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Corporate Pension Risk Management and Corporate Finance:

Bridging the Gap between Theory and Practice in Pension Risk Management

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SPONSORS Pension Section Research Committee

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Introduction

Since the 2007-2008 recession, de-risking has become the most discussed topic in corporate pension risk management. Despite this trend, the authors believe that the actuary's role in decision-making at a corporate strategic level regarding defined benefit (DB) pension plans has typically been confined to the pension silo; in other words, the actuary's advice regarding decision-making on corporate DB plans is often limited to statutory and accounting requirements and typically without regard to corporate finance considerations at an enterprise level. However, over the past 10 years, major decisions regarding corporate DB pension plans, such as freezing of defined pension plans or transferring pension risks to insurers, have been made in a corporate finance framework at an enterprise level. Similarly, corporate pension funding policies and investment policies are being analyzed within a set of corporate finance metrics. Therefore, there is a need for actuaries to understand current corporate finance practices and be able to provide strategic and holistic solutions for corporate decision-makers. This paper surveys current literature to fill this void for pension actuaries.

Recent examples of corporate finance involvement in strategic pension decision-making include the three largest annuity buyouts in corporate pension history: General Motors' announcement on June 1, 2012 of transferring approximately $26 billion of pension obligations to insurers (General Motors Company, 2012); Verizon's announcement on Oct. 17, 2012 of transferring approximately $7.5 billion of pension obligations to insurers (Verizon Communications Inc., 2012); and Motorola Solutions' announcement on Sept. 25, 2014 of transferring the pension obligations for approximately 30,000 company retirees to insurers (Motorola Solutions Inc., 2014). Coincident with the announcement of the annuity buyout, General Motors and Motorola Solutions also announced lump-sum offerings to their retirees.

The objectives stated in the GM 2012 announcement were: "These actions represent a major step toward our objective of de-risking our pension plans and will further strengthen our balance sheet and give us more financial flexibility going forward," while the VZ 2012 announcement stated that "the transaction is expected to further Verizon's objective of de-risking the pension plan while improving the company's longer term financial profile." In an interview with *Pensions and Investments*, Robert O'Keef, Motorola Solutions' corporate vice president and treasurer, indicated that the pension discussion started after Motorola Solutions decided to divest its enterprise business to Zebra Technologies Corp, and the pension buyout and lump-sum offering was related to right-sizing the pension obligations relative to its remaining business: "This is a company that has gotten smaller over the last decade and a half, so if you rewind 15 years, the company had $45 billion in sales, six major businesses, (and) 150,000 employees. What

we're going to be left with after the divesture … is a monoline business with about $6 billion in revenue and about 15,000 employees. And this business is still saddled with a legacy pension." (Kozlowski, 2014)

Thus, balance sheet, financial flexibility and financial profile, including corporate leverage and the relationship between the size of the pension plan and the size of the operating business, are corporate finance considerations important to corporate decision-makers. Moreover, such actions taken on corporate pension plans are not expected to impact the corporation's credit rating (Kozlowski, 2014).

Corporations raise capital, borrow money and then invest the proceeds in their operations to generate a profit. Modern corporate finance sees a corporation as a pass-through entity, and the corporation is managed to maximize shareholder value. In this context, pension plans are pass-through entities as well, where shareholders assume the risk of a pension plan (Enderle et al., 2006; Exley, Mehta & Smith, 1997; Peskin & Hueffmeier, 2008). Corporate pension plans are managed to enhance and, at a minimum, not to destroy shareholder value. Although this shareholder-centric perspective may not be the only perspective of a corporate decision-maker, the authors believe that increasingly it is the framework within which many of the pension decisions are made; such decisions include which pension risk to retain, which pension risk to transfer, and what corporate capital structure should be maintained to optimize risk-taking.

This calls for actuaries to understand important corporate metrics used by the corporate decision-makers. From a literature search, the authors identified three key corporate finance metrics and measures impacted by corporate pension plans that are increasingly being used by corporate decision-makers. The first is corporate leverage. There are various financial metrics related to corporate leverage—for example, the debt-to-equity ratio (Coughlan, 2003; Kuipers, 2014; Turnbull, 2013). The augmented or holistic balance sheet, where pension assets and liabilities are integrated with other operating assets and liabilities, is an important determinant in calculating corporate leverage. The second is accounting adjustments made by rating agencies to income statements and cash flow statements. In our research, we surveyed adjustments made by rating agencies as examples of how the economics of the pension plans flow through the income and cash flow statements (Smyth, 2013; Standard & Poor's, 2002). The third is the weighted average cost of capital (WACC) where it is felt that the calculation of the WACC from market data may be biased if corporate pension plans are ignored (Gallagher & McKillop, 2010; Jin, Merton & Bodie, 2006; Mckillop & Pogue, 2009; Merton, 2006).

Another important aspect of the corporate risk management framework is the trade-off between holding equity capital and mitigating risk. Corporations may hold a certain amount of money, credit or equity to cover potential losses from unforeseen events. The more risks a corporation assumes, the more capital is required. This trade-off is made explicit with financial companies that have capital requirements. Here the concept of value at risk is used. For example, a company may hold enough capital to survive a 1-in-200 year event with respect to its pension plans; that is, a company may want to have

enough liquid assets or can raise additional funds to cover pension shortfall at the 99.5 percent level, so that the pension shortfall would not bankrupt the company.

More generally, pension risks give rise to volatility in corporations' financial statements. How do corporations evaluate this volatility and decide how much to spend to mitigate pension risks? This is generally described as risk budgeting. Besides using value at risk, we have identified two other approaches described in the literature. One is the traditional sensitivity analysis, where pension volatility is translated into its impact on corporate earnings and cash flows. The impact on earnings or cash flows is multiplied by a market multiple to estimate its impact on a corporation's stock price. Alternatively, the net present value of contributions is calculated. This provides an estimate of the impact of pension risks on shareholder value (Mathur, 2013). The other approach is based on the beta of a corporation's stock. Pension risks increase the beta of a corporation. By targeting a fixed beta, one can calculate how much equity capital is needed for a given level of pension risk. This approach is presented by Merton in his analysis of the WACC (Merton, 2006).

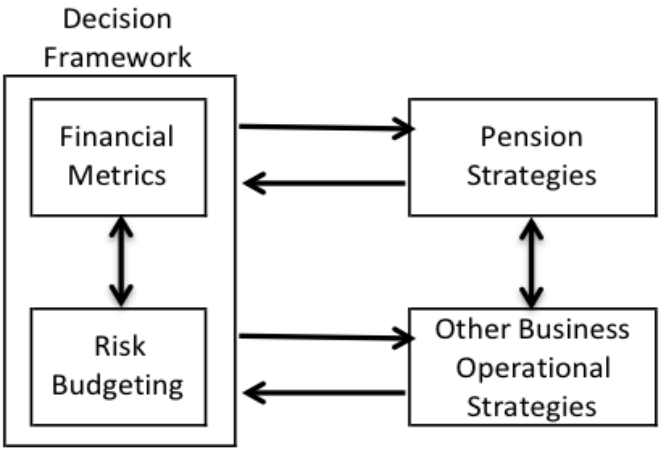
Equally important is to look for empirical evidence on how corporate pension plans impact shareholder value. While theoretical analysis can provide prescriptive solutions on how pension plans should fit into a corporation's financial profile, empirical studies look at how a corporation actually behaves and how the market values corporate pension plans. Here we identified literature discussing the following questions:

1. How does a corporation's pension plan impact its stock price?
2. How does a corporation's pension plan impact its credit rating or credit spread?
3. How does a corporation manage its pension plan in the presence of pension insurance (i.e., Pension Benefit Guaranty Corporation (PBGC) in the United States)?

The empirical studies provide additional insight on how corporations should manage their pension plans. By combining the empirical findings of the key corporate financial metrics impacted by pension plans, and the analysis of the trade-off between capital and risk, we assembled a body of corporate finance knowledge that will be valuable to actuaries.

The following diagram illustrates how pension plans and other corporate strategies can be integrated into an enterprise-wide decision framework.

Figure 1: Enterprise-Wide Decision Framework



In our view this decision framework involves various financial metrics and the process of allocating capital to risks, with pension strategies interacting with and impacting both of them. Different corporations may employ different processes for risk management and strategic planning, but they almost always involve financial metrics and capital allocation procedures.

Throughout this paper, by pension plans, we mean corporate DB pension plans. We only consider corporate pension risk management at a strategic level—that is, at the level of how much pension risk a corporation should take and where on the corporation's capital structure should the risk be taken. Once these questions are answered, objectives regarding a corporation's pension plans can be set, and different de-risking strategies can be evaluated and implemented against these objectives. There is a large body of literature on the evaluation and implementation of de-risking strategies, but this is outside the scope of this paper. Additionally, we did not survey pension risk management literature related to public pension plans.

The rest of the paper is organized as follows. In Section 1, we evaluate how well corporations and consultants who advise corporations have accepted key corporate finance concepts. The emphasis is not on evaluating the prescriptive conclusions reached by financial economists, but on themes and principles that have increasingly been incorporated into the corporate pension plan decision-making process. In Section 2, we present the calculation of key corporate metrics and show how corporate pension plans impact these key corporate metrics. In Section 3, we discuss different approaches to quantifying the trade-off between risk and capital. In Section 4, we present findings from empirical studies on how pension plans impact shareholder value. In Section 5, we discuss the result of a survey we conducted of pension plan sponsors on the application of risk management concepts to pension plans. In Section 6, we provide our conclusion.

Section 1. Principles from Financial Economics

Modern corporate finance is part of financial economics. A discussion of financial economics principles as they are applied to corporate pension plans can be found in the Society of Actuaries' (SOA's) "Pension Actuary's Guide to Financial Economics" (Enderle et al., 2006). We begin our commentary by examining themes and principles from financial economics that have gained increasing acceptance by corporate decision-makers. We also point out areas where they have not been adopted.

1. Both the corporations' view and the pension plan's view of DB pension plans are important.

   The business of pension, apart from fiduciary responsibilities, should take shareholder value into account. At a minimum, corporate pension plans should not destroy shareholder value. However, because of corporations' responsibilities to their retirees and other pension plan stakeholders, strategic pension decisions are not made solely based on shareholder interest.

   A main conclusion reached by financial economists is that corporate pension plan investments should be in bonds. This argument is based on the fact that, in the United States, returns from bonds are taxed at a higher rate than returns from equities. If a corporation shifts pension investments from equities to bonds, a shareholder of the company can make the opposite shift in her personal portfolio and realize tax savings (Gold & Hudson, 2003). Therefore, a corporation can increase shareholder value by investing in bonds. This is known as the Black-Tepper tax arbitrage.

   De-risking pension plans often involves shifting pension investment from equities to bonds; however, there is little evidence that more investments in bonds are motivated by the Black-Tepper tax-arbitrage arguments. De-risking strategies are made in the context of overall corporate strategy and their impact on shareholder value, as well as their impact on retirees and other stakeholders.

   The strategic pension initiatives—such as pension buyout, lump-sum offerings, or change to mark-to-market accounting (unless required by international accounting rules)—are unlikely to be undertaken by corporations if they result in adverse investor reactions, or negative analyst and rating agency responses. This is especially important if a corporation is required to spend cash to complete the pension transaction. For example, in Motorola's pension buyout transaction, maintaining the same credit rating was a necessary condition for any pension transactions (Kozlowski, 2014).

   In a study of mark-to-market accounting for corporate pensions, SEI conducted event studies around accounting change announcements. SEI also reviewed analyst and rating agency reactions. Its conclusion was that a change to mark-to-market pension accounting has no direct impact on share prices, and has a negligible impact on the corporation's credit rating (SEI Investment Management Corporation, 2013a). This

conclusion is an important consideration for corporations contemplating changes to their pension accounting. Similarly, Moody's concluded that de-risking activities are typically credit-rating neutral (Smyth, 2013).

Even though corporate finance often has the most influence on strategic pension discussions, plan sponsors are also mindful of their fiduciary responsibilities. For example, in General Motors' announcement, it stated, "we have taken great care in ensuring the security of their (retirees') retirement benefits." The separation of the plan sponsor's settlor function and fiduciary function is crucial in pension buyout transactions. For significant pension plan restructuring, an independent fiduciary may be engaged to oversee the retiree's interest. In the General Motors case, State Street has served as the independent fiduciary who represents members of the pension plan (Burr, 2012).

2. Pension liability should be assessed economically.

   The financial economists' preferred pension liability measure is a market-consistent valuation of the Accumulated Benefit Obligation (ABO). This measure reflects market interest rates but does not assume an implied labor contract of continued employment. Financial economists view this as the true economic measure of the pension liability, and the use of this measure leads to less distortion in the benefit for wage trade-off in the labor market (Bodie, 1990; Bulow, 1982; Enderle et al., 2006; Exley et al., 1997).

   While the ABO measure of economic liability is not widely used in the accounting presentation of balance sheet liabilities (Projected Benefit Obligation (PBO) is still the widely used measure and is required under FAS 158), there is recognition that an economic assessment of pension plans is the first step in understanding their real cost. Usually this involves adjusting accounting PBO to obtain an appropriate liability measure to be used in strategic pension analysis.

   Three types of adjustments are frequently made:

   a. Update mortality and mortality improvement assumptions if the accounting mortality assumptions are inadequate. This is especially important if longevity risk is under consideration.
   b. Lower discount rate assumptions. In a plan termination analysis, the discount rate should reflect annuity purchase rates.
   c. Reflection of the value of embedded options—specifically, options available to participants when interest rates change, such as adjustable cash balance crediting rate, or interest rate used for lump-sum options.
   d. Reflection of the value of contingent liabilities based on the funded status of the pension plan—for example, additional PBGC premiums or taxes on pension surpluses.

Corporations considering pension risk transfer or pension liability hedging will make these adjustments to the PBO. As an example of such analysis, Mercer's Pension Buyout Index gives an indication of the adjusted pension liability relative to the PBO (Mercer, 2014). Coughlan makes the same point in his analysis of longevity risk (Coughlan, 2013). These developments speak to the importance of an economic assessment of corporate pension plans in any strategy development.

3. Pension accounting should be transparent to decision-makers.

   Closely related to an economic assessment of pensions is accounting transparency. Accounting obfuscation has been cited by financial economists as an impediment to sound decision-making. The criticisms are usually in the area of pension smoothing and the presentation of pension information in the footnote of corporations' financial statements rather than in the actual income statement (Blake, 2009; Coronado et al., 2008). The use of long-term expected return assumptions and the smoothing of actuarial gains and losses create an artificial stability in corporate income statements and hide the risks of corporate pension plans (Hueffmeier, 2010).

   The change in pension accounting rules such as FAS 158 and IAS 19 can be viewed as a response to such criticisms. Moreover, in recent years, several companies have adopted mark-to-market accounting for pension costs (SEI Investment Management Corporation, 2013a). This, among other things, provides more transparency for pension obligations and pension costs. Meanwhile, credit rating agencies have incorporated pension information into their rating systems (Smyth, 2013).

   More transparent accounting reveals volatility in pension investments and makes the risk of the mismatch between assets and liabilities more apparent (Peskin, 2012). Managing pension-related volatility has become a new paradigm for pension risk management (Peskin & Hueffmeier, 2006, 2008).

4. Pension deficits are corporate debts.

   It is now widely accepted that pension deficit is a form of corporate debt. The next question is: What are the characteristics of pension debt, and is it desirable for corporations to hold such pension debts?

   Financial economists have argued that pension debts are borrowings from the corporations' employees and are an inefficient form of corporate debts. This conclusion is increasingly shared by corporations, and supported by empirical findings (Enderle et al., 2006).

   For example, it has been argued that pension debts are more expensive than other forms of corporate debt because the size of the pension debts is volatile. Studies have shown that pension deficit has a greater impact on a corporation's credit rating than other long-term corporate debts (Cardinale, 2007; Gallagher & McKillop, 2010; Mckillop & Pogue, 2009).

A ratio frequently used in strategic pension analysis is the size of the pension plan relative to the corporation's operating business, or the size of the pension plan relative to the corporation's market capitalization. As this ratio increases, the corporation becomes more leveraged, and pension risk management becomes more important (Hueffmeier, 2010; Long et al., 2010). The relationship between pension debts and corporate leverage will be discussed in more detail in the next section.

5. Pension surpluses and pension deficits have asymmetric impacts on corporations.

   In Canada and the United States, the use of pension plan surpluses is limited. In an ongoing pension plan, pension surpluses can typically be used to pay for future benefit accruals, but if the pension plan is frozen, it is difficult for corporations to realize the full value of pension surpluses (Enderle et al., 2006; Goldman Sachs Asset Management, 2010; Hueffmeier, 2010). For a frozen plan, as the pension plan approaches full funding, the upside of asset returns is outweighed by the downside of asset returns. This asymmetric impact alters the risk-reward equation and is especially relevant for de-risking decisions. The result is usually a dynamic asset allocation strategy where the asset allocation depends on the funded status of the pension plan. This is known as a glide path, or a journey plan (Goldman Sachs Asset Management, 2010; NISA Investment Advisors, 2013a; Ransenberg et al., 2012; SEI Investment Management Corporation, 2013c).

   This asymmetric impact is also observed in the credit spread and the stock price of corporations. For example, pension surpluses do not seem to have the same favorable impact on corporations' credit spread as the unfavorable impact that pension deficits have (Cardinale, 2007; Gallagher & McKillop, 2010). Therefore, as the pension plan approaches full funding, there is a premium placed on pension risk management to forgo the upside in order to avoid adverse outcomes.

6. Pension plan risks should be allocated and managed efficiently.

   Financial economists have long argued that pension investment in equities does not create value. A dollar in equities today is the same as a dollar in bonds today. Therefore, in corporate finance, the focus is shifted to risk management (Enderle et al., 2006). Risk management is not against risk-taking, but is about allocating and managing risks effectively. The asymmetric impact of corporate pension plans is an example of the risk-reward characteristics of pension plans that need to be managed.

   Furthermore, how does taking risks in pension plans reward a corporation? Which risk should be hedged? For nonfinancial corporations, if the market does not reward interest rate and longevity risk-taking, then such risks should always be hedged for such corporations (Coughlan, 2003, 2007, 2013). For financial corporations, interest rate risks and longevity risks should be managed on an enterprise-wide basis. As another example, a corporation may optimize investment risk in a pension plan by

appropriate diversification into alternative investments such as private equity, real estate and hedge funds (Peskin & Hueffmeier, 2008; Peskin, 2012).

It is widely accepted that pension plan risks should be allocated and managed efficiently. Allocating risks inefficiently can have systemic implications. This consideration plays an important role in discussions surrounding the PBGC insurance system in the United States. Since pension insurance premiums charged by PBGC are not risk-based, this has created economic incentives for financially constrained companies to shift pension risks to the PBGC and punish financially strong, better-managed corporations with higher PBGC premiums, contributing to corporations abandoning DB pension plans (American Academy of Actuaries, 2013; Coronado & Liang, 2005; Marcus, 1983; Mitchell, 2013; Rauh, 2009).

In summary, we have observed that there is generally not an acceptance of the prescriptive conclusions of financial economics, such as the Black-Tepper tax arbitrage or the all-bond pension investment portfolio, but there is an increasing acceptance of the principles and tools developed by financial economists in strategic pension analysis. It remains to be seen how tightly the financial impacts of pension plans are incorporated into corporate financial metrics and corporate decision-making.

In a tight integration of pension plans into corporate decision-making, one would expect the impact to go both ways: The strategic decisions regarding pension plans are impacted by general corporate strategies and considerations; and on the flipside, the general corporate financial decisions of the corporations are impacted by their pension strategies. In our experience, we have observed an increasing impact of corporate strategies on pension plans, but less evidence that pension strategy is impacting corporate decisions.

Pension plans can have material impacts on issues affecting corporate decisions such as:

- Should the corporation raise equity capital or debt capital? The leverage due to pension plans can be an important factor.
- Should the corporation issue fixed-rate debt or floating-rate debt?[1] The interest rate risk of pension plans can change this decision.
- Will a particular corporate project provide sufficient return to be justified? The hurdle rate is usually given by the WACC, and this rate may change if pension plans are taken into account.

Integrating these elements can be complicated and many corporate decision-makers are not accustomed to thinking in this integrated manner. In fact, in our experience, the trend seems to be for corporations to consider pension plans as a noncore part of the business to be divested eventually. De-risking activities are supportive of this corporate decision regarding corporate pension plans. Regardless of whether or not this trend will continue,

[1] This can be an important consideration for financial corporations. Floating-rate debt is less common for nonfinancial corporations.

actuaries should understand how pension plans impact corporate financial metrics so that they can advise their clients effectively.

Section 2. Calculation of Key Corporate Financial Metrics

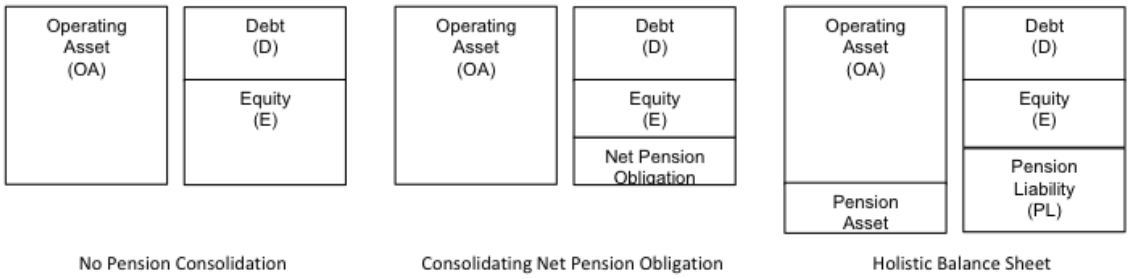
In this section we present key corporate finance metrics and show how they are impacted by pension plans. We also show different ways they can be adjusted for pension plans.

2.1. Holistic Corporate Balance Sheet and Corporate Leverage

Since the early 1970s, it has been articulated that DB pension plans should be consolidated into a corporation's balance sheet like a corporate subsidiary, even though there is a legal separation of the corporation and the pension plans (Treynor, Regan & Priest, 1978). The consolidated balance sheet was called the *augmented balance sheet* by Treynor. Following Coughlan, the *holistic corporate balance sheet* was used to describe the consolidation of pension plans into the corporate balance sheet (Coughlan, 2013).

Current accounting standards (FAS 158 and IAS 19) recognize a net pension obligation on a corporation's balance sheet. Net pension obligation is defined as the PBO minus the market value of pension assets. Prior to the current accounting standards, the net pension obligation was not required to be recognized on a corporation's balance sheet. Consolidating pension plans into a corporation's balance sheet simply adds the pension assets and liabilities to other corporate assets and liabilities. Based on the accounting identity, asset = debt + equity, we have the following diagrams.

Figure 2: Holistic Corporate Balance Sheet



Our observations on the holistic corporate balance sheet are as follows:

- The holistic balance sheet should be an economic balance sheet (Coughlan, 2013). The pension liability that is commonly used is the PBO, because it is the most available measure used by accounting standards. However, the PBO does not represent an economic liability. As discussed in the previous section, the PBO is frequently adjusted for interest rates and mortality before consolidation into a corporate balance sheet. For example, if a settlement liability is desired to represent the cost of accrued benefits when the pension plan is terminated,

Mercer's US Pension Buyout Index shows that the pension buyout liability is approximately 110 percent of the PBO (Mercer, 2014).

- If there is an unfunded pension obligation, the inclusion of pension obligations will reduce shareholder equity.
- The inclusion of net pension obligation only in the corporate balance sheet suffers from a few shortcomings. First, it does not reflect the risk of pension plan investments. An all-equity or all-bond asset portfolio can have the same net pension obligation, but very different risks. Second, it does not adequately account for the size of the pension plan relative to the operating part of the business. The larger the size of the pension plan relative to the operating part of the business, the more leveraged the corporation is, and the larger the impact of pension plans on the corporation.
- A pension buyout effectively removes pension assets and liabilities from the balance sheet and reduces corporate leverage.
- If a portion of the pension liabilities is effectively hedged, one can also remove assets and liabilities from the holistic balance sheet. However, most hedges are subject to tracking errors, and not 100 percent effective. Therefore, they should not be completely removed from the holistic balance sheet.
- For financially distressed firms, it is possible to put the value of pension insurance on the balance sheet as an asset. Even though theoretical considerations suggest a corporation should consider the value of pension insurance as an asset to the corporation, the value of pension insurance is only realized in corporate bankruptcy. The empirical evidence is mixed in terms of whether financially distressed corporations consider pension insurance in their pension strategy.

The key purpose of using the holistic corporate balance sheet approach is that it consolidates the asset and liability information for determination of financial ratios commonly used for corporate leverage. Corporate leverage is an important ratio used by credit rating agencies. Commonly used measures for corporate leverage include debt-to-equity ratio, long-term debt to equity, and total assets to equity (Bender & Ward, 2009; SEI Investment Management Corporation, 2013b). Below, we illustrate an example of the corporate leverage calculation using the holistic corporate balance sheet for an electric utility company.

2.2. Example of How a Pension Plan Impacts Debt-to-Equity Ratio

The following information is taken from the 2013 annual report (Form 10-K) of the American Electric Power Company Inc., and subsidiary companies.

Total assets (OA)	$56,414,000,000
Total liabilities (D)	$40,328,000,000
Shareholder's equity (E)	$16,085,000,000
Long-term debt (LD)	$16,828,000,000
Pension assets (PA)	$4,711,000,000
Pension liability (PL)	$4,841,000,000

The total liabilities (D) include the net pension obligation of $130,000,000 (= PL – PA). In what follows, we calculate the debt-to-equity ratio based on these accounting liabilities with and without adjustment for pensions:

1) Debt-to-equity ratio without adjustment for pensions:

Debt-to-equity ratio = D / E = 40,328 / 16,085 = 2.5.
Long-term debt to equity = LD / E = 16,828 / 16,085 = 1.0.
Asset-to-equity ratio = OA / E = 56,414 / 16,085 = 3.5.

2) Adjust long-term debt by net pension obligation:

Debt-to-equity ratio = D / E = 40,328 / 16,085 = 2.5.
Long-term debt + net pension obligation = 16, 828 + 130 = 16,958.
Long-term debt to equity = 16,958 / 16,085 = 1.1.
Asset-to-equity ratio = OA / E = 56,414 / 16,085 = 3.5.
Note: Debt-to-equity ratio and asset-to-equity ratio remain the same as 1) above.
This is the approach used in Moody's adjustment for DB pension plans.

3) Debt-to-equity ratio using holistic corporate balance sheet:

Total assets + pension assets = 56,414 + 4,711 = 61,125.
Total liabilities + pension liability = 40, 328 -130 + 4,841 = 45,039.
Long-term debt + pension liability = 16,828 + 4,841 = 21,669.

Debt-to-equity ratio = 45,039 / 16,085 = 2.8.
Long-term debt to equity = 21,669 / 16,085 = 1.3.
Asset-to-equity ratio = 61,125 / 16,085 = 3.8.

This example illustrates the typical situation when pension plans are consolidated into a corporation's balance sheet:

- The debt-to-equity ratios increase when pension plans are consolidated into the corporate balance sheet. In this example the ratio increases by 0.3.
- When the pension liability is hedged, or if the pension liability is transferred to an insurance company, the debt-to-equity ratios are reduced by up to 0.3.

The following table shows the debt-to-equity ratio of 10 similar electric utility companies.[2] When pension liability is added to long-term debt, the long-term debt-to-equity ratios for the corporations are in a similar range, except for the PPL Corporation, which appears to be more leveraged than the other electric utility companies.

[2] Electric utilities, being in a regulated industry, can pass on pension costs to their customers and tend to have better-funded pensions. Different industries may exhibit different characteristic in terms of corporate leverage.

	Assets (1)	Liabilities (2)	Equity (3)	Long-Term Debt (4)	Pension Asset (5)	Pension Liability (6)	Pension Deficit (7) = (6) – (5)
American Electric Power	56,414	40,328	16,086	16,828	4,771	4,841	70
Duke Energy	114,779	73,371	41,408	38,152	8,142	7,510	-632
Edison International	46,646	34,955	11,691	9,825	3,477	4,178	701
Exelon Corporation	79,924	56,984	22,940	17,325	13,571	15,459	1,888
Nextera Energy	69,306	51,266	18,040	23,969	3,692	2,254	-1,438
PPL Corporation	46,259	33,793	12,466	20,592	11,440	12,734	1,294
The Southern Company	64,546	44,407	20,139	21,344	8,733	8,863	130
Xcel Energy	33,907	24,341	9,566	10,911	3,010	3,441	431
Northeast Utilities	27,796	18,184	9,612	7,777	3,986	4,677	691
Firstenergy Corp	50,424	37,732	12,692	15,831	6,171	8,263	2,092
Entergy Corporation	43,406	33,680	9,726	12,139	4,567	5,925	1,358

	Debt / Equity = (2) / (3)	Long-Term Debt / Equity = (4) / (3)	Asset / Equity = (1) / (3)	(Long-Term Debt + Pension Deficit) / Equity = ((4) + (7)) / (3)	(Liability + Pension Liability) / Equity = ((2) + (6)) / (3)[3]	(Long-Term Debt + Pension Liability) / Equity = ((4) + (6)) / (3)	(Asset + Pension Asset) / Equity = ((1)+(5)) / (3)[4]
American Electric Power	2.5	1.0	3.5	1.1	2.8	1.3	3.8
Duke Energy	1.8	0.9	2.8	0.9	2.0	1.1	3.0
Edison International	3.0	0.8	4.0	0.9	3.3	1.2	4.3
Exelon Corporation	2.5	0.8	3.5	0.8	3.1	1.4	4.1
Nextera Energy	2.8	1.3	3.8	1.3	3.0	1.5	4.0
PPL Corporation	2.7	1.7	3.7	1.8	3.6	2.7	4.6
The Southern Company	2.2	1.1	3.2	1.1	2.6	1.5	3.6
Xcel Energy	2.5	1.1	3.5	1.2	2.9	1.5	3.9
Northeast Utilities	1.9	0.8	2.9	0.9	2.3	1.3	3.3
Firstenergy Corp	3.0	1.2	4.0	1.4	3.5	1.9	4.5
Entergy Corporation	3.5	1.2	4.5	1.4	3.9	1.9	4.9

2.3. Holistic Balance Sheet—Pension Plan Perspective

The concept of a holistic balance sheet applies to pension plans as well as to corporations. It considers all the resources (assets) available for the pension plans to pay the benefits. From the pension plan's perspective, the resources available to the pension plan are not limited to the assets in the pension fund. In most jurisdictions, because the corporate plan sponsor is obligated to fund the pension plan so that there are sufficient assets to pay future benefits, the pension plan has a call on the plan sponsor's future cash flows. The value of this call option depends on the financial health of the sponsoring corporation. This call option, often called the sponsor covenant or the sponsor support, should be greater than the current unfunded pension obligations. Otherwise the pension plan may be considered insolvent.

The following discussion follows the concept of holistic balance sheet used by the European Insurance and Occupational Pension Authority (EIOPA) (European Commission, 2014; Turnbull, 2013).

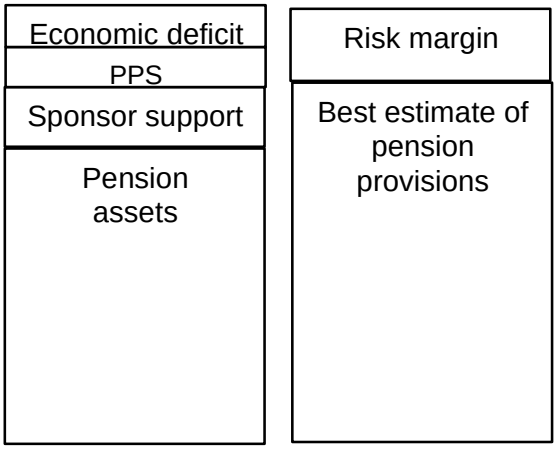
[3] Net pension liabilities are subtracted from total liabilities to avoid double counting.
[4] Net pension assets are subtracted from total assets to avoid double counting.

On the asset side, in addition to the market value of assets, two items are added: (1) sponsor support, also called the sponsor covenant, which is the ability and willingness of the plan sponsor to fund the pension plan benefits; and (2) pension protection schemes (PPS) which capture the value of pension insurance such as the PBGC in the United States.

On the liability side, a best estimate of the benefit liability based on the plan's benefit provisions is made. The benefit provision includes unconditional, conditional and discretionary benefits, as well as possible benefit reductions.[5] The liabilities are valued on a market-consistent basis. However, since not all pension obligations can be replicated in the financial markets, a risk margin is added to the best estimate to represent additional costs if the pension obligation is transferred to an insurer.

If the assets are not sufficient to meet benefit obligations, there is an economic deficit. The holistic pension plan balance sheet is depicted in the diagram below.

Figure 3: Holistic Pension Plan Balance Sheet



This holistic balance sheet concept may be the basis for future European pension regulation, and the calculation of the solvency capital requirement (SCR). The SCR measures whether pension plans have sufficient financial capital, security mechanisms or benefit adjustment mechanisms to survive demographic or economic shocks at a 99.5 percent confidence level. The valuation of sponsor support and pension protection schemes typically involves an option pricing model or Monte Carlo simulation and is still an emerging field of research.

The importance of holistic balance sheets, both the holistic corporate balance sheet and the holistic pension plan balance sheet, cannot be overstated. This is the foundation for

[5] In certain jurisdictions, national social and labor law may allow pension benefits to be reduced when the pension plan is expected to be insolvent.

evaluating whether the pension program is sustainable for the long term (Coughlan, 2013; Kessler, 2013), and a basis for developing sound corporate pension strategy.

2.4. Rating Agency Adjustments

In addition to balance sheet impacts, pension plans also impact reported earnings and cash flows. In this section we describe how Moody's and Standard and Poor's adjust financial statement for DB pension plans. The adjusted earnings and cash flows are the inputs for various corporate finance metrics and measures.

Moody's Adjustment

On the income statement, Moody's Investment Service makes two adjustments (Smyth, 2013). First, only service cost is included in the pretax income. All of the pension costs related to smoothing are removed. Next, if the pension plan is underfunded, an implied interest equal to the underfunded pension debt multiplied by the marginal borrowing rate is subtracted from the pretax income. On the cash flow statement, any contribution in excess of service cost is reclassified to financing activities.

As an example, we continue the calculations with respect to information taken from the 2013 annual report (Form 10-K) of the American Electric Power Company Inc., and subsidiary companies.

From the company's 10-K, we have the following for the year ending Dec. 31, 2013:

Pretax income	$2,110,000,000
Pension cost	$124,000,000
Service cost	$69,000,000
Interest cost	$203,000,000
Contribution	$6,000,000
Actual pension return	$340,000,000
Net pension obligation (BOY)	$509,000,000
Assumed borrowing cost	4.00%

For adjusted pretax income, we first calculate the implied interest, and then we back out the pension cost and replace it with the service cost and the implied interest.

Implied interest	$20,000,000 (= 509,000,000 x 4.00%)
Pretax income after adjustment (000,000)	$2,145,000,000 (= 2,110 + 124 – 69 – 20)

For cash flows, we first calculate the excess of pension contribution over service cost, and then we reclassify this amount as financing cash flows. Since the service cost ($69

million) is greater than the pension contribution ($6 million), we made no adjustment to the cash flows.

Cash flow from operating activities	$4,106,000,000
Cash flow from financing activities	($449,000,000)
Reclassification of cash flows	$0

Standard & Poor's Core Earnings

In 2002, Standards and Poor's (S&P) announced a methodology for calculating core earnings, which was meant to capture earnings related to a company's core business (Standard & Poor's, 2002). Adjustments were made for pension costs because they are part of a company's net income even though they were not part of a company's core business. In S&P's core earning methodology, only service costs and the portion of the interest cost that was not covered by the actual return on assets are charged against a corporation's core earnings. Service costs represent deferred compensation earned by current employees, while interest costs not covered by actual asset returns represented financing costs that needed to be borne by the corporation. Similar to Moody's adjustment, all smoothing and actuarial gains and losses were removed from the definition of core earnings.

In the above example of American Electric Power Company Inc, and subsidiary companies, since the actual pension asset return in 2013 ($340 million) is greater than 2013 interest cost ($203 million), only the service cost ($69 million) is charged against the core earnings.

2.5. Weighted Average Cost of Capital

The WACC is important in corporate finance because it is used as the hurdle rate for management to evaluate projects. Projects are only undertaken if the expected returns exceed the WACC. The standard estimate of the WACC is derived using the Capital Asset Pricing Model (CAPM); this estimate will be impacted by the presence of corporate pension assets and liabilities.

The CAPM is the standard theory used in corporate finance. It shows that for any risky asset, the expected return is equal to the risk-free rate plus a multiple of the market risk premium:

Return on risky asset = $r_f + \beta \times (r_m - r_f)$,

where r_f denotes the risk-free rate, r_m denotes the expected market return, $(r_m - r_f)$ is the market risk premium, and β is the correlation of the risky asset to the movement of the market.

Applying CAPM to a corporation's equity, the higher the beta (β), the higher the volatility of the corporation's equity and expected return. Therefore, the higher the risk a corporation takes on its pension plans, the higher the corporation's β will be. The corporation's equity β and debt β can be used to estimate its WACC.

The following discussion follows the work of Jin, Merton and Bodie (2006), and Merton (2006).

Under the holistic balance sheet, assets can be decomposed into operating assets (OA) and pension assets (PA), and liabilities can be decomposed to debt (D), equity (E) and pension liability (PL). The corresponding β's are denoted by β_{OA}, β_{PA}, β_D, β_E, β_{PL}. The WACC is based on a corporation's operating assets. β_{OA} is the unleveraged beta. Thus we have:

(1) $WACC = r_f + \beta_{OA} \times (r_m - r_f)$,

A corporation's equity β, β_E and debt β, β_D, can be estimated from market data. If the β's observed in the market reflect the accounting balance sheet, then

(2) $\beta_{OA} = (\beta_D \times D + \beta_E \times E) / OA$;

But, if the β's observed in the market reflect the holistic balance sheet, then

(3) $\beta_{OA} = (\beta_D \times D + \beta_E \times E + \beta_{PL} \times PL - \beta_{PA} \times PA) / OA$.

If pension plans are taken into account by the market, equation (3) should be used to estimate β_{OA}; otherwise equation (2) should be used. In turn, the WACC will be calculated via equation (1).

Consider the following example from Merton (2006).

	Value	Beta		Value	Beta
Operating Assets	\$40	β_{OA}	Debt	\$19	0.00
Pension Assets	\$46	0.6	Equity	\$21	2.00
			Pension Liability	\$46	0.00
Total Assets	\$86		Total L&E	\$86	

In this example, we assume that the corporation's equity beta is 2 and the corporation's debt beta is zero. Empirically, the beta is approximately 0.175 for corporate debt. Since the pension liability is debt-like, we also assume a beta of zero for pension liability. For pension assets, we assume a diversified portfolio with a 60/40 equity/debt asset allocation. So the beta for pension assets is 0.6.

If we only look at the accounting balance sheet, then the operating asset beta would be

β_{OA} = (0 x 19 + 2 x 21) / 40 = 1.05.

Using a risk-free rate of 3 percent and a market risk premium of 4 percent, the weighted average cost of capital is

WACC = 3% + 1.05 x 4% = 7.20%.

However, if the market takes into account the holistic balance sheet, then the operating asset beta would be:

β_{OA} = (0 x 19 + 2 x 21 + 0 x 46 – 0.6 x 46) / 40 = 0.36,

and the weighted average cost of capital is

WACC = 3% + 0.36 x 4% = 4.44%.

Thus there is a significant difference in the WACC estimate depending on whether one uses the accounting balance sheet or the holistic balance sheet.

Which one is correct? Does the corporation's equity beta observed in the market take into account the accounting balance sheet, or the holistic balance sheet? In Jin, Merton and Bodie (2006), they studied this question empirically and concluded that the market takes into account the holistic balance sheet.

This means that if the pension plan is not taken into account, the WACC will be overestimated. Jin, Merton and Bodie (2006) looked at several companies and concluded that the overestimation can be as high as 30 percent. This overestimation of WACC may cause the management to abandon projects that would have been justified under a lower WACC.

Equation (3) shows that this overestimation is related to pension asset/liability mismatch. If the pension liability is perfectly hedged by pension assets, then pension asset beta is equal to pension liability beta, and equation (3) is reduced to equation (2).

Alternatively equation (3) can be used to estimate what would happen to a corporation's equity beta if it de-risks its pension plans by changing asset allocations. Rearranging equation (3), we have

(4) $\beta_E = (\beta_{PA} \text{ x } PA + \beta_{OA} \text{ x } OA - \beta_D \text{ x } D - \beta_{PL} \text{ x } PL) / E.$

In the previous example, we have an operating asset beta of 0.36 and a 60 percent allocation of pension assets to equity, resulting in the corporation's equity beta of 2. If the equity allocation is reduced to 25 percent, then the corporation's equity beta is reduced from 2 to 1.23.

$\beta_E = (0.25 \times 46 + 0.36 \times 40 - 0 \times 19 - 0 \times 46) / 21 = 1.23.$

This calculation shows how de-risking can change the corporation's risk profile and reduce the corporation's equity beta. Reducing the corporation's equity beta is not expected to create shareholder value because in an efficient market, the market has already taken this into account. However, using the correct estimate of the WACC is essential for corporate managers.

Section 3. Approaches to Risk Budgeting

In the previous section we looked at the key corporate finance metrics and measures impacted by pension plans. The key goal of enterprise risk management is to determine how the risk should be taken and how much risk a corporation should take. A quantitative analysis of this question involves an analysis of the trade-off between risk and capital, and an allocation of shareholder capital to different risks (Bauer & Fletcher, 2013; Nocco & Stulz, 2006). This is commonly referred to as risk budgeting. In this section we outline prevalent approaches to risk budgeting. These approaches can be applied to a variety of risks so that this kind of analysis can be done in a consistent and enterprise-wide manner.

3.1. Value-at-Risk Approach

Given a time horizon and a probability *p*, value at risk (VaR) is defined as the threshold loss level so that the probability that losses over this time horizon will exceed this threshold level is *p* (Sweeting, 2011).

Although different parameters can be used, for a DB pension, the loss is commonly defined as the pension deficit, the time frame is usually one year, and the probability is usually 5 percent or 1 percent.[6] This is also called the funded status at risk. For example, if the pension plan is fully funded at the beginning of the year, and the VaR is determined to be $40 million at the 1 percent level, then this means that there is a 1 percent chance that the pension deficit will exceed $40 million at the end of the year. For VaR, a market-consistent value of pension liabilities and the market value of assets should be used in the VaR calculation. The calculation of VaR usually requires Monte Carlo simulation over a simulated set of economic scenarios. Inflation, interest rates, and other macroeconomic factors that drive both the asset returns and the valuation of liabilities are modeled together.

A related measure is the tail value at risk (TVaR), also known as the conditional tail expectation (CTE). This is the expected loss given an event outside the probability level has occurred. Continuing with the previous example, if the TVaR is $60 million at the 1 percent level, this means that when a 1 percent event occurs, the average pension deficit is $60 million.

[6] The company can select the probability level. A probability of 5 percent represents a 1-in-20-year event. A probability of 1 percent represents a 1-in-100-year event.

VaR is the most frequently used risk measure and is the framework for capital requirements under Solvency II, the European Union's regulatory framework for setting capital requirements for insurance companies. The probability level under Solvency II is 0.5 percent, that is, a 1-in-200-year event. When VaR or TVaR is used for risk budgeting, the corporation will keep enough capital on hand so that when an event outside the probability level occurs, the corporation has sufficient money to make up the pension deficit.

Similar concepts can be applied to pension plans using different measures. For example:

- Ruin probability. If a corporation cannot survive a pension deficit in excess of $X, one can calculate the amount of capital needed so that the probability that over a one-year time horizon the pension deficit will be in excess of $X is less than *p*.
- Funded ratio. A low funded ratio can be substituted for the probability of ruin. Thus one can calculate the amount of capital needed so that the probability that over a one-year time horizon the funded ratio will be below X percent is *p*.

Given a risk budget, the corporation can use these risk measures to determine the risk level of the pension plan investment with a certain level of confidence (Hueffmeier, 2010; Wilson & Lisella, 2012).

3.2. Traditional Sensitivity Analysis

In the traditional sensitivity analysis, the projected pension expenses, pension contributions and/or pension funded statuses are calculated for a range of different economic scenarios. By looking at a certain percentile outcome—for example, at the worst 5 percent or 1 percent level—one can determine the impact of pension plans on corporate earnings or cash flows. These impacts can be translated into shareholder value by multiplying them with a price-to-earnings multiple, or a price-to-cash-flow multiple (Mathur, 2013).

For example, suppose it is determined that if pension assets return 0 percent for the coming year, the required cash contributions will increase by $10 million. If the price-to-cash-flow multiple is 10, this can create a $100 million impact on the market value of the corporation.

With this approach, the modeling usually reflects realistic accounting and funding rules, and a multiyear forecast is performed. While the modeling is not based on a market-consistent valuation of the pension plan, this approach can forecast the financial metrics most relevant to the corporation and most useful for corporate decision-makers. Pension strategies can be formulated to keep these financial metrics within a certain range, or within a certain level of volatility.

3.3. Maintaining the Same Equity and Debt Beta

In this approach to pension risk budgeting, a corporation can estimate the amount of equity capital needed to maintain the same equity beta based on an application of the CAPM, as discussed in the section on the WACC. A corporation's beta is a measure of volatility and risk. Changing the pension plan's risk profile changes a corporation's equity beta. By targeting the same equity data, one can solve for the relationship between pension asset and liability beta and the additional amount of required equity capital (Merton, 2006).

From equation (4) in Section 2, we solve for E:

(5) $E = (\beta_{PA} \times PA + \beta_{OA} \times OA - \beta_D \times D - \beta_{PL} \times PL) / \beta_E$.

Now we take delta in equation (5), assuming PA, OA, D, PL, β_{OA}, β_E and β_D stay fixed, we have

(6) $\Delta E = (\Delta\beta_{PA} \times PA - \Delta\beta_{PL} \times PL) / \beta_E$, or

(7) $\Delta E = PA \times (\Delta\beta_{PA} / \beta_E - \Delta\beta_{PL} / \beta_E \times (PL/PA))$,

where (PL/PA) is the funded ratio of the pension plan.

To show an example of this calculation, let us continue the example in the WACC section and assume PA = 46, PL/PA = 1, $\beta_E = 2$, $\beta_{PL} = 0$. Assume further that there is no change in β_{PL}. Then the change in equity capital is related to a change in β_{PA} via the equation

(8) $\Delta E = PA \times \Delta\beta_{PA} / \beta_E$.

The following table shows the change to the amount of equity capital when the management changes the asset allocation of the pension plans.

Equity Allocation in Pension Assets	β_{PA}	$\Delta\beta_{PA}$	β_E	PA	D	E	ΔE	D/E
60%	0.6	0.0	2.0	46	19	21.0	0.0	0.9
40%	0.4	(0.2)	2.0	46	19	16.4	(4.6)	1.2
20%	0.2	(0.4)	2.0	46	19	11.8	(9.2)	1.6
10%	0.1	(0.5)	2.0	46	19	9.5	(11.5)	2.0
0%	0.0	(0.6)	2.0	46	19	7.2	(13.8)	2.6

This example shows that by reducing the equity allocation in pension assets, pension asset beta is reduced and the required equity capital is also reduced. The corporation can take more risk in its operating part of the business, as evidenced by an increase in D/E ratio. Looking at it in another way, investing 60 percent of pension assets in equities requires 13.8 (21.0 – 7.2) in equity capital (compared with a fully hedged asset portfolio). This amount can be compared with the corporation's risk budget for pension plans. If the

corporation invests 20 percent of its pension assets in equities, it would only require 4.6 (11.8 – 7.2) in additional equity capital (compared with a fully hedged asset portfolio).

Equations (5) and (7) show that the amount of equity capital required is proportional to the size of pension asset and the mismatch between the pension asset and pension liability. The corporation may have limited capacity to change the liability inputs in equations (5) and (7). To the extent they can be modified, for example by freezing the pension plan, they will also impact the amount of equity capital required. Thus equations (5) and (7) can be used for allocating shareholder capital to pension plans.

In summary, all of the approaches above are intended to quantify the risk-to-capital trade-off for pension plans. They are analytical frameworks that determine, for a given risk budget, how much risk can be taken in the pension plan; and conversely, for a given level of pension risk, how much shareholder capital should be allocated to pension plans.

Section 4. Evaluation of Empirical Evidence

In practice, the theoretical calculations performed in the last section should be compared against empirical findings. Corporate decision-makers should be mindful of the extent to which the market rewards risk management in pension plans. Some of these empirical findings confirm theoretical considerations, while some empirical findings are inconclusive. In this section we review some of the empirical findings in this area.

4.1. Impact of Pension Plans on Stock Price

Recent corporate activities on pension risk transfer seem to find their theoretical underpinning from a study by Morgan Stanley on the impact of corporate pension plans on stock prices (Long et al., 2010). The study found that the plan size and funded status seem to impact stock prices the most, while reducing a company's WACC may outweigh the cost of funding or terminating pensions. According to the study, low interest rates have exposed risks associated with pension plans. "Pension-heavy" stocks (defined as the PBO in excess of 25 percent of the market capitalization) are correlated with higher betas and a higher cost of capital. Since the financial crisis began, pension risk has added volatility to a company's stock prices, as pension-heavy stocks have underperformed during the credit crisis, and outperformed during recovery. Investors also tend to view pension liabilities as riskier than debt, because pension liabilities are subject to more uncertainty. Thus, to mitigate the effects of pension size on stock prices, a company may fund the pension, which replaces a more volatile form of debt with a less volatile form. Companies can also reduce pension liability by changing or terminating the plan, or accelerating lump-sum payments, despite the low level of interest rates.

This study suggests that the stock price takes into account the corporations' pension plans. This is consistent with analysis done in the 1980s, when the pension economics were very different from today's (Bodie et al., 1986; Bulow et al., 1987; Feldstein &

Seligman, 1981).[7] However, the stock price may not completely capture pension economics. Franzoni and Marin (2006) showed that the market has significantly overvalued firms with severely underfunded pensions. They speculated that the investors did not anticipate the impact of unfunded pension liability on future earnings and cash flows and were surprised when they materialized.

A study by McFarland, Pang and Warshawsky looks at whether freezing or closing a DB pension plan increases a plan sponsor's market value (McFarland et al., 2009). They found that generally negative or insignificant abnormal returns in stock prices can be associated with such events. Thus freezing or closing a DB pension plan does not increase the plan sponsor's market value.

On the other hand numerous studies have analyzed corporate sponsors' attempt to manage earnings by changing pension plan assumptions (such as the discount rate, salary growth rate or expected return on assets) or plan asset allocations (Addoum et al., 2010; Bergstresser et al., 2006; Gopalakrishnan & Sugrue, 1995; Jones, 2013; Kasaoka, 2011; Salah & Smaoui, 2014). For example, Salah and Smaoui studied 190 Canadian firms from 2000 to 2006 and found that higher leveraged firms are more likely to choose aggressive assumptions (such as higher discount rate or higher return on asset assumption), while larger firms are more likely to choose conservative assumptions, perhaps to avoid the visibility of costs. However, they did not find relationships between pension underfunding and aggressive assumptions.

Thus it seems that the market reflects the economics of the pension plan to some extent, but the market may not reflect the economics of the pension plan fully, in part due to non-transparent pension accounting and potential earning management by corporations.

4.2. Impact of Pension Accounting on Stock Price

To address concerns that the valuation of pension plan assets and liabilities was measured inadequately and inconsistently, the Financial Accounting Standards Board (FASB) issued FAS 87 to standardize actuarial assumptions for valuing pension liabilities. However, prior to FAS 158, a plan's funded position was not shown on the corporate balance sheet, but the disclosure of fair market value was included in the footnotes of annual financial statements. Pension accounting has continued to evolve in order to address these criticisms.

Under FAS 87, net periodic pension cost (NPPC), which is the measure of pension expense reflected in the corporate income statement, uses expected return on plan assets. However, one key criticism for using expected return on plan assets is that firms are explicitly directed to use an expected rate of return without regard to the riskiness of the underlying portfolio. It has been argued that FAS 87 formalizes a systemic financial bias,

[7] In the early 1980s, a typical corporate DB pension plan had more pension assets allocated to bonds, and the liability discount rate was lower than corporate bond yields.

favoring equity investments, as the volatility of actual returns on pension plan assets is not shown in the sponsor's financial statements.

In a study based on S&P 500 firms between 1993 and 2001, Coronado, Mitchell, Sharpe and Nesbitt found that investors react to pension accounting earnings rather than pension funded status in their stock valuations (Coronado et al., 2008). Although accounting expenses or earnings associated with pension plans could be a misleading measure of the underlying value of net pension obligations, the market seemed to focus on pension accruals rather than the pension balance sheet information revealed in footnotes. Valuation placed on pension-related accruals was indistinguishable from that placed on sponsors' core earnings. During the late 1990s when corporations in the United States were recording pension incomes, their study showed that because investors did not value pension incomes differently from operating incomes, pension incomes could lead to stock market overvaluation. Subsequently, their study was updated to include data through 2005 to reflect the aftermath of the dot-com bubble. The results using a larger data set were similar to prior results. Thus, there has been controversy as to whether investors are fully aware of the funded status of the DB pension plans, and whether more accounting transparency would benefit investors.

A recent study by Jiang showed that a pension smoothing mechanism tends to induce long-term biases in reported pension expenses (Jiang, 2011). Using data from 1988 to 2007, he found that the unrecognized gains/losses do not mean revert over time. In other words, the empirical evidence is that gains and losses do not offset and the amortization of gains/losses above corridor is not effective in reducing unrecognized gains and losses. He also found that the long-term deferred gains or losses are nonzero. Thus there are long-term biases in reported pension expenses. Interestingly the bias is negative for most firms—that is, most firms have a long-term bias toward under-reporting pension expenses, but firms with a positive bias are in regulated industries. This further supports the view that firms manage earnings through actuarial assumptions and other means. Since 2006 FAS 158 requires the recognition of changes in net pension asset through other comprehensive income. However, investors tend to price other comprehensive income as transitory income on a dollar-for-dollar basis (Jiang, 2011). Thus the author believes that it is important to have procedures that do not produce long-term biases in reported earnings.

On the other hand, the change to mark-to-market accounting may recognize all changes in the net pension assets in reported earnings.[8] The change to mark-to-market accounting appears to be stock-price neutral (SEI Investment Management Corporation, 2013a).

[8] There are different flavors of mark-to-market pension accounting. For example, AT&T and Verizon recognize into pension expense all actuarial gains and losses in the year when the gains and losses occur.

4.3. Impact of Pension on Credit Rating and Credit Spread

We have seen that rating agencies are now adjusting corporate financial measures for pension plans. How does de-risking impact the corporation's credit rating? A report by Moody's (NISA Investment Advisors, 2013b; Pitts, 2013; Smyth, 2013) concluded that de-risking is credit-risk neutral because the risk associated with the pension plan is offset by the upfront cost of de-risking. In the case of annuity buyout, the upfront liquidity drain impacts the company when the firm fully funds the plan and pays the premium demanded by the insurer. Thus, in the majority of cases, annuity buyouts will be credit-risk neutral due to liquidity drain offsetting the benefits of the eliminated volatility. Certain pension de-risking techniques can offer benefits of annuity purchases without incurring any of the upfront liquidity costs. De-risking through decreased allocations to risky assets in favor of liability hedging assets may improve credit ratings for firms with large pension plans relative to their core business.

A study by Cardinale (2007) investigated the extent to which the bond market incorporates pension liabilities in its implicit assessment of the company creditworthiness. The key objective was to test whether pension liabilities are priced by spreads on traded corporate bonds included in the Merrill Lynch index. Using bond data from 2001 to 2003, the author found that, in general, the relative size of unfunded pension liabilities is a significant predictor of credit spreads. Furthermore, the sensitivity of market spreads to pension deficits is larger than the sensitivity to ordinary long-term debt. There is also an asymmetric impact between overfunding and underfunding, as the market does not seem to reward excess assets as it punishes excess liabilities. However this relationship can be complex because the bond market appears to see risk in pension liabilities themselves, and not just unfunded pension liabilities. Furthermore, the paper considered whether the riskiness of the pension assets or the length of the pension liability duration would increase the volatility of the firm value and therefore increase the credit spread. On the question of risky pension assets, the study found that asset allocation of the plan did not seem to be a significant predictive factor for credit spreads. On the question of the length of the pension liability duration, the study used the ratio of interest cost to the sum of service cost and interest cost as a proxy, and found that a lower ratio of interest cost to the sum of service cost and interest cost increased credit spreads, but not for investment grade bonds. Thus the market appears to penalize for longer pension liability durations, but only for bonds at the lower end of the rating spectrum.

Similar conclusions were reached by McKillop and Pogue when they studied the impact of pension plans on crediting ratings for FTSE 100 companies (Mckillop & Pogue, 2009), but there were some differences. For U.K. companies, the credit spread is related to the size of the pension liability rather than to the amount of pension underfunding.

Another study conducted by Gallagher and McKillop tested whether corporate bond spreads are priced according to pension information from corporate pension accounting disclosures (Gallagher & McKillop, 2010). The authors used a model based on traditional accounting ratio-based models of credit risk and market-based structural models of bond spreads utilized by Merton (1974), and fit the model to data from 2002 to 2006 for U.S.

and European companies. Their results showed that DB pension risk has a significant influence on the option-adjusted spread (OAS) on corporate debt, but underfunded pension liabilities are not priced as aggressively as traditional leverage. There are also some international differences. The pension-credit risk relationship is most evident for the United States and Germany, but is not significant for the U.K., Netherlands and France.

4.4. Firm Behavior with Respect to PBGC

It has been theorized that the institutional structure of DB pensions and management control over pension fund asset allocation incentivize firms to invest in risky securities in the presence of pension insurance. Since the creation of the PBGC in the United States, if a firm declares bankruptcy with insufficient funds to cover its liabilities to workers, the U.S. government provides pension payments to plan recipients subject to certain maximum PBGC benefits. As a result, the PBGC creates a moral hazard incentive for firms to underfund pensions and invest assets in risky securities. However, one caveat on this moral hazard is that a financially distressed firm avoiding bankruptcy must continue to fund the pension plan with liquid assets.

In one of the more recent studies (Rauh, 2009), it was noted that contrary to the moral hazard hypothesis, financially distressed firms are less likely to have risky pension fund asset allocations. Analysis of survey data on pension fund asset allocation for DB pension sponsors between 1997 and 2004 with respect to the firms' credit ratings and bankruptcy status indicated that financially distressed firms allocate a larger portion of pension assets to fixed income securities. In other words, financially distressed firms risk-manage their pension plans rather than risk-shift their pension plans to the PBGC. A possible explanation is that financially constrained firms have fewer funds for investment projects and risk management can reduce the probability of financial distress, increasing shareholder value.

Anantharaman and Lee proposed that managerial risk aversion is a possible explanation for the absence of risk-shifting in financially distressed firms (Anantharaman & Lee, 2014; Anantharaman, 2011). After separating firms into stockholder-controlled firms and manager-controlled firms, it was found that stockholder-controlled firms have greater underfunded pension plans and invest a greater proportion of pension assets in risky classes such as equity and alternatives. Managers tended to be more risk-averse than stockholders, and the stockholder-manager agency conflict actually offset risk-shifting arising from the stockholder-debtholder conflict. However, risk-shifting through pension underfunding was most prevalent amongst firms with high managerial stockholdings and concentrated ownership. Thus the authors identified a fresh, new set of factors—the ownership and governance structure of the firm—driving pension funding and investment strategies.

4.5. Impact of Pension on Company Beta

The main study in this area is by Jin et al. (2006). The study focused on the systematic risk of the firm, using beta from the Sharpe (1964) CAPM as a measure of risk. If pension risk is not accurately reflected in a firm's equity beta, then the market is informationally inefficient and the standard analysis usually underestimates the true systematic risk of the firm. If a firm's equity beta does accurately reflect pension plan risk, then it can have a significant implication for corporate finance in estimating a firm's cost of capital.

Because pension liabilities typically have a longer duration than corporate debt, there is reason to believe that pension liabilities have higher beta. Jin et al. confirmed that compared with the precision of pension asset beta estimates, pension liability beta estimates are "noisier." The stock market seemed to process available pension information without bias despite the practical difficulties of deciphering corporate pension accounts. Regression tests indicated that equity betas of firms did accurately reflect the betas of their pension assets and liabilities, which is positive for the market efficiency of capital markets. The downside is that standard cost-of-capital calculations used in corporate finance, which do not distinguish between operating asset risk and pension plan risk, can greatly overestimate the discount rate for net present value analysis of operating projects.

Long et al. (2010) studied the same relationship and found that the correlation between pension risk and company beta was weaker amongst data from 2002 to 2009 than from 1993 to 1998. The authors suggested that for a 1.0-unit increase in pension beta, the company beta increases by 0.38, indicating that slight changes in pension beta can measurably influence stock beta. However, this relationship is weaker than that found by Jin et al. (2006), whose study suggested that a 1.0-unit increase in pension beta caused a 1.5 increase in company beta. The difference between the authors' results indicates a need for further analyses or standardization of methodology. McKillop and Pogue in their study of the FTSE 100 companies also found this relationship to be less than 1-to-1 (Mckillop & Pogue, 2009).

Overall, these empirical findings portray a mixed picture of the market valuation of pension plans. On the one hand, investors seem to react to pension accounting expenses and are "fooled" by accounting, but on the other hand, the market seems to take the holistic balance sheet into account when market data are used to estimate the corporation's equity beta.

Section 5. Summary of Sponsor Survey

The authors developed a detailed questionnaire to solicit input from pension plan sponsors. Responses were provided in written and verbal format. Unfortunately, the volume and format of data collected were not adequate to provide a breakdown of responses by pension plan size or regions (United States and Canada). The following

observations were evident from the responses:

1) Corporate pension plans continue to be managed in silos, but there is increasing awareness that a consolidated approach may result in better risk management for the corporate pension plan and at the enterprise level. The pension consulting community believes that better understanding of enterprise and corporate financial metrics and measures, and easier access to the chief financial officer and/or corporate financial decision-makers, may allow for meaningful dialogue and more robust decisions regarding corporate pension plans.

2) The shareholder was identified as the key stakeholder when making strategic decisions regarding the corporate pension plan. Implicitly, the focus was on increasing shareholder value.

3) Improving operating earnings and reducing earnings volatility were identified as the measures most important to the enterprise. Other objectives such as enhancing pension security for plan members, making the enterprise attractive to investors and shareholders, and improving the ability to raise capital had limited appeal. The key financial metric relevant to most enterprises was earnings before income tax, depreciation and amortization (EBITDA). Other financial metrics such as cash flow and corporate leverage are also important. Credit rating and balance sheet volatility were identified but were not associated with corporate pension plan management. This may not be a surprising result as all of these companies noted that they do not consolidate or augment the pension plan and corporate balance sheets in a holistic corporate balance sheet except as required by accounting requirements.

4) From a risk management standpoint, most companies were neutral on how well they integrated or consolidated pension risks within their enterprise risk management plan. The following risks were identified as the key pension risks: a) investment (risk of not attaining desired/target level of return); b) governance (risk due to lack of policies); and c) statutory and regulatory (risk due to regulatory and statutory changes). However, most companies felt that the governance risk has been minimized due to implementation of robust governance structures, processes and policies.

5) None of the companies surveyed were integrating or consolidating the corporate pension plan with their corporate balance sheet for strategic management. Consequentially, there has been the lack of use of consolidated financial metrics or measures to determine corporate leverage, adjustment of earnings and WACC. The general consensus was that pension debt is more volatile than corporate debt but this was not material, and that the corporate pension plan has little impact on the share price.

Section 6. Conclusion

In this paper we presented the perspectives, tools, analytical frameworks and empirical evidence for the application of corporate finance in the strategic decisions regarding corporate pension plans. We found that these tools and analytical frameworks are important in strategic pension analysis, but corporate managers have yet to incorporate these concepts in their corporate planning and risk management in a holistic manner.

For example, the holistic balance sheet is often considered for the purpose of strategic pension analysis; however, the holistic balance sheet is not used routinely in corporate planning, risk management and financial reporting.

To move toward a more holistic way of including pension plans in corporate planning and risk management, key financial metrics should be adjusted for pension and pensions should be included in the process of risk budgeting. Such information will in turn inform corporate decision-makers on the appropriate strategy for managing the pension plans. It is likely that different corporations will focus on different financial metrics and develop their own processes of risk management and capital allocation that are appropriate for their respective businesses. Thus it may not be possible to have a single process that will work for all corporations. Nevertheless, we have identified elements of pension analysis from a corporate finance perspective that can be integrated into such processes.

Empirical evidence helps to validate the perspective of corporate finance on pension plans, and provides helpful guides for selecting the right financial metrics to focus on. For example, corporate managers may not want to focus *only* on pension underfunding, but also on the size of the pension liability, and the relationship of pension liability to the market capitalization of the corporation, since these relationships tend to impact stock prices and credit spreads.

In the middle of all the analysis regarding corporate pension plans are pension actuaries, who, as subject-matter experts, should be familiar with the corporate finance perspective of pension plans in order to provide relevant and decision-useful advice to their clients.

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