I

Economic Design of Cash Balance Pension Plans

by Jeremy Gold, FSA, PhD

Abstract

Black (1980) and Tepper (1981) showed that shareholders would gain if corporate defined benefit pension assets were invested in taxable fixed-income securities instead of equities. This paper extends their analyses to cash balance plans, concluding that additional shareholder gains arise when plan liabilities mimic equities. A numerical example demonstrates that the present value of riskless gains to shareholders can exceed the entire after-tax value of plan assets. Lack of transparency in actuarial methods and assumptions is shown to impede implementation

1. Introduction

Extending Black (1980) and Tepper (1981), this paper demonstrates that cash balance plans should invest all of their assets in taxable fixed-income securities (e.g., T-bills) and credit employee account balances with the total return on an equity index (e.g., the S&P 500). This result challenges common sense, actuarial intuition, and the current practice of all such plans. To derive this conclusion we, as did Tepper and Black, need to rely upon arbitrage principles and economic transparency. Tepper and Black, however, took transparency for granted, neither asserting it as a necessary condition nor noting that actuarial methods and assumptions stood as an opaque barrier. Let us begin by looking at transparency and arbitrage.

1.1 Transparency in Economics

In economics, transparency describes an ideal condition in which all interested parties have costless access to the best information. In an allied sense, transparency refers to the ability of market participants to see through to the economic realities of an enterprise or a transaction. Rational agents operating in a transparent environment make efficient decisions. Lack of transparency is costly. A familiar example to actuaries is adverse selection, which leads to a tradeoff between the benefits of accurate information and the costs of underwriting. Lack of transparency may also be engendered by arbitrary averages and amortizations such as those found in accounting and actuarial valuations.

In science, it is common practice to study idealized frictionless systems first, before incorporating inevitable frictions. In economics, as in the physical sciences, the greatest insights and the broadest principles are developed absent friction. Economic frictions include lack of transparency, transaction costs, taxes, regulatory barriers, costly bankruptcy, etc.

Section 2 lays out the assumptions for a frictionless model. Taxes are factored in almost immediately (Section 3) and lead directly to the model's primary result: In the interests of shareholders, cash balance plans should invest entirely in taxable fixed-income securities and credit plan balances with the total returns on a benchmark equity portfolio. This creates remarkably large gains to shareholders (Section 4). Section 5 explains current practice as a logical outcome of the lack of transparency introduced by actuarial methods and assumptions. Finally, regulatory issues may limit, but not reverse, full implementation of the primary results. A practical partial implementation under a transparent actuarial/accounting regime combines fixed-income investments with employee choice of return benchmarks. Section 6 offers some conclusions.

1.2 The Role of Arbitrage in Modern Finance

Modern corporate finance begins with Modigliani and Miller (M&M 1958). M&M conclude that, in a frictionless framework, firm value does not depend on capital structure. The result alone would make their paper important, but its significance is even greater because it is the first paper to use an arbitrage argument as its logical backbone. The absence of arbitrage opportunity in equilibrium has become the central tenet of modern finance. The principle is simple: If two or more, seemingly different, financial instruments or strategies

produce the same cash flows in all states of nature, then they must have identical present values.

In the M&M world, investors can borrow money at the same market rate that is available to the firm. Following their reasoning, we can suppose that Firm A is entirely equity-financed; the equityholders own all the cash flows generated by the firm assets. Firm B, otherwise identical, is 50% debt-financed; its equity holders are entitled to all the net cash flows after debt payments are made. Observe that an investor can create the same cash flows that Firm B shareholders receive by buying an A share with 50% borrowing. Such a position must trade at the same price as shares of B. If it does not, an arbitrageur can profit risklessly by buying one and selling the other short.

When transactions occur in an accessible transparent market, all arbitrage opportunities are visible to all investors. For any entity with marketable assets and liabilities, this is sufficient to establish a unique market price for its shares. The market price cannot drift far before some investor offers to buy (sell) any under (over) priced share. Although the argument is made in terms of an opportunity for an independent arbitrageur, it is not necessary for a special class of arbitrage investors to be active. Investors need only be prepared to establish or unwind positions using the financial instruments most favorable to them.

Frictions do not generally prevent the development of a market price by an arbitrage argument. If some investors can borrow more cheaply, if transactions are costly, if bankruptcy is costly, if information is costly, a range of prices may be developed in which no arbitrage opportunity exists. The market price, not unique, will be in that range.

1.3 From Modigliani-Miller to Black and Tepper, Briefly

The original M&M propositions assume no taxes. Miller (1977) defines three key marginal rates applying to corporations (t_c), individual bond holdings (t_{pb}) and to individual stock holdings (t_{ps}). When the following relationship holds among these tax rates, the original M&M indifference result holds:

$$(1-t_c)(1-t_{ps}) = (1-t_{pb}).$$

When, as is frequently the case in practice, the right-hand side is larger, a marginal gain for shareholders may be achieved by increasing corporate debt

while shareholders reduce their borrowing. This implies that corporations should be entirely debt-financed. An extensive literature addresses the additional considerations that limit debt financing.

Treynor (as Bagehot 1972) introduces the idea of the "augmented balance sheet" to analyze the role of defined benefit (DB) pension plans in the corporate structure. This approach depicts the plan as a financial subsidiary of the corporation. With transparency, shareholders of the corporation recognize that they own the corporate assets less the corporate liabilities plus the pension surplus. After allowance for taxes, marginal changes in the pension surplus flow directly into shareholder wealth. Treynor's financial integration of the corporation and the plan deliberately ignores the separation of the entities under law and regulation. Section 5 discusses how legal separation may curtail full implementation of the shareholder-optimal cash balance plan.

Black (1980) and Tepper (1981) combine Miller (1977) and Treynor (1972), concluding that equities held by DB plans should be exchanged for fixed-income assets. After this exchange is reversed at the corporate level (Black) or in the hands of shareholders (Tepper), shareholders receive a riskless tax-based gain.

The subsequent literature has been primarily empirical and has generally concluded that corporate plan sponsors have not implemented the Tepper-Black proposals.[1]

2. Model Approach

I employ two cash balance models herein. Each invests a fraction ($0 \le a \le 1$) of the assets in equities with the remainder in fixed income and defines the investment crediting rate based on a hypothetical portfolio that invests a fraction ($0 \le b \le 1$) in equities and the remainder in fixed income. Thus, plan designs may be characterized by this parameter pair $\{a, b\}$. For any deviations from an $\{a = 0, b = 0\}$ base case, each model requires offsetting investment and financing arrangements by the corporation or its shareholders.

[1] A recent exception may be found in Myers (1999).

The "Tepper" model traces the risks and returns of the pension plan through to the hands of the shareholders. The shareholders adjust their personal portfolios to offset any pension changes from the base case, restoring their pre-tax distributions of wealth. I measure the effects of this hedging by looking at the changes in the total personal tax liabilities of shareholders.

The "Black" model follows the risks and returns of the pension plan to the after-tax corporate balance sheet where they are neutralized by changes in the firm's capital structure. Decreases in a or increases in b imply repurchase of the firm's own shares financed by issuance of new corporate debt. For diversified and optimized shareholders, this might necessitate the reallocation of their equity holdings between the shares of the plan sponsoring firm and other firms. I measure the effects of the Black model by looking at the tax liabilities of the corporation.

2.1 Assumptions

The models are based on the following assumptions: about markets (A.1 -A.7), about relative tax rates (A.8), about the operation of the cash balance plan (A.9 and A.10) and about employee compensation (A.11):

A.1 The shares of the corporation are marketed (i.e., traded in a liquid market).

A.2 Shareholders diversify assets to reflect their preferred distribution of returns.

A.3 Shareholders hold fixed-income securities or else can borrow at the market rate.

A.4 Securities may be traded without transaction costs.

A.5 The plan holds, as assets, a portfolio of marketed securities.

A.6 Corporation and pension plans are ongoing; probability of bankruptcy is negligible.

A.7 Transparency: The market value of the corporation accurately reflects the marginal value of any marketed securities held.

A.8 Taxes: Total returns on fixed-income assets held by individuals are subject to higher effective tax rates than are the total returns on equity assets; corporate contributions to pension plans are tax deductible. Tax rates are fixed for all time and companies and shareholders continue to pay taxes in their current bracket.

A.9 Plan demographics are sufficiently predictable to be modeled without uncertainty.

A.10 The investment crediting rate to be applied to account balances is set periodically in advance and is equal to the total return (whether positive or negative) for the period on a benchmark portfolio made up of marketed securities.

A.11 Each employee's compensation, as well as the compensation crediting rate applied thereto, is set without regard to the investment crediting benchmark and without regard to the plan asset amounts and investment returns.

Assumption A.6 means that we are focusing on generally well-funded plans sponsored by successful companies. I exclude those plans that are so well funded that the plan sponsor cannot, even over time, avoid excise taxes on excess assets.

A.7 is the most controversial assumption. In the cash balance case, even though the plan assets and liabilities may be readily valued in current dollars, the actuarial methodology that cash balance plans inherit by virtue of their status as DB plans allows liabilities to be arbitrarily valued and plan costs to bear only the slimmest relationship to the changing current values of assets and liabilities.

3. Transparent Model

3.1 With Marketed Assets, Market-Benchmarked Liabilities, and Without Tax Considerations

Consider a transparent pension plan without taxes:

Let $\mathbf{A_P}$ = pension plan's assets.[2]
Let $\mathbf{L_P}$ = pension plan's liabilities.[3]
Let $\mathbf{E_P} = \mathbf{A_P} - \mathbf{L_P}$ = plan net worth, by A.7.

Consider a business entity with all values at market:

Let $\mathbf{A_B}$ = business' assets, valued at market.
Let $\mathbf{L_B}$ = business' liabilities, at market.
Let $\mathbf{E_P} = \mathbf{A_B} - \mathbf{L_B}$.

Consider the pension plan as a transparent financial subsidiary of the business entity that sponsors it. Such an approach follows the *augmented balance sheet* concept introduced by Jack Treynor (as Bagehot 1972 and Treynor et al. 1976, 1978). Figure 1 is based on the 1978 article.

Figure 1
Augmented Balance Sheet
(at Market value)

Assets	Liabilities
$\mathbf{A_P}$ = Pension portfolio	$\mathbf{L_P}$ = Present value of pension obligations
$\mathbf{A_B}$ = Corporate assets	$\mathbf{L_B}$ = Corporate liabilities
	$\mathbf{E=E_P + E_B}$ = Corporate equity

Thus the composite corporate entity is valued:

$$\mathbf{E=A_B - L_B + A_P - L_P}.$$

[2] All marketed.
[3] For a traditional DB plan, the value of the liabilities is the sum of the value of deferred annuities. For a defined contribution (DC) plan, it is the sum of the account balances. For a fully vested cash balance plan it is the sum of the account balances provided that the investment crediting rate is set equal to the periodic total return on a benchmark asset portfolio.

When we combine Treynor and Modigliani-Miller, what may we conclude about the impact that pension plan asset allocation has upon shareholder value?

- *Result 1: With marketed assets and liabilities and no taxes, the present value and future distributions of shareholder wealth are immune to the allocation of assets and liabilities within pension plans.*

Each shareholder forms his or her portfolio to achieve a preferred distribution of future wealth. With A.7, he or she is able to incorporate the pension subsidiaries into the portfolio. If, on the margin, a pension subsidiary holds more equities, the shareholder will allocate less to equities and more to bonds in his or her personal portfolio, and vice versa. The total shareholder portfolio will be the same regardless of the pension plan asset allocations.

Are shareholders indifferent to the liability benchmarks? Without tax considerations, shareholder wealth is immune to the choice of marketed liability benchmarks. Liabilities are included as short positions within each shareholder's aggregate portfolio. A marginal increase in the equity component of a liability benchmark will cause the shareholder to allocate more to equities and less to bonds in his or her personal portfolio, and vice versa.

These considerations maintain the future distributions of wealth for each shareholder, making him or her indifferent to the asset/liability allocations of the pension plan, provided that the plan assets and liability benchmarks are restricted to marketed securities.

3.2 When the Investment Crediting Rate is Not Marketed

In many of the cash balance plans adopted to date, the investment crediting rate is set once a year to a numerical quantity that may be set arbitrarily or may represent a market rate on an instrument of maturity other than one year (e.g., the current coupon rate on the 10-year Treasury bond) or may be a rounded or adjusted version of some published rate (e.g., prime rate or the one-year T-bill plus 1%). How shall we understand this in light of the shareholders' inclination to maintain a preferred investment strategy? We can interpret it as a riskless profit or loss to the shareholders:

- *Result 2: When a liability benchmark is defined as a marketed instrument plus a measurable amount, shareholder wealth is lesser by that amount.*

When a cash balance plan credits a fixed investment return, the rate is usually set one year at a time shortly in advance of the beginning of the year for which it is effective. In this case, shareholder personal portfolios will hold one-year T-bills purchased on the date that the plan's investment rate is set.

If, for example, the plan credits a 7% annual effective rate on the prior year's balance, and the annual effective rate on the one-year bill is 5%, then each shareholder loses, at year's end, 2% of his or her share of the aggregate opening account balances of the plan. In effect, the plan is offering employees a near riskless return of 7% when the market rate for such an investment is only 5%. There is no *riskless* investment strategy that the shareholder can use to reduce this loss.

Suppose that the investment crediting rate equals the S&P index less 1% annually. In this case, of course, the ending plan balances cannot be computed until the S&P index is evaluated at year's end. In accordance with Result 1, shareholder personal portfolios will hold an appropriate amount of the S&P index. This locks in a year-end gain for shareholders equal to 1% of the opening plan balances.

3.3 With Tax Considerations

Next we consider taxes and, consistent with Tepper (1981) and Miller (1977), define:

t_c = corporate tax rate.
t_{pb} = personal tax rate on bonds.
t_{ps} = personal tax rate on stocks.

Per assumption A.8: $t_{ps} < t_{pb}$

Now apply tax rules to the pension plan, the corporation and the shareholder. Note that contributions to the plan by the corporate sponsor are deductible, within limits, when made, and investment returns inside the plan are not taxed. Results 3a, 3b and 3c are developed as three properties of these rules.

- *Result 3a: A dollar inside the pension plan may be equated, at any point in time, to* $\$(1-t_c)$ *in value on the balance sheet. Equivalently, \$1 on the balance sheet may be equated to a plan asset of* $\$1/(1-t_c)$.

At the time of the Black (1980) and Tepper (1981) papers, assets reverted to the corporate sponsor after plan termination and settlement of all of the accrued liabilities of the plan were subject to income tax at the corporate rate t_c. Since 1986, the Metzenbaum excise tax means that assets reverting to an employer from its pension plan are taxed at a much higher rate than that which applied when contributions to the plan were made on a tax-deductible basis.

How, then, may we develop the Black-Tepper assertion that a dollar in the plan is worth $\$(1-t_c)$ on the corporate balance sheet? Recall that we have assumed an ongoing corporation and an ongoing DB plan. An ongoing plan will, at some future date, be required to make contributions. We want to track the impact of a marginal dollar of contributions made at time zero that results in reduced contributions at time *n*.

First, let us develop the converse, that $\$(1-t_c)$ on the balance sheet may be equated to \$1 inside the pension plan. This is trivial since the contribution of \$1 to the plan,[4] results in a contemporaneous tax reduction equal to $\$ t_c$.

Next we note that, since the flow of contributions to the plan continues, the existence of a marginal dollar in the plan will drive out a \$1 contribution which would have been tax deductible if made, thus adding a net $\$(1 - t_c)$ to the after-tax balance sheet.

- *Result 3b: A dollar contributed to a plan at time zero and used to reduce future contributions effectively delivers a pre-tax rate of return to the balance sheet after the payment of corporate income tax.*

One dollar may be contributed to a DB plan at an after tax cost of $\$(1- t_c)$. Inside the plan, the \$1 grows over time to $\$(1+i)^n$, where *i* is the annually compounded untaxed rate of return on invested assets. After *n* years, the corporation reduces the contribution that it would otherwise have made for the year by $\$(1+i)^n$. This increases the corporate taxes for the year by $\$(1+i)^n t_c$ and, thus, $\$(1+i)^n (1- t_c)$ is the net addition to the balance sheet. Since the net investment *n* years earlier was $\$(1 - t_c)$, the after-tax rate of growth may be seen to equal the annual untaxed rate of return, *i*.

[4] It is assumed that the \$1 is within the annual deduction limits under IRC § 404(a).

This result relies on the tax-free accumulation of assets within the pension plan and not upon the deductibility of pension contributions. All that is required with respect to deductibility is that the same rules and rates apply as contributions are made at different times. [5] To see that deductibility per se is unimportant, consider the result above in the case where $t_c = 0$. Since 1986, result 3b has also required that assets do not accumulate to such a degree that they cannot escape the reversion excise taxes.

Combining 3b with taxes that shareholders pay on returns on company shares, we get:

- *Result 3c: A shareholder's marginal investment that is contributed to the corporate pension plan earns the market rate of return over time and is taxed at the personal equity tax rate regardless of whether the pension plan invests in fixed income or in equity securities.*

Note that the after-tax return to \$(1- t_c) of shareholder investment (which supports a \$1 contribution to the pension plan) is $\$(1+i)^n(1-t_{ps})(1-t_c)$ and that the tax rates are independent of the nature of the asset allocation within the pension plan.[6]

3.4 Shareholder Optimal Policy

Define:

r = the riskless return on the one-year T-bill.

$\tilde{q}$ = the one-year stochastic rate of return on equity investment.

$\bar{q}$ = the one-year expected rate of return on equity investment.

a = the fraction of assets invested in indexed equities, balance in T-bill.

b = the fraction of liabilities benchmarked to equities, balance to T-bill.

Consider investment/crediting pairs designated as $\{a, b\}$, where each variable is restricted to the range [0,1],[7] and ask whether there exists a shareholder optimal pair.

---

[5] Tepper (1981) analyzes the case where contributions may be made in excess of IRC deductibility limits and the resulting deductions must be deferred. We do not address this case.

[6] This keeps as our consistent measure \$1 of pension assets, or $\$(1-t_c)$ of corporate assets.

[7] This range is arbitrary but convenient. We can certainly design crediting and investing strategies that would extend outside these boundaries. The linearity of the arbitrage results makes the implications obvious. At some point, within or without this range, the linearity must fail, as we exhaust the opportunity for tax gains or as the asset-liability mismatch raises the probability of cash flow crises and bankruptcy above a negligible level.

Note that these pairs admit no offsets from the marketed benchmarks and, thus, absent tax considerations, shareholders should be indifferent among them. Recall that we have assumed that employee compensation and satisfaction will not vary with the definition of the liability benchmark and that variations to this assumption are explored in Section 4. Thus, all demonstrable differences in shareholder wealth attributable to the cases above must derive from the tax treatment that attaches to each pair.

- *Result 4: Shareholders gain as* a *is decreased and as* b *is increased. With each variable restricted to the range [0,1], the optimal pair is* $\{a = 0, b = 1\}$*, that is,* ***the plan invests entirely in T-bills and credits equity returns on employee account balances!***

Following Tepper (1981), assume that shareholders offset pension allocation decisions in their personal portfolios after adjusting for corporate taxes by multiplying by $(1-t_c)$. So, for example, a \$1 greater investment in equities by the pension plan, accompanied by \$1 less in T-bills will be offset by personal portfolio adjustments aggregated for all shareholders: $\$(1-t_c)$ less in equity holdings and $\$(1-t_c)$ more held in T-bills.

The shareholder personal adjustments maintain shareholder wealth distributions prior to the payment of taxes on personal portfolio income. Thus, we can measure the effectiveness of any pension asset or liability allocation by looking to the taxes paid after adjusting shareholder personal portfolios.

To normalize our analysis, we begin with all assets and liabilities in T-bills $\{a = 0, b = 0\}$ identified as the *base* case. Because Tepper and Black assumed that all liabilities could be represented by fixed-income securities (i.e., $b = 0$) and concluded that all plan assets should be invested in fixed income ($a = 0$), our base case matches their best case.

In the base case, shareholders will pay taxes at their personal stock tax rate, t_{ps}, based on the net income of the pension plan diminished by the corporate tax:

$$t_{ps}(1-t_c)rE_P \qquad (1)$$

Suppose, instead, that the pension plan is allocated as $\{a, b\}$. Shareholders offset this allocation by holding $\$(1-t_c)(aA_P - bL_P)$ less of equities and the same amount more of T-bills. They pay taxes on their income generated by the pension plan:

$$t_{ps}(1-t_c)[(\tilde{q}-r)(aA_P - bL_P)] + rE_P$$

and they pay additional taxes on the offsetting personal holdings:

$$(1-t_c)(aA_P - bL_P)(rt_{pb} - \tilde{q}t_{ps}),$$

a total of:

$$t_{ps}(1-t_c)rE_P + (t_{pb} - t_{ps})(1-t_c)r(aA_P - bL_P), \qquad (2)$$

where the first term of Equation (2) may be recognized as the base case Equation (1) and so the second term represents the incremental taxes associated with the $\{a, b\}$ pension allocation. Since we have $t_{pb} - t_{ps} > 0$, taxes increase with a and decrease with b. Without leverage, taxes are minimized with $\{a = 0, b = 1\}$, which means that our shareholder-optimal pension investment is 100% in T-bills with the liability crediting rate benchmarked 100% to an equity portfolio. The maximum tax case is presented by $\{a = 1, b = 0\}$. The typical corporate plan today may be identified as $\{a, b = 0\}$, which constitutes an inferior strategy for shareholders and becomes progressively worse with increasing a. Note that the base case $\{a = 0, b = 0\}$ is superior to the typical plan, as is shown by both Tepper and Black. A locus of cases equivalent to the base case is traced out by strategies that follow $\{a = (L_P / A_P)b, b\}$.

3.4.1 The Black Variation

Black (1980) developed a strategy where the tax benefits of investing pension assets entirely in bonds arise at the corporate balance sheet level. This version would seem to provide greater incentive to corporate managers than does the Tepper (1981) approach, which relies on shareholder action. The basic Black approach (he offers more than one) may rely on shareholder action as well.

Black proposes that a corporation:

- Sell all stock held by its DB pension plans.
- Invest the plan assets entirely in taxable fixed-income securities.
- Borrow, on the balance sheet, $(1-t_c)$ times the pension transaction amount.
- Use the borrowed funds to repurchase the corporation's own stock.

Black argues from the augmented balance sheet perspective of Treynor (assuming transparency and ignoring some ERISA technicalities and existing bond covenants) that lenders should be willing to provide the funds because these transactions are leverage-neutral. As do I, he considers well-funded pension plans maintained by corporate sponsors, where bankruptcy is deemed to have a very low probability.

Black parses the four transactions as two pairs:

- Sale of pension plan stock holdings and purchase of $(1-t_c)$ as much of the corporation's own stock.
- Borrowing of $\$(1-t_c)$ on the balance sheet to support each \$1 of bond purchases (equal to stock sales) inside the pension plan.

As I do, he equates \$1 in the plan with $\$(1-t_c)$ on the balance sheet and makes the necessary supporting assumptions, some explicitly, others implicitly. The stock transactions above have no tax implications, because neither pension plan transactions nor the corporate transactions in company stock are taxable. The entire tax effect is thus derived from borrowing at the after-tax rate $(1-t_c)r$ while earning the pre-tax rate r. The after-tax annual gain is $(1-t_c)rt_cA_P$ with a perpetuity value of t_cA_P. Black comments that, with a 50% combined federal-state value for t_c, this is equivalent to borrowing $.5A_P$ in perpetuity without ever paying interest or principal. This is comparable in magnitude to the results in our numerical example in Section 4.

Black observes that the sale of diversified equities by the plan accompanied by the repurchase of company stock does not constitute a perfect hedge. He says that the company is now more idiosyncratic, which should not be a problem in diversified shareholder portfolios, and he asks "would many

investors pay five percent[8] per year for the sake of added diversification within their holdings of a single firm's stock?" (p. 26).

He suggests an alternative approach that provides a better hedge at a small tax cost. Instead of repurchasing one's own stock, he proposes that the proceeds of the corporate borrowing be invested in diversified balance-sheet equity implemented via a mutual fund designed to convert capital gains to dividends.[9]

3.5 Black in a Cash Balance Plan

As noted previously, the sale of diversified stocks by the plan and the repurchase of company stock is not a hedge. Under any DB plan, the sponsor who wishes to sell pension equities and buy its own stock will not be hedging. But this cash balance proposal goes one step further and calls for the promise of equity returns to participant accounts and the repurchase of additional company stock.

This suggests an untried plan design: a company may choose to credit the total return on its own stock to employee plan balances.[10] This approach would, with respect to the liability side of the plan, constitute an exact hedge at the company level after allowance for corporate taxes (multiplying plan shares by $(1-t_c)$ to compute balance sheet repurchases). In the tradition of new designs in the employee benefit arena, such a plan might naturally be dubbed a CBSOP, thus highlighting its ESOP-like features.

---

[8] Computed as $t_c r$ in an era where the riskless rate might be 10% and the combined federal-state tax rate might be 50%.

[9] In a tax regime where 85% of dividends received by a corporation from other corporations was tax exempt. Today this rate is 70% (IRC §243). Corporate capital gains are taxed at the t_c rate.

[10] This raises a number of ERISA issues. Employee benefits that are dependent on employer stock performance are often qualified as employee stock ownership plans (ESOPs). Some non-ESOP defined contribution plans provide that some of the assets will be invested in the sponsor's stock and, thus, employee accounts are dependent on the employer's stock performance. DB plans are generally restricted to investing no more than 10% of their assets in the sponsor's stock. While even the settled ERISA issues are well beyond the scope of this paper, this design raises ERISA issues that have never before been addressed

The similarity to the actual issuance of company shares will undoubtedly raise issues under the jurisdiction of the SEC.

While plan sponsors have often encouraged employee ownership of company stock with and without the use of qualified retirement plans, companies do not "short" their own stock in such programs (they have, however, often used shares repurchased or held as Treasury shares for that purpose). The public relations implications of a company or its employees shorting its stock always result in dismissal of such ideas. Lastly, it would seem that the "shares" implicitly "sold to participants" using this approach should result in an accounting dilution.

3.6 Reconciling Black and Tepper

Black's annual after-tax balance sheet gain is

$$r(1-t_c)t_c$$

per $1 of pension assets shifted from stocks to bonds, a shareholder after-tax gain of

$$r(1-t_c)t_c(1-t_{ps}).$$

Tepper's shareholder after-tax gain (from Equation 2) is:

$$r(1-t_c)(t_{pb}-t_{ps}).$$

Equate the nonidentical elements:

$$(t_{pb}-t_{ps}) = t_c(1-t_{ps})$$
$$(1-t_c)(1-t_{ps}) = (1-t_{pb}),$$

which is Miller's (1977) formulation for leverage indifferent tax rates. When the left-hand side (LHS), representing the shareholder cost of corporate borrowing is less than the right-hand side (RHS), representing the cost of shareholder personal borrowing, there is an advantage to borrowing at the corporate rather than at the personal level and the Black gain exceeds the Tepper gain. This makes sense because the Black proposal borrows on the corporate balance sheet, whereas the Tepper version relies on personal borrowing.

- *Result 5a: Absent gains from leverage, the gains from tax arbitrage using the Black and Tepper approaches are identical.*

Because not all shareholders actually have the same marginal tax rates, some shareholders may prefer the approach of Black and others prefer that of Tepper. An important special case arises for tax-exempt institutions (including, perhaps misguidedly, pension plans). In this case:

- *Result 5b: When the shareholder is tax exempt, $t_{ps} = t_{pb} = 0$ for all positive values of t_c, the **LHS < RHS** and the Black proposal is preferable.*

3.7 Black and Tepper Gains Merely Offset Losses

The common strategy for both cash balance and DB plans consists of a fixed-income promise combined with an investment strategy that includes equities. Black and Tepper describe their proposals to invest the pension fund entirely in fixed-income securities as a "gain". Certainly it represents a comparative gain vis-á-vis common practice, but I prefer to describe it as a recovery of losses created by an ill-advised equity investment strategy.

I do not make this characterization arbitrarily. It may be developed by an *ab ovo* look at the exchange of ordinary compensation for a pension benefit of any sort (DC, DB or cash balance). Suppose a company creates a DC plan and contributes a percentage of each employee's pay in lieu of an equal amount of compensation. Such a plan would preserve total compensation cost for the company on both pre- and post-tax bases.[11]

Thus, with a DC plan, the tax advantages inure to the benefit of the employees. In the case of a DB plan with contributions equal to annual increases in the value of accrued benefits, and with fixed-income investments matching any benefits promised, the position is the same as it is in DC plans. If the corporation decides to hold equities instead of fixed-income assets, as so many DB plan sponsors have done, shareholders under either the Tepper or the Black model pay unnecessary taxes. In short:

- *Result 6: Shareholder value for the base case,* $\{0,0\}$*, equals the Tepper and Black proposals equals cash compensation*[12] *equals a DC plan.*

Viewed from this perspective, it is clear that the first opportunity for substantial shareholder gains from pension tax arbitrage arises with the advent of the cash balance plan and the concomitant power to set the value of b to a value greater than zero.

---

[11] The employees might benefit from the tax deferral. To the extent that they have alternative tax-advantaged savings (e.g., pre-tax IRAs) available, they should not be expected to accept a reduction in total compensation. To the extent, if any, that the pension plan extends their tax advantages or that they value professional asset management and administrative convenience, total compensation may be reduced. Without denying this possibility, for analytic purposes, assume that total compensation is unaffected by the plan creation.

[12] Except for the value, if any, reflected off of employee utility gains and further excepted for the gains (losses) attributable to the tax shelter applied to positive (negative) pension surplus, E_p.

4. Implications

The obvious first implication is that companies should invest all DB pension plan assets in taxable fixed income, as observed by both Tepper and Black. Further, with a cash balance plan, shareholders should desire an equity benchmark for the plan's investment crediting rate. The first subsection below presents a numerical example of the value of such decisions. The second subsection looks at plans that offer employees choices with respect to the investment crediting rate.

4.1 A Numerical Example

With the top personal federal tax rate now equal to 39.6% and the corporate rate equal to 35%, we can use the following assumptions to develop a numerical example of the shareholder value derived from an optimal cash balance plan design:

$t_{pb} = .4$
$t_c = .35$
$t_{ps} = .15$[13]

Add the assumption that $a = .6$, the classic 60:40 asset allocation for DB plans. Using the second term of Equation (2) compute taxes in excess of those on the base case:

$$(.4-.15)(1-.35)r(.6A_P) = 9.75\% \text{ of } rA_P$$

This can be compared to the shareholder-optimal allocation $\{a = 0,\ b = 1\}$ and resulting tax where the minus sign indicates a deduction from the base case:

$$(.4-.15)(1-.35)r(-L_P) = -16.25\% \text{ of } rL_P$$

If, by chance, the assets of the plan equal the liabilities (total account balances), the annual loss of potential value to the shareholders is 26% of the

[13] This is an approximation to the annual effective rate of taxation applicable to equity held in personal taxable accounts. Because capital gains are not taxed until realized, this "constant" is really a declining function of the holding period.

riskless return on the plan. In the perpetuity form of Miller and Tepper, the value of such additional returns is

$$\frac{.26rA_P}{r(1-t_{pb})} = .4333\ A_P,$$

so that the shareholders of a corporation with a $1 billion cash balance plan crediting the T-bill rate will give up $433 million of after-tax present value. Consider the common case where the plan credits 1% over the T-bill rate. This adds

$$\frac{(1-t_c)(1-t_{ps})(.01)L_P}{r(1-t_{pb})} = \frac{.5525(.01)L_P}{r(.6)} = \left(\frac{.00921}{r}\right)L_P$$

to the shareholder loss. With the riskless rate less than 5%, this exceeds $184 million.

This total after-tax loss of $617 million can be compared to the after-tax value of $1 billion of plan assets. Such assets would be worth $650 million after corporate taxes and $552.5 million after personal taxes. In effect, the mismanagement of the cash balance plan costs shareholders more than would the loss of the entire $1 billion of plan assets!

4.2 Employee Choice Plans

Pensions and Investments (2000) reports that the largest corporate DC plans averaged 31.8% of assets in company stock and 36.7% in other equity in 1999. The company stock allocation may not reflect employee choice, but the other 36.7% (54% of the amount not in company stock) does. In public sector plans, *P&I* reports 57.5% is invested in equities. Bodie and Crane (1997) find that slightly more than half of retirement accounts of a 1996 TIAA-CREF sample are invested in equities, with these same individuals allocating just under half of their nonretirement accounts to equities. These percentages vary very little by wealth quartile.

In light of the experience of employee-choice DC plans, it is likely that firms may conclude that offering employees a choice of liability benchmarks is an attractive part of implementing the tax-based design strategy proposed in this paper. Such choices might well include indexed equity (managed equity makes no sense since the asset side of these plans should be invested entirely in fixed

income), company stock, and a short-term Treasury rate.[14] When firms offer employee choice in both a DC plan and a cash balance plan, shareholders may benefit by offering cash balance crediting rates just above their DC counterparts (e.g., if the DC plan offers an index fund, the cash balance plan might offer the index plus 10 basis points). This should encourage (otherwise indifferent) employees to concentrate equity investments in the cash balance plan and fixed income in the DC plan.[15]

Although this design is not shareholder-optimal, it should provide shareholders with several benefits compared with the usual design:

- Investments by the cash balance plan in fixed income can assure that shareholders will not be losers when the plan is compared to the base case or to cash compensation. This will only hold strictly if the plan is at least fully funded as measured by $E_P \geq 0$.

- Employee elections of company stock might allow the Black version of the plan to be implemented, thus benefiting nontaxable as well as taxable shareholders without increasing bankruptcy risk and without threatening managerial interests.

- Employee elections of index stock allow tax gains using either Black or Tepper.

- Employee utility enhancements derived directly from their choices and from their opportunities for non-corner allocations should inure to shareholders in various ways including reduced compensation.

[14] Moore (2001) suggests that options (e.g., equity exposure with a positive guarantee less than Treasury rates) would be feasible, attractive to employees, and consistent with the shareholder objective of adding equity to the liability crediting rate.

[15] A popular fixed-income choice in DC plans is stable value (formerly GICs). These investments take advantage of employee persistency to offer "up-the-yield-curve" returns on money market terms. These should not be offered on the liability side of the cash balance plans.

Interestingly, at least two firms have recognized this last advantage and have offered such plans to their employees.[16] Industry sources, however, report that each of these firms continues to invest the plan assets such that:

$$aA_P - bL_P > 0,$$

believing that this inequality measures the firm's advantage. As employees alter b, the sponsors may adjust a to perpetuate the relationship.

5. Implementation Impediments

The Tepper-Black tax arbitrage was articulated by its authors in 1981 and 1980 respectively. Until 1999, empirical researchers failed to find evidence in support of corporate implementation of the theory. In a working paper, Myers (1999) cites Bodie et al. (1987), Friedman (1983), Landsman et al. (1986) and Peterson (1996) as empirical studies that did not find support for popular acceptance of the Tepper-Black prescription. Myers has, for the first time, found a positive empirical response to the tax arbitrage theory, reporting a significant relationship between corporate tax benefits from leverage and the percentage allocation to bonds in DB pension plans. She estimates that approximately one-third of the potential benefit from the tax arbitrage opportunity is utilized, with the other two-thirds representing the "aggregate costs of other factors," (p. 27).

The use of arbitrage to measure shareholder value stands upon two cornerstones: transparency and the augmented balance sheet. This section reviews three major impediments to implementation of the arbitrage. Mainstream actuarial practice defies transparency and leads to the first two impediments by encouraging: (1) the anticipation of returns to risky investment prior to the acquittal of the risk (ASOP 27, 1996); (2) the smoothing of volatile results from all sources (including both equity and interest rate risks) by amortization. Statutory separation of the pension plan and its sponsor creates the third impediment by challenging the applicability of the augmented balance sheet.

[16] Anand (1999) identifies several firms offering employees "investment options," including BankAmerica and its sister NationsBank, and PricewaterhouseCoopers LLP.

5.1 Decision makers contemplating a $\{0,1\}$ cash balance plan face pension expenses and cash flows in excess of the value received by the employees; with an $\{a,0\}$ strategy, the employees receive more value than the employer must contribute or recognize as expense.

This paper asserts that the transparent economic liabilities of cash balance plans must always equal the total account balances.[17] It follows that the annual pre-tax economic cost of the plan to the operating company is equal to the compensation credits granted.[18] In contrast, Kwasha Lipton (1985) says: "A '5% of pay plan' might require a contribution of only 4% of pay, after a realistic investment differential is taken into account" (p. 3). Lowman (2000) identifies "anticipated leverage" as the reason that the "actuarial liability is [typically] less than the sum of the account balances" (p. 4).[19] These statements rely on an actuarial process that violates the transparency assumption, A.7.

The view of Kwasha Lipton and most pension actuaries and actuarial consulting firms derives from another statement made by Kwasha Lipton: "The investment differential can be anticipated" (p. 3). Many actuaries and their plan sponsor clients believe that $\{a,0\}$ plans are "profitable" in the sense that an employer can provide $1 to an employee at a cost well below $1. By the same measure, $\{0,1\}$ plans are unprofitable.

There are three overlapping ways to support the $\{a,0\}$ "bargain" claim: (1) a long view of pension plans implying that employers can profit by accepting risks that their employees will not bear; (2) accounting support for the same conclusion under FAS 87; and (3) support derived from the cash contribution calculations prescribed by ERISA.

5.2 Employer Profits by Accepting Risks

Actuaries and financial economists agree that expected returns are positively related to the degree of investment risk that one is willing to take. Actuarial methods suggest that it is appropriate to anticipate the returns as soon as one commits to accept the risk for the long run. Financial economists use

[17] Assuming full vesting and a market crediting rate.
[18] Financial operation of the pension subsidiary reduces that cost by a risk-adjusted rE_P.
[19] Anticipated leverage is defined by Lowman (2000) as the excess of the return on plan assets over the investment crediting rate of the plan; this excess is expected to be positive. When the investment crediting rate is marketed, this amounts to advance recognition of expected gains on a financially valueless market-to-market swap.

arbitrage to assert that returns cannot be anticipated because such anticipation amounts to earning something for nothing. Gold (1999) uses arbitrage to show that anticipation delivers excess returns to early constituents while later constituents bear excess risk.

Bader (2001) shows that a pension plan may be modeled as a cash flow matched plan plus an asset swap. Actuarial anticipation misvalues the swap. Although such swaps often deliver *ex post* profits to the party that accepts the greater risk, Bader uses arbitrage to demonstrate that the *ex ante* market value of the expected profits must be zero.

In the context of cash balance plans, the employer promises the employees a fixed market rate of return and invests the value of the promises in risky assets. This may be interpreted as borrowing at a fixed marketed rate to invest in the equity market. Such "investing on margin" may lead to long-run "profits." On an expected basis, such profits are merely compensation for risks yet to be taken. Actuarial anticipation takes these profits before they materialize.

Lowman (2000), discussing the risk faced by the PBGC when it takes over a cash balance plan where assets equal the actuarial liability but fall short of the account balances, says "… the PBGC may bear a greater risk of taking over the plan. [However,] this risk may involve more administrative problems than actual liabilities since the PBGC should be able to earn some of the anticipated leverage that the employer did not have the time to enjoy" (p. 35). By this logic, the PBGC need never collect any assets since, as a government agency, it can borrow cheaply and invest in equity for the long run. Actuaries often view the equity risk premium as a reward for patience rather than as a reward for risk.

5.3 Accounting Gains Under FAS 87

We will show by example that accounting under FAS 87 implies that an $\{a,0\}$ plan is cheaper than a $\{0,0\}$ plan which, in turn, is cheaper than a $\{0,1\}$ plan, despite their pre-tax equivalence and despite their opposite post-tax arbitrage ordering.

Buck Consultants (1999) has issued a study of assumptions used by 552 of the *Fortune* 1000 companies for their 1998 FAS 87 computations.[20] The average values are:

[20] Many of these plans are traditional DB rather than cash balance plans.

- Discount (settlement) rate = i =6.77%
- Expected return on plan assets = j =9.11%
- Salary increase rate = s =4.54%

Consider the accounting cost for one employee hired at age 25, receiving his account balance at age 65, using these assumptions with no early exits, contemporaneous funding of the amount expensed, the market related value of assets (**MRV**) defined to equal the market value of assets, and an investment crediting rate equal to i =6.77% for any $\{a,0\}$ plan and equal to $\frac{5j-2i}{3}=10.67\%$ [21] for the $\{0,1\}$ plan.

Table 1 presents the resulting compensation credits and plan expenses, assuming initial year's compensation of $10,000 and a 10% compensation credit at the end of each year of employment (the ratio is independent of these last assumptions).

Table 1
Compensation (Pay) Credits and FAS 87 Expense

Age	Pay	$\{a,0\}$		$\{0,0\}$		$\{0,1\}$	
$x+t$	credit	Expense	Ratio	Expense	Ratio	Expense	Ratio
26	1000	682	68%	682	68%	1642	164%
30	1194	809	68	887	74	2133	179
35	1491	988	66	1231	83	2960	199
40	1862	1184	64	1707	92	4107	221
45	2325	1383	59	2369	102	5699	245
50	2903	1558	54	3287	113	7908	272
55	3624	1662	46	4561	126	10972	303
60	4525	1613	36	6329	140	15224	336
65	5650	1276	23	8782	155	21124	374

Part of the effect shown in Table 1 is a decrease in ratios at younger ages and an increase at later ages due to the assumption that $s<i$. If $s=i$; the

[21] Assumes that j reflects 60% of the expected equity return plus 40% of i.

expenses of the $\{0,0\}$ plan would equal the compensation credits and the ratio for this plan would equal 100% at all ages. The same relationship may be found using the traditional unit credit (TUC) method which does not incorporate future compensation increases.

5.4 Cash Gains Under ERISA—Tables 2 & 3

The apparent bargain in the FAS 87 accounting costs derives substantially from the equity premium in j. Under the projected unit credit (PUC) and TUC methods, the rates each equal j.

Table 2
Compensation (Pay) Credits and PUC Contributions

Age $x=t$	Pay credit	$\{a,0\}$		$\{0,0\}$		$\{0,1\}$	
		Expense	Ratio	Expense	Ratio	Expense	Ratio
26	1000	293	29%	682	68%	1642	164%
30	1194	415	35	887	74	2133	179
35	1491	642	43	1231	83	2960	199
40	1862	993	53	1707	92	4107	221
45	2325	1536	66	2369	102	5699	245
50	2903	2375	82	3287	113	7908	272
55	3624	3672	101	4561	126	10972	303
60	4525	5679	126	6329	140	15224	336
65	5650	8782	155	8782	155	21124	374

Table 3
Compensation (Pay) Credits and TUC Contributions

Age	Pay	{a,0}		{0,0}		{0,1}	
$x+t$	credit	Expense	Ratio	Expense	Ratio	Expense	Ratio
26	1000	429	43%	1000	100%	4052	405%
30	1194	559	47	1194	100	4192	351
35	1491	778	52	1491	100	4375	293
40	1862	1083	58	1862	100	4565	245
45	2325	1507	65	2325	100	4764	205
50	2903	2097	72	2903	100	4972	171
55	3624	2918	81	3624	100	5188	143
60	4525	4060	90	4525	100	5414	120
65	5650	5650	100	5650	100	5650	100

Recall that each of these illustrations is developed as an expectation when the employee is hired at age 25 and that each assumes that all assumptions are met. That is, fixed income returns = 6.77% each year, equities return 10.67% each year, a 60:40 allocation returns 9.11%, and compensation increases 4.54% each year.

If presentations[22] such as these are used to make decisions, it is not surprising that {a,0} plans predominate. These results are so strikingly in favor of the {a,0} plan that it may seem difficult to believe that the transparent model can reverse the order of plan dominance.[23] It may be helpful to recognize that the {0,1} plan column of Table 3 assumes that the pension plan promise approximates a 40-year compound equity market return financed by 40 years of fixed-income investing.

[22] Actuaries often prepare "stochastic" projections that show a range of results around those illustrated above. However, unlike the stochastic processes used in modern finance to value assets, there are no explicit adjustments for the price of risk.
[23] Dominance becomes equivalence on a pre-tax basis and is only reversed after consideration is given to differential tax treatments.

The {a,0} plan column assumes 40 years of 60:40 investing to meet a 40-year compound fixed-income promise. But these *expected* return differentials are available to virtually all market participants every day and are understood to represent nothing more than the market price of risk. If the differential expected returns could be achieved without proportional risk (merely by having the patience to wait 40 years), then corporations need not engage in any more gainful pursuits and governments need never collect taxes.

In sum, the argument that an {a,0} plan is an actuarial and accounting bargain is reinforced by methodologies that contradict the implications of transparency. Many corporate managers will find the accounting outcome sufficient to lead them to conclude that the {a,0} plan is a bargain and the {0,1} plan is costly. Those managers who are able to "see through" the accounting cannot count on their financial constituents to join them and, thus, they will often conclude that the {a,0} plan represents the wiser course.

5.5 Actuarial cost methods smooth out equity investment volatility, allowing the corporation to earn expected risk premiums without apparent risk. The Tepper-Black arbitrage is not viable under this regime.

Actuarial cost methods (ACMs) were designed to facilitate an orderly budgeting process for cash contributions to DB plans. To achieve orderliness, each ACM incorporates a self-correcting process for coping with year-to-year deviations from long-term expected progress of the plan.

ACMs always assume a convergence of assets and liabilities at some distant horizon (e.g., 15 or 30 years hence). Each year, an actuarial valuation is performed that develops a stream of expected contributions that, if all assumptions are met, will assure such convergence. The expected contribution stream is inherently smooth; it may, for example, represent a constant percentage of each future year's expected compensation. Thus, on a prospective basis, volatility is not part of the scheme.

Each year's valuation is also designed to measure the expected contribution for this year against the actual. The procedure must be able to account for differences between actual and expected population data and asset values, and plan cash flows between the previous and current valuations. Additionally, there must be provision for changes in plan benefits and actuarial assumptions about future rates of mortality and retirement and interest, if any.

The aggregate impact of all these variations in the present value of plan liabilities less plan assets is called "actuarial gain and loss."[24]

If the total actuarial gain and loss were immediately accounted for, there could be substantial year-to-year changes in required contributions. Instead, each ACM has an amortization scheme that identifies the entire gain and loss and spreads it out over the future stream. Part of the rationale for this procedure is to create an orderly process. Another is the actuarial tenet that market fluctuations tend to cancel out.[25] This implies that many actuaries subscribe to a very strong mean reverting market model.

Because the pension actuarial process is arcane (somewhere between translucent and opaque), the major impact that pension plans transmit to their sponsor's financial status flows through the annual pension expense into corporate P&L. Prior to the adoption of FAS 87, plan expenses were identical to plan cash contributions except for occasional, generally minor, timing differences.[26]

FAS 87 removed some of the smoothing tools from the actuarial toolbox and standardized the application of others so as to make company-to-company comparisons easier. A series of legislative acts, notably the Omnibus Budget Reconciliation Act of 1987 (OBRA '87) and the legislation enabling the General Agreement on Tariffs and Trade of 1994 (GATT),[27] reduced actuarial flexibility with respect to cash contributions.

Nonetheless, the amortization of actuarial gains and losses over many years survives powerfully today. Under FAS 87, the *expected* return (j) on *smoothed* plan assets (MRV) flows directly into the pension expense. The difference between the actual return on the market value of plan assets and $jMRV$ goes into a suspense account. The difference between the newly computed PBO and its expected value based on the prior valuation is lumped into the same bucket which is rolled forward from year to year in order to accommodate any offsets that occur.

[24] For details of gain and loss analysis see, e.g., Berin (1976).
[25] "Any market downswing experienced in one generation will be offset by an upswing in later generations." (Burrows 1999 p.1)
[26] Prior to the adoption of FAS 87, Accounting Principles Board Opinion 8 (APB 8) ruled.
[27] GATT legislation of 1994 incorporated provisions of bills sometimes identified as the Retirement Protection Act of 1994.

As long as the entire bucket value remains in a "corridor" (a range of error equal to plus or minus 10% of the greater of the *PBO* and the *MRV*), the accumulated gains and losses do not affect the current year's pension expense. Once the corridor is exceeded, a fraction (e.g. 1/15) of the overflow is added or subtracted in the current year.

To the extent that financial analysts deal with pension plan effects primarily through pension expenses, the Tepper-Black arbitrage is not viable. For the arbitrage model of firm pricing and shareholder value to apply, investors must experience the financial impact implied by the transparent model.

Smoothing pension plan assets, liabilities and expenses not only defeats the arbitrage pricing model, but also introduces systematic bias into the valuation of securities by financial analysts. This is an issue addressed in Gold (2000).

5.6 The "augmented balance sheet" is a theoretical nicety but it ignores the strong legal separation between the pension plan and the corporation. The legal reality implies that the corporate leveraging recommended by Black may constitute an unacceptable risk to lenders.

Treynor's augmented balance sheet is designed to emphasize the financial integration of a corporation and its pension plan. As such, it suggests integrated financial management of the kind employed by Black and Tepper. It does not, however, describe an entity with all the freedom that we usually associate with a single balance sheet. We cannot freely move assets across the horizontal border between the corporation and the plan. I have already discussed the tax considerations that govern this border crossing and know that these can work for or against shareholders depending on plan design.

There is also a strong statutory barrier. Although many of the financial implications of a corporation's contribution strategy and a plan's asset allocation affect shareholders (particularly in a well-funded plan), Sharpe (1976) and Treynor (1977) discuss employee interests before and after the passage of ERISA and the PBGC's interests since then.[28]

[28] Pre-ERISA, promises received by employees were only as good as the assets of the plan. If plan assets fell below plan liabilities, the corporation had the right to put the assets to the plan participants without incurring a residual liability. This put option represented an asset of the corporation that Treynor (1977) records in the augmented balance sheet. With the passage of ERISA, the PBGC was inserted as a guarantor of a substantial portion of benefits accrued by participants and the PBGC had the right to pursue the sponsor to recoup the shortfall. ERISA

One issue sometimes raised and often dismissed is the ERISA admonition: "…a fiduciary shall discharge his duties with respect to a plan solely in the interest of the participants and beneficiaries…."[29] Some misunderstand this to mean that some effort to maximize returns is required. Because the primary societal role of plan assets is to collateralize benefit promises, a better interpretation is that the probability that all promises are met should be kept high. In the context of amending ERISA to strengthen the PBGC, Congress declared: "[it] is desirable to increase the likelihood that full benefits will be paid to participants and beneficiaries of such plans."[30] Under this interpretation, plan strategies along the $\{a = (L_P / A_P)b, b\}$ line of Section 4 might be deemed especially prudent.

In the context of the Black version of the arbitrage proposed in Section 3, the most important impediment to implementation derives from the fact that plan assets may not be easily reached by corporate creditors. This means that any proposal to increase corporate leverage by borrowing to buy back company stock will face an uphill battle. Not only can the assets not be pledged or assigned, but the lenders also cannot have any assurance that the plan will continue to invest in bonds rather than in equities.

Even after all parties thoroughly understand the financial issues, lenders (banks and bond holders) will be placed at some disadvantage. Covenants in current borrowings may make it difficult or impossible to add leverage even if new borrowing is available.

How much of a disadvantage depends, of course, on the numbers. We know that any borrowing done to support the transaction will have to be done at a higher cost than if the augmented balance sheet representation were not in conflict with ERISA. In effect, the benefits of the arbitrage plan are certain to be reduced by this and other friction costs. This cost should be modest when compared to the value of the arbitrage but the cost will be greater for those corporations whose borrowing costs are already relatively high.

Black (1980) argues that the value of the arbitrage derives from the reallocation of plan assets and that the rest of the arbitrage is offered by him

---

also tightened fiduciary standards for plan managers in the name of protecting employee interests. Treynor (1977) observes that the major beneficiary of these standards was the PBGC.

[29] USC 1104(a)1.

[30] 29 USC 1001(b), as modified by SEPPAA (1986).

primarily to defend or prove his case. His point is that, after tax considerations, the corporation's risk-adjusted returns will have been increased whether or not the corporate leveraging is executed.

6. Conclusions

This paper extends the Tepper-Black pension tax arbitrage into a cash balance plan environment. Black and Tepper each assumed that DB pension liabilities were well represented by fixed-income instruments. The paper extends the liability model to include arbitrary marketed securities. This model tells us that shareholders benefit when the liabilities are defined in terms of equities.

Based on the experience of 401(k) plans, we may conclude that employee demand for equity investments is substantial. The idea that the liability equity allocation b can be raised above zero, producing benefits for shareholders and for some employees, offers potential for a whole class of innovative cash balance plan designs. Certainly, the employee choice plan (individual b s) combined with fixed-income investments($a = 0$) can work to the benefit of all direct constituents (arguably, taxpayers are the losers).

The major impediments to the implementation of designs in this new class include actuarial and accounting systems that obfuscate financial realities. The old admonition "eschew actuarial obfuscation" has new justification. The very nature of the cash balance plan (where liabilities are first stated as present values rather than as contingent future cash flow streams) may make the intellectual hurdle lower than it was when the Black and Tepper papers were published. The question "How can it be possible to give an employee $1 at a cost of $.50?" may gain some traction among financial officers, shareholders, accountants, and actuaries.

The impediments related to the statutory separation of the plan and the sponsor may persist, but for a great number of solid companies with well-funded plans, this impediment is more a process that requires management than it is a barrier to action.

References

Actuarial Standards Board. 1996. Actuarial Standard of Practice No. 27 (ASOP 27), "Selection of Economic Assumptions for Measuring Pension Obligations," December.

Anand, V. 1999. "Evolution: Other Firms Build on Trend that BankAmerica Initiated," *Pensions and Investments* (May 31).

Bader, L. N. 2001. "Pension Forecasts, Part 2: The Model Has No Clothes," *Pension Section News*, Society of Actuaries (June).

Berin, B. B. 1976. *The Fundamentals of Pension Mathematics*, Schaumburg, IL: Society of Actuaries.

Black, F. 1980. "The Tax Consequences of Long-Run Pension Policy," *Financial Analysts Journal* (July-August): 21-30

Bodie, Z. and D. B. Crane. "Personal Investing: Advice Theory and Evidence," *Financial Analysts Journal* (Nov.-Dec.): 13-23.

Bodie, Z., J. Light, R. Morck, and R. Taggart Jr. 1987. "Funding and Asset Allocation in Corporate Pension Plans: An Empirical Investigation," in *Issues in Pension Economics,* edited by Bodie, Shoven, and Wise, Chicago: University of Chicago Press, pp. 15-44.

Buck Consultants. 1999. "Buck Issues Study on Retirement Plan Disclosures," *For Your Information* (October 25).

Burrows, E. E. 1999. "A Cash Balance Solution for Social Security," *Enrolled Actuaries Report* (May).

Friedman, B. 1983. "Pension Funding, Pension Asset Allocation and Corporate Finance: Evidence from Individual Company Data," in *Financial Aspects of the United States Pension System,* edited by Bodie and Shoven, Chicago: *University of Chicago Press*. pp. 107-52.

Gold, J. 1999. "Assumed Rates of Discount for Valuations of Publicly Sponsored Defined Benefit Plans." Working paper, Pension Research Council, Philadelphia, PA.

——— 2000. "Biased Methodology Enables Equity Investment by Defined Benefit Pension Plans." Working paper, Pension Research Council, Philadelphia, PA.

Kwasha Lipton. 1985. "Exciting New Retirement Concept: The Cash Balance Pension Plan," *Kwasha Lipton Newsletter* 18 (1).

Landsman, W., B. Miller, and S. Yeh. 1986. "An Empirical Investigation of Pension Fund Property Rights," *The Accounting Review* 61: 662-691.

Lowman, T. B. 2000. "Actuarial Aspects of Cash Balance Plans." Online at http://www.soa.org/researc/actuarial_aspects.pdf.

Miller, M. H. 1977. "Debt and Taxes," *Journal of Finance* 32(2): 261-75.

Modigliani, F. and M. Miller. 1958. "The Cost of Capital, Corporation Finance, and the Theory of Investment," *American Economic Review* 48: 261-97.

Moore, J. 1999. Personal communication with the author.

Myers, M. M. 1999. "The Impact of Taxes on Corporate Defined Benefit Pension Plan Asset Allocation." Working paper, Graduate School of Business, University of Chicago, (July 31).

Peterson, M. A. 1996. "Allocating Assets and Discounting Cash Flows: Pension Plan Finance," in *Pension, Savings and Capital Markets,* edited by Fernandez, Turner, and Hinz, pp. 1-26. Washington, D.C.: U.S. Department of Labor, Pension and Welfare Benefits Administration.

Sharpe, W. F. 1976. "Corporate Pension Funding Policy," *Journal of Financial Economics 3*, (June): 183-93.

Tepper, I. 1981. "Taxation and Corporate Pension Policy," *Journal of Finance* 36(1): 1-13.

Treynor, J. L. (using pseudonym, Walter Bagehot) 1972. "Risk and Reward in Corporate Pension Funds," *Financial Analysts Journal* (January-February): 80-4.

Treynor, J. L., P. J. Regan, and W. W. Priest, "Pension Claims and Corporate Assets," *Financial Analysts Journal* (May-June): 84-8.

_____. 1976. "The Financial Reality of Pension Funding Under ERISA," Homewood, IL: Dow Jones-Irwin.

Treynor, J.L. 1977. "The Principles of Corporate Pension Finance," *Journal of Finance* (May) 32(2): 627-38.

Warner, M. M. 1986. "A Layman's Guide to Actuarial Methods and Assumptions," *Enrolled Actuaries Report,* American Academy of Actuaries (May).