pool of assets and liabilities.
- The Tepper-Black (Session 98 tomorrow) argument has traction with shareholders, analysts and the financial press.
- Managers have to modify their behavior
- No more DB equity allocations.

I have ignored all taxes except for the corporate tax on slide 13. While this alters the magnitude of some of the numbers, it does not distort the relationships. The conclusion that the value of the actuarial bias can exceed the value of the plan assets holds at the shareholder level after all taxes.

If transparent accounting ("fair value" is the name the accountants employ to describe this idea) was adopted, we might expect that the folly of equity investing by pension plans could be articulated by the *Wall Street Journal* and soon afterwards we might expect CFOs to move to bonds. Incidentally, the tax advantages shown by Tepper and Black are on the same order of magnitude as the actuarial bias and these advantages favor bond investing as well. In other words, today's shareholder *thinks he is $.65 to $.75 richer* when a dollar is shifted from bonds to equity. When accounting is transparent and taxes are taken into consideration, the shareholder is *actually losing $.40 to $.60* per dollar shifted.

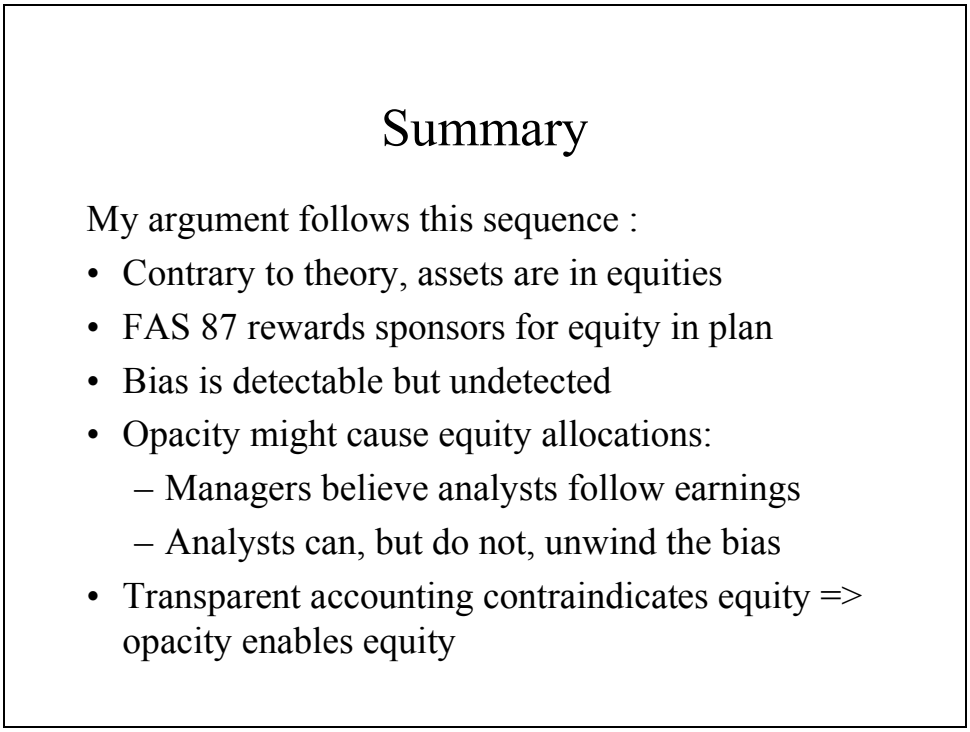
Slide 15



ERISA has the same kind of algebra, the same kind of embedded errors. It then has an extra almost unbelievable error. The primary purpose for requiring assets in a pension plan and the primary purpose for ERISA doing it is to provide collateral for promises made by a potentially strong and knowledgeable party to a weak and ignorant party. Promises were not always collateralized pre-ERISA because funding was not mandated. Pension promises made were not necessarily kept and government and society's action was to require collateral for the promise. That is the most significant and important reason for mandating funding. Some people argue that funding reduces the cost of providing a given benefit. Finance says no, you make a promise and that is the cost of the benefit. How you finance it is an investment exercise that can win or lose.

Thinking about this collateral role of the assets to make good on the promises, consider the following truism: for a given level of assets, fixed income provides better collateral for fixed income promises. If I made you a promise that is effectively $100 in discounted value, and I back it with $110 worth of well matched bonds, you are very well collateralized. If instead, and the original ERISA allowed this, I back it with $70 worth of equity, tell me how good your collateral is. Before the Current Liability was introduced, ERISA said the actuary will use his best estimate, the more equity in the plan, the higher the rate of return, the lower the collateral. This is dangerous nonsense.

Slide 16



This repeats everything I have just said. I will stop and turn it over to Zvi.

MR. BODIE: First of all, I want to point out a little trick that I learned about getting students involved. I have been teaching for 30 years at Boston University. The answer is you ask them the questions and you sit down, you do not do all the talking. What I would like to do is make my points briefly and allow a little time for discussion and clarification.

I think the work that Jeremy has been doing is really terrific. I am in complete agreement with it, and I have sort of been waging my own crusade in a different realm, and that is the realm of financial planners, virtually all of whom try to convince people in their own personal accounts, defined contribution accounts, that they should be heavily invested in equities. If you have a long time horizon, the conventional advice goes, then equities are not risky. That is the conventional wisdom. That conventional wisdom is wrong. Let us see why. First of all, the proposition that stocks are safe in the long run really is the foundation for just about all the conventional advice. When I say that, I mean you can go to any web site that dispenses asset allocation advice for 401(k) plans, and this goes right through to the most advanced, including Bill Sharpe's financial engines, if you are familiar with that one, and they all say the same thing. The key ingredient of how much you should invest in equities is the length of your time horizon. It is explicitly stated. The more your time horizon, the more you should invest in equities because stocks are safe in the long run, or at least they are a lot less risky the longer you

hold them.

I think you can all see the conceptual connection between that and what Jeremy has been talking about. It is really the same thought process, the same line of reasoning. Unfortunately, the reasoning behind the proposition, although it is intuitively appealing as we will see in a second, is wrong. It was first shown to me to be wrong when I was a student doing my doctorate in economics at MIT in the late '60s. Paul Samuelson and Robert C. Merton, very well-known economists wrote papers showing that in a model of life time utility maximization from consumption, for a whole class of very commonly used utility functions, namely constant relative risk aversion, which includes the logarithmic case, the Bernoulli function as special case, the optimal fraction to invest in equities is constant. It does not vary with the length of your time horizon. From a purely theoretical point of view, at least as far as economists are concerned, that pair of articles ended the debate. It never, however, filtered down to the world of practicing financial planners and actuaries apparently either.

Why are people misled? This is very important because there is a powerful intuition which drives people in the wrong direction and it is the following observation. These two propositions are true. One, the volatility of the average compound rate of return on stocks declines with the length of the time horizon. That statement is true, just like the volatility of any sample average declines with the size of the sample. But, this simple proposition from statistics which has no investment implication whatsoever has made the basis of time versus risk, which is very widely used. It is this Java applet which proves to you in living color that the longer your holding period, the smaller the volatility of your holding period return. You have seen that. How can you argue with the Java applet? The point is true. It is true, it just has no investment implications, because you do not care about the average compound return, you care about the wealth at the end of your time horizon and that is not averaged over the number of periods, and therefore, its standard deviation does not get smaller.

The second thing is the probability of a shortfall declines with the length of the time horizon. Now, everybody talks about the likelihood of a loss or a shortfall. I define shortfall as you are going to earn less than the risk-free rate of interest. That is a very meaningful definition in financial terms, very meaningful definition of a shortfall, because your alternative as we have just been talking about, your alternative to investing in equities is just hedging by investing in the risk-free asset. So what happens if you switched? It has been shown time and time again usually by means of Monte Carlo simulations, these so-called asset/liability models, which can get very complicated, but what they boil down to is showing that the longer the horizon, the smaller the probability of a shortfall. The probability of a shortfall is a terrible measure of risk because it ignores severity. In fact, there are two ways to take account of severity. One is the way Samuelson did in his original '69 paper, which is weighting by utilities. If you take expected utility, you see that the negative utility that comes from a severe shortfall offsets the decline in probability

of shortfall and it exactly offsets it so that there is no reason that your time horizon would effect how much you would invest in equities. Does everybody get the central idea there?

In the Samuelson model what's going on is this. Let us say I am investing, my life time is only a year and I have logarithmic utility, to take a common case, so I am risk averse with log utility, and it turns out that my optimal fraction to invest in equities is 60%. Samuelson shows that regardless of my time horizon, if I lengthen my horizon now, but the set up is the same for the problem, that is still going to be my optimal fraction to invest in equities. You say to yourself, "Wait a second, how do I square that with the fact that the longer the time horizon, the lower, the smaller the probability of a shortfall relative to the risk-free rate?" The answer is as you go further out, the worst possible outcome becomes worse, and the negative utility associated with that exactly offsets the reduced probability of a shortfall. Do you all see the point?

That is one way to do it. What this shows is as long as there is a positive risk premium on equities, you are going to have this effect that the longer the time horizon, the lower the probability of a shortfall. This is what is driving the intuition behind all of this thinking that stocks are less risky the longer you hold them. That shortfall probability will get smaller unless there is no risk premium. In other words, if the expected return on stocks would just equal the risk-free rate, then there would not be that effect. That effect arises entirely from the positive risk premium on stocks.

The flaws in the conventional analysis are that it is only looking at probability, not taking account of severity of the shortfall. The other thing is that in all of these studies, the history that they present is the history of the United States over the last 100 years. Well, think about the selection bias associated with that. You are looking at the one country that had the most successful equity market history. How about we use Japan over the last 20 years? There are lots of objections to doing that. A big part of the problem is we overestimate the size of the positive risk premium on equities by relying entirely on the experience of the United States. That is an aside. I just make that point because that, too, is flawed statistics.

The valid ways to account for severity are the ways Samuelson and Merton did through expected utility. I published a paper (Bodie, 1995) in which I tried to do it in a much more simple intuitive way and that was using options theory. I said instead of looking at what happens to the probability of a shortfall, let us ask what happens to the cost of insuring against a shortfall. That is a put option — where the strike price is the future value compounded at the risk-free rate. Do you all see that point? I said let us use the following metric, because it takes account of severity, the cost of insurance takes account of severity. Let us see what option pricing theory says, which is based entirely on no arbitrage, which is a very powerful assumption. That is to say just about anybody who knows anything is willing to buy the idea that there is no free lunch in financial markets. So what does finance

theory say about the cost of that kind of a put option as a fraction of your investment? Let us say you are investing $100,000, and you are comparing the following types of insurance policies or puts. One says it will make up for any shortfall a year from now versus a policy that will make up for any shortfall two years from now, versus a policy that will pay for any shortfall thirty years from now. This is what we call a European-type option. It is exercised only at the expiration date.

Think about this in intuitive terms. If it were true that stocks were less risky in the long term, what should happen to the cost of that insurance. It should go down the longer the period, right? In fact, I have done this as a rhetorical device with people from the mutual fund industry. I say to them, "I am going to invest my money for thirty years, surely you are willing to throw in a free insurance policy that guarantees I will do at least as well as I would have done investing in thirty year treasuries." Of course, some of these people say sure, because they do not know anything about options. Lots of insurance companies have fallen into this problem too. They really do think it is less risky in the long run, but talk to someone on Wall Street and they will say you are out of your mind, because the cost of that put option increases directly in proportion to the square root of time. If you are 25 years out, it is going to cost you five times as much as a policy for one year, and it is not as if you are insured for a shortfall during any of the subperiod. You are insured only as of the horizon date. Do you follow?

MR. GOLD: Think about what your communications department is telling your clients — if your client is telling the participants in the plans with your help, with the long view they should be in equities. Think about the story you are telling and think about the story Zvi is telling and I am not saying you are all telling it, but I am pretty sure your clients want it told and that in fact, most of the history of the 1990s in communication about DC plans was generally designed to encourage this view, that if you are patient, equity will win out. One more comment in this vein. We all share this belief, we cannot help it. Try to remember what I think is critical language difference here. Actuaries, looking at an equity risk premium seem to believe that instead it is a patience premium. It is not. It is a risk premium.

MR. KRA: Jeremy, just as a sidebar, how do you personally invest that, or should we not ask that?

MR. GOLD: We should not ask that.

MR. BODIE: Let me answer it though. Notice, there is nothing in this that says you should not invest in equities. All it is saying is you should not invest in equities and think that you are having your cake and eating it. Let me say, because Jeremy is so hard on actuaries — It is not the actuaries that are driving this, it is the financial planners, and the investment advisors, the so-called finance professionals who have driven this. I do not, for a minute, hold the actuaries responsible. In fact, if anything, I think the actuaries are more inclined to understand the basic statistical flaws.

MR. GOLD: That is why I carefully chose the word enable in the title of the original paper. We are enablers. Our methods enable this. As for my personal strategy, I have not had a real job since 1989 and if you look closely at the hotel water fountain, you will discover three dimes, a quarter and four pennies were removed some time last night, and I am $.59 richer today.

MR. DAVID CASS: I have a two-part question that is the same thing in different guises as you will perceive. First, what order of magnitude or how does one derive as of today the risk-free return? Secondly, to the extent 12 months from now one arrives at the then prevailing risk-free rate of return, if that is not an immutable number and has changed in the meantime, where does that affect your sequential assignment of pension costs from one year to the other?

MR. GOLD: As I did that, that is the substitution in value terms of **r-bar** versus **r**, but ex-post. It is **r-tilde** minus **r**. You actually lose the total return on your liabilities and in fact, if your liabilities go down, you win. If the interest rates replicated themselves in some fashion, the liabilities would go up by the risk-free rate applicable to that year.

MR. BODIE: I interpret your question differently. First of all you are saying what is the risk-free rate anyhow correct, since there are different times to maturity. We know there is a whole term structure of risk-free rates. Not only that, we know it depends on what unit of account you are using. There are risk-free rates in yen, there are risk-free rates in dollars, there are risk-free rates denominated in terms of the consumer price index. I do not care which definition you are using, because the result that I am talking about applies to any and all of them. In other words, choose. The key point here is if you are matching, you have defined a certain maturity, whatever it is, to years. The longer is **t**, the more that insurance will cost, so there is no foundation whatsoever for the view that equities become less risky with **t**.

MR. CASS: The reason I framed the question as I did was on the one hand, to bring it down to cases with Jeremy's treatment, and secondly, I guess if I were to rephrase it for the response that indeed I appreciate from your end, the emphasis would be, "How does one identify the risk-free premium return?" And I gather you say, "By picking one."

MR. BODIE: I do not think it is arbitrary, it depends on the context. In other words, given a particular context, whether it is a DB plan, a DC plan or my 401(k) or Keogh plan, I can define for you what I consider to be the risk-free asset. For me right now, the risk-free asset is an inflation protected annuity. In other words, I am thinking in terms of my consumption stream in the future. That is what defines risk. No zero coupon bond would for me, be risk-free at this point in my life. It is context dependent. That is my short answer.

MR. CASS: It seems to me that Jeremy's treatment is essentially the wheel has come full circle in the sense that I cut my teeth in the actuarial pension world with the accounting criteria, do not anticipate future gains as a conservative thing to do, and therefore, I personally have not been the least bit comfortable with the mandate from the Society of looking to modify your interest assumption based on the actual mix in one context, and I think Jeremy offers a more sophisticated rationale for my instinct on that subject.

MR. GOLD: FAS 87 will not let you be as conservative as my claim is.

FROM THE FLOOR: Jeremy, where were you when the small plan audit cases went to trial?

MR. GOLD: I am a big plan kind of guy.

MR. BRUCE CADENHEAD: I'm with Mercer. It sounds like what you are saying is there are a lot of people out there who have an unrealistic view of the riskiness of investing in equities and therefore would, in effect, pay more for equities than their own utility would dictate they should.

MR. BODIE: In fact, there was an article in *Atlantic Monthly* on a book called *DOW 36,000: The New Strategy for Profiting From the Coming Rise in the Stock*. The guys who wrote it were serious. They claim that stocks indeed — the risk premium should be zero on stocks because they are not riskier in the long run. You can see the idiocy in this the minute you realize it. If there were no risk premium, then the probability of a shortfall would not go down. It sort of self destructs even their own basis for claiming the stocks are not risky in the long run. I think it is flawed reasoning.

MR. CADENHEAD: But there are a lot of people apparently willing to overpay for equity, or do you take exception to that?

MR. GOLD: In fact, in over 70 years, equities have had a very high average return ex-post. We have been discounting the future value too much by anticipating returns that are too high.

MR. CADENHEAD: Let us say all the investors are people just like me and we all have the same utility and they are all under the misconception that equities are not as risky as they really are and I am the only one who's not. Does that mean I should not buy equities because they are bidding the prices too high?

MR. BODIE: That is exactly what it means. There is a book that Bob Schiller wrote, a classmate of mine from MIT called *Irrational Exuberance*, which puts forward that hypothesis which I think is widely shared at least by academic economists today. If you talk to Franco Modigliani, you will hear him talking about the stock market bubble, which is just another way of saying the same thing, that stocks are over priced today. In fact, Paul Samuelson wrote a wonderful little essay that appeared

in *Bloomberg Personal Finance* magazine in the very first issue and that was his opening paragraph. Some people are wondering why the price earnings multiples are as high as they are today and Paul Samuelson said I think I know why, because they are buying this story that stocks are not risky for the long run investor.

MR. CADENHEAD: Sounds like I should go and sell until everybody readjusts their expectations.

MR. GOLD: And talk to your communications department dealing with your 401K clients. You should have talked to them a year and a half ago.

MR. KRA: Maybe one last question and then we are out of time.

MR. STEVE INGRAD: It seems to me that you probably have an opinion on the whole privatizing of Social Security and I wondered if you'd share that, and also if you could tell me where the two of you stand amongst your colleagues. I mean would your colleagues consider you — you just gave some indication of that.

MR. BODIE: In that connection, I have to tell you this story. There is a book written by a Jeremy Siegel, who is a professor at the Wharton School called *Stocks for the Long Run*, and it has gotten a lot of press. It basically is putting forward the belief that risk goes away, the risk of stocks goes away in the long run. The Boston Society of Financial Engineers sponsored a debate between Jeremy Siegel and me. This was a couple of years ago. Roughly 100 people turned out equally divided between academics and investment professionals. Boston is a big mutual fund town, so most of them worked for the mutual funds. Paul Samuelson was the moderator of the debate, and he did not hide his opinion that I was right and that Jeremy was wrong. He did not try to be neutral. We took a vote before the debate and it split right down the middle, who agreed with my proposition, who agreed with Jeremy's. It was clearly along the lines of academic versus practitioner. Then we had a 45-minute debate, during which I presented my arguments, essentially the case that you have seen. Jeremy presented the standard arguments, all of which were fallacious and then for 45 minutes after that the moderator lectured the audience about how Jeremy's arguments were fallacious and Zvi Bodie's were correct. We took another vote. 50/50 right down the middle. Not a single opinion was changed.

MR. GOLD: You did ask about my colleagues. I am a Johnny-Come-Lately to this Ph.D. business. I am a lifelong pension actuary. You are my colleagues. Over time you will tell me what you think.

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