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# Effects of Pension Plans on Corporate Valuation

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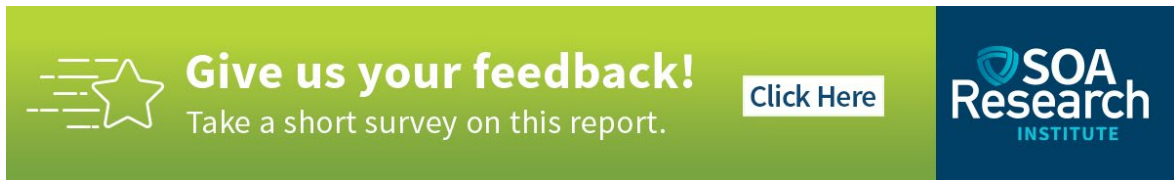


# Effects of Pension Plans on Corporate Valuation

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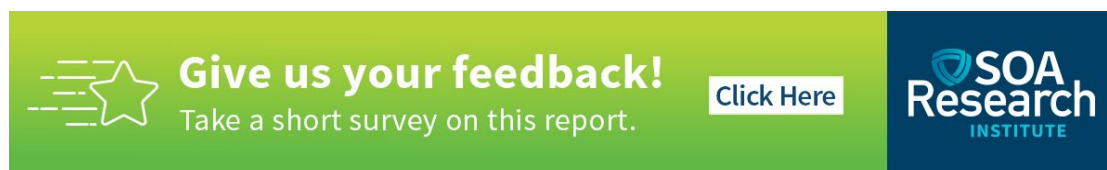
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# Effects of Pension Plans on Corporate Valuation


## Executive Summary

This report provides a comprehensive literature review on the effects of pension plans on corporations and presents an enterprise discounted cash flow model for firm valuation incorporating pension risks. Under this model, only the pension service cost from the pension-related items is included in the operating earnings calculation, and the adjusted net pension balance is later added to the equity value as nonoperating asset or debt equivalent. Importantly, by introducing a surplus excise penalty into the valuation framework, the model provides an effective way to compare various pension surplus management strategies.

The authors find that, under the pension-consolidated valuation approach, the pension funding and asset mismatch risks have significant impact on the cost of equity. It is important to understand and determine pension funding and investment policies from a corporate financial perspective. The case studies also show that pension de-risking strategies should be considered under the firm's optimal capital structure. The firm can carefully evaluate the financing strategies for buy-out in order to maximize the debt interest tax shield and create shareholder value. Finally, the model also emphasizes the importance of managing pension surplus. While the primary goal of pension surplus is to enhance the benefit security of plan participants, pension surplus may also be a strategic asset that can potentially improve the corporate value.



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## Section 1 Introduction

It has been increasingly known to the actuarial profession that pension plans are not merely an employee benefit but also a significant corporate asset and liability requiring strategic planning at the enterprise level. In addition to the traditional actuarial functions focusing on plan design and valuation, many pension actuaries nowadays play a critical role in providing corporate guidance on plan investment and funding policies and de-risking strategies, such as plan freezes, longevity hedges, pension buy-in and buy-out. In today's rapidly changing environment, it is important for pension practitioners to understand the effects of pension plans from a corporate financial perspective.

Pension plans are generally considered as non-operative items for corporations.<sup>1</sup> Depending on the size of pension plans relative to that of operating business, they can introduce significant volatility to corporations' financial statements (e.g., Gannon, 2021). First, the net pension funded positions are recognized on the balance sheet under both U.S. and international accounting standards. Funding deficits are debt-like liabilities and reduce equity value. Second, pension plan expenses, such as service costs and interest expenses, materially impact firm's reported earnings. Third, market fluctuations and population longevity create asset liability mismatch, passing volatilities to the balance sheet. A severe underfunding position may further require employer contributions and hinder corporate cash flows. Huang and Lalani (2015) call for evaluating these effects under key corporate finance metrics and measures, such as corporate leverage and the weighted average cost of capital (WACC) (e.g., Huang & Lalani, 2015). The objective of this paper is to provide a stylized corporate valuation framework and assess the effects of pension plan and various pension strategies on value creation. The authors outline the important considerations of the valuation framework using recent developments in the pension market as examples.

A corporate valuation framework with pensions can reflect the impact of pension funding decisions as well as the risks embedded in asset allocation strategies. The financial landscape of pension plans has significantly reshaped over the past decades. Driven by a complex interplay of market forces, regulations and accounting rules, and corporate priorities, mitigating pension exposures has become a major trend in corporate risk management. To some extent, this is aligned with a key tenet of corporate finance that firms may take on risks within their primary areas of expertise and mitigate others to maximize shareholder value. To control the volatility of pension funded status, the first tools corporate managers often utilize are their funding and investment policies. The pension funding policy determines the corporation's optimal contribution levels, which typically involves cash flow management and capital budgeting, tax benefits, and credit worthiness, among others. Pension investment policies have overall shifted from a bond-dominant approach in very early years to a more diversified asset allocation strategy with a mix of multiple primary asset classes, such as equities, bonds, real estate, and alternative assets. Many plans have adopted liability-driven investment strategies (e.g., Sharpe & Tint, 1990; Ang et al., 2013) to dynamically match their pension assets to liabilities. The prudent risk management approach adopted in asset allocation can have important implications on the cost of equity and thereby increase the attractiveness of the corporation to equity investors. The cost of equity represents the minimum return a firm must generate to satisfy shareholders, and acts as a benchmark for valuing firm investment and making capital budgeting decisions.

The corporate valuation framework can help decision-makers evaluate and form an optimal pension de-risking strategy. A more fundamental strategy for corporate managers to de-risk their pension plans is to

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<sup>1</sup> Non-operating items are those items (such as revenues, expenses, gains, or losses) that arise from activities outside a firm's core business operations.

shift their defined benefit (DB) plans to defined contribution (DC) plans. Many DB sponsors reduce their plan sizes by terminating their DB plans or transferring risk to insurers via buy-out and buy-in annuities.<sup>2</sup> Since the \$29 billion mega buy-out deal between GM and Prudential in 2012, the single premium buy-out assets in the U.S. have reached \$296.5 billion as of December 2024, according to LIMRA's Group Annuity Risk Transfer Sales Survey (LIMRA, 2025). In 2024, record-high 794 single-premium contracts were sold, and "greater plan sponsor awareness of these solutions will keep interest high and sales above pre-pandemic levels," said Keith Golembiewski, assistant vice president, head of LIMRA Annuity Research. From a corporate finance perspective, pension buy-out not only affects the benefit security of plan members but also fundamentally changes the corporate balance sheets and capital expenditures. Moreover, it requires the corporation to make a strategic balance between initial transferring costs and long-term corporate gains.

The corporate valuation framework can also reasonably convert pension surplus into firm value. While pension de-risking events continue to grow, perhaps the most trending topic in very recent years has turned to strategic management of pension surplus. As a result of high interest rates and a strong equity market, the GAAP funded status of the largest 100 U.S. corporate pension plans has reached 101.3% in 2024, the first time exceeding 100% since 2009 (Buchenholz, 2025). There are several pioneer examples that involve pension surplus reversion strategies, aimed at improving corporate financial positions. IBM, one of the largest DB plan sponsors in the U.S., has made a huge announcement that they decided to reopen their frozen cash balance plan to replace its ongoing 401(k) plan starting from January 2024. At the time of the announcement, IBM had approximately \$3.6 billion surplus based on its 2022 10-K filing. In the U.S., reverting the surplus back to the corporation would be subject to a maximum of 50% excise tax in addition to the ordinary corporate income tax. The unfreezing decision allowed IBM to cover its annual pension contributions using the surplus in the frozen plan without excise penalty. It is unclear if there would be a consistent trend back to DB plans for firms with overfunded plans, but at least it has triggered a wave of discussions on reconsidering pension strategies for surplus management (e.g., Cook, 2023; Murray, 2023; Ignatenko & Townsend, 2024; Benya et al., 2025; Buchenholz, 2025; Schuman, 2026).

Kodak, previously one of the world's largest film and camera manufacturers, announced a planned pension termination and asset sale in November 2024, according to its filing with the Securities and Exchange Commission. The market suddenly realized that the firm had approximately \$1.1 billion pension surplus, far exceeding its approximate \$450 million market cap. The stock price jumped significantly following the news. As of October 2025, the company stated that "its U.S. pension plan was terminated earlier this year, and the process of fulfilling the obligations to all plan participants is almost complete." A new cash balance plan has been established for current U.S.-based employees, and the company expects to distribute its pension surplus assets to the company and the new cash balance plan in December 2025. Kodak presented a direct termination strategy to reverse pension surplus, and it would be taxed at 20% only due to its unique corporate situation (Root, 2024; Owens, 2025). The above two examples highlight the importance of assessing the interactive impact of excise tax on the value of pension surplus.

In 2025, Memorial Sloan Kettering Cancer Center (MSKCC) received a Department of Labor (DOL) prohibited transaction exemption to terminate its frozen DB plan, allowing its wholly-owned captive

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<sup>2</sup>In Canada, some DB plans may be converted into target benefit plans (TBPs), provided they meet specific criteria and get regulatory approval. TBPs are hybrid pension plans with both DB and DC features. However, their benefits are "targeted" rather than guaranteed and can be lowered if the plan is underfunded.

insurance subsidiary, MSK Insurance, to reinsure the plan risks. This is the first application of captive insurance for pension liabilities in the U.S. The arrangement includes two phases: a buy-in phase where the plan purchases a group annuity from a third-party insurer and a buy-out phase where the third-party insurer enters into a full reinsurance agreement with MSK Insurance. This is in principle an “in-house” buy-out, given that MSKCC also provides a parental guarantee to the captive insurer (e.g., Buchenholz, 2025; Cantor, 2025).

It is worth noting that the plan participants remain protected by the insurer and state guarantee association, even if the captive insurer becomes insolvent. The transaction helps MSKCC increase its surplus reversion through elimination of buy-out premium and capital margins and better use of illiquid assets (Cantor, 2025). In addition to these practices, there are many other strategic approaches related to overfunded plans. The goals of these strategies are typically to reverse the surplus to the corporation at the lowest cost, use the surplus for new benefit accruals or other employee benefits (e.g., retiree health and life insurance), or drive the surplus for further enhancement of the corporate balance sheet. From a valuation perspective, the question centers on how to maximize the surplus value for a corporation, considering both the firm’s financial situation and regulatory environment.

A primary goal of any pension plan, which may not be fully reflected in a corporate valuation framework, is to secure the retirement benefits of plan participants. In the U.S., when the firm defaults and does not have sufficient pension assets to cover the benefits accrued by its plan participants, the Pension Benefit Guaranty Corporation (PBGC), created under the Employee Retirement Income Security Act (ERISA) of 1974, will step in and provide uninterrupted payment of pension benefits to plan participants with a maximum guarantee limit (e.g., Lin et al., 2023). In addition to taking over the pension assets, the PBGC may further claim unfunded pension liabilities from the bankrupt firm as non-priority general unsecured claims in the liquidation process (Lewis & Melwani, 2006). In Canada, the Pension Protection Act (PPA) has amended the bankruptcy and insolvency laws to give “super priority” to registered pension plan funding deficits during employer insolvency proceedings, effective April 27, 2027. This extension of protection can potentially increase firms’ borrowing costs and require them to increase capital budget for their DB plans. Moreover, the DOL provides detailed guidelines for plan fiduciaries to “conduct an objective, thorough, and analytical search for purposes of identifying and selecting annuity providers” for pension risk transfers (Department of Labor, 2024). These factors, such as the changes in firms’ borrowing costs due to the PPA amendment, should be carefully considered and implicitly incorporated into parameter determination for corporate valuation models.

The rest of the paper is organized as follows. Section 2 provides a comprehensive literature review on the effects of pension plans on a corporation, valuation of pension plans, and the impact of pension de-risking. Section 3 presents an enterprise discounted cash flow model for corporate valuation with pensions. Section 4 applies the valuation model for a hypothetical firm with DB plan and investigates the effects of buy-out. Sensitivity tests are also performed for parameters. Section 5 concludes the paper.

## Section 2 Literature Review

There has been rich literature exploring the effects of DB pensions on corporate policies, capital structure and the cost of capital, managerial incentives and manipulation, and more recently the value creation from pension de-risking. Cocco (2014) and Huang & Lalani (2015) have provided comprehensive reviews of corporate pension plans in the context of corporate finance and risk management. In this report, the authors complement their studies by tracking recent developments in the pension market and providing a brief review on the evolution of the role of pension plans in corporate finance. The focus is on how DB pension plans affect corporate valuation.

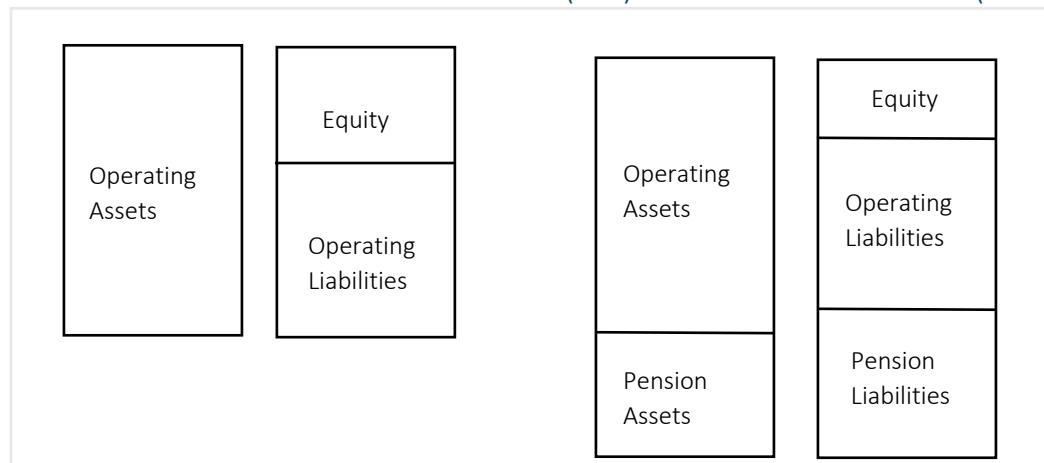
### 2.1 ROLES OF PENSION PLANS IN CORPORATE FINANCE

#### 2.1.1 CAPITAL STRUCTURES AND THE COST OF CAPITAL

The first consensus reached by researchers is that DB pension plans are an important consideration for determining optimal corporate capital strategies and the cost of capital. Corporate pension plans are arguably the most sizable off-balance-sheet item that has significant implications for firms' capital structures (Shivdasani & Stefanescu, 2010). Although there is a legal separation between pension plans and their sponsoring firms, DB sponsors are liable for any funding deficits if the pension plan assets are not sufficient to cover the pension liabilities. Moreover, any pension surpluses may accrue to shareholder value by offsetting future pension contributions. Therefore, from an economic point of view, it has been widely agreed that DB pension plans should be consolidated into the balance sheet for corporate valuation, capital structure, and leverage studies (e.g., Coronado et al., 2008; Shivdasani & Stefanescu, 2010; Bartram, 2016; Lin, MacMinn, et al., 2017). As illustrated in Figure 1, the equity value in a consolidated corporate balance sheet is adjusted by the net pension liabilities.

**Figure 1**

**CORPORATE BALANCE SHEET: OPERATIONAL ONLY (LEFT) AND PENSION-CONSOLIDATED (RIGHT)**



When pension assets and liabilities are incorporated into the capital structure, the consolidated leverage ratios for firms are on average about 35% higher in the U.S. (Shivdasani & Stefanescu, 2010).<sup>3</sup> Similarly, Bartram (2016) finds that the consolidated leverage ratios are on average 20-70% higher than regular leverage ratios around the world, with the leverage effects varying as a function of rule of law, tax incentives, and bankruptcy costs. Since pension

<sup>3</sup> The consolidated leverage ratio is defined as the ratio of the value of financial debt and other liabilities plus pension liabilities over the total value of operating assets and pension assets.

contributions are tax deductible and may lower the tax advantages from debt financing, Shivdasani & Stefanescu (2010) demonstrate that managers partially substitute pension-related deductions for interest deductions in capital structure decisions. They estimate that the tax benefits of consolidated leverage are 31% higher than the tax benefits of financial debt alone, and a one percentage point increase in the pension liability to total assets ratio is associated with a 0.36 percentage point decrease in the debt to total assets ratio. The tax savings from pension contributions on average account for 1.5% of the market value of the firm. The substitution effect between pension and debt financing helps explain the capital structure puzzle raised in Graham (2000) that most firms adopt an inefficient capital structure from a tax perspective: their debt choices are far from the point where marginal tax benefit from debt starts declining.

Sponsoring DB pension plans has a direct impact on corporate capital expenditures. For firms facing greater external financing constraints, mandatory pension contributions may increase the cost of capital (Campbell et al., 2012; Lin et al., 2019) and result in foregone investment (Rauh, 2006; Franzoni, 2009). Despite the complex and often opaque pension accounting rules, Jin et al. (2006) show empirically that a firm's equity beta and returns, as measured by the capital asset pricing model (CAPM), reflect the risk of its pension plan, and the cost of capital calculation should be adjusted for pension risk. Failure to do so for the estimate of the operating asset beta generally leads to a positive bias and hence, an overestimation of the cost of capital for budgeting. Bartram (2017) points out that the relation between pension obligations and capital decisions depends on the type of investment opportunity. While the size of the DB plan has a negative association to capital expenditures, it is positively related to research and development (R&D) expenditures. DB plans allow R&D intensive firms to better retain and borrow from their employees. Moreover, Almaghrabi (2023) finds a positive curvilinear relationship between pension risk and cash holdings, particularly among financially unconstrained firms, suggesting that firms may hold excess cash as a hedging mechanism against the potential future cash flow volatility caused by pension obligations.

### 2.1.2 PENSION FUNDING AND INVESTMENT: TAX ARBITRAGE, RISK SHIFTING, AND RISK MANAGEMENT

The second important strand of pension studies focuses on managing pension plans (i.e., pension funding and investment decisions) at the corporate strategic level. Earlier research proposes the so-called Black-Tepper tax arbitrage hypothesis (Black, 1980; Tepper, 1981) and investigates how corporate taxes affect pension funding and asset allocation. The tax arbitrage theory suggests that firms hold fixed income securities within their pension plans, as the returns on pension assets are tax exempted but will be subject to corporate taxes if generated at the corporate level (e.g., Tepper & Affleck, 1974; Black, 1980; Tepper, 1981; Gold & Hudson, 2003). Firms may also issue bonds at the corporate level and hedge the risk by purchasing similar bonds in their pension plans, yielding a tax shield benefit from the interest paid on the bonds issued (e.g., Cocco, 2014).

While the tax arbitrage hypothesis has some empirical support (e.g., Francis & Reiter, 1987; Thomas, 1988; Frank, 2002), many firms appear to be reluctant to make more pension contributions than their required amounts, and many pension plans invest heavily in equity rather than mainly in debt securities. One possible explanation is that firms may maximize the option value of the guarantee from the PBGC by underfunding their pension plans and allocating pension funds in risky assets. This risk-shifting behavior was initially studied by Sharpe (1976) and Treynor (1977). Studies later point out that underpriced pension insurance encourages excessive risk taking by plan sponsors (Niehaus, 1990; Coronado & Liang, 2006; Brown, 2008; Love et al., 2011; Romaniuk, 2021). An et al. (2013) find that the risk-shifting incentive dominates for financially distressed sponsors and sponsors that de-risk DB pension plans (i.e., shift pension risks to pension participants). Chen et al. (2013) show that high-bankruptcy-risk sponsors have a strong risk-shifting incentive due to the high value of the PBGC protection, but for low-bankruptcy-risk sponsors, maximizing tax benefits associated with pension contributions becomes a powerful incentive.

However, empirical evidence is mixed in supporting the risk-shifting theory and more often indicates a positive or insignificant association between firm risk and pension allocation in safe securities such as bonds (Friedman, 1983; Hsieh et al., 1994; Petersen, 1996; Coronado & Liang, 2006; Lucas & Zeldes, 2006; Rauh, 2009). Notably, Rauh

(2009) shows that firms with poorly funded pension plans and weak credit ratings allocate a greater share of pension fund assets to safer securities such as government debt and cash, whereas firms with well-funded pension plans and strong credit ratings invest more heavily in equity. Therefore, Rauh (2009) suggests that risk management (i.e., the incentive to avoid costly financial distress) plays a considerably larger role than risk shifting in explaining variation in pension fund investment policy. Phan & Hegde (2013) provide evidence that firms with good external and internal corporate governance take more risk by having higher equity and lower safe asset allocations, yielding higher investment returns and better pension funding status. Moreover, Bartram (2018) finds that pension management strategies are highly related to the economic condition of the sponsor. While firms with less cash holdings and smaller profit margins tend to make smaller contributions, take more aggressive plan assumptions, and have larger funding deficits, there is little evidence of risk shifting in firms with high business or financial risk.

### 2.1.3 MANAGERIAL INCENTIVES AND MANIPULATION

Pension plans significantly affect top executives' managerial incentives. Several studies have analyzed the effects of top managers' pension-related compensation structure on corporate decisions. When top managers receive significant compensation in the form of pension, they reduce overall firm risk by investing in less risky projects, lowering corporate leverage level, and shifting value from equity to debt (Sundaram & Yermack, 2007; Wei & Yermack, 2011). When top managers have a larger interest in the firm's pension plan, the plan tends to be better funded and risk shifting through pension underfunding is less likely (Anantharaman & GyuLee, 2014; Begley et al., 2015). Moreover, evidence shows that some executives manipulate pension benefits (i.e., boost payouts or increase pensionable earnings) immediately before plan freezing or their retirement (Stefanescu et al., 2018).

## 2.2 CORPORATE VALUATION WITH PENSION PLANS

Incorporating non-operating pension assets and liabilities into corporate valuation involves many challenges. A common approach in corporate finance is to discount enterprise free cash flows (FCFs) using the pension-adjusted weighted average cost of capital (WACC) (e.g., Jin et al., 2006; Cooper & Jullens, 2020; Koller et al., 2020). Here the authors survey and highlight several important items that financial economists recommend.

The very first step of pension plan valuation is to estimate the fair value of pension liabilities, which is highly sensitive to plan assumptions, such as the pension discount rate. Although relatively strict rules exist on the choice of discount rate, financial economists generally advocate a market-consistent valuation approach and suggest using market discount rates inherent in the debt market to calculate the present value of pension liabilities (e.g., Enderle et al., 2006; Huang & Lalani, 2015). Another important plan assumption is whether the pension liability calculation broadly assumes continued appointment and project future salary increases and mortality improvement. The projected benefit obligation (PBO) is a commonly used measure to take these effects into consideration, while the accumulated benefit obligation (ABO) estimates the accrued pension liabilities to date without salary projection. Researchers tend to agree that ABO better reflects the real cost of pension liability (e.g., Bulow, 1982; Bodie, 1990; Bader, 2003; Enderle et al., 2006). Importantly, the PBGC guarantee only covers benefits accrued before the pension plan is taken over, and no future accruals are allowed thereafter, which makes ABO a more relevant measure for PBGC valuation purposes (Novy-Marx, 2015).

Second, pension-related earnings and expenses in the financial statements can be adjusted or reorganized for corporate valuation. In the U.S., the Financial Accounting Standards Board (FASB) governs pension accounting under generally accepted accounting principles (GAAP). For the purpose of determining enterprise FCFs, only the service cost should be reflected in operating earnings, and pension performance-related gains/losses and smoothing terms

need to be removed (e.g., Bader, 2003).<sup>4</sup> Starting from 2018, the US GAAP requires firms to disaggregate service cost from other pension expenses and report it as operating experiences, and thus not as many adjustments are required (e.g., Koller et al., 2020).<sup>5</sup> Although pension accounting rules have evolved from time to time, the complex system has historically caused a lot of controversy and biases (e.g., Coronado & Sharpe, 2003; Gold, 2005; Coronado et al., 2008; Glaum, 2009). Managers appear to manipulate earnings by changing pension plan assumptions (such as expected rate of return) or pension plan asset allocation (e.g., Bergstresser et al., 2006; Amir et al., 2010; An et al., 2014). While non-operating pension earnings and expenses have been better recognized under the current accounting standards, accounting standards vary by country, and it remains necessary to examine pension items to avoid potential distortions.

Third, pension risk can be adjusted in the calculation of the cost of capital for operating assets. There are two types of pension leverage: pension funding and mismatch. When the pension plan is underfunded, the funding deficit essentially creates debt-like financial leverage (i.e., borrowing from employees) and may increase both the cost of debt and cost of equity due to increased risk. The pension leverage due to asset mismatch occurs when the pension asset cash flows are not fully matched with pension payments. Jin et al. (2006) show that the biases from ignoring the pension asset risk can be substantial for firms with significant pension plan size. Moreover, to reduce the noise around beta estimates of different firms, Koller et al. (2020) suggest using an unlevered industry beta in the CAPM model for operating assets, as firms in the same industry face similar operating risks.

Finally, the net pension balance can be incorporated into equity value as nonoperating asset or debt equivalent. To value firms with pension deficit, the unfunded pension liabilities are treated as debt equivalent and reduce enterprise value by the after-tax deficit amount (e.g., Koller et al., 2020). On the other hand, if a firm is overfunded, it is important to note that recapturing pension surplus is subject to a 20-50% excise tax, in addition to applicable federal and state income taxes (e.g., Murray, 2023). Therefore, the value of pension surplus could be further discounted by the excise restriction, and the enterprise value may only be increased by the after-tax pension surplus at a penalty rate. This asymmetric effect of surplus and deficit on firm value is consistent with the observations from debt rating and credit spreads (e.g., Carroll & Niehaus, 1998; Cardinale, 2007; Gallagher & McKillop, 2010). For example, Carroll & Niehaus (1998) find that unfunded pension liabilities reduce debt ratings more than can be increased by an equivalent amount of excess pension assets.

The above framework generally considers pension assets and liabilities as non-operating items for valuation purposes. Ratkowski (2025) proposes a completely different approach to assess the value of pension. They essentially treat pension management as an operating business of the firm and focus on the excess earnings generated through different asset allocation strategies. Under this approach, the value of pension is determined as the product of expected excess pension returns and a valuation multiplier equivalent to the price-to-earnings (P/E) ratios of life insurers. Therefore, the value of pensions directly depends on the adopted pension asset allocation strategy (i.e., business operating model). In this paper, the authors mainly discuss valuation approaches based on the assumption that pension plans are non-operating items.

### 2.3 EFFECTS OF PENSION DE-RISKING

Pension de-risking events provide an excellent opportunity to further explore the effects of pension plans on corporate valuation. Common de-risking strategies include pension freezing, termination, longevity swap, buy-in,

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<sup>4</sup> Service cost is the present value of incremental retirement benefits earned by employees for their service during the reporting period.

<sup>5</sup> Diversity in practice exists in dealing with pension administrative costs, due to limited guidance from the FASB Standard, ASC 715. Pension administrative costs include PBGC premiums, recordkeeping, actuarial and audit fees. As pointed out in Ernst & Young (2025), the administrative costs are typically included as a reduction to the expected return on plan assets assumption when they are paid from plan assets. However, some firms include administrative costs in the service cost or in SG&A expense (i.e., outside of net periodic benefit cost), and hence they are incorporated as operating expenses.

and buy-out (e.g., Tian & Chen, 2020). Firms may adopt a series of de-risking strategies to eventually shift their DB plans to DC plans. For instance, DB sponsors may first freeze their pension to new employees and prevent current employees from further benefit accruals. They may then offer lump-sum or annuity buyout options to retirees in the frozen plan.

A number of studies have investigated the determinants of firms' de-risking decisions and the constraints of performing de-risking strategies. Earlier research proposes an implicit contract's view: a DB pension plan creates a "pension bond" that has been implicitly agreed upon between the firm and employees and will materialize at retirement (Cocco, 2014). Wealth can be transferred from employees to shareholders through early pension termination or freezing, as firms are only liable for the explicit earned benefits (e.g., Pontiff et al., 1990; Petersen, 1992; Rauh et al., 2020). Cobb (2015) shows that firms' willingness to shift pension risk onto their employees highly depends on their ownership structure. Dedicated institutional investors with preference for long-term value accumulation are more likely to utilize DB plans, compared with large-block, passive, and active financial investors. De-risking decisions are also related to a firm's specific financial conditions, pension plan characteristics, and macroeconomic variables (e.g., Tian & Chen, 2020; Silverstein, 2021; Klingler et al., 2022; Li & Kara, 2022). For example, firms with higher leverage and market-to-book ratios and larger total pension liabilities have higher chances of de-risking their plans (Silverstein, 2021). Klingler et al. (2022) find that de-risking is more likely to occur in firms with higher flow-through costs due to downside deviations in pension funded status, larger PBGC insurance premium burdens, lower stock market investments, more inactive employees, and lower default risk based on the U.S. pension risk transfers between 2012 and 2020.

While many studies find that de-risking can create firm value (e.g., Lin, MacMinn, et al., 2017; Cantor et al., 2017, 2018; Rauh et al., 2020; Klingler et al., 2022; MacMinn et al., 2023; Jorgensen et al., 2024), firms do need to consider various associated de-risking costs during the decision-making process. First, some de-risking strategies are capital intensive. A DB plan must fully fund the transferred liabilities in a partial buy-out and the entire liabilities in a plan-wise termination (i.e., full pension buy-out), preventing deeply underfunded plans from these options. Significant upfront risk premiums are also imposed on group annuities and longevity hedges (e.g., Lin et al., 2015; Lin, Shi, & Arik, 2017; Cox et al., 2018).<sup>6</sup> Second, firms may face direct employee resistance and hurt employee incentives when implementing de-risking strategies. Comprich & Muller (2011) provide evidence that firms select downward biased pension assumptions to exaggerate the economic burden of their benefit plans, in order to obtain employee concessions on freezing. Lin et al. (2023) show that pension buy-outs may impact the benefit protection of some plan participants in the U.S. There have been several major lawsuits against pension buy-outs, including the Verizon case starting from 2012 and the recent lawsuits from retirees of AT&T and Lockheed Martin against their firms in 2024 (e.g., Kozlowski, 2024). Moreover, firms will have restrictions on tapping pension surplus in a frozen DB pension plan due to the excise tax. As previously discussed, to release \$3.6 billion surplus, IBM decided to reopen their frozen cash balance plan starting in 2024 to strategically avoid the excise tax.

Overall, pension de-risking strategies have important implications on corporate valuation and can bring significant market movements upon announcement. Simasek (2021) studies the impact of pension group annuity purchases on capital structure and corporate policies. The paper finds that reduction in pension debt is replaced with a commensurate dollar value of long-term debt for financially unconstrained firms, while financially constrained firms reduce total leverage. Besides, financially constrained firms increase capital expenditures in the year of implementing buy-out, and pension annuity buy-outs are associated with significantly negative abnormal returns due to disappointing cash flow news upon announcement. Silverstein (2021) shows that firms increase aggregate corporate risk-taking after pension buy-outs and a de-risking event on average produces a 6.3% increase in a firm's

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<sup>6</sup> Buy-out risk premiums are heavily impacted by the interest rate environment. The average buy-out risk premium is around 4% of the accounting liabilities (ABOs) as of June 2025, according to the Milliman Pension Buyout Index (Pringle & Cook, 2025).

credit spread. On the other hand, Cantor et al. (2017, 2018) find that pension risk transfer announcements, particularly annuity buy-outs, lead to positive short-term stock market reactions and reductions in credit default swap spreads, indicating a decrease in perceived credit risk. For firms with underfunded plans, the stock market reaction is temporary and quickly turns negative over a longer period. They also find that firms are viewed as less risky by the debt market around the announcement. Similarly, Jorgensen et al. (2024) find positive cumulative abnormal returns around the lump-sum buy-out announcement using event study methodologies. While the contradictory findings in the above studies could be due to different sample periods, it indicates the overall challenges in predicting market movements following buy-out. Therefore, rather than focusing on market reactions, the author's aim is to investigate how pension plans impact firms' intrinsic value.

## Section 3 Corporate Valuation Framework Incorporating Pensions

In this section, the authors present an enterprise discounted cash flow (DCF) approach for corporate valuation, incorporating the impact of pension assets and liabilities. It is worth noting that similar DCF approaches using the cost of equity as the discounting rate can be developed based on equity free cash flows (see, e.g., Cooper & Jullens, 2020). However, pension risks and the corresponding cash flows must be identified in a manner that is consistent for the different approaches.

### 3.1 ENTERPRISE DCF MODEL

The enterprise DCF model estimates the corporate value by discounting enterprise free cash flows using the weighted average cost of capital from all investors, such as debt holders and equity holders. Specifically, the enterprise value (EV) is determined as

$$EV = \sum_{k=1}^{\infty} \frac{FCF_k}{\prod_{j=1}^k (1 + WACC_j)}, \quad (1)$$

where  $FCF_k$  is the  $k$ th year enterprise free cash flow, and  $WACC_k$  is the  $k$ th year WACC. In practice, one may project the cash flows for a certain period (i.e.,  $n$  years), and then use a perpetuity-based model to approximate the firm's continuing value, i.e.,

$$EV = \sum_{k=1}^n \frac{FCF_k}{\prod_{j=1}^k (1 + WACC_j)} + \left( \prod_{j=1}^n (1 + WACC_j) \right)^{-1} \frac{FCF_{n+1}}{WACC - g}, \quad (2)$$

where the second term represents the present value of the firm's terminal value, assuming a constant revenue growth rate  $g$  and a constant WACC after  $n$  years.

As discussed in Section 2.2, pension service costs are considered as operating expenses and embedded in FCF calculations. It is also important to note that pension contributions are treated as financing (i.e., non-operating) cash flows and thus are not explicitly included under the enterprise free cash flow approach. Pension funding is entirely a mechanism to pay off the pension debt. Unfunded pension liabilities or excess pension assets are subtracted or added to arrive at the corporate value. The pension-adjusted enterprise value ( $EV^p$ ) can be expressed as

$$EV^p = EV + (1 - \tau \cdot \mathbf{1}_{\{PA > PL\}})(1 - T_m)(PA - PL), \quad (3)$$

where  $PA - PL$  represents the excess pension assets (or unfunded liabilities if negative),  $T_m$  is the marginal corporate tax rate,  $\mathbf{1}_{\{PA > PL\}}$  is an indicator function taking value of 1 if  $PA > PL$  and 0 otherwise, and  $\tau$  is an excise penalty rate imposed on pension reversion.

It is worth noting that the penalty rate  $\tau$  is defined in general and depends on how the firm utilizes pension surplus. If the firm uses excess pension assets to offset future required contributions, then the surplus may be eventually depleted without penalty (i.e.,  $\tau = 0$  as in Koller et al. (2020)). However, this strategy may not work for a frozen pension plan as new benefit accruals are not allowed. If the pension plan is valued on a termination basis, then the excise tax penalty  $\tau$  can be as high as 50% in the U.S.<sup>7</sup> Moreover, if the firm does not plan to utilize the surplus at all,

<sup>7</sup> Different countries may have different excise rules. The excise tax in the U.S. can be reduced to 20% if 1) at least 25% of the amount of excess assets is transferred to a qualified replacement plan, or 2) at least 20% of the amount of excess assets is used to increase benefits (Murray, 2023).

it is not unreasonable to assume a penalty rate close to 100%. Therefore, it might be helpful to adopt a probability weighted average penalty rate ( $E[\tau]$ ) to incorporate all possible scenarios.

### 3.2 IMPACT OF PENSION LIABILITIES ON WACC

In the traditional debt-equity capital structure, the WACC is the weighted average of the after-tax cost of debt and cost of equity, reflecting the average returns that debt and equity holders expect to earn:

$$WACC = \frac{D}{D+E}k_d(1 - T_m) + \frac{E}{D+E}k_e, \quad (4)$$

where  $k_d$  and  $k_e$  are respectively the cost of debt and cost of equity, and  $\frac{D}{D+E}$  and  $\frac{E}{D+E}$  are the weights of debt and equity in firm's target capital structure. The cost of debt  $k_d$  may be approximated using the firm's yield to maturity on its long-term debt or comparable debts implied by the credit rating. The cost of equity is typically estimated using the Capital Asset Pricing Model (CAPM):

$$k_e = r_f + \beta_e(r_m - r_f), \quad (5)$$

where  $r_f$  is the risk-free rate,  $(r_m - r_f)$  represents the market risk premium (MRP), and  $\beta_e$  is the equity's sensitivity to the market portfolio. Therefore, an important task is to determine the firm's equity beta  $\beta_e$ .

To reduce estimation noise, it is necessary to unlever different firms' equity betas and determine an industry-wide operating asset beta across firms with similar operating risks. This unlevered beta can then be relevered to estimate the cost of equity according to firm's target capital structure. The general relation between the unlevered beta (or operating asset beta),  $\beta_{oa}$ , and the levered equity beta is given by

$$\beta_e = \beta_{oa} + \frac{D}{E}(\beta_{oa} - \beta_d) - \frac{V_{txd}}{E}(\beta_{oa} - \beta_{txd}), \quad (6)$$

where  $V_{txd}$  is the value of debt tax saving,  $\beta_{oa}$ ,  $\beta_d$ , and  $\beta_{txd}$  are the betas of operating assets, debt, and debt tax saving, respectively (e.g., Koller et al., 2020). If the firm is assumed to adopt a constant leverage policy,<sup>8</sup> then the risk of interest tax shields equals the risk of operating assets (i.e.,  $\beta_{oa} = \beta_{txd}$ ), and Equation (6) becomes

$$\beta_e = \beta_{oa} + \frac{D}{E}(\beta_{oa} - \beta_d), \quad (8)$$

or

$$\beta_{oa} = \frac{D}{D+E}\beta_d + \frac{E}{D+E}\beta_e. \quad (9)$$

To incorporate the pension risk, both the formulas for betas and WACC should be adjusted. In the case of no tax, Jin et al. (2006) point out that the operating asset risk should be estimated as

$$\beta_{oa} = \frac{D}{OA}\beta_d + \frac{E}{OA}\beta_e + \left[ \frac{PL}{OA}\beta_{pl} - \frac{PA}{OA}\beta_{pa} \right], \quad (10)$$

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<sup>8</sup> If the debt amount is assumed to be constant, then  $\beta_{txd} = \beta_d$ , and the relation becomes

$$\beta_e = \beta_{oa} + \frac{D}{E}(1 - T_m)(\beta_{oa} - \beta_d). \quad (7)$$

where  $OA = D + E + (PL - PA)$  is the consolidated operating asset, and  $\beta_{pa}$  and  $\beta_{pl}$  are the betas for pension assets and liabilities, respectively. Typically,  $\beta_{pl}$  is assumed to be the same as  $\beta_a$ , and the pension asset beta is the weighted average beta of invested assets. The third term in Equation (10) reflects two pension related risks: pension underfunding risk and asset mismatch risk.

When the tax effects are considered, the authors keep the assumption that the risk of debt interest tax shields is the same as the operating asset risk,  $\beta_{oa} = \beta_{txd}$ , and adjust Equation (10) for equity beta estimation into

$$\beta_{oa} = \frac{D}{OA^p} \beta_a + \frac{E}{OA^p} \beta_e + (1 - T_m) \left[ \frac{PL}{OA^p} \beta_{pl} - \frac{PA}{OA^p} \beta_{pa} \right], \quad (11)$$

where  $OA^p = D + E + (1 - T_m)(PL - PA)$ . After-tax pension cash flows are used in the above formula because pension contributions and investment proceeds are all tax deductible.

Finally, the WACC with pension risk can be estimated as

$$WACC = \frac{D}{OA^p} k_d(1 - T_m) + \frac{E}{OA^p} k_e + (1 - T_m) \left[ \frac{PL}{OA^p} k_{pl} - \frac{PA}{OA^p} k_{pa} \right], \quad (12)$$

where  $k_{pa}$  and  $k_{pl}$ , calculated using CAPM, are the costs of pension assets and liabilities, respectively. Overall, empirical evidence shows that the observed equity beta does reflect the risk of pension plans. If the pension betas are excluded from the operating asset beta calculation, it tends to overestimate the operating asset beta and the WACC used for capital budgeting as long as the pension surplus is not too large (see, e.g., Jin et al., 2006). This can also be seen by examining the difference between Equations (11) and (9). Moreover, as part of the firm's capital structure movement, pension asset allocation does not impact the operating asset beta. Equation (11) implies that a higher pension asset beta would require a higher equity beta to keep the operating asset beta unchanged. Therefore, pension asset allocation towards riskier assets increases the pension asset beta and further increases the required cost of equity.

## Section 4 Case Studies

### 4.1 CASE DESCRIPTIONS

In this section, several case studies are provided to illustrate how corporate value changes after the pension risk is incorporated. The detailed calculations can be found in the accompanying Excel spreadsheet. A hypothetical firm is considered with the current financial parameters shown in Table 1. The revenue of the firm stands at \$18 billion and is expected to grow at an annual rate of 12% in the first five years and then linearly reduce to a target growth rate of 5% at the end of the tenth year. Similarly, the operating margin (without pension service cost) is assumed to linearly increase to a target of 13% in ten years from the current margin of 11.67%. Both the revenue growth rate and the operating margin are assumed to remain constant after ten years. Using these assumptions, the enterprise cash flows of the firm are projected for the next ten years, and the cash flows become a perpetuity thereafter as described in the DCF model (2).

**Table 1**  
**FINANCIAL CHARACTERISTICS OF THE HYPOTHETICAL FIRM**

Current Financial		Operation Projection	
Revenues (in \$M)	18,000	Revenue Growth Rate (Yrs 1-5)	12%
Operating Income or EBIT (in \$M)	1,900	Target Revenue Growth Rate	5%
Interest Expense (in \$M)	240	Operating Margin*	11.67%
Book Value of Equity (in \$M)	2,700	Target Operating Margin	13%
Book Value of Debt (in \$M)	12,000	Years of Convergence for Revenue	5
Cash and Equivalents (in \$M)	800	Sales to Capital Ratio	1.30
Shares Outstanding (in \$M)	199		
Current Stock Price	100		
Effective Tax Rate	20%		
Marginal Tax Rate	25%		
Average Maturity of Debt (in Years)	5		

\*Here the authors exclude the pension service cost in the profit margin calculation and list the pension service cost separately in the cash flow statement to highlight the role of pension service cost in the enterprise DCF model.

The firm has a DB plan with current liabilities of \$10 billion. It is assumed that it is 70% funded with \$7 billion in pension assets. The plan assets are allocated in stocks (50%), bonds (45%), and money market instruments (5%).<sup>9</sup> The service cost and benefit payouts are \$200 million and \$600 million, respectively, with a growth rate of 3% for both. The plan administrative cost rate is 1%. The surplus excise penalty rate is assumed to be 50%. Detailed assumptions on the firm and its DB plan can be found in the accompanying Excel spreadsheet.

To apply the CAPM model for estimating the WACC of the firm, it is assumed that the risk-free interest rate is 4%, and the MRP is 5%. The operating asset beta of the hypothetical firm is 1.1, while both the debt beta and pension liability beta are 0.17 as in Jin et al. (2006).

### 4.2 VALUATION WITH PENSION

The authors first compare the valuations with and without a DB plan, and the results are shown in Table 2. When the DB plan is completely ignored (i.e., as if the firm has no DB or DC plans), the implied equity beta based on the target capital structure using (8) is 1.59, which yields a cost of equity of 11.96%. The equity beta is increased from

<sup>9</sup> In practice, the plan assets could be invested in many other asset categories, such as real estate, alternative investments (e.g., private equity and hedge funds), etc.

1.59 to 1.80, when both the pension assets and liabilities are considered. This is because the higher debt level due to pension deficit and the asset allocation leverage increase the firm's total financial risk. As a result, equity holders require a higher return to compensate for the increased risk, and the cost of equity increases to 13.02%.

**Table 2**

**CORPORATE VALUES UNDER THE ENTERPRISE DISCOUNTED CASH FLOW MODEL**

	DCF Valuation		De-risking via Buy-out		
	w/o Pension	with Pension	Pension Assets Only (1)	Debt Financing (2)	Equity Issuance (3)
Implied $\beta_e$	1.59	1.80	1.75	1.77	1.70
Cost of Equity	11.96%	13.02%	12.76%	12.86%	12.51%
Cost of Capital	9.08%	9.11%	9.11%	9.08%	9.11%
Value of Operating Assets	35,720	32,160	32,148	32,469	32,148
Market Value of Debt (-)	10,513	10,513	10,513	11,406	10,513
Cash and Equivalents	800	800	800	800	800
Pension Surplus (Deficit)	-	(3,000)	(3,140)	(1,950)	(1,950)
Surplus (after Tax & Penalty)	-	(2,250)	(2,355)	(1,463)	(1,463)
Intrinsic Value of Equity	26,007	20,197	20,080	20,401	20,972
Shares Outstanding	199	199	199	199	208
Value Per Share	130.69	101.49	100.90	102.52	100.86

It is important to note that, without the debt interest tax shield, different capital structures (even after incorporating pension risk) do not impact the WACC of the firm, as the cost of equity changes to offset any risk from increased debt levels or pension allocation. Under this scenario, the WACC can be obtained by directly applying the CAPM model on Equation (11), i.e.,

$$WACC = r_f + \beta_{oa}(r_m - r_f). \quad (13)$$

When the debt interest tax shield is taken into consideration, the WACC will be lowered based on the corporate debt level, provided that the debt level is not excessively high. Therefore, when the pension deficit lowers the weight of corporate debt in the consolidated capital structure,<sup>10</sup> the WACC modestly increases from 9.08% to 9.11%.

At a WACC of 9.11%, the value of operating assets is estimated at \$32.16 billion, around \$3.56 billion lower than the case without pension mainly due to pension service cost. After adjusting the pension deficit, the difference between the firm values under these two cases is further increased. The value per share decreases from \$130.69 to \$101.49.

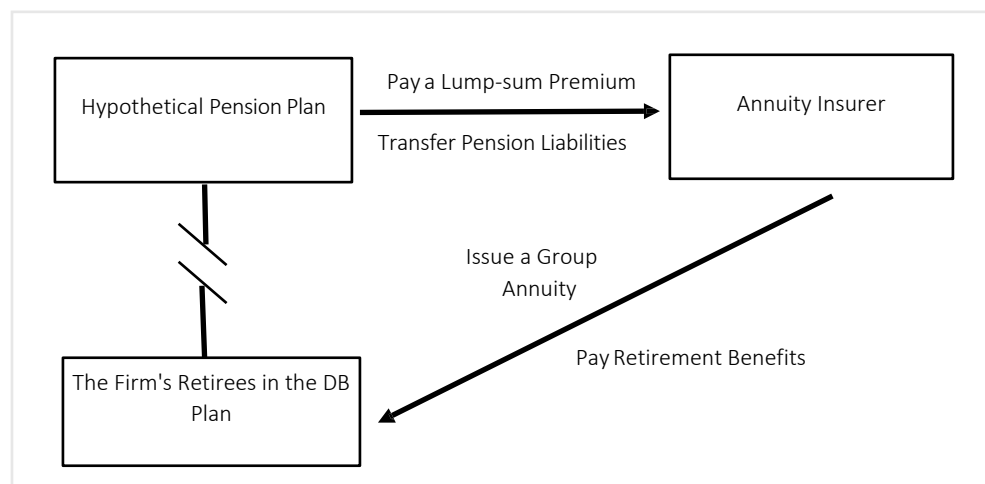
#### 4.3 VALUE CHANGES AFTER PENSION BUY-OUT

Next the effects of pension buy-out on corporate value are considered. The authors examine a scenario where the firm seeks a buy-out deal to transfer 35% of its total pension liabilities (all the transferred participants are assumed to be retirees) to an insurer. After the buy-out, both the transferred pension assets and liabilities are removed from the firm's consolidated balance sheet. The retirees will receive retirement benefits directly from the insurer via a group annuity policy. The buy-out cost is assumed to be 104% of the accounting liabilities, which is the average buy-

<sup>10</sup> Although pension deficit is debt-like obligation, the tax interest shield only applies to the corporate debt.

out rates in June 2025 estimated by Milliman (Pringle & Cook, 2025).<sup>11</sup> Figure 2 provides a graphic illustration of the buy-out deal.

**Figure 2**  
**PENSION BUY-OUT BETWEEN THE FIRM AND ANNUITY INSURER**



The firm has several options to close the buy-out deal. First, it may entirely use its pension assets to pay off the buy-out cost. That is, the firm directly transfers  $\$10 \times 35\% \times 104\% = \$3.64$  billion of its pension assets to the insurer, reducing the funding ratio from 70% to 51.7% for remaining pension participants.<sup>12</sup> The main advantage of this approach is that no operating capital is needed to execute the buy-out deal. Second, in addition to pension assets, the firm may raise extra capital to fill up any pension deficit (for the transferred liabilities) and pay off the buy-out risk premiums so that the pension funding ratio remains the same before and after the buy-out deal. The firm may raise the extra funding through debt financing, issuing new equity, or a combination of both. The valuation outcomes based on (1) using pension assets only, (2) funding via debt financing, and (3) funding through issuing new equity are presented in Table 2. In Cases (2) and (3), the total buy-out costs are paid through \$2.45 (i.e.,  $7 \times 35\%$ ) billion pension assets and \$1.19 billion extra funding from the operating side. After adjusting for pension contribution tax savings, the “effective” capital required for the buy-out deal is \$0.89 ( $= \$1.19 \times (1 - 25\%)$ ) billion.

Since buy-out effectively reduces the pension liabilities (i.e., pension debt), the authors find that equity beta and hence, the cost of equity in all three cases decreases from the base scenario. The WACCs in Cases (1) and (3) are minimally changed, given that the tax shield on corporate debt does not change. In contrast, the WACC in Case (2) is reduced slightly from 9.11% to 9.08%, as the corporate debt raised to fund the buy-out brings additional debt interest tax shield. As a result, the value of operating assets in Case (2) is improved by \$0.309 billion through buy-out, while those in Cases (1) and (3) are modestly decreased by \$0.012 billion.

The authors also observe that, when the buy-out deal is solely funded by pension assets, the total pension deficit is increased by \$0.14 billion (i.e., the 4% buy-out risk premium), which further reduces the equity value. The equity value drops from \$101.49 per share to \$100.90 per share. This is consistent with the findings in MacMinn et al.

<sup>11</sup> While the average buy-out quote across a set of insurers was around 104%, the most competitive buy-out rate during the same period can be lowered to near 100%.

<sup>12</sup> Note that this is a hypothetical scenario for comparing the effects of different buy-out financing methods. In practice, maintaining a prudent funding ratio after buy-out is an important consideration for deciding financing approaches.

(2023) that buy-out reduces the value of the pension insolvency put and transfers firm value from shareholders to pension holders, other things being equal. It is important to mention that the enterprise DCF model developed in this report assumes no change in corporate revenue and operating margin projection before and after the buy-out. In other words, the buy-out impact on new investment opportunities is not incorporated. MacMinn et al. (2023) point out that buy-out can solve the under-investment problem by encouraging new investment opportunities and hence improve firm value in longer terms.

Cases (2) and (3) show that financing buy-out through operating capital can have very different outcomes, depending on the source of funding. When the firm raises equity to fund the \$1.19 billion pension deficit and buy-out risk premium in Case (2), the firm essentially shifts equity value to pension participants and hence results in the lowest equity value per share (i.e., \$100.86) among all three cases. On the other hand, if the funding is from debt issuance, the increased firm value due to debt interest tax shield directly improves the equity value from \$101.49 per share to \$102.52 per share, the highest among the three cases. Overall, the numerical experiments suggest that substituting pension liabilities with corporate debt in pension buy-out is a promising approach to shape or maintain an optimal debt structure and create firm value. Although buy-out transactions in practice are often funded by pension assets, empirical evidence shows that the reduction of pension debt is replaced with long-term debt by financially unconstrained firms (Simasek, 2021).

#### 4.4 SENSITIVITY TESTS

In this subsection, the authors perform several sensitivity tests and examine the impact of pension asset allocation and surplus level on corporate value.

First, the pension asset allocation is changed by lifting the stock weight from 50% to 75% and reducing the bond weight from 45% to 20%. The new pension investment portfolio is naturally riskier than that in the base scenario. However, the authors find that both the firm and equity values with and without pension buy-out are not affected by this new asset allocation, as shown in Table 3. This is because the corporate value is determined by its operating assets and is independent of the consolidated capital structure (i.e., the Modigliani-Miller theorem). The WACC remains at 9.11% (without buy-out) and 9.08% (buy-out with debt financing) when the pension asset allocation changes. Moreover, although the pension investment risk changes, the present value of the pension assets at time zero does not change. Thus, the surplus level remains the same and hence, the equity value does not change. As previously mentioned, Ratkowski's (2025) valuation approach will deliver different equity values when asset allocation changes, as asset allocation changes imply a business operating model shift under their assumptions.

**Table 3**  
**SENSITIVITY TEST: PENSION RISKS**

	Pension Asset Allocation		20% Surplus	
	with Pension	Buy-out (Debt Financing)	with Pension	Buy-out (PA Only)
Implied $\beta_e$	1.86	1.81	1.71	1.65
Cost of Equity	13.29%	13.03%	12.53%	12.27%
Cost of Capital	9.11%	9.08%	9.06%	9.06%
Value of Operating Assets	32,160	32,469	32,655	32,639
Market Value of Debt (-)	10,513	11,406	10,513	10,513
Cash and Equivalents	800	800	800	800
Pension Surplus (Deficit)	(3,000)	(1,950)	2,000	1,860
Surplus (after Tax & Penalty)	(2,250)	(1,463)	750	698
Intrinsic Value of Equity	20,197	20,401	23,691	23,623
Shares Outstanding	199	199	199	199
Value Per Share	101.49	102.52	119.05	118.71

Note: In the pension asset allocation test, the plan invests 75% in stocks, 20% in bonds, and 5% in money market instruments. In the 20% Surplus test, the pension assets are increased from \$7 billion to \$12 billion.

While the WACC is unchanged, it is important to note that a change in pension asset allocation directly affects the firm's cost of equity. When the stock weight increases to 75%, the cost of equity increases from 13.02% to 13.29% in the base case and increases from 12.86% to 13.03% after the buy-out. When the pension plan invests in riskier assets, it increases the asset liability mismatch risk and causes greater underfunding. Higher returns are required to compensate equity holders for the added risk. Therefore, even with the same firm value, investors may prefer a less risky pension asset portfolio.

In the second test, the pension assets are increased from \$7 billion to \$12 billion so that the pension plan becomes overfunded with 20% surplus. The valuation results are also reported in Table 3. With a surplus in the consolidated capital structure, the WACC is modestly lowered from 9.11% to 9.06%, which improves the firm value from \$32.16 billion to \$32.65 billion. Moreover, the tax and penalty adjusted surplus further adds \$3 (= 0.75 - (-2.25)) billion to equity. The value of equity jumps to \$119.05 per share, a 17% increase from \$101.49 per share. Clearly, pension surplus has a significant impact on corporate value.

With a large surplus, it is expected that pension buy-out costs are fully covered by pension assets. It is assumed that the firm performs exactly the same pension buy-out as described in Section 4.3, except that the pension funding ratio goes from 70% to 120%. Very similarly, the authors find that the buy-out transaction de-risks the pension portfolio and hence, reduces the cost of equity. Although the WACC and firm value are minimally changed, due to the 4% pension buy-out risk premium, the surplus is reduced by \$0.14 billion, resulting in a modest drop in per share equity value.

Lastly, the authors keep the 20% surplus assumption and investigate the impact of surplus excise penalty  $\tau$ . The corporate values with  $\tau = 0$  and  $\tau = 90\%$  are presented in Table 4. As expected, the corporate value is not affected by surplus tapping strategies. However, the surplus excise penalty directly determines the percentage of surplus to be reflected in equity value. When  $\tau = 0$ , the firm is assumed to be able to utilize the surplus value without any excise friction. The \$2 billion surplus is only adjusted by the marginal tax rate, and the equity value increases from \$119.05 per share to \$122.82 per share. On the other hand, when  $\tau = 90\%$ , only \$0.15 billion of the total surplus is incorporated into valuation, and the equity value reduces to \$116.04 per share. When the surplus is deeply discounted, the immediate impact of buy-out costs on equity value is significantly reduced. It can be seen that there is only a \$0.13 per share reduction in equity value.

**Table 4**  
**SENSITIVITY TEST: SURPLUS PENALTY**

	$\tau = 0$		$\tau = 90\%$	
	with Pension	Buy-out (PA Only)	with Pension	Buy-out (PA Only)
Implied $\beta_e$	1.71	1.65	1.71	1.65
Cost of Equity	12.53%	12.27%	12.53%	12.27%
Cost of Capital	9.06%	9.06%	9.06%	9.06%
Value of Operating Assets	32,655	32,639	32,655	32,639
Market Value of Debt (-)	10,513	10,513	10,513	10,513
Cash and Equivalents	800	800	800	800
Pension Surplus (Deficit)	2,000	1,860	2,000	1,860
Surplus (after Tax & Penalty)	1,500	1,395	150	140
Intrinsic Value of Equity	24,441	24,321	23,091	23,065
Shares Outstanding	199	199	199	199
Value Per Share	122.82	122.21	116.04	115.91

The model can help understand some recent events related to pension surplus management. To utilize its \$3.5 billion, IBM reopened its frozen cash balance plan in January 2024 so that the surplus can be used to offset the plan's future normal contributions. The unfreezing provides IBM an effective way to tap its surplus without any excise tax (i.e.,  $\tau = 0$ ), directly improving the shareholder value.<sup>13</sup> The market reaction on Kodak's plan termination tells us another story. It appears that the market did not incorporate the surplus value much for Kodak's equity valuation (i.e., evaluated at a very high  $\tau$ ) until the firm had a determined surplus tapping strategy. It is important to point out that the effects of various surplus strategies are multi-dimensional and long-term in nature. Stochastic models are further needed to capture the dynamic effects of surplus management strategies.

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<sup>13</sup> Here the authors only consider the value improvement due to excise tax saving. To evaluate the IBM case, the authors suggest revising the input parameters to reflect pension service cost and other corporate measure changes after shifting from a 401(k) plan to a cash balance plan. For instance, the saved normal contributions may be further invested to increase corporate revenue.

## Section 5 Conclusions

This study discussed some recent developments and trends in the pension industry and provided a brief literature review on the roles of pension plans in corporate risk management. As one of the most important nonoperating items, pension plans have vital impacts on a firm's financial health, and the pension risks can be factored into corporate valuation. For this purpose, this paper also presented a simple enterprise DCF model to determine the value for equity holders, considering both the pension underfunding leverage and asset mismatch risk. Under this model, only the pension service cost from the pension-related items is included in the operating earnings calculation, and the adjusted net pension balance is later added to the equity value as nonoperating asset or debt equivalent. Importantly, by introducing a surplus excise penalty  $\tau$  into the valuation framework, the model provides an effective way to explore the insights behind various pension surplus management strategies.

The authors find that, under this pension-consolidated valuation approach, the pension funding and asset mismatch risks have significant impact on the cost of equity. While the WACC overall reflects the operating asset risk and does not change much by the capital structure, the implied cost of equity needs to be adjusted to reflect the required costs of pension assets and liabilities. The authors also applied the model to examine the effects of pension buy-out on corporate valuation. Generally speaking, the author's case studies suggest that it is beneficial for pension de-risking strategies to be considered under the firm's optimal capital structure. The firm can evaluate carefully the financing strategies for buy-out in order to maximize the debt interest tax shield and create shareholder value. Finally, the model also emphasizes the importance of managing pension surplus—a strategic asset that can potentially improve the corporate value. Since the primary goal of pension surplus is to enhance the benefit security of plan participants, any surplus strategies can be designed with both prudent risk management and value creation.

While the enterprise DCF model can serve as an effective tool to assess the impact of pension plans on corporate valuation, several aspects can be further explored for future research. First, the model provides a static mean analysis based on given assumptions on future corporate operations. It would be helpful to perform a distributional study by extending the model into a stochastic framework. More distribution-based risk measures can then be derived for decision-making. Second, the current model does not consider the longer impacts of buy-out on corporate earnings, such as new investment opportunities, changes in borrowing costs, and operating efficiencies. Integrating these effects could provide a more comprehensive picture of corporate value change due to pension buy-out. Third, the model provides a holistic cash flow analysis at the enterprise level, and the pension risks are mainly captured through the initial funding level and the assumed asset allocation weights. However, to tackle the complex random nature of pension liabilities, both advanced actuarial modeling and dynamic asset and liability management strategies are required in daily pension management. More insights into pension risks may be added by diving into these important components.

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