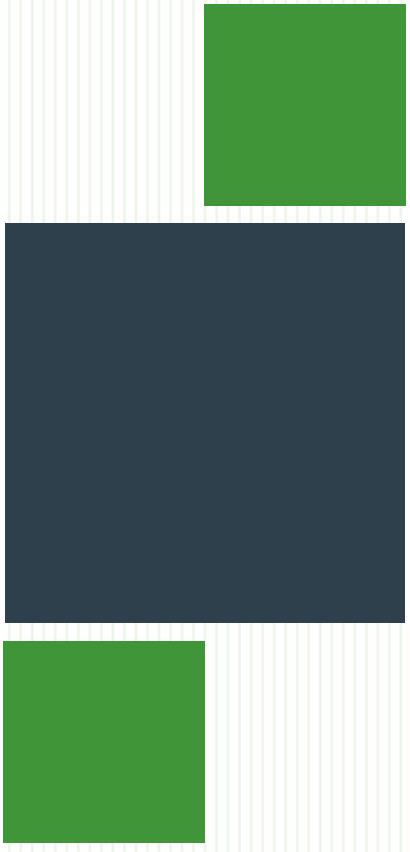
Pension Actuary's Guide to **FINANCIAL ECONOMICS**



Joint AAA/SOA Task Force on Financial Economics and the Actuarial Model

Dedicated to the memory of James Hickman, noted researcher, award-winning professor and contributor to this book.

Purpose and Acknowledgements

The pension actuary's guide is a product of the Joint American Academy of Actuaries/Society of Actuaries Task Force on Financial Economics and the Pension Actuarial Model. The task force offers the pension actuary's guide for actuaries and others to learn what financial economics says about how pension plans are designed, invested, accounted for and funded. This guide is not a statement about how actuaries should practice nor how pension plans should be operated.

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Please note that this guide was written before the PPA of 2006 (U.S.) was enacted.

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These are important questions that each pension actuary needs to consider. The financial economics perspective on pension plans has many facets and raises a number of questions that need more than three or four pages of summary narrative to appreciate fully. For a more complete treatment of the issues, please refer to the balance of this document or the pension finance section of the SOA Web site, www.soa.org.

Actuaries should be aware that financial economics is discussed throughout the world and has gained an influential audience among accountants, actuaries, stock analysts, investment bankers and other users of actuarial work product. While actuaries do not need to *accept* the conclusions that many people reach when they apply financial economic theory to pension plan management, it is imperative for actuaries to *understand* the arguments and perspective behind those conclusions.

Financial Economics and Fair Value

Recall from undergraduate days that students are introduced to economics via courses in macroeconomics and microeconomics. Financial economics is a subset of microeconomics and is primarily devoted to studies of capital markets. One particular interest for the financial economist is how markets determine current values or prices of items that involve future cash flows. Two familiar examples are shares of stock, which generate future dividends and/or earnings growth, and bonds, which generate future interest and principal payments.

As everyone knows, stocks and bonds trade openly on markets. That makes it easy to determine their current value. However, there are some cash flow items that don't trade openly, such as pension payments, which makes them not so easy to value. In the latter case, economists look for openly traded items that are close in nature to the un-traded item to help assess its value. If a $100 five-year, zero-coupon bond is currently trading at $90, the economist has a starting point for valuing other types of payments that are due in a lump sum five years hence.

A fundamental task for pension actuaries is to evaluate the present value of expected cash flows from a pension plan. Pension actuaries make this evaluation using various methods and assumptions, depending on the purpose at hand. Actuaries often value cash flows differently from the way in which capital markets value similar cash flows—including complex contingent cash flows. When this happens, the financial economist asks the actuary: Why?

There we have the crux of the challenge financial economics poses to traditional actuarial practice. Why do actuaries place different values on future cash flows than capital markets? And, why does it matter?

One answer to the latter question involves a very important topic for the financial economist: *arbitrage*. Arbitrage—sometimes called a "free lunch"—is said to exist if a person can make an immediate risk-free profit. Economists generally model markets as though they were arbitrage-free (if an arbitrage opportunity arises, market participants will act quickly to profit, thereby making the opportunity disappear). If company assets or liabilities are valued at anything other than fair market value, arbitrage is introduced into that asset/liability valuation. When an actuarial liability is determined on a basis other than fair market, and a plan sponsor puts that liability in its financial statements, this produces distorted prices and a misallocation of resources. A fair market determination of the liability eliminates the price distortion and improves the economy's efficiency.

A second answer to the "Does it matter?" question involves the plan sponsor's understanding of the pension liability. There are several different actuarial measures of plan liability that are used in current pension practice. It is important that the plan sponsor understand how and why each measure is used. Plan sponsors would be missing a key piece of information if they did not understand that the actuary's measure of liability often differs from the plan's fair market liability.

Pension Plans as Corporate Debt; Employees as Lenders

Financial economics takes the view that benefit payments to pension plan participants are a form of corporate debt and that assets held in the pension trust are corporate assets. Section 4 of this guide explores this concept more fully and identifies this viewpoint as the *augmented balance sheet*.

With the perspective that an unfunded pension plan represents an employer debt, the funded status of a pension plan can be translated into a capital structure question for the plan sponsor. How much pension debt should the plan sponsor carry? Is pension debt preferable to other types of employer debt?

Any debt has a borrower and a lender. The plan sponsor is the borrower of pension plan debt. Who is the lender? The plan participants. An unfunded pension plan indicates the sponsor has not fully segregated assets to back the pension promise made to employees and has, instead, kept those assets in the company's coffer. In effect, this is a loan from the employees to the plan sponsor. Economists argue that employee debt is inefficient and therefore sponsors should borrow money elsewhere. See Section 8 of this guide for further explanation.

Financial Reporting for Pension Plans (Accounting)

If we combine the perspective that pension plans are a form of corporate debt with the global trend towards transparent financial reporting, we can derive the financial economics approach to pension accounting. The financial economist would put pension liabilities and pension assets on the plan sponsor's balance sheet, each measured at fair market value. The annual income statement entry for pension expense is then defined as the net increase or decrease in funded status (fair market liability compared to fair market assets) during the income statement period. This is discussed in Section 7.

Shareholder Value

If you read articles concerning financial economics and pensions, you will not travel too far before you see the names Modigliani and Miller. These two economists published an influential paper which, among other things, identified a corporation as a pass-through entity

that shareholders employ to invest their capital in projects with the expectation to earn a profit. The authors argued that projects must pass only one test: "Will the project, as financed, raise the market value of the firm's shares?" Thus, business decisions should be made from a shareholder value perspective. This theory finds its way to pension practice as follows:

- A pension plan is not a self-standing entity, but a pass-through entity. A pension plan is a vehicle used by shareholders to compensate employees for their services. Analyses that focus on the pension plan alone ("pension-centric" or "plan-centric") are unable to reflect the shareholder value perspective.

- Statements like "a pension plan is a long-term enterprise" or "pension plans can take a long-term view of risk and reward" are not supported. Pension plans cannot be managed on a time horizon that differs from that of the shareholder.

Principals and Agents[1]

As we know, shareholders need to employ labor in order to get anything done. Economists use their own definition of agency theory to explain the tensions that arise between shareholders and the managers who run firms. Agency theory, in the view of financial economists, defines the firm owners (shareholders) as *principals*. The managers, who act on behalf of shareholders, are called *agents*. In theory, agents are supposed to act solely in the interests of the principals. In reality, agents sometimes place their own interests over owner interests. The resulting conflict or tension is known as the *principal-agent problem* and poses the following potential issues:

- The distinction between principal and agent can blur, causing firm managers and professional service providers to lose sight of how their advice, service or work affects shareholder value.

- Firm managers who have duties associated with the pension plan and who control relationships with third-party vendors may make decisions that make their jobs more interesting and secure without considering the effect on shareholder value.

Asset Allocation

Many pension actuaries have heard that financial economics says that all defined benefit (DB) plans should be invested entirely in bonds. Although this is something of an overstatement, actuaries ought to understand how (and for which companies) financial economics does reach this conclusion. This topic is discussed in Section 4.

[1] We are not herein describing the principal agent relationship as it is defined in tort law or the legal relationship between shareholders and corporate managers as defined in law or precedent generally applicable to corporations. The discussion in this paper of these relationships is solely based on financial economists' views as we understand them.

The central argument that financial economics makes for fixed-income investment does not involve anticipated investment return. Financial economics readily accepts that equities are expected to earn a higher return than bonds. The question financial economics asks is whether equity investments in a pension plan provide any real value to shareholders. In theory, shareholders have access to the same investments as the pension plan. Thus, the shareholder can experience in his individual portfolio the same investment gains and losses that the pension plan can experience. With that in mind, where is it best for the shareholder to experience those gains and losses? Taking into account the special tax treatment afforded pension trusts, financial economics argues that shareholders are better off on an after-tax basis if the pension plan holds higher-taxed investments (bonds under U.S. and Canadian tax code) and shareholders hold lower-taxed investments (equity under U.S. and Canadian tax code) in their individual portfolios.

What about the "Real" World?

Economics is a science; a "dismal" science per Scotsman Thomas Carlyle, but a science nonetheless. Science provides us with tools and theoretical constructs that help us explain the past and the present. Equally important, however, is the fact that science can help us anticipate what we will see in the future. The financial economic perspective on pension plan measurement and investment is not always consistent with current U.S. pension practice. That inconsistency causes some people to dismiss the theory and invalidate the tools. It is important to keep in mind that science informs us about the future as much as it explains the status quo.

Other Resources

There is a pension finance section on the Society of Actuaries' Web site, www.soa.org. That section of the SOA site contains links to several articles on the topic of financial economics and pension plans. You will also find references to relevant articles and authors in Sections 12 and 13.

Conclusion

What can we now say regarding the questions that were posed at the beginning of this summary? Is this about investing pension assets in bonds? Is this about rewriting FAS 87? Or is it something more? It is something more. Financial economic perspectives cut to the core of traditional actuarial practice and how actuaries present their work to plan sponsors. By understanding financial economics, actuaries can play an increasingly important role in helping plan sponsors make informed decisions.

Sect. 1

Introduction

The teachings of financial economics are forcing pension actuaries to review their traditional practice critically. The AAA/SOA Joint Task Force on Financial Economics and the Actuarial Model has assembled this guide to give pension actuaries an introduction to the application of financial economics to pension plans sponsored by widely held corporations. This guide does not directly address plans sponsored by governments, churches, non-profit organizations, multi-employer organizations and closely held businesses. The task force intends this
guide to:

- Provide an overview on how financial economics applies to pension plans;
- Act as a springboard for actuaries to do their own, more in-depth, study of financial economics; and,
- Provide readers with references and links to articles and papers on the subject.

The application of financial economics to DB plans is not universally accepted.
Many of the assumptions underlying financial economic theory seem heroic, but, heroic assumptions should not cause us to dismiss financial economics.

The task force believes it is important for actuaries to consider what financial economics teaches so that we can better evaluate our practice and our role as actuaries. It is not necessary that every actuary agree with what financial economics says about pension plan management. But in light of the importance attached to financial economics by financial professionals, actuaries should not ignore financial economic theory.

The task force intends this guide to provide actuaries with the basic financial economic perspectives in order to engage in the global pension debate now taking place among plan sponsors, actuaries, accountants, rating agencies, equity analysts and others.

Financial Economics

This section provides an overview of financial economics and an outline for the rest of the guide.

Economics is primarily concerned with analyzing and explaining the decisions people make about the allocation of scarce resources. *Microeconomics* deals with decision-making by individuals and institutions. *Financial economics* is a subset of microeconomics that is focused on the capital markets. Financial economics is the study of how individuals and institutions acquire, save and invest money. Individuals decide how much to save and how to invest their savings. Institutions raise capital by offering securities to investors and invest that capital in business opportunities.

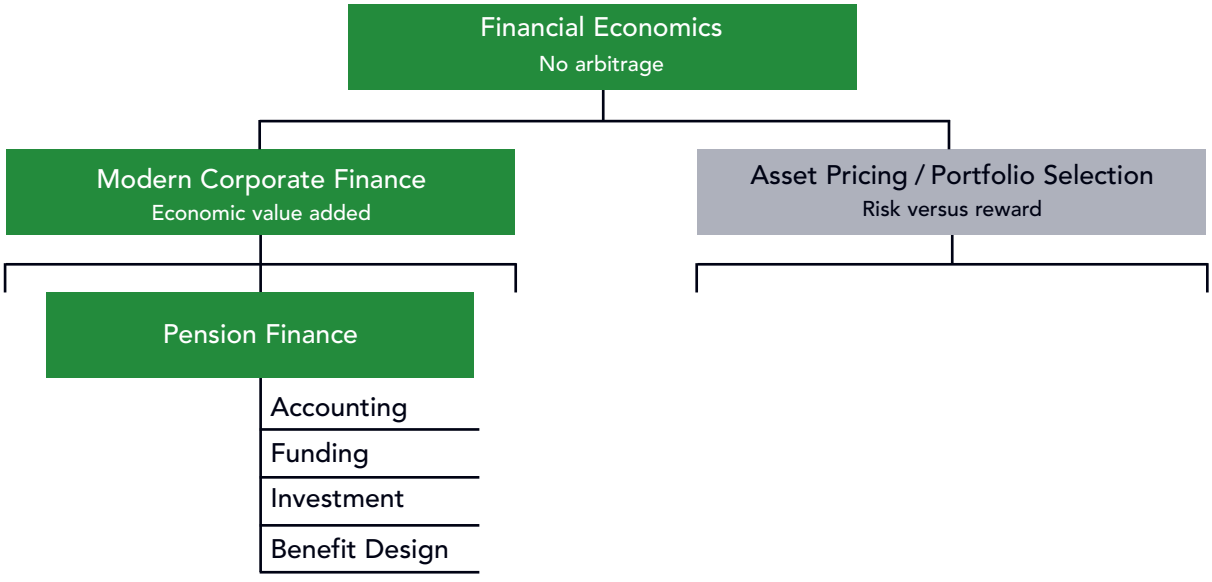
"FE"

Most financial professionals use "FE" to denote financial engineering, not financial economics. Thus, we need to be careful how we use the term.

A key tenet of financial economics is "no-arbitrage." Arbitrage is said to exist if an investment can yield an immediate, risk-free profit, described colloquially as a "free lunch." A key assumption of financial economics is that markets gravitate toward an arbitrage-free state. If an arbitrage opportunity arises, market participants will act quickly to seize the opportunity, thus eliminating the arbitrage.

Chart 1, immediately below, breaks financial economics into its two main branches. Note that the work of a pension actuary involves *pension finance*, which is a subset of corporate finance.

Chart 1



- **Modern corporate finance** considers how institutions make decisions about raising and deploying capital. Firms exist in order to "add economic value" and, in theory, all firm decisions should add value and some or all of that value should inure to the firm's owner-shareholders. Thus firms are often described as value maximizers.

- **Asset pricing and portfolio selection** (also called *investment*) is the branch of financial economics that studies the risks and rewards faced by savers who invest in the capital markets. Because they balance risks and returns, investors are described as *expected utility maximizers*. Work in this area includes the efficient frontier of Markowitz (1952), the Capital Asset Pricing Model (CAPM) of Sharpe (1964) and the Black-Scholes (1973) option pricing model. The investment branch also includes the pricing of derivatives such as futures, options, mortgage-backed securities and catastrophe bonds. Derivatives are often used to reposition the risks and rewards associated with underlying portfolios of assets and liabilities. When the net effect is the reduction of risk, the activity is often called *hedging*.

Although the decision criteria differ between the two branches, practitioners on each side are presumed to understand both disciplines. Individuals will be more adept investors if they understand how corporations add value; corporations will better serve their shareholders if the corporate managers understand investor risk preferences.

The topics on the left side of Chart 1 are covered in more detail in the following sections.

Firms add economic value by investing in projects whose expected returns exceed the cost of capital. Capital is provided by shareholders and lenders. Firms borrow from lenders and suppliers, including employees who supply labor in exchange for current and deferred compensation. Since a pension plan is a form of deferred compensation, an unfunded pension plan can be considered to be a form of corporate borrowing from plan participants.

Economists refer to corporations as *pass-through* entities; all of the value generated by a corporation's assets passes through to the shareholders after satisfying higher priority claims of liability holders. The standard finance model treats shareholders as diversifiers because they invest only a small fraction of their personal portfolio in any one security.[2] It is the shareholder's role to balance risk and return at the aggregate portfolio level, and it is the corporation's role to create value.

DB plans are also considered to be pass-through entities. From a financial perspective, shareholders own the assets and owe the liabilities of the plans they sponsor. The asset and liability risk of the plan passes through to the shareholders.

Modigliani-Miller

In 1958, economists Modigliani and Miller (MM) published a very influential paper in financial economics entitled, "The Cost of Capital, Corporation Finance and The Theory of Investment." One major conclusion in the paper is that a corporation's market value is independent of its capital structure.

In support of their conclusion, MM argue that a corporation is not an entity unto itself; rather, it is a conduit for shareholders to deploy capital in the production of goods and services. MM argue that evaluation of capital decisions is most properly done from the shareholder's perspective, not from the corporation's perspective. In an economy where shareholders have unfettered access to information and capital, shareholders manage their own portfolios and maintain their own preferred debt/equity ratios. If Company A increases the debt on its balance sheet, shareholders of Company A can make adjustments in their personal portfolios to offset Company A's action. Under the MM assumption that shareholders respond to corporate transactions, the make-up of the corporate balance sheet does not create or destroy shareholder value.

[2] Notice that the diversified shareholder assumption may not apply to closely held corporations and partnerships.

MM made four key assumptions:

1. No taxes (for a corporation or its investors);
2. No bankruptcy or other contracting costs;
3. Decision makers have all the information they need; and,
4. Managers' investment decisions (deployment of capital) are not affected by whether capital is raised by issuing stock or selling bonds.

The implication of the MM assumptions is that if a change in capital structure is going to impact the value of a corporation, then the change in value must come from one or more of the assumptions being violated, i.e., (1) tax effects, (2) information, transaction or contracting costs (including bankruptcy costs) or (3) management operating or investment decisions. Much of the development of corporate finance since the original 1958 paper has been in exploring and elaborating on theories around these three possibilities.

Modigliani-Miller didn't cover corporate pension plans in their paper. But, other economists have done so, and the basic principles of how MM would apply to corporate pensions are as follows:

- A pension plan is not considered to be a self-standing entity, but a pass-through entity. A pension plan is a conduit used by shareholders to compensate employees for their services. Analyses that focus on the pension plan alone ("pension-centric" or "plan-centric") are unable to reflect the shareholder perspective.
- Statements like "a pension plan is a long-term enterprise" or "pension plans can take a long-term view" are irrelevant for decisions made from a corporate finance perspective.
- The debt/equity mix of pension plan assets does **not** affect shareholder value on a *first-order* basis. Shareholders are able to adjust their personal portfolios to reflect the pension plan's holdings.
- The debt/equity mix of pension plan assets **does** matter to shareholder value on a *second-order* basis. Second-order issues typically consist of taxes, agency costs and surplus ownership. See Section 4 for more detail.

Agency Cost

Economists use agency theory to explain the tensions that arise between shareholders and the managers who run firms. Agency theory describes the shareholders on whose behalf these agents act as *principals*, and calls the managers who act on behalf of shareholders *agents*. In theory, agents are supposed to act solely in the interests of their principals. In reality, agents sometimes place their own interests over shareholder interests. The resulting conflict or tension is known as the *principal-agent problem* and is invariably accompanied by *agency costs*.

If we apply agency theory to corporate pension plans, we see the following:

- Professional service providers sometimes treat firm managers as principals, causing firm managers and professional service providers to lose sight of how their management, advice, service or work affects shareholder value.

- Firm managers who have duties associated with the pension plan and who control relationships with third-party vendors may make decisions that make their jobs more interesting and secure without considering the effect on shareholder value.

Actuaries who would like to read more on modern corporate finance are referred to the capital structure indifference model of MM that we just discussed, the agency costs model of Jensen and Meckling (1976), and the Merton (1974) option model for valuing the financial obligations of limited liability institutions (e.g., corporations).

Pension Finance Explained

Pension finance takes a market-oriented approach to DB plans. It brings this market view into the valuation of plan assets and liabilities and thus into accounting, funding, investment and benefit design as well. In this section, we look at the question: should pension assets be invested in stocks? While that is primarily an asset allocation decision, the process of developing the financial economics answer illuminates the central theme of pension finance: adding value for shareholders.

As we develop the pension finance answer, we will be calling upon the lessons of modern corporate finance that derive from the Modigliani-Miller model. We will see, in a fashion consistent with MM, that when we ignore personal taxes it doesn't matter whether the plan invests in stocks or bonds. MM takes the approach that a shareholder can make his own risk-reward decision for his whole portfolio. If a plan holds more or less stock, the investor could hold less or more stock elsewhere. But when we take personal taxes into account, we are able to see a substantial shareholder value impact. When we take the strength of the sponsor and the existence of the PBGC into account, we get a new answer and further insight. We note that the principal-agent conflict can also impact asset allocation decisions made in practice.

Many pension actuaries have heard that financial economics says that all DB plans should be invested entirely in bonds. Financial economics does often, but not always, reach this conclusion. In this section, we develop the pension finance model and its associated assumptions, which will help the actuary see how 100 percent bond portfolios are supported. Later, in Section 8, we will see the scenarios where the pension finance model indicates 100 percent bond portfolios are not adding shareholder value. We present the most common criticisms of the pension finance model in Section 5.

Augmented Balance Sheet—Defined

The pension finance model begins with the *augmented balance sheet* (Treynor, 1972) which takes the view that shareholders **own** the assets and **owe** the liabilities of DB plans.

The augmented balance sheet is an economic balance sheet only. It is not meant to represent current accounting under any particular accounting system. Additionally, it ignores the legalities that separate the DB plan from its sponsor. These considerations do not change the conclusions reached in this section.

Recall that the question posed at the beginning of this section was whether pension plan assets should be invested in stock. Modern corporate finance rewrites the question this way: does investing pension plan assets in stocks add to shareholder value? We start by addressing the impact of corporate taxes. We then follow with an example of how investors could re-align their personal portfolios (outside the pension plan) to compensate for asset allocation changes made to the corporation's pension plan. Finally, by applying personal taxes, we are able to quantify the extent to which shareholder value is destroyed when pension plans invest in equities. For now, we ignore the PBGC and any chance that the employer can go bankrupt.

Augmented Balance Sheet—Adjusted for Corporate Taxes

Suppose the pension plan lost $100; the corporation would need to replace it. Upon doing so the corporation would receive a $35 tax savings. The net cost to the corporation would be $65 assuming a 35 percent corporate tax rate. Similarly, if the pension plan gained $100 it would drive out $100 in contributions, which would save the corporation $65 after the tax deduction.

A similar argument can be made on the liability side. If, for instance, the demographic experience caused the liabilities to increase by $100, the corporation would need to fund an additional $100, which would cost the corporation $65 after the tax deduction.

Thus an apples-to-apples integration of the corporate and pension balance sheets requires the tax adjustment as illustrated in Figure 1.[3]

Adjusting the Personal Portfolio for Pension Plan Changes

Consider the following scenario:

- Corporation A has the balance sheet shown in Figure 1 and Corporation A invests its $500MM pension plan entirely in equities.
- Consider a group of individual investors (hereinafter referred to as "Investors") who in aggregate own A. These Investors have a combined portfolio of $10BB.
- Our Investors re-balance their portfolio in order to maintain a 50/50 equity/bond allocation. Thus, these Investors' combined $10BB individual portfolios are split evenly into $5BB in equities and $5BB in bonds.

[3] Note that the financial statements will not show the tax-adjusted pension balance sheet as shown. Instead the gross pension balance sheet will appear in the footnotes and the tax adjustment will be reported separately in deferred taxes.

Figure 1

We will assume that Corporation A's pension investments are transparent so Investors are able to impute their share of the pension plan. Thus, our Investors own the $500MM in gross plan assets ($325MM net of corporate taxes) shown in Figure 1.

Since the corporation invests the entire pension plan assets in equities, our Investors indirectly hold $325MM in their portfolios. The middle column in Table 1 shows how our Investors could

collectively realign their personal holdings to compensate for their indirect equity investment in the pension plan while maintaining their goal of a 50/50 equity/bond mix.

Now let's suppose Corporation A changes its pension investments to be 100 percent bonds, instead of 100 percent equities. How does this affect our Investors?

One of our assumptions is that our Investors can see this change in Corporation A's pension investments and now realize that their share of the plan assets have become $325MM of bonds. Since our Investors want to maintain their overall portfolio to contain equal amounts of equity and bond investments, they will adjust their portfolios outside the pension plan to reflect the change by Corporation A. The right hand column in Table 1 summarizes how our Investors could collectively realign their personal holdings to compensate for the change in asset allocation in the pension plan.[4]

Table 1 Investors' Portfolio ($ Millions)

Investors' Holdings	Pension Plan: 100% Equity	Pension Plan: 100% Bond
Indirect holdings: through corporate pension plan		
■ Equity	$325	$0
■ Bonds	0	325
Total	$325	$325
Investors' direct holdings		
■ Equity	$4,675	$5,000
■ Bonds	5,000	4,675
Total direct holdings	$9,675	$9,675
Investors' combined holdings		
■ Equity	$5,000	$5,000
■ Bonds	5,000	5,000
Total portfolio	$10,000	$10,000

Personal Tax Adjustment

So far, no shareholder value has been created or destroyed. We now investigate how personal income taxes affect the foregoing example. Our goal is to see if equities in a pension plan provide our Investors with more value than equities held directly. Table 2 shows one set of assumptions regarding taxes and investment returns.

[4] If companies invest their pension plans in bonds the company stock will exhibit less risk. If stocks exhibit less risk, investors on average will buy more of them for their personal portfolios. Table 1 incorporates the act of this average investor.

Table 2	Assumptions

Shareholder personal tax rates

- Equity 15%
- Bonds 40%

Returns

- Equity 10%
- Bonds 5%

We further assume that changes in the augmented shareholder equity (including returns in the pension plan) flow through to the Investors and are taxed at the 15 percent personal equity tax rate.

Our Investors' initial position and development of after-tax income is shown in Table 3A (corresponding to the middle column of Table 1).

Table 3A — Investors' Portfolio ($ Thousands)

Pension Plan: 100% Equity	Investor Holdings	Pre-tax Income	Personal Tax	After-tax Income
Pension plan				
■ Equity	$325,000	$32,500		
■ Bonds	0	0		
Total	$325,000	$32,500	($4,875)	$27,625
Direct holdings				
■ Equity	$4,675,000	$467,500	($70,125)	$397,375
■ Bonds	5,000,000	250,000	(100,000)	150,000
Total personal holdings	$9,675,000	$717,500	($170,125)	$547,375
Total portfolio	$10,000,000	$750,000	($175,000)	$575,000

Based on the return and personal tax assumptions, our Investors would receive $575MM after taxes.

The effect on our Investors' portfolios after Corporation A moves its entire pension portfolio away from equities and into bonds (corresponding to the right-hand column of Table 1) is shown in Table 3B.

We see that moving the pension assets to bonds increased the Investors' after-tax income from $575,000,000 to $579,062,500 per annum. Equity investment by Corporation A's pension plan

Table 3B	Investors' Portfolio ($ Thousands)			
Pension Plan: 100% Bonds	Investor Holdings	Pre-tax Income	Personal Tax	After-tax Income
Pension plan				
■ Equity	$0	$0		
■ Bonds	325,000	16,250		
Total	$325,000	$16,250	($2,437)	$13,812
Direct holdings				
■ Equity	$5,000,000	$500,000	($75,000)	$425,000
■ Bonds	4,675,000	233,750	(93,500)	140,000
Total personal holdings	$9,675,000	$733,750	($168,300)	$565,250
Total portfolio	$10,000,000	$750,000	($170,937)	$579,062

is costing its shareholders $4,062,500 per year (i.e., $579,062,500 in Table 3B less 575,000,000 in Table 3A) based on $500 million invested in equities in the plan.

Valuing the Shareholder Loss from Plan Equity Investment

The figure of $4,062,500 may not seem like much in terms of a $500 million pension. However, note that this $4 million comes out of shareholders' pockets, after all levels of taxation, risk free, year after year.

How may we measure the principal value of such a stream of losses? One way is to consider the amount that shareholders would have to hold to generate $4 million per year after tax and without risk. Using the same assumptions as before, this amount is $135,416,000.

What might make this lost value higher or lower? The calculated loss of $135 million, assumes that the plan has $500 million in assets every year in the future and that the asset allocation is unaltered. If the assets grow over time, the loss may well exceed $135 million, but, if the plan consists entirely of beneficiaries in pay status, the wind-down implies that $135 million is an overstatement. (Note that even a frozen plan may have assets that increase well above $500 million before winding down.) Lastly, the decision to continue to invest in equities may be reversed at any time in the future and this decision to stop losing money could significantly reduce the $135 million amount.

The ability to increase income without increasing risk suggests that an arbitrage exists. This real arbitrage opportunity is why financial economists say shareholder value is being destroyed by pension plans that invest in equities.

Do the Assumptions Matter?

What if we vary the investment return and tax assumptions? Under what conditions does the arbitrage grow larger? Under what conditions does it disappear, or reverse? The Pension Arbitrage Example worksheet found on the SOA Web site, www.soa.org, will allow you to see how the after-tax income reacts to varying assumptions and investor preferences. Some key findings from altering the assumptions in the worksheet include:

- **Equity return assumption does not impact after-tax income.** Irrespective of whether the equity return is 20 percent or -5 percent, the pension plan, by investing in equities, still costs its shareholders $4,062,500 per year.

- **Arbitrage is proportional to bond return assumption.** If the bond return were doubled to 10 percent (versus 5 percent in Table 2), the after-tax income would also double to $8,125,000 annually. If the bond return were lower, the arbitrage value would decrease proportionally. The irrelevance of equity returns and the proportionality of the bond returns verify that the arbitrage is indeed free of market risk.

- **Arbitrage is proportional to individual tax rate spread.** We assumed that the difference between individual tax rates for equity and bond income is 25 percent in Table 2 (40 percent on bond income vs. 15 percent on equity income). If this differential were cut to, say, 15 percent, the after-tax income would be cut, to $2,437,500 annually. If the individual tax rate on equities were higher than bonds, the arbitrage would be negative. Since risk management considerations for pensions generally point to bond investing, we can say that, under today's tax rules, the risk and value arrows both point to bonds. In a world where equities were more highly taxed than bonds, however, we would have to look for tradeoffs between the benefits of risk management and the cost of a negative tax arbitrage.

- **The arbitrage is proportional to (1 – the corporate tax rate).** What if the corporate tax were reduced to 0 percent? The arbitrage would achieve its maximum value of $6,250,000 annually. This means that even if a company is not paying corporate taxes, as long as the plan is well funded, shareholder value can be increased by investing plan assets in bonds rather than stocks.

Finally, a quick formula for the arbitrage is: multiply the dollars in the plan ($500 million) times the tax spread (25 percent) times the bond return (5 percent) times one minus the corporate tax rate (65 percent) equals $4,062,500. This shows why the arbitrage is unaffected by the equity return and why it is proportional to the bond rate, the tax spread and to one minus the corporate tax rate. Please refer to the Pension Arbitrage Example worksheet for details.

The Debt Interest Tax Shield

Another financial economic argument in favor of debt investment in the pension trust involves the *debt interest tax shield*. The tax shield argument is enhanced by the fact that the payoff for bearing risk in the corporation is usually better than the payoff for bearing the same risk in the pension plan. The reason for this is the asymmetry of surplus versus deficit in the plan. It is usually difficult for shareholders to fully recover the surplus that may emerge from risk-bearing activities, whereas any deficit that emerges must be fully financed. The topic of asymmetry is further explored in Section 9.

Debt Interest Tax Shield

Companies can deduct interest paid on debt from taxable income. With the "all other things being equal" assumption, debt financing is less expensive on an after-tax basis than equity financing. The after-tax savings to the company (and thus, shareholders) is often called the debt interest tax shield.

Principal-Agent Concerns (again)

The portfolio selection branch of financial economics teaches that shareholders invest in widget makers to get the benefit of their widget-making ability. Shareholders do not invest to get the benefit of the widget maker's skill at managing equity investments.

Financial Economics and Current Practice

Actual investment practice in the United States does not reflect the pension finance theories we have briefly reviewed. It is interesting to note that these ideas are not new, but in fact have formed the core of academic theory on pension funding and investing for almost 30 years. An important challenge for actuaries and other service providers is to understand these theories, as well as the reasons why they have not made their way into common practice. Achieving the right balance between challenging the status quo and challenging both new and old theories is important and difficult. It requires relentless questioning and the recognition that there may be no clear-cut right and wrong answers. To that end, Section 5 addresses some of the most common criticisms of the pension finance model.

Pension Finance Challenged

This section explores the common criticisms and practical difficulties of putting the pension finance model into place.

Challenging the Assumptions

The following assumptions were used to develop the all-bonds strategy in the prior chapter:

- **Transparency:** Shareholders can always see the plan assets and liabilities.
- **Corporate Valuation:** Shareholders can value corporations economically by reference to the capital markets.
- **Risk:** Rational investors will adjust their own portfolios to their desired level of risk.
- **Default:** Promised benefits will be paid by the plan because it remains sufficiently funded and/or the corporation is strong enough to make up any pension deficits.

To a greater or lesser extent, each of these assumptions is weak, or even false. What does this mean for the model and its results? Let us consider each assumption in turn:

- **Transparency:** We know that shareholders, even trained financial analysts, cannot see the pension plan assets and liabilities. Nor can they observe plan cash flows on anything like a timely basis. Even though asset and liability values are disclosed at fair or market value, pension expense is based on smoothed asset values with gains and losses further smoothed. Put simply, under FAS 87 and its international counterparts, this is an all-but-fatal flaw in the pension finance model. Unless shareholders (and the capital markets generally) can see what's going on, the arbitrage argument falls on deaf ears. Can the markets see, or infer, what is happening? Coronado and Sharpe (2003), based on data several years old, say that the markets appear to be blind. Jin, Merton and Bodie (2006), using somewhat later data, say some transparency effects do exist.
- **Corporate Valuation:** Because a pension plan is a financial intermediary (in contrast to the operating company that sponsors it), Bader (2002), tells us that it should be valued much like a mutual fund. The "net asset value" of the plan (surplus or deficit, adjusted for taxes) may be added to the value of the operating company. The company would then be assessed independently for its different lines of business: its core business(es) and this additional "mutual fund" represented by the pension plan. Under this methodology, the value of the core operating company would be developed independently of the value of the pension plan "mutual fund" (for example, as a multiple of operating income). The exception would be to include the value of newly accrued benefits ("service cost") as a

current operating expense for the "core" business. Coronado and Sharpe (2003) showed that this is not how the market values sponsors. Instead, reported pension earnings are assigned the same multiple as the operating company. Thus, under FAS 87 and for the period of their study, a company that increases its earnings by investing in assets with high expected returns will be more highly valued than the company that puts all its pension assets into bonds.

- **Risk:** Investors do collectively balance risk and reward in their investment portfolios, maximizing their returns for a given level of risk. But, unlike the corporate finance view, shareholders will not always include value-adding transactions (e.g., a shift of pension assets to bonds) in their valuation of a company unless they believe that other market participants will soon perceive that value has been added. Value not perceived might just as well be value not added.

  It may also be that the smoothing mechanisms in current contribution and accounting calculations mute the risk of holding equity investments in the pension plan. Investors do not immediately experience the gains or losses of investment risk, so their perception of the risk is less than the pension finance model would indicate.

- **Default:** The pension finance model in Section 4 does not anticipate an entity like the PBGC. When we add the PBGC to the pension finance model, we find that the world of pension finance has more than one answer when circumstances differ from case to case.

In 1976, shortly after ERISA and after Treynor defined the augmented balance sheet, and still several years before the work of Irwin Tepper and Fischer Black, William F. Sharpe wrote a paper that argued in favor of underfunded plans with 100 percent equity investments. Sharpe (1976) noted that the newly created PBGC was writing puts to all plan sponsors on undifferentiated terms—i.e., sponsors were charged the same per head PBGC premium regardless of how well their plan was funded and no matter how invested. Under these circumstances most benefits would be fully protected and employees would concede wages based on the PBGC-insured value of the pension promise, not on the pension's market value. The market value of the plan liability, without the guarantee, could be minimized by underfunding the plan and by investing entirely in equities. This combination maximizes the value of the "PBGC put" (the right to dump the plan on the PBGC when it is far underwater) held by shareholders. Sharpe ignored taxes.

After the publication of the Tepper and Black papers, Harrison and Sharpe (1983) revisited the asset allocation issue, this time considering both taxes and default. They concluded that weak sponsors with underfunded plans should invest entirely in stocks, while strong companies or companies with well-funded plans should invest entirely in bonds.

What about the "Real" World?

With so few plan sponsors adopting the conclusions of the pension finance model, how should today's actuary view the model? Many actuaries suggest that since the model does not correspond to current behavior, the model is flawed and should be discarded. We need to keep in mind that economics is a science. As such, economics not only tries to explain past and current behavior; it also tries to help us anticipate future behavior.

Certainly, actuaries will be hesitant to suggest an all-bond portfolio to their clients today. Historically, there have been excellent reasons not to pursue 100 percent bond allocations. Even those few who have gone to bond strategies have often done it for other reasons. In recent years, risk management has led some sponsors to reduce pension equity exposure and to lengthen their bond portfolios to approximate liability durations. In the early 1980s, a number of plans immunized some or all of their liabilities through duration-matching bond portfolios, but this was generally motivated by extremely high interest rates and a desire to coerce actuaries to lower pension plan contributions.

However, there are forces already in play (e.g., the revision of FAS 87) that make the all-bond strategy worthy of consideration today and, perhaps, worthy of implementation tomorrow. Even if you disagree, you will want to know enough about the strategy, and the model and assumptions, in order to converse intelligently with the financial officers of your clients and to counsel them if and when a changing environment changes your mind or, just as importantly, the financial officers decide they wish to pursue the strategy.

Section 9 continues the discussion of pension investing.

Pension Liabilities

One of the primary functions today's pension actuary performs is the calculation of a pension plan's liability. You will find that pension finance focuses considerable time on a plan's market liability. However, this is not the only liability of interest. Pension finance utilizes the following three different liability calculations:

1. **Market liability:** A measure of value determined as the market value of a *reference portfolio* comprised of traded securities. A reference portfolio matches the benefit stream in amount, timing and probability of payment.

2. **Solvency liability:** A measure of value determined as the market value of a *defeasance portfolio* comprised of risk-free traded securities (e.g., U.S. Treasuries). A defeasance portfolio matches the deterministic benefit stream in amount and timing, but, unlike the reference portfolio used to measure the market liability, payment is assumed to be certain.

3. **Budget liability:** The traditional actuarial accrued liability used to budget cash contributions over a period of years.

Most pension actuaries are familiar with the budget liability as defined above. This is a measure that we use routinely in developing contribution amounts. The solvency liability and market liability as defined above are less commonly used in current practice, if they are used at all. The market liability is akin to the ABO measure envisioned by FASB. The solvency liability might be equivalent to an annuity quote, the PBGC vested liability or the ABO discounted at a riskless rate. To begin our discussion, we will spend the next few paragraphs discussing market liability. Let's put actuarial cost methods to the side and consider the following discounted cash flow exercise.

Company A has an outstanding loan. The terms of the loan provide that A will pay the lenders $1.5 million per year for the next 10 years. The re-payment schedule is shown in Table 4.

Table 4	Re-payment schedule for 10 years									
	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr7	Yr 8	Yr 9	Yr 10
Payment ($ million)	$1.5	$1.5	$1.5	$1.5	$1.5	$1.5	$1.5	$1.5	$1.5	$1.5

If Company A's debt is publicly traded, the financial markets will place a price tag on this debt and the market value of the future cash flow from A will be clear. Note that the market value of the debt payments is, by definition, the same as the discounted present value of the payments. As pension actuaries, we usually think of discounted present values as *liabilities*. It is important to note that the market value of a cash flow and the market liability of a cash flow are synonymous.

Law of One Price

Financial economics tells us that two cash flows that are identical in amount, tax treatment, credit risk, liquidity, etc. must have identical market values. If this were not the case, there would be an arbitrage opportunity to exchange the higher-priced cash flow for an identical cash flow at a lower price. This is known as the Law of One Price.

Now consider that the cash flow requirements for Company A in Table 4 are future nonqualified[5] pension payments to be made from company assets rather than debt repayments to lenders. What is Company A's market liability for the pension payments? If the nonqualified pension payments and debt repayments are equally creditworthy, all we have done is change the label on the payment stream. The market liability for the nonqualified pension payments should be identical to the market value of the debt repayment.

What if the future cash flows in Table 4 are benefit payments from a qualified pension plan? What is Company A's market liability for those pension payments?

If the qualified pension payments and debt payments are equally creditworthy, the source (qualified plan or company assets) of the payments is irrelevant. Thus, pension finance suggests the market liability of a pension plan should be determined by looking at how the financial markets price similar cash flows. Cash flows from bonds may be closely matched to pension payments, and thus, financial economics looks to the discount rates inherent in the debt markets to determine pension liability market values. It is important to note that, from this perspective, the determination of a market liability is **not** based upon the expected investment return of assets held in trust. Do financial economists include the plan assets at all in the market liability determination? Yes. The assets collateralize the debt. Thus, the assets help determine the credit risk of the payments—which is reflected in the market liability.

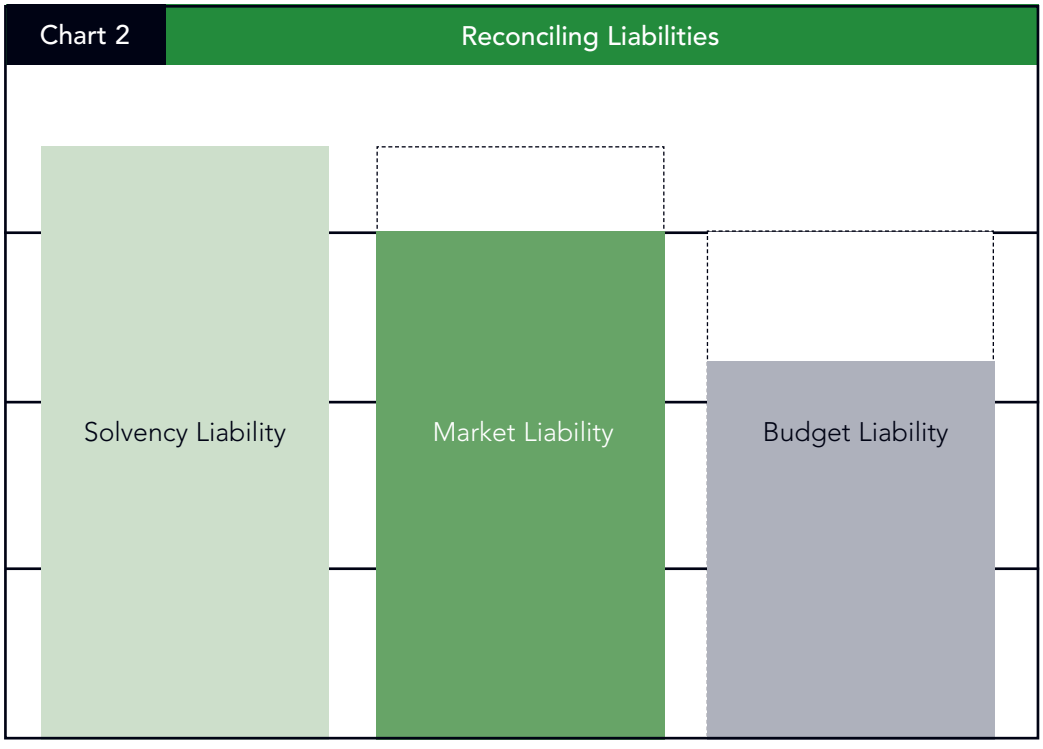
Although the example above is good for illustration purposes, actual pension cash flows are rarely as neat and orderly. Pension payments often span several decades and may extend beyond the liquid debt market. Pension payments also have contingencies as to timing and amount. Although these complications make it difficult to find a matching cash flow, the debt markets should be a starting place for a market liability calculation.

[5] The key distinction here is that there are no assets segregated to act as collateral for promises under such plans.

Chart 2 shows the relationship between the solvency liability, the market liability and the budget liability that we would typically find in today's market (ca. 2005, with market interest rates far below typical actuarial accrued liability discount rates). The budget liability in Chart 2 is determined under the unit credit funding method with no reflection of future salary increases.

The difference between a plan's market liability and its solvency liability is default risk. The solvency liability, by definition, does not reflect any risk that benefit payments will not be made.

Discount rates usually account for a big portion of the difference between the market liability and the budget liability. In calculating the budget liability (or actuarial accrued liability), today's pension actuary often uses a discount rate that is based on the long-term expected return on the pension assets held in trust. This rate is usually higher than a pure bond market rate, because most pension plans have a significant portion of their assets in equity investments. Traditional actuarial practice reflects a "risk charge" (the anticipated equity premium) in discounting future pension cash flows. Chart 2 identifies the anticipated equity premium as the difference between the market and budget liabilities.



2005 Economic Environment

Pension Liabilities continued

A central theme in pension finance is that the budget liability is not the market liability, with which it has been confused. This confusion can lead plan sponsors to under-appreciate or be unaware of the risk they carry. Chart 2 depicts the plan's market liability as a combination of the traditional accrued liability and the associated risk charge the plan sponsor carries with its investments. The total of those two items equals the market value of the plan liability.

The budget liability can be viewed as a funding target that the plan sponsor can set above or below the plan's market liability. In today's economic environment, plan sponsors will often set this target **below** the plan's market liability. Actuaries who were practicing in the 1980s will remember times when a plan's funding target was often set **above** the market liability. When the funding target is set below (above) the market liability, plan sponsors effectively borrow from (lend to) employees. This "borrowing" is a source of capital and reminds us that setting the funding target is a corporate finance decision. (Section 8 contains further discussion about borrowing from employees).

The challenge for today's pension actuary is to try to educate plan sponsors on how to interpret the different pension liabilities we produce. When a plan sponsor is told that its plan's market liability is $100 million while the plan's traditional actuarial liability is $90 million, how can we help them understand the difference and correctly interpret the two numbers?

Pension Accounting

Financial statements are intended to provide users with decision-relevant information about an entity. In the case of DB pension plans, the most straightforward accounting would measure the liabilities (Section 6) and the assets at fair market value each period. This information would appear on the balance sheet.

The net difference between the balance sheet items one period and the next would be the pension expense in the income statement. For a more complete understanding, this total difference needs to be subdivided into, at least, the following three components:[6]

- **Charge against operating income** = the price of benefits awarded in lieu of compensation, i.e., the service cost.
- **Financing charge** = the liability return[7] minus the actual return on assets.
- **Charge against other income** = the remainder, i.e., demographic gain/loss, demographic assumption changes and amendments.

Users of financial statements want a clear understanding of these three components. They would like core earnings to include charges that are part of the core business (e.g., service cost). They would like to track, but not consider in the evaluation of the core business, charges against other income.

FAS 87 accounting is regarded as seriously deficient not only by financial economists but also by a wide community of accountants, actuaries, investors and government agencies. The principal complaints are:

- Pension assets and liabilities are measured at other than fair value.
- Pension assets and liabilities often do not appear on the balance sheet at all.
- Pension expense is presented as a single number in the corporate income statement whereas different components of pension expense should be characterized as operating income, financing charges or charges to other income.
  - As a result, a distorted pension expense enters into earnings per share and share prices influencing market capitalization and executive compensation.

[6] The reader should note that the second and third bullets do not represent the typical practice of analysts today.

[7] The change in liabilities due to accrual of discount and changes in interest rates.

- Changes in liabilities and assets are smoothed.
- A sponsor's plan liability, and thus expense, is measured with reference to future salaries.

With regard to the final bullet point, financial economics notes that accumulated benefit obligation (ABO) pricing of pensions would produce a fairer exchange of benefits and salary than would projected benefit obligation (PBO) pricing. With PBO pricing, the shareholders will see a charge for future salary increases while the employee will receive a benefit based on current salary—a mismatch. Moreover, the employer may freeze or terminate the plan and take a curtailment gain. Without an enforceable multi-period contract between the employer and the employee, employees are at a disadvantage in this case. With no basis for the employee to assume that he will be entitled to anything more than his accrued benefit, he will have to accept lower current pay in return for a promise that his employer can unilaterally rescind.

Pension Funding

Pension finance looks at plan funding from an employee/shareholder contracting perspective and, **without** the PBGC, concludes the efficient contract would include full funding. In this section, we first review this perspective. We then reconsider the case **with** the PBGC in place.

Let's look again at the augmented balance sheet first introduced in Section 4. In that section we looked at the arbitrage for a group of investors investing in bonds. Now we investigate a second arbitrage, issuing debt to fund the pension plan. The pension liabilities are unchanged from Section 4 at $480 million. This time, however, we will assume plan assets are $460 million instead of $500 million. In this case, we typically say that the plan is underfunded by $20 million. But, is the plan really underfunded? Or, is it just not fully collateralized with marketable securities? If the plan sponsor really has promised the benefits, we can see that the pension trust contains a $20 million promise from the plan sponsor.

As introduced in Section 4, Figure 2 shows the augmented balance sheet adjusted for corporate taxes and illustrates a key economic point. Since the employer stands behind the pension promise and is on the hook for the contributions to the plan, the employer is indebted to the pension plan. In the rational, transparent world of economics, lenders and shareholders view this employer debt as no different from any other employer debt. In fact, funding rules and the existence of the PBGC combine to make this a "fuzzy" debt. In order to follow the pension finance perspective, let's unplug the PBGC for now and assume that lenders and shareholders view the employer's $20 million pension debt as equivalent to $20 million of any other employer debt.

PBGC Unplugged

Without the PBGC, economic theory tells us that shareholders and lenders would view unfunded pension obligations as they would view any other sponsor debt. But, how should employees think about the employer promise? Should employees attach the same value to the employer's pension promise that an arm's length lender would attach to a similar obligation of the plan sponsor?

Employees are already exposed to the fortunes of their employers. Lending money, when you're already exposed, is a concentrated risk. Arm's length lenders are careful to diversify. Employees cannot diversify their exposure to their employer. Thus, finance theory says, employees should charge their employer a higher rate of interest. Employees should say "I'll give you less for your promise because you represent a bigger risk to me." Whereas an arm's length lender might give the employer a $20 million loan, the employees should only be willing to offer, say, salary reductions of $19 million for the same promise of future cash flows.

Figure 2

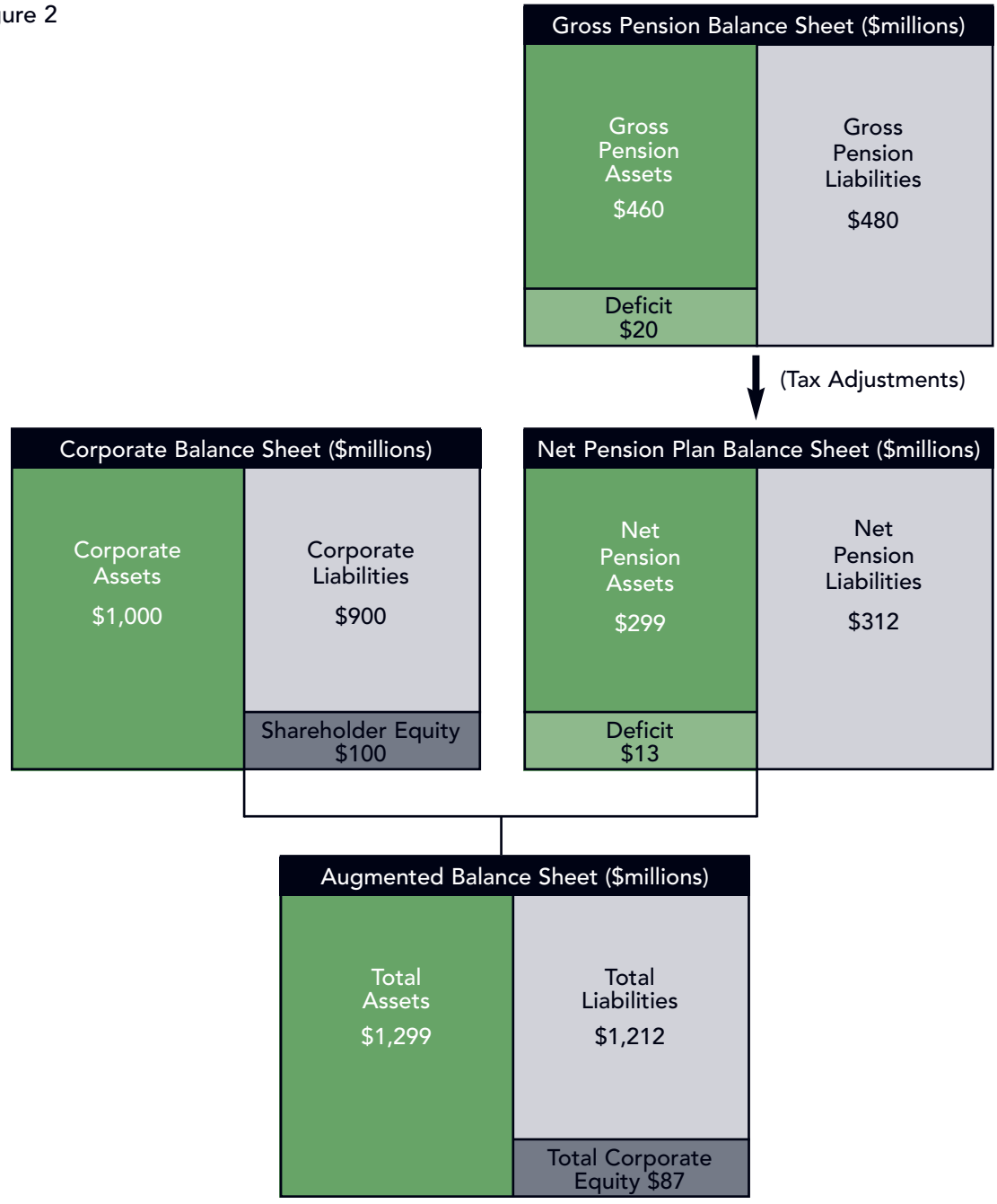
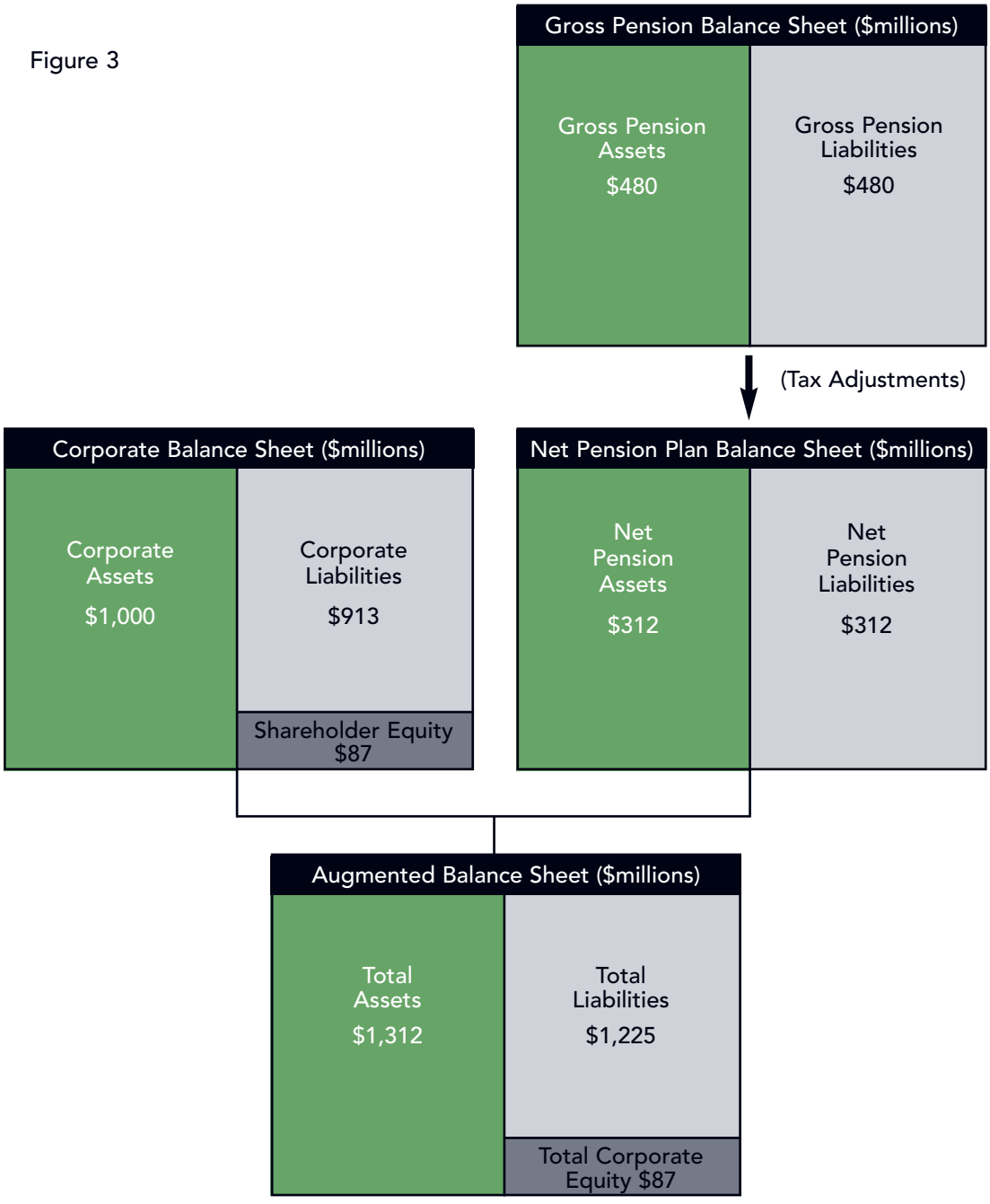


Figure 2 demonstrates that uncollateralized employer pension debt should be avoided. Thus, we have the basis for the pension finance conclusion that pension plans should be fully funded.

In order to fully fund the plan, the employer could simply write a check for $20 million, which directly impacts cash flow. However, assuming a 35 percent corporate tax rate, the employer

Figure 3



could instead issue debt for $13 million and supplement this with a $7 million contribution. Ignoring timing, the actual tax deduction on the entire $20 million contribution, at our assumed corporate tax rate of 35 percent, would replenish the $7 million contribution. Thus, cash flow is not impacted by this strategy. Figure 3 shows the augmented balance sheet if our employer issued $13 million of debt and placed the sale proceeds in addition to a $7 million contribution to the pension plan.

Economists argue that the employer's debt positions in Figure 2 and Figure 3 are identical. In the scenario behind Figure 2, the employer owed the plan, and thus its participants, $20 million ($13 million net of taxes). In the scenario behind Figure 3, the employer owes its lenders $13 million. In this scenario, rational employees should be much more confident in the pension plan and place more value on it.

The shareholders are also better off because full funding can create a tax arbitrage. The interest on debt raised in the capital markets is tax-deductible. The interest on debt raised from employees through underfunding is only tax-deductible when finally paid.

PBGC Plugged In

OK, but the PBGC does really exist. How does that change the picture? For some plan sponsors, it changes the picture entirely.

For some plan sponsors, the price of insurance from the PBGC is cheap. Some plan sponsors have poorly funded plans and dim financial prospects. For these sponsors, the price the PBGC charges to underwrite the pension benefits the sponsors have promised to employees is very attractive. In these situations, it might make sense for the plan sponsor to take advantage of the PBGC insurance and not fully fund their plan(s).

The existence of a pension insurance system like the PBGC encourages financially weak plan sponsors to offload debt onto financially strong sponsors. In fact, the system actually encourages weak sponsors to make unfunded pension promises to participants because the cost for making these promises is small compared to the value the participants receive. Unless the cost of the insurance is borne by sponsors in proportion to the risk they are creating, pension insurance drives strong employers away from the system and encourages weak employers to transfer their obligations to third parties. If not controlled, this moral hazard can cause a cost spiral and destroy the private pension system.

Financial economics evaluates the PBGC system in terms of financial efficiency and financial incentives. Others will look at the system and add ethical and public policy points to the discussion that we have not.

Further Thoughts on Pension Plans as Debt

This section argues that employer debt is created by a plan that is not fully collateralized (market value of assets in trust is less than market value of liabilities). Once you adopt this perspective, you can see that the funded status of a pension plan becomes a debt management question for the sponsor. Should the sponsor be indebted to the pension plan? If so, how much pension debt should the sponsor carry? What are the characteristics of pension debt compared to debt owed to third-party lenders?

This section also argues that the PBGC currently makes pension debt cheap for some plan sponsors, encouraging them to underfund.

Financial professionals working for the plan sponsor are usually comfortable with this pension debt perspective. Discussions between actuaries and sponsors about funding levels can often be clarified by bringing in this perspective.

Pension Investment

This section assumes that the reader has gone through the prior sections. It further assumes some familiarity with general investment principles and the major investment tools available. Readers of prior sections will note that we discussed whether pension plans should hold equity investments elsewhere. We do not address that issue in this section.

Under financial economics, the driving force for investing pension assets is corporate finance, not portfolio selection. Thus, whether equities or bonds provide higher expected returns is irrelevant. Pension investing seen through the financial economic lens has nothing to do with the size or even the existence of an equity risk premium. The equity risk premium is a critical feature of portfolio theory and analytics, but is all but irrelevant to corporate finance.

In the corporate finance paradigm the right question is not which asset class has a higher return, but, rather, where in the corporation's capital structure should risk be taken? Taking risk in an attempt to pursue higher return comes at the cost of increased potential for underperformance. The financial economic answer to where risk should be borne was largely provided in Section 4. Given the current tax structure, where excess returns that arise from equity risk bearing are taxed at a lower rate than fixed income, it is more tax efficient to take such equity risk (beta) outside of the tax-sheltered pension plan.

There are, however, three other major risks usually taken in pension investing that merit consideration. These are *interest rate risk* (duration mismatch), *credit risk* (from investing in bonds that can default) and the *risk taken to generate returns in excess of benchmarks* (alpha). The returns associated with these risks are generally not tax-advantaged to individual investors and we need to consider when and if such risk bearing is justified from the shareholder perspective.

Interest Rate Risk

The duration (interest sensitivity) of traditional DB pension liabilities is typically in the range of 12 to 15 years; i.e., a 1 percent change in interest rates commonly changes pension liabilities by about 12 to 15 percent. If the pension plan is large relative to the corporation, this interest sensitivity may add considerably to the overall interest sensitivity of the corporation's financial health and, unless addressed, will cause the corporation to be vulnerable to declining interest rates. The overall sensitivity of the corporation usually stems from three major sources: business operations, outstanding balance sheet debt, and the pension and other postemployment benefit (OPEB) plans. The corporation can manage this risk by shortening the duration of its outstanding corporate debt and/or lengthening the duration of plan assets. These strategies may be executed in the cash market or by using swaps and/or other derivatives.

Financial economics takes the position that interest rate bets are taken by individual investors who will adjust any interest rate bet taken by the corporation to suit their own individual preferences. This is not to imply that individual investors make portfolio changes every time one of their stocks tweaks its interest rate position a tiny bit, but simply that the broader market will respond to changes in the overall level of interest rate risk in specific corporations. The driving force is thus not the existence of a duration mismatch, but rather second order impacts of such mismatch that cannot be reversed by the investor. In pension finance such second order impact is caused by the asymmetry of surplus versus deficit to shareholders.

Pension surplus, especially significant surplus that sometimes arises when the "risk game" is won, may not inure to the benefit of the shareholder. If returns for bearing risk are poor, the shareholders make up each dollar of poor return through higher contributions. If returns for bearing risk are superior and end up producing a pension surplus, shareholders may not be able to capture a full dollar of value for each dollar of overfunding. In the United States, for example, excise taxes essentially prevent excess pension assets from reverting to shareholders. Shareholders bear the full brunt of poor performance, but do not get the full benefit of good performance.

Thus, because the surplus may not be fully available to stockholders whereas deficits must be financed, it will pay equity holders of stronger corporations to avoid any significant asset liability mismatch. For weaker companies with poorly funded plans, the situation is reversed. Such companies may deliberately mismatch knowing that they can use the entire upside value, while the PBGC will bear much of the downside risk.

Credit Risk

Credit risk is costly to shareholders because lenders demand higher coupons (credit spreads) for riskier debt. Unlike equities, which are currently taxed at low personal tax rates, high yield bonds are heavily taxed. Consequently, tax considerations point to taking credit risk inside the tax-sheltered portfolio (the pension plan) even though fiduciary and risk considerations may suggest otherwise.

Pursuit of Alpha

If a pension plan, by virtue of size, has access to lower cost or better managed investments than an individual investor, then there could be an argument for pursuing such investments. Many financial economists doubt such claims and there is no clear answer to this question.

Pension-Finance-Based DB

Pension finance generally rejects attempts to add value by manipulation of funding levels and investments in equities. Value may be found, however, in plan design. Labor economists view pensions as contracts between employees and shareholders which define a portion of total compensation. Value is added when such contracts lower total compensation costs or increase worker productivity. Compensation costs may drop when compensation is made more tax effective or when employee risk exposures are reduced. Worker productivity may be increased when the pension contract is designed to attract, retain, and motivate employees and ease their transition into retirement—in short, workforce management.

Workforce Management

- **Attraction**: Actuaries used to think it was obvious that traditional DB plans would attract new employees. In the last two decades, it has become clear that young employees—those who aren't currently thinking about retirement—prefer individual account balances and the opportunity to spend their "retirement" savings (through cash-outs) long before they retire. One source of dissatisfaction among the young may be traced to the PBO accounting that overvalues their benefits in comparison to the ABO values that they are actually earning. (Solutions to this problem may have to be found at the societal level, where tax favor can be directed at those plan designs that encourage long-term savings and lifetime payouts.)

- **Retention**: Retaining employees may be cost-effective in situations where investment in training prepares employees to be more productive. This is especially true when the training develops skills that are not firm specific, skills that may be used by competitors as well as by the company that invests in training. DB plans were designed with vesting rules to protect such investments. Occasional vesting abuses and the seemingly minor cost associated with earlier vesting made room for ever tighter vesting laws and regulations. Curiously, however, some benefits still may be offered with very long cliff vesting, e.g., early retirement subsidies and post-employment medical.

- **Motivation**: Vesting rules can also be used to motivate employees who lose unvested benefits when they quit or are fired. Class-year vesting (not permitted for DB plans) can make employees pay for their own exit, and thus strive not to be fired. Final pay plans also make early exits appear to be costly to employees—but pension financial analysis indicates that this is only true if they have been charged PBO prices for ABO benefits.

- **Exit**: DB plans of all sorts have been used to manage the retirement transition. Early retirement subsidies, Social Security supplements, window plans and phased retirement programs are examples. Some of these ideas were designed to move us through specific demographic or economic conditions, e.g., making way for the baby boom, and may no longer be useful. Value-oriented transparent analysis can help us design more cost-effective approaches. Poor accounting and funding rules can often lead to value-destroying designs.

For more on the economics of workforce management, the reader may wish to read Gold (2005) and the works cited therein. Especially pertinent are Lazear (1979, 1983), Bulow (1982) and Balan (2003).

Reducing Employee Risk Exposures

DB plans often contain ancillary risk-reducing features such as disability, death benefits and various forms of annuities. In the last two decades, there has been a shift away from mandatory annuities and towards greater employee choice, including lump sums.

Economists, following the trail set by Franco Modigliani's investigation of life-cycle saving and investment, recognize that fairly-priced annuities create value by pooling longevity risk across a cohort of comparable risk-averse retirees. The option to elect lump sums may be attractive to many employees, but the cost of such options is likely to be borne by shareholders, other employees and by society generally. An extended discussion of this issue with emphasis on the societal costs may be found in Gold (2003).

Designing for Value

Pension finance actuaries have only begun to apply the lessons of economics (especially the economics of labor contracting) to the issues of benefit design. The list of topics being debated is a long one and beyond the scope of this paper, which has the limited objective of outlining the principles.

Pension finance brings a new perspective and some opportunities to think about how benefit design can enhance labor contracting. Some of the implications may directly affect benefit designs in the near future; others may affect national policy and the regulatory environment. With economic insight, the profession can look for win-win results—policies that encourage productivity-enhancing, risk-reducing designs and the freedom to innovate in search of value.

Conclusion

Financial economics has something to say about almost all aspects of a pension actuary's core work for plan sponsors. We have seen that financial economics informs:

- **Actuarial liability determination**: Pension finance utilizes three measures of liability.

  1. Market liability: A measure of value determined as the market value of a *reference portfolio* comprised of traded securities. A reference portfolio matches the benefit stream in amount, timing and probability of payment.

  2. Solvency liability: A measure of value determined as the market value of a *defeasance portfolio* comprised of traded risk-free securities, e.g., U.S. Treasuries. A defeasance portfolio matches the deterministic benefit stream in amount and timing, but, unlike the reference portfolio used to measure the market liability, payment is assumed to be certain.

  3. Budget liability: The traditional actuarial accrued liability used to budget cash contributions over a period of years.

- **Pension accounting**: Fair market value measurements for assets and liabilities are the appropriate measurements for financial statements.

- **Pension funding**: Pension plans are a form of employer debt which should be fully funded. For financially weak sponsors, however, the option to have unfunded liability supported by the PBGC can change the analysis so that leaving a plan unfunded makes economic sense.

- **Pension investment**: The driving force for investing pension assets is corporate finance, not portfolio selection. Thus, whether equities or bonds provide higher expected returns is irrelevant. In the corporate finance paradigm the right question is not which asset class has a higher return but, rather, where in the corporation's capital structure should risk be taken? Given the current tax structure, where excess returns that arise from equity risk bearing are taxed at a lower rate than returns from fixed income, it is more tax-efficient to take equity risk (beta) outside of the tax-sheltered pension plan.

One of the largest lessons that financial economics teaches us is that a pension plan needs to be evaluated as part of the plan sponsor's overall enterprise. Analysis that looks at the pension plan as a self-standing entity is incomplete and too narrow. The effect of the pension plan on shareholders, employees and other stakeholders must not be ignored.

As stated in the introductory pages, this guide focused on single-employer plans sponsored by private employers with widely-held stock. The reader is encouraged to consider how the lessons of financial economics can be applied to other types of plans, e.g., multiemployer, church, single-proprietor or public plans.

The reader is also encouraged to consider how the lessons of financial economics might inform actuarial standards of practice. The lessons in financial economics can be applied in the assumption-setting process, as well as other areas of actuarial practice.

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Further Reading

Actuaries interested in financial economics may wish to delve more deeply into the subject than this guide permits. This section provides a pension finance bibliography which is more representative than exhaustive and which favors papers by actuaries over papers by others.

Where textbooks are listed, we have tried to include books that have appeared on the basic education syllabus of the Society of Actuaries.

Pension Finance Resources at SOA

The Society of Actuaries' Web site includes a pension finance resources section. Just go to www.soa.org, click on section and practice areas, sections, pension, and resources.

When possible, papers in this bibliography may be found on the site. Many of the classic papers in financial economics, however, are restricted by copyright and may not be mounted on the SOA site. The citations include sufficient information for the reader to track these papers elsewhere. We suggest that you explore resources in public and university libraries and the Internet.

The bibliography is organized in accordance with the sections of the guide. Several papers are included in a miscellaneous group at the end of the list.

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