International Review of Financial Analysis 104 (2025) 104328

Contents lists available at ScienceDirect

International Review of Financial Analysis

journal homepage: www.elsevier.com/locate/irfa

Executive retirement plan freezes and firm policies

Zacharias Petrou [a,*], Adamos Vlittis [b]

[a] Management School, University of Liverpool, Chatham Street, Liverpool L69 7ZH, United Kingdom
[b] Department of Accounting and Finance, University of Cyprus, University Ave#1, Nicosia 2109, Cyprus

ARTICLE INFO

Keywords:
Pension plan freezes
Supplemental executive retirement plans
Efficient contracting
Managerial power

ABSTRACT

When firms freeze their employees qualified defined benefit (DB) pension plans, they often re-evaluate and may similarly freeze their non-qualified supplemental executive retirement plans (SERPs). This study draws from agency theory to investigate the determinants and consequences of SERP freezes. We find that the decision to freeze SERPs is predominantly influenced by the power dynamics between top executives and the board of directors, alongside talent retention concerns. Moreover, our analysis reveals that SERP freezes lead to significant changes in corporate behavior. Firms that implement these freezes tend to distribute pension-related cost savings to their shareholders and are less likely to pursue diversification strategies than firms that keep their SERPs open. This risk-shifting behavior manifests in lower equity and higher credit risk post-freeze. Overall, this study provides insights into the determinants of SERP freezes and enhances our understanding of the incentive alignment function of SERPs' within top executives' compensation structures.

J.E.L. codes

G3
Corporate Finance and Governance

1. Introduction

To de-risk their pension plans and save costs, several large and financially healthy firms have chosen to "hard freeze" their rank-and-file employees' qualified defined benefit (DB) plans and replace them with defined contribution (DC) plans. At the same time, when firms freeze their qualified DB plans, they often re-evaluate their executives' non-qualified supplemental executive retirement plans (SERPs) and may choose to either similarly freeze these plans or to keep them intact, notwithstanding the cessation of future accruals under the qualified plan. For example, Towers Watson (2014) reports that around 75 % of Fortune 200 firms that froze their qualified DB plans follow the same treatment for their executives' plans.[1] However, in contrast to qualified DB plan freeze decisions that have drawn considerable attention from both the popular press and academic literature, freezes of SERPs have largely escaped public and academic scrutiny. This study empirically examines this phenomenon and addresses two research questions. First, given the unique contractual features of SERPs, why do firms freeze their top executives SERPs? Second, how do SERP freezes affect managerial incentives and firm policies in the period following the freeze?

SERPs, which are unsecured and unfunded DB plans, provide additional retirement benefits to top executives, circumventing statutory limits on benefits provided by qualified DB plans. Until recently, SERPs have been prevalent among S&P 1500 firms representing a substantial portion of the overall CEOs' compensation (Bebchuk & Jackson Jr., 2005; Sundaram & Yermack, 2007; Cadman & Vincent, 2015). Importantly, SERPs constitute a significant part of the inside debt component in top executives' compensation structure and are promoted as valuable tools for retaining top talent and for mitigating risk-shifting behavior (Anantharaman, Fang, & Gong, 2014; Sundaram & Yermack, 2007). Therefore, a SERP freeze represents a pivotal shift in a firm's compensation policy, offering a unique setting to examine the determinants and consequences of changes in the compensation structure of top

* Corresponding author.
E-mail addresses: z.petrou@liverpool.ac.uk (Z. Petrou), avlittis@ucy.ac.cy (A. Vlittis).

[1] For instance, SunTrust, and Newell Rubbermaid have frozen their SERPs at the same time they froze their qualified DB plans. These companies report that the intention of the SERP freeze was to treat executives and rank-and-file employees equally and to have executives sharing the impact of the change. Other firms keep their SERPs open or grandfather their top executives into the older plan. For example, Circor International Inc., and Bryn Mawr Bank Corp shielded their top executives from the freeze arguing that SERPs are a critical component of executives' overall compensation and are essential for attracting, motivating, and retaining talented executives (e.g., Grantham, 2009).

https://doi.org/10.1016/j.irfa.2025.104328
Received 1 August 2024; Received in revised form 18 March 2025; Accepted 7 May 2025
Available online 12 May 2025

executives.

Addressing these research questions is important, as it sheds light on the underlying factors that drive decisions to freeze SERPs, and it enhances our understanding of SERPs' role in aligning incentives within executive compensation frameworks. Moreover, by examining the impact of SERPs on managerial decisions and firm policies, this research offers broader insights into the effects of inside debt on a firm's risk profile and the alignment of interests between shareholders and executives. Consequently, the insights derived from this study have significant implications for corporate governance and compensation strategies. These findings are particularly relevant for corporate board members, practitioners, and policymakers involved in designing executive compensation.

Initially, we identified a sample of 239 firms that implemented a hard freeze on their qualified DB plans between 2000 and 2015. Through a careful proxy statement examination, we determined that 178 firms, or 74 % of these firms, froze their SERPs, while 61 chose to keep them active. This figure corroborates Towers Watson (2014) and suggests that, across a relatively broad sample of firms, many sponsors re-evaluate and similarly freeze their SERPs when they freeze their qualified DB plans.

Given the observed variation in decisions to freeze SERPs, we begin our empirical analysis by investigating the determinants of the SERP freeze decision. This decision is particularly intriguing since, unlike qualified DB plans, SERPs are not bound by mandatory minimum funding requirements and do not pose significant liquidity risks to sponsoring firms. Consequently, while economic factors may justify the freezing of qualified DB plans, the rationale behind SERP freezes is less obvious. To address this question, we primarily draw upon agency theory to formulate testable hypotheses on factors influencing SERP freezes. Specifically, we examine how factors that proxy for a CEO's negotiating power, talent retention concerns and debtholder-shareholder alignment relate to a firm's propensity to freeze the SERP. However, we also recognize that reasons unrelated to agency theory, such as government intervention and political pressures, could explain a fraction of the variation in SERP freezes (Frydman & Jenter, 2010; Murphy, 2013).

The findings indicate that the power dynamics between top executives and the board of directors, and talent retention concerns influence the decision to freeze SERPs. Specifically, we find that firms are less likely to implement SERP freezes when the CEO is also the board chair, when there is a lower fraction of non-executive directors serving on the board, and when the CEO does not yet have the right to draw the full amount of their pension benefits. These results suggest that firms led by more powerful CEOs opt to keep their SERPs open, while freezing the pension of rank-and-file employees. We also find that SERP freezes are less likely in firms operating in a more competitive environment, as proxied by the Herfindahl–Hirschman industry concentration index, where top talent retention concerns are likely more intense.

We then explore the effect of SERP freezes on firm-risk and risk-taking policies after the freeze. Building on the documented heterogeneity among firms that implement DB plan freezes, we hypothesize that firms freezing their SERPs will exhibit higher risk-shifting behavior compared to firms opting to keep them active. Our proposition builds on the theoretical intuition of agency theory that managerial holding of debt can help mitigate shareholder-debtholder conflicts in leveraged firms by exposing executives to the risk of bankruptcy (Edmans & Liu, 2011; Jensen & Meckling, 1976). Accordingly, because firms that choose to freeze their SERPs deliberately reduce the fraction of unsecured debt in top executives' compensation, agency theory posits that this change can gradually reshape the agency balance by aligning managerial interest more closely with shareholders vis-à-vis bondholders (e.g., Choy, Lin, & Officer, 2014).

Our investigation aims to complement prior predominately cross-sectional studies on the effect of inside debt on firm policies, by utilizing a regime shift that fundamentally alters the relative inside debt component in top executives' compensation structure (e.g., Caliskan & Doukas, 2015; Cassell, Huang, Manuel Sanchez, & Stuart, 2012; Choy et al., 2014; Eisdorfer, Giaccotto, & White, 2013; Eisdorfer, Giaccotto, & White, 2015; Li & Zhao, 2020; Phan, 2014; Srivastav, Armitage, & Hagendorff, 2014). Our study takes advantage of the heterogeneity between firms that have frozen their SERPs (hereafter *SERP-freezing* firms) and those that did not (hereafter *non-SERP-freezing* firms). While the endogeneity of the SERP freeze decision poses a methodological challenge, the advantage of this setting is knowing exactly when the compensation structure change occurred, which allows the use of a more robust event study methodology to further our understanding of inside debt's effect on firm outcomes.

To this end, we use regression analysis to compare investment, diversification, financing, and payout policy between SERP-freezing firms and non-SERP-freezing firms, in the years following a qualified DB plan freeze. We use an indicator variable for a post-DB freeze observation and its interaction with a SERP freeze indicator that separates firms that freeze their SERPs from those that choose to keep their SERPs open over a span of up to ten years surrounding the pension freeze. The interaction term captures the differential responses to qualified DB plan freezes as a function of the SERP freeze decision. To address endogeneity concerns, given that pension freezes are not random events, we employ three empirical methodologies. First, we narrow our analysis to firms that have frozen their qualified DB plans, enabling a focused investigation within a relatively homogeneous group of firms that have initiated pension freezes. Second, we extend our analysis to all firms offering a DB plan, applying the double-selection model developed by Tunali (1986) to address the endogeneity associated with the decision to freeze both DB plans and SERPs. Lastly, we use entropy balancing and propensity score matching to address covariate imbalances between firms that freeze their DB plans and those that do not.

Our results show that SERP-freezing firms are, on average, more likely to return the cost savings from the qualified DB pension freeze to shareholders through share repurchases, and less likely to engage in diversifying acquisitions in the post-freeze period relative to non-SERP-freezing firms. Refocusing firm operations and distributing cash to shareholders are two strategies that shift risk from shareholders to debtholders, underscoring the role of SERP freezes in shaping shareholder-bondholder alignment. Moreover, our analysis reveals no significant impact of SERP freezes on capital and R&D investments or financing policies in the years following the freeze.

Finally, we expand our analysis to several market-based measures of firm risk, including total firm risk (measured by distance-to-default), equity risk (reflected in idiosyncratic risk), and credit risk (as indicated by S&P ratings). We find that SERP-freezing firms are associated with lower equity risk and higher credit risk in the post-freeze period compared to non-SERP-freezing firms. Collectively, our results align with the predictions of agency theory, suggesting a trend of risk-shifting where SERP-freezing firms shift risk from shareholders to debtholders.

Our empirical analysis controls for several well-known determinants of firm policies and risk, incorporating both year and firm-fixed effects in the main tests, and year and CEO-firm fixed effects in further robustness tests. These controls help mitigate the influence of time-variant characteristics and macroeconomic conditions that affect all firms in a given year or time-invariant firm/CEO heterogeneity that can affect the results. Moreover, our analysis remains robust when accounting for CEO changes around the freeze, controlling for the effect of financing constraints, and utilizing a sample of propensity score matched non-DB freezing firms as the baseline group. Finally, we show that our results cannot be explained by changes in other components of the CEO compensation structure, or differential cost savings between firms that freeze their SERPs and firms that do not.

This study contributes to the literature in several ways. To the best of our knowledge, it is the first to investigate the determinants of SERP freezes. It adds to a long line of research documenting the decline of

qualified DB plans (Ippolito & Thompson, 2000; Kruse, 1995), as well as research focused on factors leading to qualified DB plan freezes (Anantharaman & Lee, 2014; Beaudoin, Chandar, & Werner, 2010; Begley, Chamberlain, Yang, & Zhang, 2015; Comprix & Muller, 2011; Horton, Kiosse, Koumenta, & Mitrou, 2021; Munnell & Soto, 2007; Rauh, Stefanescu, & Zeldes, 2020; Vafeas & Vlittis, 2018). Our investigation reveals that firms led by more powerful CEOs choose not to freeze the SERPs, thereby shielding their top executives' retirement benefits from cutbacks affecting the wider workforce. This finding corroborates arguments that the emergence of the two-tier pension system that separates top executives' pensions from those of rank-and-file employees could partially explain the decline in qualified DB plans (e.g., Begley et al., 2015; Horton et al., 2021; Munnell, Haverstick, & Sanzenbacher, 2006), and extends the literature on opportunistic behavior in executive pension-related decisions (Bebchuk & Jackson Jr., 2005; Gerakos, 2010; Kalyta, 2009; Kalyta & Magnan, 2008; Stefanescu, Wang, Xie, & Yang, 2018).

Further, this study provides valuable insights to a growing literature examining the economic implications of SERPs in top executive compensation. Our study is closely related to Choy et al. (2014) and Li and Zhao (2020), which also examine the effect of reductions in inside debt incentives on firm risk-taking policies. Choy et al. (2014) documents decreases in capital investments and increases in R&D expenditures and leverage in the years following qualified DB plan freezes in the US, while Li and Zhao (2020) reports no significant changes in capital or R&D expenditures following two UK pension reforms that materially reduced rank-and-file employees and CEO pension benefits. These studies, while insightful, leave open the question of whether the observed outcomes are driven by changes in top executives' incentives, which are mostly influenced by SERPs, or by the improved access to internal funds and tax considerations that usually accompany qualified DB plan amendments.[2] By distinguishing between firms that implement SERP freezes and those that do not, our research aims to isolate the incentive effects of SERPs, while mitigating the confounding effects of qualified DB plan freezes.

Our findings are consistent with agency theory's predictions on the role of inside debt in shareholder-debtholder alignment and underscore the need to account for both the direct (i.e., financial constraints) and indirect effects (i.e., inside debt incentives) of pension plan amendments on corporate strategies. Specifically, and in line with Li and Zhao (2020), our findings indicate that SERP freezes do not significantly affect capital and R&D investments or financing policies. However, our analysis indicates that firms opting to freeze their SERPs mitigate diversification incentives and tend to prioritize returning the cost savings to their shareholders through share repurchases, a behavior that is also reflected in market-based measures of firm risk.

The findings of this study are also pertinent to the body of research that highlight the role of effective governance and managerial-shareholder incentive alignment in determining the outcomes of shocks to internal sources of funds (see, e.g., Jensen, 1986; Blanchard, Lopez-de-Silanes, & Shleifer, 1994; Richardson, 2006; Franzoni, 2009; Choy et al., 2014; Dambra, 2018; Vafeas & Vlittis, 2018; von Beschwitz, 2018; Kubick, Lockhart, & Robinson, 2021).[3] Our study extends this research by uncovering the role of managerial alignment through compensation contracts in determining whether the financial slack resulting from the qualified pension freeze is returned to shareholders or invested in acquisitions.

2. Pension plans in top executives' compensation structure

Top executives usually participate in broad-based qualified DB plans but gain most of their retirement benefits through SERPs. A SERP is inherently a long-term compensation agreement granting top executives a right to a stream of monthly retirement benefits commencing at retirement, determined by years of service and pensionable earnings.

Qualified DB plans are regulated by the U.S. Department of Labour under the Employee Retirement Income Security Act is ERISA, 1974 and are subject to minimum funding, participation, vesting, fiduciary trust, and disclosure requirements. ERISA also requires firms to insure qualified DB plans by paying premiums to the Pension Benefit Guaranty Corporation (PBGC). If a firm goes bankrupt, the PBGC takes over as a trustee of the plan and pays plan benefits up to a maximum limit reset by law annually ($60,136 per beneficiary in 2015). Qualified DB plans are, therefore, partially shielded from firm bankruptcy.

Because qualified DB plans are eligible for immediate tax deductions by the sponsor without imposing an immediate tax liability on the participants, the Internal Revenue Code (§415(b) and 401(a)(17)) limits the deferral amounts and total plan contributions and also defines the total maximum allowable compensation for the calculation of benefits ($265,000 per year in 2015 for DB plans). SERPs were first developed to offset these "reverse discrimination" rules and provide highly paid executives with supplemental retirement benefits. Importantly, SERPs are not subject to ERISA compliance requirements and are usually unfunded and unsecured, exposing executives to the risk of loss in bankruptcy and the firm's liquidation value in the event of default.

SERPs have several unique characteristics that make them valuable components in top executive compensation packages. First, because SERPs are structured to avoid ERISA compliance requirements, SERP liabilities are usually unfunded. Consequently, unlike qualified DB plans, the discretionary funding of SERPs does not impose any liquidity risk on firms. Second, SERPs and DB plans have been traditionally offered as a human resource tool to discourage turnovers and to attract employees with desirable characteristics. Typical DB plans are designed to backload pension accruals by giving disproportionate weight in the final years before retirement in the calculation of benefits. Under the "implicit contracts" framework this backloaded nature of benefits enables employers to promote long-term employment relationships by imposing a penalty on those who quit prematurely (e.g., Allen, Clark, & McDermed, 1993; Ippolito, 1987). This prediction is supported by an extensive body of empirical research that has documented lower employee mobility in jobs covered by DB plans (e.g., Allen et al., 1993; Cornwell, Dorsey, & Mehrzad, 1991; Gustman, Mitchell, & Steinmeier, 1994; Ippolito, 1987; Mitchell, 1982).[4]

Finally, the similarity between SERP payoffs with unsecured

[2] Previous research, including studies by Rauh (2006), Bakke and Whited (2012), and Shivdasani and Stefanescu (2009), underscores how mandatory pension contributions can shape capital and R&D investments and the capital structure choices of pension-sponsoring firms. These studies imply that firm policies following significant amendments to qualified DB plans could be influenced not just by top executives' incentives, but also by the broader effect of these pension plan changes on firms' liquidity and tax planning strategies.

[3] For example, Franzoni (2009) shows that both financial constraints and governance structures affect the impact of unexpected mandatory pension contributions on stock returns, while Dambra (2018) and Vafeas and Vlittis (2018) highlight the critical role of governance structures in managing decreases in mandatory pension contributions.

[4] Pension plans' importance in attracting and retaining top executives is emphasized in firms' proxy statements. These statements highlight pensions' role in promoting stability and continuity in leadership within the competitive managerial labor market. For instance, Avery Dennison articulates this perspective clearly, stating: "The Company believes that it is in the stockholders' best interest to retain key executives in critical roles to provide continuity of leadership and to focus them on the Company's long-term success."

corporate debt can help align top executives' interests with those of debtholders and mitigate risk-shifting incentives. Starting with Sundaram and Yermack (2007), an emerging stream of empirical research suggests that SERPs in the top executive compensation structure play an important role in mitigating firm risk and risk-taking policies (e.g., Anantharaman et al., 2014; Cassell et al., 2012; Choy et al., 2014; Eisdorfer et al., 2013; Li & Zhao, 2020; Liu, Mauer, & Zhang, 2014; Phan, 2014; Tung & Wang, 2012). Anantharaman et al. (2014) even show that, between SERPs and other debt-like payoffs, such as qualified DB plans and other deferred compensation plans, the perceived debtholder incentive alignment effect is driven entirely by SERPs.

However, while prominent in top executives' compensation, SERPs are less well understood than other forms of compensation and have also been at the center of heavy criticism for their opacity and for being less sensitive to firm performance. SERPs have often been labelled as "stealth compensation", that could allow powerful executives to extract rents from shareholders by hiding "excessive" non-performance related compensation (Bebchuk & Fried, 2004; Colvin, 2001; Hodgson, 2004).[5] In fact, the potential for SERPs to serve as a vehicle for offering top executives excessive compensation, coupled with their lack of transparency before 2007, were primary factors behind the U.S. Securities and Exchange Commission's (SEC) decision to revise the disclosure rules on executive pensions on December 15, 2006.[6]

3. Sample selection and description

The sample starts with all U.S. firms having defined pension obligations and pension plan assets between 2000 and 2015 in the Compustat Pension annual data file and available data on boards of directors from the MSCI GMI Ratings database. The sample period begins in 2000 because, before 2000, pension plan freezes were rare and mostly associated with financial distress (Munnell & Soto, 2007). It ends in 2015 to allow adequate data for the five-year post-freeze analysis.

To identify qualified DB plan freezes, we manually examine the proxy statements and footnote disclosures in the 10-K reports to identify freezes of qualified DB plans.[7] Of all the events identified, we only retain those related to the hard freeze of the broad base qualified DB plan that affects all or most employees. We focus on hard freezes that affect most employees because they have an immediate impact on the sponsoring firm regarding funding requirements, as well as on current employees and executives. This screening step removes freezes of acquired DB plans following a takeover and in connection with spinoffs, subsidiary or foreign employee plans, union plans, multiemployer plans, and freezes due to bankruptcy or reorganization.[8]

Because participation in the MSCI GMI Ratings database significantly reduces the available pool of pension sponsoring firms, and to ensure that we construct a complete sample of hard freezes, we manually examine the proxy statements and 10-K reports of excluded firms suspected of having frozen their pension plans.[9] We follow the same screening criteria described above for these firms and manually collect the board structure variables.

Once we identify a qualified DB plan freeze, we determine whether the SERP is also frozen through a proxy statement examination. Under the proxy statement's pension/retirement benefits section, firms disclose information on all retirement plans that the CEO and the other top executives participate in, including the status of these separate plans (i.e., whether they are frozen or not).[10]

Overall, we identified 239 unique firms that hard froze their qualified DB plans from 2000 to 2015, of which 178 (74.5 %) sponsors followed with a SERP freeze. This figure is very similar to the 75 % reported by Towers Watson in the Fortune 200 companies. Financial data and stock returns for all firms included in the empirical analysis are collected from Compustat and the Center for Research in Security Prices (CRSP), respectively.

Fig. 1 shows the temporal distribution of freezes from 2000 to 2015. DB freezes increased sharply between 2004 and 2009, peaking in 2006 and 2009 with 38 and 37 events, respectively. This time series distribution is very similar to that reported in Stefanescu et al. (2018) and Rauh et al. (2020).[11] The peak observed in 2006 coincides with a series of significant changes in regulatory and reporting requirements implemented during that year, including the enactment of the Pension Protection Act, the adoption of Statement of Financial Accounting

[5] In the US, instances of "excessive" executive pension benefits have frequently made headlines in the financial press. Recently for example, AT&T's CEO Randall Stephenson stepped down in 2020 with a $64 million retirement plan; CEO Rex Tillerson left Exxon Mobil with a $180 million retirement package (See, articles in *Forbes*, May 12, 2020 "AT&T's CEO steps down with a $64 million gold-plated retirement plan"; in *Fortune*, January 5, 2017 "Rex Tillerson would head to D.C. with $180 million retirement package from Exxon", respectively.

[6] For proxy statements prior to 2007, disclosures on SERPs were limited, and estimating the expected present value of an individual manager's pension benefits was a challenge, even for sophisticated investors (Sundaram & Yermack, 2007; Wei & Yermack, 2011). The SEC revised the disclosure rules on SERPs on December 15, 2006, requiring sponsors to include the annual accrual of pension benefits in the Summary Compensation Table and to disclose the present value of accrued pension benefits in the Retirement Plans section. However, even with the SEC-mandated increased disclosure, SERPs are less well understood than other forms of executive compensation, and firms continue to exercise discretion in the disclosure of pension benefits (Den Uyl & Frederick, 2006; Gerakos, 2010; Jackson & Honigsberg, 2014; Scannell & Lublin, 2006).

[7] A 10-K report is an annual filing that publicly traded companies are required to submit to the SEC. It provides a comprehensive overview of the company's business and financial condition and includes audited financial statements, discussions of financial results, and descriptions of risk factors and management analysis. This report is a primary source of year-end information for investors and analysts.

[8] We excluded acquired plans because firms usually freeze acquired plans and enrol the employees to the firm's existing pension plan. We also excluded foreign plans because they are subject to a different governance structure and do not have to comply with the same funding requirements as domestic plans. Finally, we excluded union or collectively agreed plans, since amendments to these plans require time consuming negotiations and their outcome may depend on a number of uncontrollable factors.

[9] Following Anantharaman, Gao, and Manchiraju (2022) we flag firm-years for which the service costs goes from a non-zero value to zero, and firm-years for which the ratio of service cost to pension liabilities (PBO) declines by more than two-thirds of its prior-year value.

[10] The majority of firms that disclose a frozen qualified DB plan also provide information on the status of the SERP within the same proxy statement. However, there is a small subset of firms (32 firms) where the status of the SERP is not clearly stated. To ascertain the freezing status of the SERP for these firms, we examine changes in the value of the SERP and changes in the service years credited to the CEO for up to five years following the DB plan freeze. This analysis ensures that any increase in the value of the SERP cannot be solely attributed to changes in the interest rate, and that increases in service years are not solely counted for vesting purposes.

[11] In contrast, Phan and Hegde (2013) and Choy et al. (2014), observe a peak in pension freezes in 2003. We attempted to reconcile this difference by examining pension freezes reported in IRS Form 5500, the main source of pension freezes in these studies, and reliably linked to Compustat using the employer identification number (EIN). Since 2002 there has been a question (check box) on Form 5500 that asks whether the pension plan is hard frozen. Very few firms checked the box in 2002, while a disproportionately large number of firms checked the box in 2003. Since 2003 is effectively the first year that this information is reported in the form, it is not clear whether these firms froze the pension in 2003, or in a prior year. A careful examination of 10-Ks and proxy statements reveals that the screening criteria employed in this study thoroughly explain this difference. Specifically, after excluding freezes implemented before 2000 but first reported in 2003, freezes of acquired plans or related to a spinoff, freezes lacking 10-Ks or proxy statements during or following the year of the freeze, and errors in Form 5500 filings, all remaining freezes reported in Form 5500 are included in our sample.

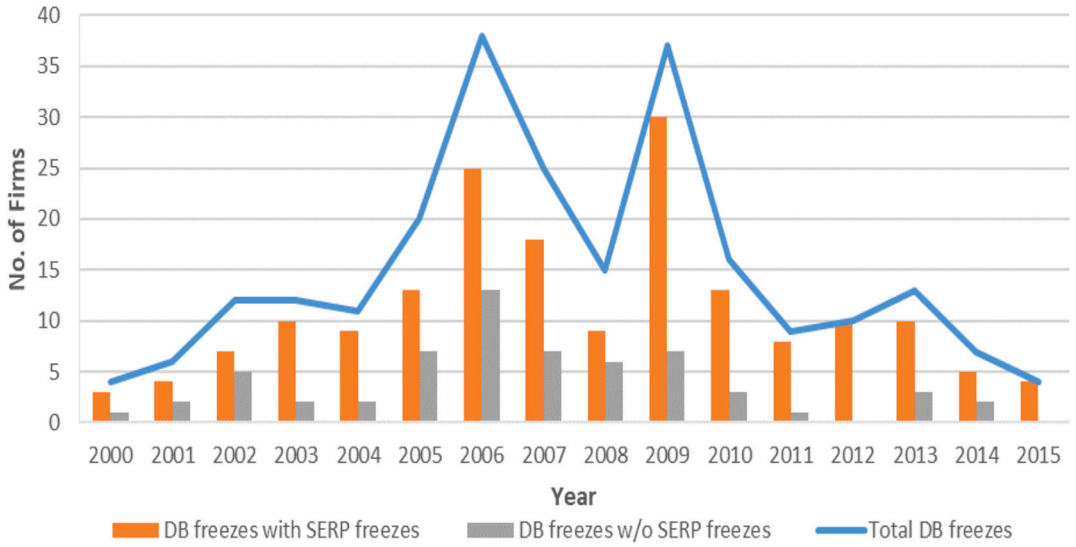

Fig. 1. Distribution of DB pension plan and SERP freezes by year. The figure presents the distribution of 239 dB-plan freezes from 2000 to 2015 by year.

Standards 158, and the SEC's mandate to enhance disclosure of compensation in 2006. SERP freezes follow a similar pattern, peaking in 2006 and 2009 with 25 and 30 events, respectively, reinforcing the argument that most firms that freeze their qualified DB plan often re-evaluate and hard freeze their SERPs. The figure also shows that the gap between qualified DB plan freezes and SERP freezes narrowed after the SEC's 2006 enhanced compensation disclosure mandate that significantly increased the transparency of SERP benefits, and eventually disappeared in more recent years. This result supports the conclusion that government intervention and political factors play a pivotal role in executive compensation trends (Frydman & Jenter, 2010; Murphy, 2013).

Fig. 2 shows the industry distribution. Pension freezes are distributed over almost all major industry groups, with a higher concentration in the manufacturing sector (47.9 % of qualified DB freezes and 47.2 % of SERP freezes) and the financial sector (25.4 % of qualified DB freezes and 24.0 % of SERP freezes).

4. Empirical analysis

4.1. Determinants of SERP freezes

Qualified DB plan hard freezes have drawn considerable attention from both the popular press and academic literature because of their substantial wealth implications for firms' employees and sponsors (e.g., Towers Watson, 2014; Vanguard Group, 2016). For rank-and-file employees, such freezes often entail a reduction in anticipated future retirement benefits, accompanied with the assumption of significant retirement risk previously borne by the sponsors (Rauh et al., 2020; VanDerhei, 2006).[12] Conversely, sponsors experience a positive shock on internal sources of cash as a result of pension freezes, which mitigate the level and unpredictability of pension contributions (Munnell et al., 2006; Rauh et al., 2020).[13] The literature on the determinants of qualified DB plan freezes emphasizes the role of financial considerations, including cost and risk reductions, alongside employee negotiating power, changes in regulatory and reporting standards, and corporate governance structure as significant factors influencing a sponsors' decision to freeze (e.g., Beaudoin et al., 2010; Begley et al., 2015; Comprix & Muller, 2011; Horton et al., 2021; Li & Kara, 2022; Munnell & Soto, 2007; Rauh et al., 2020; Vafeas & Vlittis, 2018).

In contrast to qualified DB plan freezes, there is a paucity of academic research on the determinants of SERP freezes. A unique characteristic of SERPs that makes this question intriguing is that, unlike qualified DB plans, SERPs are unfunded and do not pose significant liquidity risks for sponsoring firms. Consequently, while financial factors may explain the freezing of qualified DB plans, the rationale behind SERP freezes is less obvious.

To address this question, we draw from agency theory to develop testable hypotheses. First, given that pension freezes typically involve extensive negotiations with affected parties, we hypothesize that CEOs with greater negotiating power may leverage their influence to pressure the board to keep their SERPs intact and shield their compensation from cost cuts affecting the wider workforce. This hypothesis reflects the resilience of collectively bargained pension plans for rank-and-file employees, where the necessity for sponsors to engage in negotiations with unions typically results in these plans being less prone to freezes and often the last to be modified (Munnell & Soto, 2007).

Second, rooted in the extensive academic literature on pensions, which highlights the crucial role of DB plans in discouraging employee turnovers, we posit that firms with greater retention concerns will be less likely to implement SERP freezes (Allen et al., 1993; Cornwell et al., 1991; Dorsey, 1995; Gustman et al., 1994; Ippolito, 1987; Mitchell, 1982). Retention concerns are more pronounced for top executives, where separations typically entail higher firm-specific capital losses and greater disruptions to the firm's production technology in comparison to those of rank-and-file employees (Baranchuk, MacDonald, & Yang, 2011; Edmans & Gabaix, 2009; Grantham, 2009; Rosen, 1981).

Lastly, guided by inside debt theory, we hypothesize that firms with a greater reliance on debt financing and higher debt-related agency costs will be less inclined to implement SERP freezes (e.g., Sundaram & Yermack, 2007). Conversely, we posit that firms with significant investment opportunities will prefer freezing their SERPs, shifting towards equity-based over debt-like compensation to better align managerial and shareholder interests (e.g., Baber, Janakiraman, & Kang, 1996; Edmans & Liu, 2011).

[12] For example, VanDerhei (2006) shows that mid-career and longer-tenured employees are the most affected by a pension freeze, and they are unlikely to recoup the losses even with enhanced 401(k) contributions. In the U.S., a 401(k) plan is an employer-sponsored retirement savings plan that allows employees to save and invest a portion of their paycheck before taxes are taken out.

[13] Rauh et al. (2020) shows that long-term payroll savings from pension freezes are up to 3.4 % of total assets and 13.5 % of the expected future payroll of affected employees.

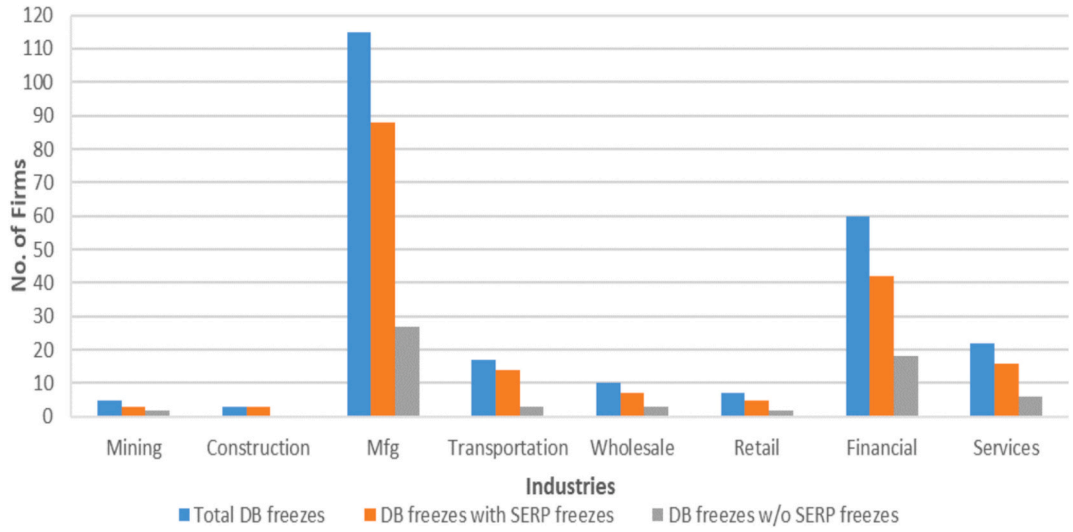

Fig. 2. Distribution of DB pension plan and SERP freezes across industries. The figure presents the distribution of 239 dB plan freezes from 2000 to 2015 by major industries.

4.1.1. Model description

Our aim is to identify CEO, firm, and pension characteristics that affect the likelihood of a firm freezing their qualified DB plans and SERPs. To analyze the sponsors' decisions to freeze their qualified DB plans and SERPs, we employ two approaches: independent probit models and a bivariate probit model. The two probit models estimate the likelihood of a DB plan freeze and a SERP freeze separately, assuming that these two decisions are independent. In contrast, the bivariate probit model recognizes the possibility that the two decisions are jointly determined, and their unobservables are correlated (Meng & Schmidt, 1985). It is a joint model for two binary outcomes and utilizes the maximum likelihood estimation (MLE) method to simultaneously estimate the two decisions.

Specifically, we estimate the following models, both as independent probits and jointly as bivariate model:

$$SERP\ FREEZE^{*}_{it} = x_{it-1}\beta_1 + \varepsilon_{1it} \quad (1)$$

$$DB\ FREEZE^{*}_{it} = z_{it-1}\beta_2 + \varepsilon_{2it}, \quad (2)$$

$$(\varepsilon_{1it}, \varepsilon_{2it}) \sim N[(0,0),(1,1),\rho_{12}]$$

where, $SERP\ FREEZE^{*}_{it}$ and $DB\ FREEZE^{*}_{it}$ are the latent variables representing the sponsor's propensity to freeze the SERP and DB plan respectively. Consequently, $SERP\ FREEZE_{it} = 1$ if $SERP\ FREEZE^{*}_{it} > 0$ and zero otherwise. Similarly, for $DB\ FREEZE_{it}$. x_{it-1} denotes the vector of variables influencing the decision to freeze SERPs measured in the year preceding the freeze, and β_1 the vector of parameters. z_{it-1} extends x_{it-1} by including factors specific to DB plan freeze decisions, and β_2 is the corresponding parameters vector. ε_{1it} and ε_{2it} are normally distributed error terms with standard deviations σ_1 and σ_2, respectively, and, without loss of generality, $\sigma_1 = \sigma_2 = 1$.

The parameter ρ_{12} estimates the correlation between the error terms of the Bivariate Probit equations. If the MLE estimate of the correlation coefficient ρ_{12} is significant, then the Bivariate Probit estimation is more efficient than independent Probit equations. When $\rho_{12} = 0$, the bivariate model reduces to two independent Probit models.

We start with factors affecting the propensity of sponsors to freeze their SERPs, as discussed in the previous section. First, we expect powerful CEOs to oppose a SERP freeze. We posit that a CEO who chairs the board, *CEO CHAIR* (Finkelstein & D'aveni, 1994), and is part of firms with larger boards, *BOARD SIZE* (Yermack, 1996), a lower fraction of non-executive directors on the board, *%NE DIRECTORS* (Adams, Hermalin, & Weisbach, 2010; Vafeas & Vlittis, 2018), and a higher fraction of insider ownership, *%INSIDERS OWNERSHIP* (Anantharaman & Lee, 2014), is more powerful and is, therefore, more likely to influence the SERP freeze decision. Further, we expect CEOs without the right to draw the total amount of their pension benefits to oppose a SERP freeze, *PENSION INDICATOR*.

Second, we posit that firms with greater retention concerns will be less likely to implement SERP freezes. We argue that retention concerns are more acute in environments where firm-specific human capital is more important and where CEO talent from inside the firm is harder to replicate (Martijn Cremers & Grinstein, 2013; Parrino, 1997). Consequently, we expect industries with a higher proportion of CEOs hired internally, *%INSIDER CEOs*, to be less likely to implement SERP freezes. Additionally, retention concerns are likely more significant in less concentrated industries, where the competition for managerial talent is more intense (Giroud & Mueller, 2010; Stefanescu et al., 2018). We proxy for industry concentration using the Herfindahl-Hirschman index, *HHI*, computed as the sum of squared market shares within the same text-based industry network classifications (Hoberg & Phillips, 2010).

Finally, we use three proxy variables to reflect the predictions of inside debt theory. First, we use the interest coverage, *INTEREST COVER*. This ratio measures the ability of firms to cover their interest expenses from earnings, where a higher ratio indicates a greater reliance on debt financing and a higher likelihood of debt-based compensation being valuable. Second, we use Zmijewski's z-score, which estimates the probability of default, *ZMIJEWSKI's SCORE*, reflecting the agency costs associated with debt. A higher score suggests increased financial distress risk and, therefore, higher agency costs. Lastly, we use the market-to-book value of assets to proxy for investment opportunities, *MARKET TO BOOK*.

Turning to the propensity of sponsors to freeze the qualified DB plan, we primarily draw from prior research and include additional explanatory variables that proxy for the health of the qualified pension plan and employee negotiating power (e.g., Beaudoin et al., 2010; Choy et al., 2014; Comprix & Muller, 2011; Munnell & Soto, 2007; Phan & Hegde, 2013; Rauh et al., 2020; Vafeas & Vlittis, 2018). Specifically, we control for pension plan funding status, *FUNDING STATUS*, pension contributions, *PENSION CONTRIBUTIONS*, the size of the pension plan, *PLAN SIZE*, and the industry union rate, *INDUSTRY UNION RATE*, measured at the 2-digit SIC industry classification (© 2010 by Barry T. Hirsch and David A. Macpherson at Georgia State University).

In both models, we control for firm profitability using sales growth, *SALES GROWTH*, non-pension cash flows, *NON-PENSION CFO* (Phan &

Hegde, 2013; Rauh, 2006), return on assets, *ROA*, and firm size, *LN (ASSETS)*. For detailed information regarding the measurement of variables, refer to the Appendix. All explanatory variables are measured at the beginning of the year, and all continuous variables are winsorized at the 1 % and 99 % levels. The models are estimated using annual data from 1998 to 2015. Following Rauh et al. (2020), all firm-year observations after the pension plans are frozen are excluded from the analysis.

4.1.2. Univariate analysis

Table 1 presents univariate results. Panel A presents summary statistics for the sample of firms that freeze their qualified DB plans partitioned into SERP freezing and non-SERP freezing subsamples. The analysis reveals that SERP-freezing firms have a higher fraction of non-executive directors serving on the board (p-value<0.05) and lower insider ownership levels (p-value<0.10). These findings point to CEO power as an important factor in the SERP freeze decision. Further, SERP-freezing firms operate in industries with fewer CEOs hired from inside the firm (p-value<0.05) and less competitive pressure (p-value<0.05), highlighting the relevance of retention concerns. Additionally, firms that freeze their SERPs exhibit higher market-to-book ratios, indicating the presence of greater growth opportunities. Finally, SERP-freezing firms are larger than non-SERP-freezing firms. Overall, the univariate comparisons suggest that managerial power, talent retention concerns, and growth opportunities can potentially explain the SERP freeze decision.

Panel B presents results for the entire set of firms offering DB plans, categorizing them into those that have frozen their qualified DB plans and those that have not. Results indicate that DB-freezing and non-DB-freezing firms differ on several observable dimensions. As expected, firms that freeze their DB plans have lower pension plan funding ratios, contribute more to their pensions, and their pension obligations are larger. Additionally, firms that freeze their pensions operate in industries with lower union density than non-freezing firms. These findings underscore the significance of both the financial health of the pension plan and employee negotiating power in the decision to freeze DB plans. Furthermore, DB-freezing firms have larger boards, higher proportions of non-executive directors and tend to appoint CEOs from within the organization. Finally, these firms tend to operate in more concentrated industries, face higher financial distress, have lower growth opportunities, lower non-pension cash flows, lower sales growth, are less profitable, and smaller in size. These univariate comparisons align broadly with existing research on the factors driving the freezing of DB plans, reinforcing the idea that both the financial health of the pension plan and the firm as well as governance structures play a crucial role in this decision.

4.1.3. Multivariate analysis

Table 2 presents the multivariate analysis. Columns (1) and (2) show the probit estimation results of the likelihood of a SERP freeze and a qualified DB plan freeze, respectively. To ease interpretation, we include the marginal effects when all other variables are at their mean next to the coefficient estimates. Column (3) presents the bivariate probit results.

The results show that board characteristics are important determinants of the SERP freeze decision. Specifically, the probability that a firm freezes its SERP is 5.6 % (p-value<0.01) lower when the CEO is also the chair of the board, while a 1 % increase in the fraction of non-executive directors increases the probability of a SERP freeze by 0.187 % (p-value<0.01). Interestingly, the likelihood of a SERP freeze is 4.8 % (p-value<0.05) higher when the CEO has the right to draw down the total amount of their pension.

The effect of retention concerns on the SERP freeze decision is mixed. The coefficient on *%INSIDER CEOs* is not statistically significant, indicating that the extent to which firms promote CEOs internally does not meaningfully influence SERP freeze decisions. However, consistent with the retention-based argument, we find that firms in less concentrated

Table 1
Descriptive Statistics.

PANEL A: Descriptive statistics for annual data used in the SERP freeze decision

	DB w/o SERP Freeze (n = 341)		DB and SERP Freeze (n = 987)		Difference
	Mean	S.D.	Mean	S.D.	t-stat
CEO Power					
CEO CHAIR	0.63	0.48	0.59	0.49	1.55
BOARD SIZE	10.29	2.68	10.23	2.42	0.39
%NE DIRECTORS	0.77	0.14	0.79	0.12	−2.58**
%INSIDERS OWNERSHIP	0.11	0.15	0.09	0.14	1.92*
PENSION INDICATOR	0.15	0.36	0.13	0.33	1.21
Retention					
INSIDER CEOs	0.74	0.10	0.72	0.12	2.19**
HHI	0.28	0.28	0.32	0.29	−2.25**
Asset substitution					
ZMIJEWSKI's SCORE	−0.45	1.53	−0.53	1.44	0.87
INTEREST COVER	0.18	0.50	0.20	0.72	−0.30
MARKET TO BOOK	1.38	0.53	1.48	0.76	−2.34**
Controls					
NONPENSION CFO	0.08	0.07	0.08	0.08	0.62
SALES GROWTH	0.06	0.15	0.06	0.19	0.06
ROA	0.08	0.00	0.07	0.00	0.90
LN (ASSETS)	7.55	1.67	8.00	1.96	−3.81***

PANEL B: Descriptive statistics for annual data used in the qualified DB plan freeze decision

	Non-Freeze (n = 12,966)		DB Freeze (n = 1328)		Difference
	Mean	S.D.	Mean	S.D.	t-stat
CEO Power					
CEO CHAIR	0.60	0.49	0.60	0.49	−0.19
BOARD SIZE	10.05	2.66	10.25	2.49	−2.55**
%NE DIRECTORS	0.78	0.13	0.79	0.12	−3.38***
%INSIDERS OWNERSHIP	0.09	0.14	0.09	0.14	−0.19
Retention					
INSIDER CEOs	0.72	0.11	0.73	0.12	−2.22**
HHI	0.28	0.27	0.31	0.29	−3.28***
Asset substitution					
ZMIJEWSKI's SCORE	−0.89	1.35	−0.51	1.47	−9.54***
INTEREST COVER	0.20	0.61	0.19	0.67	0.49
MARKET TO BOOK	1.55	0.81	1.46	0.71	4.25***
Controls					
NONPENSION CFO	0.09	0.08	0.08	0.08	2.50**
SALES GROWTH	0.09	0.22	0.06	0.18	4.04***
ROA	0.08	0.07	0.07	0.06	4.69***
LN (ASSETS)	8.06	1.71	7.88	1.90	3.65***
Pension plan health					
FUNDING STATUS	−0.01	0.04	−0.04	0.06	16.69***
PENSION CONTRIBUTIONS	0.00	0.01	0.01	0.01	−14.20***
LN (PLAN SIZE)	5.27	2.05	5.30	2.05	−6.06***
Employee negotiating power					
INDUSTRY UNION RATE	11.96	8.29	10.11	7.00	7.83***

The table presents descriptive statistics for the sample firms that declared a qualified DB freeze between 2000 and 2015. Panel A presents summary statistics on the explanatory variables used in the analysis of the SERP freeze decision for firms that freeze their qualified DB plans. The sample consists of all firm-years of firms that froze their DB plans preceding the pension freeze (n = 1338). Panel B presents summary statistics on the explanatory variables used in the analysis of the qualified DB plan freeze decision. The sample comprises all firm-years of firms that offer DB plans. For the DB freeze firms, only the years preceding the pension freezes are included (n = 14,296). *CEO CHAIR* is an indicator variable equal to one if the firm's CEO is also the Chair of the board. *BOARD SIZE* is the total number of directors on the board. *%NE DIRECTORS* is the fraction of non-executive directors on the board. *%INSIDER OWNERSHIP* is the fraction of common stock owned by insiders. *PENSION INDICATOR* takes the value of 1 if the CEO has the right to draw down 100 % of their pension benefits. *INSIDER CEOs* is the fraction of inside new chief executive officers across the Fama and French classification of 48 industry groups (Cremers and Grinstein,2014). *HHI* is the sum of squared market shares based on sales within the same text-based industry concentration. *ZMIJEWSKI's SCORE* is computed as: − 4.336 − 4.513 × *ROA* + 5.679 × *Leverage* + 0.004 × *Liquidity*. *INTEREST COVER* is Interest

expense divided by earnings before interest and taxes. *MARKET TO BOOK* is the book value of assets plus the market value of equity less the sum of the book value of equity and deferred assets scaled by the book value of assets. *SALES GROWTH* is the growth in sales from year t-1 to year t. *NON-PENSION CFO* is income before extraordinary items plus depreciation and amortization plus net period pension costs, scaled by assets. *ROA* is earnings before interest and taxes scaled by total assets. *ASSETS* are the total assets. *FUNDING STATUS* is the fair value of pension plan assets less the projected pension benefit obligation scaled by assets. *PENSION CONTRIBUTIONS* is the employer's contribution to the pension plan scaled assets. *PLAN SIZE* is the projected pension benefit obligation. *INDUSTRY UNION RATE* is the two-digit SIC's industry unionization rate (© 2002, 2016 by Barry T. Hirsch and David A. Macpherson). All variables are measured at the beginning of the fiscal year, and all continuous variables are winsorized at the 1 and 99 percentiles. ***. **, * indicate levels of significance of 1 %, 5 %, and 10 %, respectively.

industries are significantly less likely to freeze SERPs. Specifically, a 1 % increase in *HHI* is associated with a 0.057 % increase in the likelihood of a SERP freeze (p-value <0.05), suggesting that firms in more competitive industries rely more on SERPs to retain key executives. These findings are further supported by the bivariate probit model (Column 3).[14]

The analysis also provides weaker evidence, that growth opportunities influence the likelihood of a SERP freeze. A unit increase in the market-to-book ratio increases the probability of a SERP freeze by 2.6 % ($p < 0.10$). However, the coefficient is not statistically significant in the bivariate probit model suggesting that while growth opportunities might play a role in the SERP freeze decision, their impact is not as pronounced or consistent across different model specifications.

The analysis of the qualified DB freezing decision reveals several key trends. In line with existing literature, firms with better-funded pensions and those operating in sectors with greater union density are less inclined to freeze their DB plans (Column 2). On the other hand, firms bearing higher pension liabilities exhibit a higher propensity towards freezing their pensions. These findings are further corroborated by the results from the bivariate probit model (Column 3). Analyzing the remaining variables reveals that firms are less likely to freeze DB plans when the CEO also serves as the board chair, and when they exhibit greater growth prospects, higher sales growth, and are larger in size. Conversely, an increased likelihood of freezing is observed in firms with larger board sizes, a higher proportion of non-executive directors, and elevated financial distress risk.

In summary, the results presented in Table 2 indicate that the decision to freeze SERPs is influenced by CEO negotiating power and efficient contracting considerations. The results reveal that firms are less likely to freeze their SERPs when the CEO is also the board chair, when there is a lower fraction of non-executive directors on the board, and when the CEO does not yet have the right to draw down the total amount of their pension. These results suggest that CEOs might use their influence to shield their retirement benefits from cost cuts affecting the wider workforce. The results also reveal some evidence that the retention value of SERPs is potentially greater in environments where the competition for top talent is intense. Collectively, these results provide a nuanced understanding of the factors influencing the decision to freeze SERPs.

4.2. Firm policies around pension plan freezes

In this section we examine whether and how the decision to freeze SERPs affects firm risk-shifting policies in the post-freeze period. We focus on SERP freezes, because, unlike qualified DB plans that offer some protection against bankruptcy, SERPs are unsecured and unfunded, exerting a more pronounced influence on top management incentives (e.g., Anantharaman et al., 2014). Therefore, by differentiating between firms that freeze SERPs and those that do not, our study aims to investigate the incentive effect of the freeze directly while controlling for the influence of freezes in qualified DB plans. Drawing from agency theory we hypothesize that firms opting to freeze their SERPs realign top executives' incentives with those of shareholders and will potentially exhibit higher risk-shifting behavior than firms only freezing their qualified DB plans.

We, thus, examine investment and financial policies that have been previously linked to the top executives inside debt bias. The theoretical framework for this analysis is rooted in the notion that high levels of inside debt can create a risk-averse bias among top executives, which may lead them to prefer less risky investment and financial policies. Risk-averse managers are inclined to prioritize strategies that minimize the firm's exposure to uncertainty and volatility, often opting to prioritize investments in property, plant, and equipment over riskier R&D expenditures (e.g., Bhagat & Welch, 1995; Cassell et al., 2012; Coles, Daniel, & Naveen, 2006; Kothari, Laguerre, & Leone, 2002). Additionally, risk-averse managers often seek to diversify across different business segments, because, as Lewellen (1971) first noted, a combination of different businesses reduces the overall firm risk (Aggarwal & Samwick, 2003; Amihud & Lev, 1981; Cassell et al., 2012; Coles et al., 2006; Jensen, 1986). Inside debt bias can also influence financial decisions, leading CEOs to lower leverage as a measure to reduce firm risk, and to be less inclined to return cash to shareholders because payouts reduce the quantity and quality of capital available to repay debt and their future pension benefits (Sundaram & Yermack, 2007).[15]

Drawing from the above discussion, we can delineate the strategic differences between firms that choose to freeze their SERPs relative to those that keep their SERPs open. Given that qualified DB plan freezes create financial slack, we expect firms that keep their SERPs open to direct the funds towards diversifying investments over the more uncertain ventures of R&D projects. These firms are also anticipated to favor reducing debt (leverage) over making payouts to shareholders, indicating a prioritization for financial stability. Conversely, firms

[14] To further explore the role of competition for talent in SERP freeze decisions, we expand our analysis from Table 2 in Online Appendix 1, incorporating several additional proxies from prior literature. The results, displayed in Table OA1.1, indicate that while competition for talent plays a role in SERP freezes, its effect is not consistent across all measures. Specifically, firms operating in industries with a larger number of rivals (Gao, Luo, & Tang, 2015), firms led by higher-ability CEOs (Demerjian, Lev, & McVay, 2012), and firms with CEOs nearing retirement (De Angelis & Grinstein, 2020; Gao et al., 2015) are significantly less likely to freeze SERPs, reinforcing the argument that retention concerns drive these decisions. However, other proxies, such as the enforceability of noncompete agreements (Garmaise, 2009) and CEO generalist skills (Custódio & Metzger, 2014), are not statistically significant, although their coefficients are directionally consistent with expectations. Table OA1.1 in Online Appendix 1 presents these results.

[15] We should note that prior research into the impact of inside debt holdings on firm investment and financial policies has produced mixed results. For capital investments, Eisdorfer et al. (2013) show that CEOs with substantial SERP benefits tend to underinvest, while Choy et al. (2014) document a decrease in capital investments following pension freezes, suggesting inside debt is positively related to capital investments. In contrast, Li and Zhao (2020) find no significant relationship between inside debt and capital investments. Research into R&D expenditures also shows diverse findings; Cassell et al. (2012) and Choy et al. (2014) suggest a negative association with inside debt, whereas Li and Zhao (2020) report no significant relation. The empirical results regarding diversification and inside debt incentives also display variation; Cassell et al. (2012) indicate a positive link, Phan (2014) identifies a negative association, and Choy et al. (2014) observe no correlation. In terms of financing policy, Sundaram and Yermack (2007) demonstrate that firms with high inside debt are more leveraged, contrasting with Cassell et al. (2012) and Choy et al. (2014), who show that firms with high inside debt have lower leverage. Finally, regarding shareholder payouts, Eisdorfer et al. (2015) and Srivastav et al. (2014) find a negative association, while Caliskan and Doukas (2015) and Sheikh (2021) uncover a positive relationship.

Table 2
Determinants of Pension Plan Freeze.

		1		2		3	
		SERP FREEZE		DB FREEZE		SERP FREEZE	DB FREEZE
	Pred. Sign	Coeff	Marginal Effects	Coeff	Marginal Effects	Coeff	Coeff
CEO Power							
CEO CHAIR	−	−0.304***	−0.056***	−0.142**	−0.003**	−0.622***	−0.140**
		(0.089)	(0.016)	(0.060)	(0.001)	(0.195)	(0.061)
LN (BOARD SIZE)	−	−0.288	−0.053	0.252**	0.006*	−0.771	0.252**
		(0.190)	(0.035)	(0.127)	(0.003)	(0.518)	(0.128)
%NE DIRECTORS	+	1.015***	0.187***	0.815***	0.019***	1.439*	0.815***
		(0.394)	(0.072)	(0.281)	(0.006)	(0.813)	(0.282)
%INSIDERS OWNERSHIP	−	−0.385	−0.071	−0.145	−0.003	−0.220	−0.148
		(0.318)	(0.058)	(0.227)	(0.005)	(0.748)	(0.228)
PENSION INDICATOR	+	0.259**	0.048**			1.083***	
		(0.120)	(0.022)			(0.376)	
Retention							
INSIDER CEOs	−	−0.284	−0.052	0.382	0.009	−0.813	0.377
		(0.331)	(0.061)	(0.263)	(0.006)	(0.843)	(0.263)
HHI	+	0.309**	0.057**	0.073	0.002	0.678*	0.074
		(0.144)	(0.026)	(0.111)	(0.003)	(0.361)	(0.111)
Asset substitution							
ZMIJEWSKI'S SCORE	−	0.027	0.005	0.076***	0.002***	0.041	0.077***
		(0.036)	(0.007)	(0.027)	(0.001)	(0.079)	(0.027)
INTEREST COVER	−	−0.104	−0.019	−0.029	−0.001	−0.141	−0.029
		(0.078)	(0.014)	(0.039)	(0.001)	(0.140)	(0.039)
MARKET TO BOOK	+	0.143*	0.026*	−0.126**	−0.003**	0.145	−0.129**
		(0.084)	(0.015)	(0.059)	(0.001)	(0.193)	(0.059)
Controls							
NONPENSION CFO	?	−1.503*	−0.276*	0.544	0.012	−1.460	0.550
		(0.912)	(0.167)	(0.577)	(0.013)	(1.743)	(0.579)
SALE GROWTH	?	−0.363	−0.067	−0.453***	−0.010***	−0.194	−0.455***
		(0.265)	(0.048)	(0.173)	(0.004)	(0.509)	(0.172)
ROA	?	−1.255	−0.231	−0.519	−0.012	−0.102	−0.489
		(1.110)	(0.204)	(0.700)	(0.016)	(2.162)	(0.701)
LN(ASSETS)	?	−0.020	−0.004	−0.160***	−0.004***	0.156**	−0.160***
		(0.029)	(0.005)	(0.035)	(0.001)	(0.076)	(0.035)
Pension plan health							
FUNDING STATUS				−3.026***	−0.069***		−3.037***
				(0.664)	(0.016)		(0.653)
PENSION CONTRIBUTIONS				5.070	0.116		4.862
				(3.976)	(0.091)		(3.898)
LN (PLAN SIZE)				0.112***	0.003***		0.110***
				(0.029)	(0.001)		(0.029)
Employee negotiating power							
INDUSTRY UNION RATE				−0.030***	−0.001***		−0.030***
				(0.005)	(0.000)		(0.005)
INTERCEPT		−1.011*		−2.902***		−0.096	−2.953***
		(0.571)		(0.431)		(1.587)	(0.441)
ρ_{12}						0.328	
						(0.263)	
Chi-Square		127.40		287.00		30.99	
R-square		12.20 %		12.90 %			
Observations		1338		14,296		14,296	

The table presents the results examining the firms' decisions to freeze their qualified DB plans and their SERPs. Columns (1) and (2) present the probit estimation results of the likelihood of a SERP freeze and a qualified DB plan freeze, respectively. Marginal effects when all other variables are at their mean are reported next to the coefficient estimates. Column (3) presents the maximum likelihood bivariate probit results. The models are estimated from 1998 to 2015. All firm-year observations after the pension plans are frozen are excluded from the analysis. In Column (1) the sample consists of all firm-years of firms that froze their DB plans ($n = 1338$). In Column (2) (and 3), the sample comprises all firm-years of firms that offer DB plans ($n = 14{,}296$). *SERP FREEZE* is an indicator variable, which takes the value of one for firm years following the SERP freeze and zero otherwise. *DB FREEZE* is an indicator variable, which takes the value of one for firm years following the qualified DB plan freeze and zero otherwise. All explanatory variables are measured at the beginning of the fiscal year and are defined in the Appendix. All models include year-fixed effects. Continuous variables are winsorized at 1 % and 99 %. Robust standard errors clustered at the firm level are reported in parentheses. ***. **, * indicate levels of significance of 1 %, 5 %, and 10 %, respectively.

freezing their SERPs are expected to increase investments in R&D, and to prioritize refocusing firm operations to their core areas. Additionally, these firms are expected to return cash savings to shareholders through payouts rather than concentrating on debt reduction.

4.2.1. Model description

We use ordinary least squares regressions, with year and firm fixed effects, to explain changes in firm investment and financing policies. The analysis period is from 1998 to 2018, encompassing firm-years within a maximum span of five years before and five years after the freeze, excluding the freeze year.[16] We estimate the following regression model:

$$Y_{it} = \beta_0 + \beta_1 \text{SERP FREEZE}_i + \delta_1 \text{POST}_t + \delta_2 \text{POST}_t \times \text{SERP FREEZE}_i + \sum_{q=1}^{m} \lambda_q CONTROLq_{it} + u_i + \gamma_t + \varepsilon_{it} \quad (2)$$

where Y_{it} is a measure of firm policy. *SERP FREEZE* is an indicator variable for firms that froze both their qualified DB plans and SERPs.[17] *POST* is an indicator variable that takes the value of one in the post-DB freeze period and zero otherwise, and *POST* × *SERP FREEZE* is their interaction. The coefficients of interest are δ_1 and δ_2. Coefficient δ_1 is the estimated mean change in the outcome variable from before to after the DB-plan freeze for firms that only freeze their qualified DB plans. Coefficient δ_2 captures the incremental effect on firm outcomes for firms that freeze their qualified DB plans and SERPs.

The outcome variables used to proxy for firm policies are: (1) *CAPEX*, measured as capital expenditure minus the sale of property, plant, and equipment scaled by total assets; (2) *R&D*, measured as research and development expenses scaled by assets; (3) *SEGMENTS*, which is the number of business segments[18]; (4) *LEVERAGE*, measured as debt in current liabilities plus long-term debt divided by total assets; (5) *DIVIDENDS*, measured as cash dividends scaled by assets, and (6) *REPURCHASES*, measured as the increase in common treasury stock, or as the difference between purchases of stock and the sale of stock if treasury stock is not available (e.g., Fama & French, 2001; Skinner, 2008).

Studying the relationship between pension freezes and firm outcomes poses a methodological challenge due to the non-random nature of pension freezes and the potential influence of related factors on post-freeze policies. To address this challenge, we employ three empirical methodologies. First, we narrow the analysis to firms that have frozen their qualified DB plans. This allows for a focused examination of the impact of the SERP freeze decision within a comparatively homogeneous group of pension-freezing firms, with firms that retain their SERPs serving as the control group. Second, we analyze all firms that offer a qualified DB plan and employ the double-selection model developed by Tunali (1986) to control for the endogeneity of both the DB plan and the SERP freeze. The Tunali (1986) model extends the Heckman (1979) two-stage selection model by including a second selection equation. Specifically, we use parameter estimates from the two probit models described in the previous section to estimate selectivity correction variables, λ_{DB} and λ_{SERP}, for the decisions to freeze the qualified DB plan and the SERP, respectively.[19] The inclusion of these two variables aims to mitigate bias stemming from potential differences between firms that choose to freeze their pension plans and those that do not, which may arise from various unobserved factors. The selectivity correction variables are calculated as $\lambda = \phi(\tilde{x})/\Phi(\tilde{x})$ where $\tilde{x}$ is the predicted value from the probit model, $\phi(\bullet)$ denotes the probability density function, and $\Phi(\bullet)$ denotes the cumulative distribution function of the standard normal distribution. Finally, we employ an entropy balancing technique to address potential covariate imbalance between freezing and non-DB freezing firm. This technique ensures that the means and variances of the covariates in the treatment and control groups are virtually identical by reweighting the observations in the control group (see, e.g., Hainmueller, 2012; McMullin & Schonberger, 2020).

All regression models include the controls described in the previous section except the *PENSION INDICATOR* variable and the *INDUSTRY UNION RATE*.[20] Finally, all regression specifications include firm-fixed effects to control for time-invariant unobserved firm heterogeneity and year-fixed effects to absorb common shocks to the macroeconomic environment.[21] In the entropy balancing model, standard errors are clustered at the firm level. In the regression models that incorporate selectivity correction variables, bootstrap standard errors clustered at the firm level (1000 replications) are utilized for statistical inference (see, e.g., Cameron & Trivedi, 2005; Greene, 2018).

4.2.2. Univariate analysis

Table 3, Panel A reports the average levels of annual investments, financing, and payout policy in the years around the qualified DB freeze, grouped by the SERP freeze decision. The findings reveal a decrease in capital expenditures (p-value<0.05), a reduction in the number of segments (p-value<0.01) and an increase in stock repurchases during the post-freeze period, primarily attributed to firms that froze both their qualified DB plans and SERPs. However, there is a notable increase in the number of segments (p-value<0.10) among non-SERP-freezing firms.

Table 3, Panel B reports the univariate difference-in-difference (DiD) estimates between the two groups. The comparative analysis reveals a significant decrease in the number of segments for SERP-freezing firms relative to non-SERP-freezing firms (DiD = − 0.50, p-value<0.01) in the post-freezing period. These univariate findings provide preliminary

[16] The sample begins in 1998, coinciding with the year when pension contribution data became widely available, and ends in 2018, which is the most recent year for which board of directors' data is available in the MSCI GMI Ratings database. The inclusion of board structure controls is essential for more effectively isolating the incentive effects of the freeze. However, extending the analysis through 2020, by omitting board structure variables, does not affect the robustness of the results; findings remain qualitatively similar.

[17] Coefficient β_1 is the estimated mean difference in outcomes between firms that freeze their SERPs and firms that do not freeze their SERPs (control firms) in the pre-freeze period. In the empirical analysis, the SERP freeze effect is subsumed into the firm fixed effects.

[18] In addition to the segment count, we utilized two alternative measures as proxies for operational diversification. Firstly, we employed the segment Herfindahl index, which is calculated by summing the square of segment sales and dividing it by the square of firm sales (Choy et al., 2014). Secondly, we employed the entropy measure of diversification, as developed by Jacquemin and Berry (1979). Entropy is calculated as the sum of Ps multiplied by the natural logarithm of 1/Ps, where Ps represents the proportion of the firm's total sales in industry segments. The results obtained using these two alternative measures are qualitatively similar and are omitted for brevity.

[19] Following prior research (e.g, Choy et al., 2014; Phan & Hegde, 2013) we estimate the DB and SERP freeze models on the 11 years surrounding the freeze decision. The dependent variables used are *DB FREEZE* and *SERP FREEZE* that take the value of one in the firm-years following the freeze, and zero otherwise. Because the correlation coefficient in the bivariate probit model is not statistically significant, we estimate the two inverse mills ratios using parameter estimates from the two independent probit equations (Meng & Schmidt, 1985). However, results are similar when we estimate the two inverse mills ratios using parameter estimates from the bivariate probit model.

[20] Results do not change when these two variables are included in the models. The fraction of CEOs hired from inside the firm (*%INSIDER CEOs*) is time invariant and subsumed by the firm-fixed effects.

[21] We have also estimated Model 2 including industry fixed effects based on the 2-digit SIC code, but our results are robust to alternative industry groupings based on the Fama-French industry classifications. This approach ensures that we account for industry-specific, time-invariant characteristics that may influence the dependent variables, which may not be fully captured by firm fixed effects alone. Our conclusions remain unchanged.

Table 3
Firm Policies Around Pension Freezes.

Panel A: Difference in means by subgroup					
All firms that froze qualified DB plans.					
	Pre-Freeze (n = 1008)		Post-Freeze (n = 1037)		Post-Pre
	Mean	S.D.	Mean	S.D.	t-stat
CAPEX	0.0345	0.0375	0.0318	0.0365	−1.69*
R&D	0.0122	0.0224	0.0124	0.0237	0.79
SEGMENTS	2.3909	1.6362	2.2392	1.4772	−2.20**
LEVERAGE	0.2438	0.1889	0.2475	0.1919	0.44
DIVIDENDS	0.0121	0.0176	0.0122	0.0183	0.15
REPURCHASES	0.0164	0.0353	0.0203	0.0382	2.42**
Non-SERP-freezing firms					
	Pre-Freeze (n = 264)		Post-Freeze (n = 243)		Post-Pre
	Mean	S.D.	Mean	S.D.	t-stat
CAPEX	0.0344	0.0406	0.0354	0.0422	0.26
R&D	0.0069	0.0131	0.0070	0.0125	0.08
SEGMENTS	1.9129	1.3008	2.1276	1.4589	1.75*
LEVERAGE	0.2372	0.1842	0.2472	0.2000	0.58
DIVIDENDS	0.0113	0.0130	0.0105	0.0116	−0.69
REPURCHASES	0.0135	0.0337	0.0128	0.0286	−0.26
SERP-freezing firms					
	Pre-Freeze (n = 744)		Post-Freeze (n = 794)		Post-Pre
	Mean	S.D.	Mean	S.D.	t-stat
CAPEX	0.0346	0.0364	0.0307	0.0345	−2.17**
R&D	0.0141	0.0246	0.0141	0.0260	0.61
SEGMENTS	2.5605	1.7087	2.2733	1.4820	−3.53***
LEVERAGE	0.2461	0.1906	0.2476	0.1895	0.16
DIVIDENDS	0.0124	0.0189	0.0128	0.0199	0.35
REPURCHASES	0.0174	0.0358	0.0226	0.0404	2.68**

PANEL B: Difference-in-differences.			
SERP-freezing firms vs non-SERP-freezing firms.			
	DiD	S.E.	t-stat
CAPEX	−0.0050	0.0040	1.28
R&D	0.0000	0.0020	0.30
SEGMENTS	−0.5020	0.1580	3.17***
LEVERAGE	−0.0080	0.0200	0.43
DIVIDENDS	0.0010	0.0020	0.60
REPURCHASES	0.0060	0.0040	1.58

The table reports univariate results on firm policies before and after DB freezes from 1998 to 2018, featuring firm-years within a maximum span of five years before and five years after the freeze, excluding the freeze year. Panel A reports the average levels of annual investments, financing, and payouts in the years before and after the qualified DB freeze, grouped by the SERP freeze decision. Panel B reports the univariate difference-in-difference estimates between the two groups. Non-SERP-freezing firms are firms that froze their qualified DB plans but kept their SERPs open. SERP-freezing firms are firms that froze both qualified DB plans and SERPs. *CAPEX* is capital expenditure divided by total assets. *R&D* is research and development expenses divided by sales. *SEGMENTS* is the total number of business segments. *LEVERAGE* is the book value of short-term and long-term debt scaled by the book value of assets. *DIVIDENDS* is the dividends paid scaled by total assets. *REPURCHASES* is the increase in treasury stock, or the difference between purchases and sales of stock, when treasury data is unavailable, scaled by total assets.

evidence suggesting a strategic divergence post-freeze between the two groups. Firms that choose to keep their SERPs open appear more inclined to engage in diversification strategies than those that freeze their SERPs. This pattern indicates that the decision to freeze or maintain SERPs might influence a firm's approach to diversification, potentially impacting its broader corporate strategy and business structure in the aftermath of the pension freeze decision.

4.2.3. Multivariate analysis

Table 4 offers multivariate analyses on how SERP freezes influence investment decisions. Panel A focuses on the subsample of firms that freeze their qualified DB plans, whereas Panel B employs all firms sponsoring qualified DB plans as controls.[22] The results presented in Columns (1) and (2) indicate no changes in CAPEX or R&D expenses. Instead, in Column 3 the coefficient of *POST* is significantly positive, indicating an increase in diversification in non-SERP-freezing firms. The interaction term *POST* × *SERP FREEZE* is significantly negative, suggesting that SERP-freezing firms undergo a refocusing of their operations, leading to reduced diversification. These findings are further substantiated in Panel B of Table 4, which includes all firms offering DB plans as the control group and employs both a self-selection model and an entropy balancing approach for validation. The findings corroborate the notion that by freezing SERPs and thus realigning top executives' incentives more closely with those of shareholders, firms may curb the incentives for diversification.

Table 5 examines the impact of SERP freezes on financing and payout policies. Column (1) shows no evidence that SERP freezes incentivize managers to increase leverage. Similarly, Column (2) indicates no impact of SERP freezes on dividend policy in the years following the freeze. Conversely, the negative and statistically significant *POST* coefficient suggests that non-SERP-freezing firms tend to lower dividend payments post-freeze. Notably, SERP-freezing firms exhibit an increase in stock repurchases, as indicated by the positively significant *POST* ×

[22] For economy in presentation, although we include all control variables in both panels, we do not tabulate coefficients and standard errors for the non-governance control variables in any of the Panel B results.

Table 4
The Effects of SERP Freezes on Investments.

PANEL A: Firms that froze their qualified DB plans

	1	2	3
	CAPEX	*R&D*	*LN(SEGMENTS)*
POST	−0.000	−0.001	0.100**
	(0.003)	(0.001)	(0.047)
POST × SERP FREEZE	−0.001	0.000	−0.120**
	(0.003)	(0.001)	(0.048)
CEO CHAIR	−0.001	0.000	−0.013
	(0.004)	(0.001)	(0.055)
LN (BOARD SIZE)	0.000	−0.001	−0.090
	(0.007)	(0.003)	(0.109)
%NE DIRECTORS	0.013	−0.002	−0.363*
	(0.017)	(0.004)	(0.188)
%INSIDERS OWNERSHIP	0.009	−0.005	0.108
	(0.013)	(0.003)	(0.133)
HHI	−0.001	−0.000	0.011
	(0.003)	(0.001)	(0.048)
ZMIJEWSKI'S SCORE	−0.001	−0.001**	−0.012
	(0.002)	(0.001)	(0.022)
INTEREST COVER	−0.001	0.000	−0.005
	(0.001)	(0.000)	(0.016)
MARKET TO BOOK	0.006	0.000	−0.018
	(0.004)	(0.001)	(0.058)
NON-PENSION CFO	−0.000	−0.015**	−0.107
	(0.022)	(0.008)	(0.263)
SALE GROWTH	0.004	0.001	0.094
	(0.007)	(0.002)	(0.083)
ROA	0.109***	0.006	0.036
	(0.041)	(0.009)	(0.503)
LN(ASSETS)	−0.005	0.000	0.185***
	(0.005)	(0.001)	(0.066)
FUNDING STATUS	0.008	0.019	0.943*
	(0.047)	(0.015)	(0.532)
PENSION CONTRIBUTIONS	−0.103	−0.023	−0.318
	(0.083)	(0.021)	(1.098)
LN (PLAN SIZE)	0.001	−0.001	−0.030
	(0.006)	(0.001)	(0.052)
INTERCEPT	0.035	0.036***	0.288
	(0.052)	(0.012)	(0.491)
λ_{SERP}	−0.005	−0.001	−0.045
	(0.021)	(0.007)	(0.346)
λ_{DB}	0.006	−0.005	−0.202
	(0.015)	(0.005)	(0.179)
FIRM & YEAR FE	Yes	Yes	Yes
Chi-Square	82.12	17.86	36.79
Adj. R-square	75.90 %	96.40 %	82.50 %
Observations	2045	2045	2045

PANEL B: All Firms with DB plans

	1		2		3	
	CAPEX		*R&D*		*LN(SEGMENTS)*	
	Self-Selection	Entropy Balancing	Self-Selection	Entropy Balancing	Self-Selection	Entropy Balancing
POST	−0.004	−0.003	0.000	−0.000	0.095**	0.093**
	(0.003)	(0.003)	(0.001)	(0.001)	(0.041)	(0.043)
POST × SERP FREEZE	0.000	−0.001	0.001	0.001	−0.113**	−0.114**
	(0.003)	(0.003)	(0.001)	(0.001)	(0.049)	(0.050)
CEO CHAIR	−0.002	−0.000	0.000	0.000	0.045*	−0.026
	(0.001)	(0.001)	(0.000)	(0.000)	(0.025)	(0.017)
LN (BOARD SIZE)	0.007**	−0.000	0.001	0.001	−0.106*	−0.053
	(0.003)	(0.002)	(0.001)	(0.001)	(0.058)	(0.051)
%NE DIRECTORS	0.011	0.001	−0.000	0.000	−0.268	−0.060
	(0.010)	(0.005)	(0.003)	(0.002)	(0.175)	(0.083)
%INSIDERS OWNERSHIP	0.005	0.008	0.000	−0.002	0.060	0.047
	(0.004)	(0.006)	(0.001)	(0.002)	(0.077)	(0.077)
λ_{SERP}	0.010		0.002		−0.537**	
	(0.013)		(0.004)		(0.212)	
λ_{DB}	0.006		−0.001		0.038	
	(0.008)		(0.001)		(0.093)	
OTHER CONTROLS	Yes	Yes	Yes	Yes	Yes	Yes
FIRM & YEAR FE	Yes	Yes	Yes	Yes	Yes	Yes

(*continued on next page*)

Table 4 (*continued*)

PANEL B: All Firms with DB plans						
	1		2		3	
	CAPEX		*R&D*		*LN(SEGMENTS)*	
	Self-Selection	Entropy Balancing	Self-Selection	Entropy Balancing	Self-Selection	Entropy Balancing
Chi-Square/F-statistic	253.10	8.98	48.02	1.56	108.90	4.15
Adj. R-square	73.10 %	74.40 %	95.50 %	95.60 %	74.20 %	78.60 %
Observations	15,213	15,213	15,212	15,212	15,213	15,213

This table presents the regression results explaining the change in firms' investment activities after DB freezes from 1998 to 2018, featuring firm-years within a maximum span of five years before and five years after the freeze, excluding the freeze year. Panel A presents the regression results for the subsample of firms that froze their qualified DB plans. Panel B presents the results for all firms offering qualified DB plans. *POST* is an indicator variable that takes the value of one for firm years following the qualified DB freeze and zero otherwise. *SERP FREEZE* is an indicator variable that takes the value of one for firms that freeze their qualified DB plan and their SERPs and zero otherwise. *CAPEX* is capital expenditure divided by total assets. *R&D* is research and development expenses divided by sales. *SEGMENTS* is the total number of business segments. λ_{DB} and λ_{SERP} are selectivity correction variables used to account for the endogeneity of the qualified DB plan and the SERP decisions, respectively. They are estimated using parameters from the probit regressions of the DB plan and SERP freeze decisions using all firm years around the pension freeze. All other variables are defined in the Appendix. All regressions include year and firm fixed effects. Continuous variables are winsorized at 1 % and 99 %. In the selectivity correction models, bootstrap standard errors clustered at the firm level (based on 1000 replications) are reported in parentheses. In the entropy balancing models, standard errors clustered at the firm level are reported in parentheses. ***. **, * indicate levels of significance of 1 %, 5 %, and 10 %, respectively.

SERP FREEZE coefficient in Column (3). These findings are further confirmed in Panel B, employing both a self-selection model and an entropy balancing approach for robustness.

In summary, the results indicate that the impact of SERP freezes is evident in diversification and payout policies in the years following the freeze. Firms opting to freeze their SERPs appear to mitigate CEO incentives to use the increased liquidity resulting from the qualified DB plan freeze for diversification purposes. Instead, these firms tend to prioritize returning the cost savings from the pension freeze to their shareholders. These findings are consistent with inside debt theory, reinforcing the notion that SERPs play a crucial role in shaping managerial-shareholder alignment. Further, consistent with the recent findings of Li and Zhao (2020), we find no evidence to suggest that SERP freezes affect capital and R&D investments or capital structure policies in the years following the freeze.

4.3. Firm risk around pension plan freezes

4.3.1. Model description

This section focuses on evaluating the impact of SERP freezes on various dimensions of market-based measures of firm risk, including total firm risk, equity risk, and credit risk. We follow the methodology described in the previous section and investigate changes in firm risk in the years surrounding the pension freeze. To assess *total* firm risk, we adopt the distance-to-default metric proposed by Campbell, Hilscher, and Szilagyi (2008). This metric provides an assessment of the difference between a firm's asset value and the face value of its debt, all scaled by the standard deviation of asset value. In essence, it quantifies the number of standard deviations by which the firm's value must decline for it to default (Campbell et al., 2008; Sundaram, 2001; Sundaram & Yermack, 2007).[23] We construct the variable *DISTRESS*, by multiplying the distance-to-default metric by minus one to create a firm-level closeness-to-distress metric that increases with the default probability.

To proxy for *equity (idiosyncratic)* risk, we utilize the standard deviation of daily abnormal returns, *I-RISK*. These abnormal returns are calculated from the residuals of the Fama–French three-factor model over the fiscal year.[24] This approach captures the volatility in daily stock returns not accounted for by market factors, firm size, and book-to-market ratios, thus offering an insight into the inherent risk associated with the firm's equity.

Finally, to gauge *credit* risk, we utilize the annual credit ratings for a firm's long-term debt as provided by Standard & Poor's (S&P). S&P's rating system comprises 22 categories, from AAA (highest) to D (lowest). We translate these letter ratings into numerical values on an ordinal scale, assigning 1 to the lowest-rated firms (D) and 22 to the highest-rated firms (AAA), and then normalize these values by dividing each by 22 to create the variable *SPRATING*. This proxy reflects the firm's creditworthiness based on S&P's rating assessment. Higher values of SPRATING correspond to lower credit risk.

4.3.2. Univariate analysis

Table 6 presents univariate results. The results in Panel A indicate an increase in credit risk following the DB freeze across all firms, irrespective of their decision regarding SERP freezes. Notably, non-SERP-freezing firms demonstrate an increase in all types of firm risk during the post-freeze period. The univariate DiD analysis in Panel B reveals a statistically significant increase only in equity risk (DiD $= -0.003$; p-value<0.05) for non-SERP-freezing firms, in comparison to SERP-freezing firms.

4.3.3. Multivariate analysis

Table 7 presents the multivariate analysis results for equity risk, credit risk, and total risk in Columns (1), (2), and (3), respectively. The *POST* coefficient is positive and statistically significant in the idiosyncratic risk and distress models but only in Panel B. These results suggest that, on average, equity and total risk are higher for non-SERP-freezing firms than control firms. In economic terms, closeness-to-distress increases by 0.26, and idiosyncratic volatility increases by 10 % (Panel B, Column 3).

Interestingly, in Panel A, Columns (1) and (2), the *POST* × *SERP FREEZE* coefficients are negative and statistically significant at the 5 % level or better. The negative sign in Column (1) suggests that the mean change in equity risk is lower for SERP-freezing firms compared to non-SERP-freezing firms. Conversely, the negative and significant coefficient in the credit rating model in Column (2) points to a higher credit risk for SERP-freezing firms. Economically, firms that freeze their SERPs undergo approximately a 10 % decrease in idiosyncratic risk ($=1-exp(-0.106)$), and experience a reduction of about half a grade in credit ratings ($1/22 = 0.045$ represents the difference between each grade), indicating an increase in credit risk, compared to firms that

[23] The proxy is based on the structural equation default model of Black and Scholes (1973) and Merton (1974), which model equity as a call option on the firm's assets and requires solving a system of two nonlinear equations.

[24] Results are similar when we use the volatility of daily excess returns during the fiscal year, where excess return are raw returns minus the risk-free rate.

Table 5
The Effects of SERP Freezes on Leverage and Payouts.

PANEL A: Firms that froze their qualified DB plans

	1	2	3
	LEVERAGE	*DIVIDENDS*	*REPURCHASES*
POST	0.000	−0.002*	−0.002
	(0.011)	(0.001)	(0.003)
POST × SERP FREEZE	0.000	0.001	0.007**
	(0.013)	(0.001)	(0.003)
CEO CHAIR	−0.011	0.000	−0.006
	(0.017)	(0.002)	(0.005)
LN (BOARD SIZE)	−0.059	0.001	−0.026***
	(0.046)	(0.004)	(0.010)
%NE DIRECTORS	−0.065	−0.009	−0.000
	(0.059)	(0.006)	(0.017)
%INSIDERS OWNERSHIP	0.096*	0.010	0.016
	(0.050)	(0.007)	(0.011)
HHI	0.021	0.002	0.003
	(0.018)	(0.002)	(0.005)
ZMIJEWSKI'S SCORE	0.051***	−0.001	−0.006***
	(0.008)	(0.001)	(0.002)
INTEREST COVER	−0.002	−0.000	−0.002
	(0.006)	(0.001)	(0.001)
MARKET TO BOOK	0.031	0.005**	0.023***
	(0.025)	(0.002)	(0.005)
NON-PENSION CFO	0.150*	−0.009	−0.052**
	(0.091)	(0.010)	(0.024)
SALE GROWTH	−0.008	−0.000	−0.018**
	(0.030)	(0.003)	(0.008)
ROA	−0.175	0.018	−0.036
	(0.205)	(0.018)	(0.039)
LN(ASSETS)	0.090***	0.002	0.003
	(0.019)	(0.002)	(0.005)
FUNDING STATUS	0.611***	0.020	0.049
	(0.171)	(0.016)	(0.047)
PENSION CONTRIBUTIONS	0.386	−0.027	0.177*
	(0.384)	(0.038)	(0.092)
LN (PLAN SIZE)	−0.046***	−0.002	0.002
	(0.015)	(0.001)	(0.005)
INTERCEPT	0.061	0.014	−0.031
	(0.178)	(0.022)	(0.056)
λ_{SERP}	0.203	0.002	0.057**
	(0.133)	(0.012)	(0.028)
λ_{DB}	−0.172***	−0.005	−0.008
	(0.056)	(0.005)	(0.014)
FIRM & YEAR FE	Yes	Yes	Yes
Chi-Square	190.50	37.55	55.48
Adj. R-square	84.80 %	79.50 %	51.10 %
Observations	2045	2045	2045

PANEL B: All Firms with DB plans

	1		2		3	
	LEVERAGE		*DIVIDENDS*		*REPURCHASES*	
	Self-Selection	Entropy Balancing	Self-Selection	Entropy Balancing	Self-Selection	Entropy Balancing
POST	0.006	0.004	−0.003*	−0.002*	−0.003	−0.002
	(0.011)	(0.010)	(0.001)	(0.001)	(0.002)	(0.002)
POST × SERP FREEZE	−0.001	0.001	0.001	0.002	0.008***	0.008***
	(0.013)	(0.013)	(0.002)	(0.002)	(0.003)	(0.003)
CEO CHAIR	0.044***	−0.001	−0.000	0.000	−0.007***	−0.000
	(0.011)	(0.004)	(0.001)	(0.000)	(0.002)	(0.001)
LN (BOARD SIZE)	−0.068***	0.015	0.003	0.002	0.010***	−0.006
	(0.022)	(0.013)	(0.002)	(0.001)	(0.004)	(0.004)
%NE DIRECTORS	−0.346***	−0.010	0.009	0.002	0.048***	−0.009
	(0.086)	(0.020)	(0.006)	(0.002)	(0.013)	(0.005)
%INSIDERS OWNERSHIP	0.089***	0.047*	0.000	0.005	−0.008	0.006
	(0.020)	(0.026)	(0.002)	(0.003)	(0.005)	(0.006)
λ_{SERP}	−0.382***		0.012*		0.073***	
	(0.100)		(0.007)		(0.014)	
λ_{DB}	−0.018		−0.004*		−0.014***	
	(0.022)		(0.002)		(0.004)	
OTHER CONTROLS	Yes	Yes	Yes	Yes	Yes	Yes
FIRM & YEAR FE	Yes	Yes	Yes	Yes	Yes	Yes

(*continued on next page*)

Table 5 (*continued*)

PANEL B: All Firms with DB plans						
	1		2		3	
	LEVERAGE		*DIVIDENDS*		*REPURCHASES*	
	Self-Selection	Entropy Balancing	Self-Selection	Entropy Balancing	Self-Selection	Entropy Balancing
Chi-Square	626.80	16.34	186.60	5.92	354.70	8.65
Adj. R-square	82.40 %	84.40 %	71.60 %	74.70 %	46.50 %	50.20 %
Observations	15,213	15,213	15,213	15,213	15,213	15,213

This table presents the regression results explaining the change in firms' leverage and payout activities after DB freezes from 1998 to 2018, featuring firm-years within a maximum span of five years before and five years after the freeze, excluding the freeze year. Panel A presents the regression results for the subsample of firms that froze their qualified DB plans. Panel B presents the results for all firms offering qualified DB plans. *POST* is an indicator variable that takes the value of one for firm years following the qualified DB freeze and zero otherwise. *SERP FREEZE* is an indicator variable that takes the value of one for firms that freeze their qualified DB plan and their SERPs and zero otherwise. *LEVERAGE* is the book value of short-term and long-term debt scaled by the book value of assets. *DIVIDENDS* is the dividends paid scaled by total assets. *REPURCHASES* is the increase in treasury stock, or the difference between purchases and sales of stock, when treasury data is unavailable, scaled by total assets. λ_{DB} and λ_{SERP} are selectivity correction variables used to account for the endogeneity of the qualified DB plan and the SERP decisions, respectively. All other variables are defined in the Appendix. All regressions include year and firm-fixed effects. Continuous variables are winsorized at 1 % and 99 %. In the selectivity correction models, bootstrap standard errors clustered at the firm level (based on 1000 replications) are reported in parentheses. In the entropy balancing models, standard errors clustered at the firm level are reported in parentheses. ***. **, * indicate levels of significance of 1 %, 5 %, and 10 %, respectively.

Table 6
Firm Risk Around Pension Freezes.

Panel A: Difference in means by subgroup							
All firms that froze their qualified DB plans.							
	Pre-Freeze			Post-Freeze			Post-Pre
	N	Mean	S.D.	N	Mean	S.D.	t-stat
I-RISK	854	0.0203	0.0114	899	0.0206	0.0133	0.52
CREDIT RATING	611	0.6217	0.1335	583	0.5741	0.1467	−5.91***
DISTRESS	655	−3.0156	1.3726	699	−2.9348	1.4291	1.06
Non-SERP-freezing firms							
	Pre-Freeze			Post-Freeze			Post-Pre
	N	Mean	S.D.	N	Mean	S.D.	t-stat
I-RISK	230	0.0199	0.0101	219	0.0227	0.0142	2.43**
CREDIT RATING	143	0.6065	0.1438	128	0.5710	0.1384	−2.06**
DISTRESS	167	−2.9518	1.2570	166	−2.6742	1.3017	1.98**
SERP-freezing firms							
	Pre-Freeze			Post-Freeze			Post-Pre
	N	Mean	S.D.	N	Mean	S.D.	t-stat
I-RISK	624	0.0205	0.0118	680	0.0199	0.0129	−0.76
CREDIT RATING	468	0.6264	0.1300	455	0.5749	0.1491	−5.64***
DISTRESS	488	−3.0375	1.4105	533	−3.0160	1.4582	0.24

PANEL B: Difference-in-differences			
SERP-freezing vs non-SERP-freezing firms.			
	DiD	S.E.	t-stat
I-RISK	−0.0030	0.0010	2.47**
CREDIT RATING	−0.0160	0.0190	0.82
DISTRESS	−0.2560	0.1770	1.45

The table reports univariate results on firm risk before and after DB freezes from 1998 to 2018, featuring firm-years within a maximum span of five years before and five years after the freeze, excluding the freeze year. Panel A reports the average levels of annual *equity*, *credit*, and *total* risk in the years before and after the qualified DB freeze, grouped by the SERP freeze decision. Panel B reports the univariate difference-in-difference estimates between the two groups. Non-SERP-freezing firms are firms that froze their qualified DB plans but kept their SERPs open. SERP-freezing firms are firms that froze both qualified DB plans and SERPs. *I-RISK* is the standard deviation of abnormal returns, calculated as residuals from the Fama-French three-factor model over the fiscal year. *CREDIT RATING* converts Standard & Poor's annual long-term debt ratings into numerical values on an ordinal scale from 1 (lowest-rated) to 22 (highest-rated), normalized by dividing by 22. *DISTRESS* is calculated by multiplying the distance to default by −1, with the distance to default estimated following Campbell et al. (2008).

maintain open SERPs during the post-freeze period. Notably, the findings in Column (3) reveal no change in total firm risk between the two groups. These findings are corroborated in Panel B, where SERP-freezing firms are compared to all firms that have DB plans.

The findings discussed here corroborate the evidence introduced in the preceding section of our paper, demonstrating that refocusing firm operations and enhancing shareholder payouts represent strategies that effectively transfer risk from shareholders to debtholders. This shift in risk manifests as a reduction in equity risk and an increase in credit risk in the post-freeze period. Similar to the study by Wei and Yermack (2011), which found that disclosures of substantial inside debt holdings resulted in higher debt prices and lower equity prices, our findings illustrate the risk-shifting strategy implemented by SERP-freezing firms after the freeze.

Table 7
The Effects of SERP Freezes on Firm Risk.

PANEL A: Firms that froze their qualified DB plans

	1	2	3
	LN(I-RISK)	*CREDIT RATING*	*DISTRESS*
POST	0.047	0.010	0.084
	(0.049)	(0.010)	(0.153)
POST × SERP FREEZE	−0.106**	−0.022***	−0.229
	(0.051)	(0.008)	(0.162)
CEO CHAIR	−0.064	0.003	−0.077
	(0.049)	(0.010)	(0.155)
LN (BOARD SIZE)	0.015	0.022	0.318
	(0.117)	(0.019)	(0.393)
%NE DIRECTORS	−0.026	−0.056	0.426
	(0.210)	(0.042)	(0.634)
%INSIDERS OWNERSHIP	0.016	−0.101**	−0.198
	(0.127)	(0.044)	(0.323)
HHI	0.015	0.011	−0.011
	(0.054)	(0.015)	(0.167)
ZMIJEWSKI'S SCORE	0.096***	−0.023***	0.211***
	(0.026)	(0.004)	(0.069)
INTEREST COVER	0.021	0.004	0.091**
	(0.020)	(0.005)	(0.045)
MARKET TO BOOK	0.014	0.033***	−0.227
	(0.057)	(0.012)	(0.182)
NON-PENSION CFO	0.030	0.019	0.287
	(0.277)	(0.062)	(0.730)
SALE GROWTH	0.104	−0.022	0.271
	(0.089)	(0.021)	(0.285)
ROA	−1.060**	0.534***	−0.739
	(0.486)	(0.112)	(1.513)
LN(ASSETS)	−0.085	0.039***	−0.594***
	(0.065)	(0.013)	(0.192)
FUNDING STATUS	−0.195	−0.103	−0.837
	(0.641)	(0.104)	(2.007)
PENSION CONTRIBUTIONS	−0.345	−0.428	−3.200
	(1.080)	(0.283)	(3.460)
LN (PLAN SIZE)	−0.084	0.038*	−0.109
	(0.059)	(0.020)	(0.228)
INTERCEPT	−2.642***	−0.110	1.733
	(0.634)	(0.136)	(2.256)
λ_{SERP}	−0.086	−0.002	−0.682
	(0.272)	(0.060)	(0.905)
λ_{DB}	−0.008	0.010	0.422
	(0.199)	(0.028)	(0.626)
FIRM & YEAR FE	Yes	Yes	Yes
Chi-Square	116.50	255.60	80.38
Adj. R-square	71.60 %	86.90 %	74.00 %
Observations	1753	1194	1354

PANEL B: All Firms with DB plans

	1		2		3	
	LN(I-RISK)		*CREDIT RATING*		*DISTRESS*	
	Self-Selection	Entropy Balancing	Self-Selection	Entropy Balancing	Self-Selection	Entropy Balancing
POST	0.099**	0.077*	0.000	0.003	0.263*	0.185
	(0.045)	(0.043)	(0.011)	(0.010)	(0.137)	(0.134)
POST × SERP FREEZE	−0.096*	−0.098*	−0.026**	−0.022*	−0.205	−0.214
	(0.053)	(0.050)	(0.013)	(0.013)	(0.149)	(0.152)
CEO CHAIR	−0.259***	−0.047***	0.022	0.004	−0.386***	−0.066
	(0.046)	(0.017)	(0.016)	(0.004)	(0.134)	(0.046)
LN (BOARD SIZE)	0.459***	0.008	−0.037	0.017	0.777***	0.039
	(0.091)	(0.047)	(0.031)	(0.010)	(0.267)	(0.148)
%NE DIRECTORS	1.976***	0.011	−0.217*	−0.055**	3.142***	0.232
	(0.361)	(0.076)	(0.122)	(0.026)	(1.015)	(0.213)
%INSIDERS OWNERSHIP	−0.274***	0.030	0.007	−0.060***	−0.601***	−0.122
	(0.074)	(0.061)	(0.026)	(0.020)	(0.208)	(0.173)
λ_{SERP}	2.522***		−0.181		3.794***	
	(0.422)		(0.146)		(1.205)	
λ_{DB}	−0.179***		−0.029		−0.224	
	(0.060)		(0.020)		(0.181)	
OTHER CONTROLS	Yes	Yes	Yes	Yes	Yes	Yes
FIRM & YEAR FE	Yes	Yes	Yes	Yes	Yes	Yes

(*continued on next page*)

Table 7 (*continued*)

PANEL B: All Firms with DB plans						
	1		2		3	
	LN(I-RISK)		*CREDIT RATING*		*DISTRESS*	
	Self-Selection	Entropy Balancing	Self-Selection	Entropy Balancing	Self-Selection	Entropy Balancing
Chi-Square	434.90	12.54	335.20	19.75	210.40	7.78
Adj. R-square	74.60 %	0.748	89.20 %	0.897	74.20 %	0.753
Observations	12,962	12,962	8885	8885	10,807	10,807

The table presents regressions results of changes in *equity*, *credit*, and *total* risk after DB freezes from 1998 to 2018, featuring firm-years within a maximum span of five years before and five years after the freeze, excluding the freeze year. Panel A presents the regression results for the subsample of firms that froze their qualified DB plans. Panel B presents the results for all firms offering qualified DB plans. *I-RISK* is the standard deviation of abnormal returns, calculated as residuals from the Fama-French three-factor model over the fiscal year. *CREDIT RATING* converts Standard & Poor's annual long-term debt ratings into numerical values on an ordinal scale from 1 (lowest-rated) to 22 (highest-rated), normalized by dividing by 22. *DISTRESS* is calculated by multiplying the distance to default by −1, with the distance to default estimated following Campbell et al. (2008). *POST* is an indicator variable that takes the value of 1 in the post-DB plan freeze period and zero otherwise. *SERP FREEZE* is an indicator variable that takes the value of 1 for firms that freeze their SERPs and zero otherwise. λ_{DB} and λ_{SERP} are selectivity correction variables. All other variables are defined in the Appendix. All regressions include year and firm fixed effects. In the selectivity correction models, bootstrap standard errors clustered at the firm level (based on 1000 replications) are reported in parentheses. In the entropy balancing models, standard errors clustered at the firm level are reported in parentheses. ***. **, * indicate levels of significance of 1 %, 5 %, and 10 %, respectively.

5. Sensitivity analysis and further tests

5.1. Other components of CEO compensation structure and shocks to internal funds

The findings of this paper rely on the assumption that for firms freezing their SERPs, agency conflicts tend to shift in favor of shareholders at the expense of bondholders. However, firms that freeze their SERPs could also alter the agency balance through changes in other forms of compensation. For example, firms that freeze their SERPs may also increase equity-based compensation through stocks and options. This shift would magnify the observed effects of the SERP freeze decision on outcomes due to a correlated omitted variable bias. Similarly, firms that opt to keep their SERPs intact could use equity-based compensation to realign their CEOs' interests to shareholders, in which case, the omitted variable bias will moderate the observed effect of the SERP freeze on firm outcomes.

To test this assumption, we examine changes in the CEO's pay-performance sensitivity, *DELTA*, risk-taking incentives, *VEGA*, the value of the pension, *PENSION VALUE*, and the ratio of pension value to inside equity, *PENSION VALUE / INSIDE EQUITY,* over a period of up to ten years around the time of pension freezes.[25] We use the methodology described in Coles, Daniel, and Naveen (2013) to estimate *DELTA*, *VEGA*, and *INSIDE EQUITY,* and we primarily draw from Sundaram and Yermack (2007) for control variables. The analysis is performed on a reduced sample of firms (178 firms) with available compensation data in the ExecuComp dataset.[26]

Table 8 presents the results. The *POST* and the *POST* × *SERP FREEZE* coefficients are not statistically significant in the *VEGA* and *DELTA* models, suggesting that the CEOs' equity incentives do not significantly change in the post-freeze period. Notably, the *POST* × *SERP FREEZE* coefficient is significantly negative in the CEO pension value model and the pension to inside equity model. As expected, total pension value and the ratio of pension to equity value significantly decrease in SERP-freezing firms compared to non-SERP-freezing firms. These results suggest that the observed effects on outcomes are more likely to be driven by the SERP freeze decision than by changes in other CEO compensation structure components.

Another underlying assumption is that freezes of qualified DB plans exert a positive effect on the firms' internal funds, an effect presumed to be consistent across firms that impose freezes on their SERPs and those that do not. Acknowledging the challenge in quantifying cost savings attributable to pension freezes, as noted by Rauh et al. (2020), our investigation seeks to validate this assumption by analyzing shifts in the accounting metrics related to pension obligations, costs, and contributions in the wake of pension plan freezes. Although improvements reflected in financial statements do not equate directly to actual cash flows, they serve as a robust proxy of potential savings resulting from pension freezes. Specifically, we assess the freeze's impact on the balance sheet through the projected benefit obligation, *PLAN SIZE*, on the income statement via pension cost relative to sales, *PENSION COST*, and on the statement of cash flows through pension contributions relative to assets *PENSION CONTRIBUTIONS*. The analysis in Table 9 reveals consistently negative coefficients for the *POST* indicator variable, indicating that freezes of qualified DB plans are linked to significant reductions in pension-related expenses, leading to financial statement improvements for the sponsoring firms. Importantly, the insignificant coefficient on the *POST* × *SERP FREEZE* interaction term indicates that reductions in pension-related obligations, costs, and contributions are comparable across both groups. This suggests that our results on the effect of pension freezes on firm outcomes are not driven by differential cost savings but rather by CEO incentives, as captured by the SERP freeze.

5.2. CEO entrenchment, CEO characteristics, and CEO changes

In addition, to ensure the robustness of the results, we address potential confounding factors that could influence the outcomes of interest. One potential confounding factor could be managerial entrenchment. To explore this dimension further we draw from the literature and incorporate two proxies for managerial entrenchment. The first proxy, *CEO POWER*, is an indicator that equals one if the power index is in the top quantile of our sample and zero otherwise. This power index is constructed following a methodology similar to Stefanescu et al. (2018). It is the equal-weighted index of four power indicators defined relative to the 2-digit SIC industry and year mean (CEO-Chair duality,

[25] We focus this analysis on the CEOs' compensation structure because CEOs are likely to have a greater impact on firm policies than other top executives. However, the results are qualitatively similar when we aggregate compensation incentives at the top management team level or when we take the annual averages.

[26] The actuarial present value of a CEO's pension was first disclosed in proxy statements in 2006. For years prior to 2006, we followed the approach outlined in Sundaram and Yermack (2007) to estimate the actuarial present value of a CEO's pension within the treated subsample. Nevertheless, when we employ the CEO's actuarial pension value as reported in ExecuComp, the results remain largely consistent.

Table 8
Change in Compensation Structure around Pension Freezes.

	LN(DELTA)		*LN(VEGA)*		*LN(PENSION VALUE)*		*PENSION VALUE /INSIDE EQUITY*	
	Firms that froze DB plans	All Firms with DB plans	Firms that froze DB plans	All Firms with DB plans	Firms that froze DB plans	All Firms with DB plans	Firms that froze DB plans	All Firms with DB plans
POST	0.026	0.032	−0.036	−0.082	1.170***	0.739**	0.174*	0.073
	(0.115)	(0.106)	(0.201)	(0.201)	(0.339)	(0.353)	(0.105)	(0.120)
POST × SERP FREEZE	0.161	0.180	0.166	0.186	−1.536***	−1.417***	−0.351***	−0.340***
	(0.110)	(0.114)	(0.212)	(0.208)	(0.367)	(0.364)	(0.117)	(0.123)
CEO TENURE	0.078***	0.086***	0.036**	0.036***	0.224***	0.137***	0.027***	0.014***
	(0.011)	(0.004)	(0.016)	(0.007)	(0.032)	(0.014)	(0.009)	(0.003)
MARKET TO BOOK	0.522***	0.575***	−0.245	0.038	0.025	−0.095	−0.114*	−0.083***
	(0.098)	(0.037)	(0.159)	(0.066)	(0.187)	(0.080)	(0.058)	(0.020)
R&D	9.940**	0.568	10.376	0.131	2.087	−6.915	−7.360*	−0.844
	(4.582)	(2.148)	(9.488)	(2.957)	(16.431)	(5.696)	(4.112)	(1.342)
DEBT EQUITY	−0.368***	−0.279***	−0.148	0.051	1.234***	0.087	0.387**	0.106
	(0.127)	(0.089)	(0.221)	(0.153)	(0.354)	(0.242)	(0.157)	(0.078)
LOSS	−0.398***	−0.462***	−0.285**	−0.317***	−0.008	0.002	0.353***	0.261***
	(0.079)	(0.040)	(0.122)	(0.062)	(0.192)	(0.091)	(0.082)	(0.038)
TAX STATUS	−0.206**	−0.034	−0.180	−0.093	−0.028	0.136	0.147*	0.023
	(0.082)	(0.041)	(0.149)	(0.078)	(0.257)	(0.123)	(0.079)	(0.028)
LN (FIRM AGE)	0.316	−0.032	0.284	0.354	−0.072	−0.434	−0.215	−0.185*
	(0.344)	(0.174)	(0.578)	(0.320)	(0.802)	(0.444)	(0.260)	(0.109)
LN (ASSETS)	0.481***	0.499***	−0.089	0.173*	0.686**	0.625***	−0.292***	−0.032
	(0.112)	(0.055)	(0.165)	(0.098)	(0.265)	(0.140)	(0.106)	(0.046)
INTERCEPT	−1.133	−0.673	3.966	−0.027	−2.102	0.226	3.573**	1.486**
	(1.563)	(0.759)	(2.522)	(1.423)	(4.215)	(1.969)	(1.402)	(0.592)
Board Structure Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FIRM & YEAR FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-statitistic	25.87	80.66	2.12	6.25	7.08	13.68	3.22	7.15
Adj. R-square	79.50 %	79.10 %	73.70 %	71.00 %	63.40 %	79.30 %	38.70 %	48.80 %
Observations	1525	7789	1525	7789	1525	7789	1525	7789

The table presents regression results of changes in CEO compensation structure after DB freezes from 1998 to 2018, featuring firm-years within a maximum span of five years before and five years after the freeze, excluding the freeze year. *DELTA* is the dollar change in CEO wealth associated with a 1 % change in the firm's stock price. *VEGA* is the dollar change in CEO wealth associated with a 1 % change in the standard deviation of the firm's returns. *PENSION VALUE* is the present value of the CEO's pension through SERPs. *INSIDE EQUITY* is the value of the CEO's stock and option portfolio. *POST* is an indicator variable that takes the value of 1 in the post-DB plan freeze period and zero otherwise. *SERP FREEZE* is an indicator variable that takes the value of 1 for firms that freeze their DB plans and their SERPs and zero otherwise. *CEO TENURE* is the tenure of the CEO. *MARKET TO BOOK* is the book value of assets plus the market value of equity less the sum of the book value of equity and deferred assets scaled by the book value of assets. *R&D* is research and development expenses scaled by sales. *DEBT EQUITY* is the book value of debt over the sum of debt and stockholders' equity. *LOSS* is an indicator variable that takes the value of one if the firm has negative net income and zero otherwise. *TAX STATUS* is an indicator variable that takes the value of one if the firm has net operating loss carry-forwards on its balance sheet and zero otherwise. *FIRM AGE* is the number of years the firm has available information in COMPUSTAT. *ASSETS* is total assets. All models include controls for *CEO CHAIR*, *BOARD SIZE*, *%NE DIRECTORS*, *% INSIDERS OWNERSHIP* that are omitted for brevity. All variables are defined in the Appendix. All regressions include firm and year fixed effects. Continuous variables are winsorized at 1 % and 99 %. Robust standard errors clustered at the firm level are reported in parentheses. ***. **, * indicate levels of significance of 1 %, 5 %, and 10 %, respectively.

the size of the board of directors, the fraction of executive directors on the board, and the fraction of insider ownership). A CEO is defined as having greater power if the index is greater than or equal to two (the top quantile of our sample). For the second proxy, *CEO PAY SLICE*, we follow Bebchuk, Cremers, and Peyer (2011) and use *CEO PAY SLICE* which is a proxy of the extent to which the CEO is able to extract rents. *CEO PAY SLICE* is the fraction of the aggregate compensation of the top five executive team captured by the CEO. This proxy has been used in prior literature as a measure of managerial entrenchment (e.g., Chen, Huang, & Wei, 2013; Kim, Wang, & Zhang, 2016).

We then re-estimate Model 2 for our six firm policy variables—*CAPEX*, *R&D*, *LN(SEGMENTS)*, *LEVERAGE*, *DIVIDENDS*, *REPURCHASES*—incorporating these proxies for managerial entrenchment. The results are presented in Table 10. Our conclusions remain unchanged. Even when accounting for proxies for management entrenchment we find SERP-freezing firms refocus their operations by reducing their segments and increasing stock repurchases.

Moreover, a growing body of work suggests that CEO characteristics such as ability, education, reputation, and overconfidence influence firm strategies, potentially making the identity of the CEO an important omitted variable in explaining the results (e.g., Custódio & Metzger, 2014; Graham, Harvey, & Puri, 2013; Malmendier & Tate, 2005; Malmendier, Tate, & Yan, 2011). To alleviate this concern, we use CEO names to create CEO-firm-specific identifiers and re-estimate all the models using CEO-firm fixed effects (Online Appendix 2, Table OA2.1). Notably, the results presented in Section 4 continue to hold even after controlling for time-invariant CEO-firm unobserved heterogeneity.

Besides CEO characteristics, top management changes are also likely to shape firm strategies. To address the potential influence of such changes, we re-estimate all models, introducing an indicator variable, *ΔCEO*, which equals one if there is a change in CEO and zero otherwise. This variable is further interacted with the *POST* and *POST × SERP FREEZE* indicators. The empirical results (Online Appendix Section 2, Table OA2.2) suggest that CEO changes do not significantly impact investments, leverage, or repurchases during the post-freeze period.

5.3. Financing constraints

Furthermore, we consider the effect of financing constraints, recognizing that financially constrained firms are likely to behave differently than unconstrained firms. We use three proxies for financing constraints: the Size and Age Index (*S&A INDEX*) by Hadlock and Pierce (2010), the

Table 9
Accounting Changes Around Pension Freezes.

	1		2		3	
	LN(PLAN SIZE)		*PENSION COST*		*PENSION CONTRIBUTIONS*	
POST	−0.141***	−0.090**	−0.005***	−0.005***	−0.001**	−0.000
	(0.031)	(0.042)	(0.000)	(0.001)	(0.000)	(0.001)
POST × SERP FREEZE		−0.068		0.000		−0.001
		(0.055)		(0.001)		(0.001)
MARKET TO BOOK	0.010	0.010	−0.000	−0.000	0.000*	0.000*
	(0.013)	(0.013)	(0.000)	(0.000)	(0.000)	(0.000)
R&D	1.098	1.099	0.012	0.012	0.007	0.007
	(0.733)	(0.734)	(0.007)	(0.007)	(0.008)	(0.008)
CAPEX	−0.146	−0.148	0.007**	0.007**	−0.008***	−0.008***
	(0.272)	(0.273)	(0.003)	(0.003)	(0.003)	(0.003)
LEVERAGE	−0.189**	−0.188**	−0.000	−0.000	−0.002**	−0.002**
	(0.074)	(0.074)	(0.001)	(0.001)	(0.001)	(0.001)
LOSS	0.026*	0.025*	0.000	0.000	−0.000	−0.000
	(0.014)	(0.014)	(0.000)	(0.000)	(0.000)	(0.000)
LN(ASSETS)	0.437***	0.436***	−0.001***	−0.001***	−0.001***	−0.001***
	(0.032)	(0.032)	(0.000)	(0.000)	(0.000)	(0.000)
FUNDING STATUS			−0.014***	−0.014***	−0.009***	−0.009***
			(0.001)	(0.001)	(0.001)	(0.001)
LN (YIELD ON AAA BONDS)	−0.114	−0.113	0.001	0.001	−0.000	−0.000
	(0.079)	(0.079)	(0.001)	(0.001)	(0.001)	(0.001)
INTERCEPT	1.897***	1.904***	0.010***	0.010***	0.016***	0.016***
	(0.276)	(0.276)	(0.003)	(0.003)	(0.003)	(0.003)
Board Structure Controls	YES	YES	YES	YES	YES	YES
FIRM & YEAR FE	YES	YES	YES	YES	YES	YES
F-statistic	25.05	23.12	31.72	29.46	18.96	17.73
Adj. R-square	97.20 %	97.20 %	57.80 %	57.80 %	51.70 %	51.70 %
Observations	15,213	15,213	15,212	15,212	15,213	15,213

The table presents regression results of accounting changes following DB freezes from 1998 to 2018, featuring firm-years within a maximum span of five years before and five years after the freeze, excluding the freeze year. *PLAN SIZE* is the defined benefit projected pension obligation. *PENSION COST* is the periodic pension cost scaled by sales. *PENSION CONTRIBUTION* is the employer's contribution to the pension plan scaled by assets. *POST* is an indicator variable that takes the value of 1 in the post-DB plan freeze period and zero otherwise. *SERP FREEZE* is an indicator variable that takes the value of 1 for firms that freeze their SERPs and zero otherwise. *MARKET TO BOOK* is the book value of assets plus the market value of equity less the sum of the book value of equity and deferred assets scaled by the book value of assets. *R&D* is research and development expenses scaled sales. *CAPEX* is capital expenditure less the sale of property, plant and equipment scaled by total assets. *LEVERAGE* is the book value of short-term and long-term debt scaled by the book value of assets. *LOSS* takes the value of one if the firm has negative net income and zero otherwise. *ASSETS* is the total assets. *FUNDING STATUS* is the fair value of pension plan assets less the projected pension benefits obligations, scaled by the projected benefits obligations. *YIELD ON AAA BONDS* is the average yield on Moody's AAA bonds. All models include controls for *CEO CHAIR*, *BOARD SIZE*, *%NE DIRECTORS*, and *% INSIDERS OWNERSHIP* that are omitted for brevity. All regressions include firm and year fixed effects. Continuous variables are winsorized at 1 % and 99 %. Robust standard errors clustered at the firm level are reported in parentheses. ***. **, * indicate levels of significance of 1 %, 5 %, and 10 %, respectively.

Whited and Wu (2006) index (*WW*), and the lack of external credit ratings (*NO CR RATING*; see, e.g., Dambra, 2018).[27] We then interact *POST* and *POST × SERP FREEZE* with these proxies. The results for the *S&A INDEX, WW, and NO CR RATING* are presented in Tables OA3.1 to OA3.3 in Section 4 of the Online Appendix. Financing constraints appear to have no effect on our conclusions, as we continue to observe that SERP-freezing firms refocus their operations, leading to reduced diversification and an increase in stock repurchases.

5.4. Propensity score matching (PSM)

Finally, to further address endogeneity and functional form misspecification concerns (e.g., Shipman, Swanquist, & Whited, 2017), we use the propensity score matching approach (PSM) to identify control firms that had a similar propensity to freeze their qualified DB plans but did not do so. PSM allows us to match treated and control firms on multiple covariates based on their predicted probability of treatment (the propensity score). Further, PSM allows for non-linear relationships, and helps balance covariates more effectively than simple matching techniques between treated and control units (Rosenbaum & Rubin, 1983).

To estimate the propensity score, we use the determinants of the qualified DB plan freeze decision model described in Section 4.1. To ensure comparability in the pre-freeze period, we require both treated and matched firms to be in the same industry (measured by two-digit SIC codes) and in the same fiscal year. We then match, without replacement, a treated with a non-treated control firm that has the closest propensity score within a caliper width of 0.03 (Caliendo & Kopeinig, 2008; Shipman et al., 2017). The results from this analysis are qualitatively similar to those presented in Section 4. For further details on the PSM approach, please refer to Section 4 of the Online Appendix, where the results are also displayed in Table OA4.1.

In sum, the robustness tests reported in Section 5 provide added confidence about our interpretation of the results. However, notwithstanding such test results, we refrain from drawing strong conclusions about causality.

[27] We define an indicator variable, *S&A INDEX*, taking the value of 1 if the firm is in the top quintile of the *Size and Age Index* in a given year, and zero otherwise. The *Size and Age Index* = (−0.737 × Size) + (0.043 × Size^2) - (0.040 × Age), where *Size* equals the log of inflation-adjusted (to 2004) book assets, and *Age* is the number of years the firm is listed with a non-missing stock price on Compustat. In calculating this index, *Size* is winsorized at $4.5 billion, and *Age* is winsorized at thirty-seven years. To examine if financial constraints play a role, we classify firms in the top quintile of the *Size and Age Index*, as potentially more financially constraint than the other firms.The *WW* = −0.091 (CF/*TA*) − 0.062*DIVDUM* + 0.021(*LTD/TA*) − 0.044*LNTA* + 0.102 *INDSG* − 0.035*SG*, where CF/*TA* is cash flow over lagged book assets; *DIVDUM* equals one if the firm pays cash dividends and zero otherwise; *LTD/TA* is long-term debt scaled by assets; *LNTA* is the logarithm of total assets; *INDSG* is the firm's three-digit industry sales growth; and *SG* is the firm's sales growth.

Table 10
The Effects of SERP Freezes on Firm Policies Controlling for Managerial Entrenchment.

	(1)	(2)	(3)	(4)	(5)	(6)
	CAPEX	*R&D*	*LN(SEGMENTS)*	*LEVERAGE*	*DIVIDENDS*	*REPURCHASES*
POST	−0.001	0.000	0.127*	−0.001	−0.001	−0.004
	(0.004)	(0.001)	(0.070)	(0.013)	(0.002)	(0.005)
POST × *SERP FREEZE*	−0.003	−0.001	−0.153**	−0.004	0.001	0.009**
	(0.004)	(0.001)	(0.073)	(0.016)	(0.002)	(0.004)
CEO POWER	−0.002	−0.000	−0.011	0.007	−0.000	0.002
	(0.002)	(0.001)	(0.026)	(0.006)	(0.001)	(0.002)
CEO PAY SLICE	−0.007	−0.001	−0.065	0.014	−0.000	0.018*
	(0.006)	(0.003)	(0.120)	(0.028)	(0.002)	(0.011)
λ_{SERP}	−0.001	0.005	−0.207	−0.008	0.001	0.000
	(0.011)	(0.006)	(0.219)	(0.052)	(0.009)	(0.017)
λ_{DB}	0.011	−0.004	−0.037	−0.072***	−0.001	0.017
	(0.007)	(0.003)	(0.131)	(0.026)	(0.003)	(0.011)
OTHER CONTROLS	Yes	Yes	Yes	Yes	Yes	Yes
FIRM & YEAR FE	Yes	Yes	Yes	Yes	Yes	Yes
Chi-Square	52.79	32.40	30.69	145.70	41.90	54.46
Adj. R-square	75.90 %	92.80 %	80.80 %	83.40 %	77.00 %	51.80 %
Observations	1520	1520	1520	1520	1520	1520

This table presents the regression results explaining the change in firm policies after DB freezes from 1998 to 2018, featuring firm-years within a maximum span of five years before and five years after the freeze, excluding the freeze year. *SERP FREEZE* is an indicator variable that takes the value of one for firms that freeze their qualified DB plan and their SERPs and zero otherwise. *CAPEX* is capital expenditure divided by total assets. *R&D* is research and development expenses divided by sales. *SEGMENTS* is the total number of business segments. *LEVERAGE* is the book value of short-term and long-term debt scaled by the book value of assets. *DIVIDENDS* is the dividends paid scaled by total assets. *REPURCHASES* is the increase in treasury stock, or the difference between purchases and sales of stock, when treasury data is unavailable, scaled by total assets. *CEO POWER* equals one if the CEO power index is in the top quantile of our sample, zero otherwise. This index is calculated as the equal-weighted index of four power indicators defined relative to the 2-digit SIC industry and year mean (CEO-chair duality; board size; fraction of executive directors; fraction of insider ownership). *CEO PAY SLICE* is the fraction of the aggregate compensation of the top five executive team captured by the CEO. λ_{DB} and λ_{SERP} are selectivity correction variables used to account for the endogeneity of the qualified DB plan and the SERP decisions, respectively. They are estimated using parameters from the probit regressions of the DB plan and SERP freeze decisions using all firm years around the pension freeze. OTHER CONTROLS are the control variables used in Tables 4 and 5 and are defined in the Appendix. All regressions include year and firm fixed effects. Continuous variables are winsorized at 1 % and 99 %. Bootstrap standard errors clustered at the firm level (based on 1000 replications) are reported in parentheses. ***. **, * indicate levels of significance of 1 %, 5 %, and 10 %, respectively.

6. Conclusions

Pensions play a crucial role in the compensation packages of top executives, serving not only as a significant tool for attracting and retaining top-talent but also as a mechanism for mitigating risk-shifting behaviors. However, like qualified DB plans, DB SERPs are experiencing a decline, with many sponsors contemporaneously freezing their SERPs when they freeze their qualified DB plans. By drawing on agency theory, our research addresses two vital questions: why do firms decide to freeze their top executives' SERPs, and what are the implications of these freezes on managerial incentives and firm policies?

We find that the decision to freeze SERPs is predominantly influenced by the power dynamics between top executives and the board of directors, alongside considerations related to efficient contracting. Notably, firms with more powerful CEOs, who have higher retention concerns, and face lower growth opportunities are less inclined to impose freezes on SERPs.

Moreover, our analysis reveals that SERP freezes lead to significant changes in corporate behavior. Firms that implement these freezes are more likely to engage in risk-shifting activities, reducing diversification and reallocating pension cost savings to shareholders through increased stock repurchases. This behavior aligns with theories suggesting that changes in compensation structures, like those involving SERPs, can directly influence firm risk profiles, leading to lower equity and higher credit risks.

Our study contributes to extant knowledge in different ways. Academically, it is the first to focus on the determinants of SERP freezes, addressing a significant gap in corporate governance research. Our findings highlight the strategic and agency considerations of boards in safeguarding CEO pension benefits while reducing the pension benefits of rank-and-file employees. Moreover, our study extends existing literature on executive pensions and contributes to the broader literature on executive compensation. By isolating the incentive effect of SERPs from those of qualified DB plan amendments, our findings enhance our understanding on how changes in executive compensation structures, through pension adjustments, directly influence corporate risk-taking behaviors, and risk profiles.

For practice, this study provides a useful insight to corporate board members, compensation committees, and practitioners. It emphasizes the importance of balancing incentive alignment with financial prudence when designing executive compensation packages and highlights the need to consider how changes in compensation structures may influence corporate objectives and risk policies.

The implications of this study are also relevant to policymakers. In an era where equity-based compensation has been heavily criticised for promoting excessive risk-taking, which many believe led to the 2008 financial crisis, the idea of aligning executive compensation with debt-holders has gained momentum. The Liikanen Report by the European Commission and the U.S. Federal Reserve have advocated debt-like compensation to mitigate adverse risk-taking behaviors. Federal banking regulations, as outlined in the Incentive-Based Compensation Arrangements (76 Fed. Reg. 21,170, April 14, 2011), support this theory, suggesting a regulatory shift towards compensation structures that include debt-like elements. Our study contributes to this discussion by illustrating how SERPs, a significant component of debt-like compensation, may impact firm policies and risk profiles.

In conclusion, this study provides insights into the determinants of SERP freezes and enhances our understanding of the incentive alignment function of SERPs' within top executives' compensation structures.

Appendix A. Variable measurement

Variable	Measurement
Dependent variables	
DB FREEZE	Indicator variable that equals one if the DB plan is hard frozen and zero otherwise.
SERP FREEZE	Indicator variable that equals one if the SERP is hard frozen and zero otherwise.
CAPEX	Capital expenditure less sale of property plant and equipment scaled by total assets
R&D	Research and Development expenses scaled by sales.
SEGMENTS	The total number of business segments.
LEVERAGE	Book value of short-term and long-term debt scaled by the book value of assets.
DIVIDENDS	Dividends paid scaled by total assets.
REPURCHASES	The increase in the treasury stock, or the difference between purchases and sales of stock, when treasury data is unavailable, scaled by total assets.
DISTRESS	Distance to default multiplied by −1, where the distance to default is calculated following Campbell et al. (2008).
I-RISK	The standard deviation of abnormal returns. Where abnormal returns are the residuals from Fama-French three-factor models estimated over the fiscal year
CREDIT RATING	The Standard & Poor annual credit rating of the firm's long-term debt.
Controls	
POST	An indicator variable that takes the value one in the post DB-freeze plan period, zero otherwise.
CEO CHAIR	An indicator variable that takes the value one if the firm's CEO is also the Chair of the board, zero otherwise.
BOARD SIZE	Total number of directors on the board.
%NE DIRECTORS	Fraction of total non-executive directors on the board.
%INSIDE OWNERSHIP	Fraction of common stock owned by insiders.
PENSION INDICATOR	Indicator variable takes the value of 1 if the CEO's age is equal or greater than the minimum retirement age, and zero otherwise. The minimum retirement age is the earliest age that an executive can leave the company and obtain 100 % of the earned pension benefit. Most firms pay a reduced amount in the event of an early retirement. The minimum retirement age is collected from 10-K reports and proxy statements. In the few cases where this information is unavailable, we set the minimum retirement age at 65.
INSIDER CEOs	Inside CEOs appointments across the Fama and French classification of 48 industry groups derived from Table III of Cremers and Grinstein (2014).
HHI	The Herfindahl-Hirchman index computed as the sum of squared market shares within the same text-based industry concentration. The index is downloaded from the Hoberg-Philips Data Library (https://hobergphillips.tuck.dartmouth.edu/industryconcen.htm).
ZMIJEWSKI's SCORE	Zmijewski's *Z*-score $= -4.336 - 4.513 \times ROA + 5.679 \times Leverage + 0.004 \times Liquidity$, where *ROA* is net income scaled by assets, *Leverage* is total liabilities scaled by assets, and *Liquidity* is current assets scaled by current liabilities. A higher score indicates increased financial distress risk.
INTEREST COVER	Interest expense scaled by earnings before interest and taxes. A higher ratio suggests a greater reliance on debt financing.
MARKET TO BOOK	The book value of assets plus the market value of equity less the sum of the book value of equity and deferred assets scaled by the book value of assets.
NON-PENSION CFO	Income before extraordinary items plus depreciation and amortization plus net period pension costs, scaled by total assets.
SALES GROWTH	The growth in sales from year *t*-1 to year *t*.
ROA	Earnings before interest and taxes scaled by total assets.
ASSETS	Book value of total assets.
FUNDING STATUS	The fair value of pension plan assets less the projected pension benefit obligation, scaled by total assets.
PENSION CONTRIBUTIONS	The employer's contribution to the pension plan scaled by total assets
PLAN SIZE	Total DB pension plan liabilities (PBPRO).
INDUSTRY UNION RATE	The industry union rate measured at the 2-digit SIC industry classification (© 2010 by Barry T. Hirsch and David A. Macpherson at Georgia State University).
ρ_{12}	The parameter ρ_{12} estimates the correlation between the error terms of the Bivariate Probit equations. If ρ_{12} is significant, then the Bivariate Probit estimation is more efficient than independent Probit equations.
λ_{SERP}, λ_{DB}	Selectivity correction variables that are used to account for the endogeneity of the qualified DB plan and the SERP decisions, respectively. They are estimated using parameters from the probit regressions of the DB plan and SERP freeze decisions using all firm years around the pension freeze. They are calculated as $\lambda = \phi(\tilde{x})/\Phi(\tilde{x})$ where $\tilde{x}$ is the predicted value from the probit model, $\phi(\bullet)$ denotes the probability density function, and $\Phi(\bullet)$ denotes the cumulative distribution function of the standard normal distribution
Additional Variables	
DELTA	The dollar change in CEO wealth associated with a 1 % change in the firm's stock price.
VEGA	The dollar change in CEO wealth associated with a 1 % change in the standard deviation of the firm's returns.
PENSION VALUE	The present value of the CEO's pension through SERPs.
INSIDE EQUITY	The value of the CEO's stock and option portfolio.
CEO TENURE	The tenure of the CEO
DEBT EQUITY	The book value of debt over the sum of debt and stockholders' equity.
LOSS	An indicator variable that takes the value of one if the firm has negative net income, zero otherwise.
TAX STATUS	An indicator variable that takes the value of one if the firm has net operating loss carry-forwards on its balance sheet, zero otherwise.
FIRM AGE	The number of years the firm has available information in COMPUSTAT.
PENSION COST	The periodic pension cost scaled by sales.
YIELD ON AAA BONDS	The average yield on Moody's AAA bonds less the average yield on 20-year U.S. Treasury Bonds.

This table presents variable definitions.

Appendix B. Supplementary data

Supplementary material to this article can be found online at https://doi.org/10.1016/j.irfa.2025.104328.

Data availability

Data will be made available on request.

References

Adams, R. B., Hermalin, B. E., & Weisbach, M. S. (2010). The role of boards of directors in corporate governance: A conceptual framework and survey. *Journal of Economic Literature, 48*(1), 58–107.

Aggarwal, R. K., & Samwick, A. A. (2003). Why do managers diversify their firms? Agency reconsidered. *The Journal of Finance, 58*(1), 71–118.
Allen, S. G., Clark, R. L., & McDermed, A. A. (1993). Pensions, bonding, and lifetime jobs. *The Journal of Human Resources, 28*(3), 463–481.
Amihud, Y., & Lev, B. (1981). Risk reduction as a managerial motive for conglomerate mergers. *The Bell Journal of Economics, 12*(2), 605–617.
Anantharaman, D., Fang, V. W., & Gong, G. (2014). Inside debt and the design of corporate debt contracts. *Management Science, 60*(5), 1260–1280.
Anantharaman, D., Gao, F., & Manchiraju, H. (2022). Does social responsibility begin at home? The relation between firms' pension policies and corporate social responsibility (CSR) activities. *Review of Accounting Studies, 27*(1), 76–121.
Anantharaman, D., & Lee, Y. G. (2014). Managerial risk taking incentives and corporate pension policy. *Journal of Financial Economics, 111*(2), 328–351.
Baber, W. R., Janakiraman, S. N., & Kang, S.-H. (1996). Investment opportunities and the structure of executive compensation. *Journal of Accounting and Economics, 21*(3), 297–318.
Bakke, T.-E., & Whited, T. M. (2012). Threshold events and identification: A study of cash shortfalls. *The Journal of Finance, 67*(3), 1083–1111.
Baranchuk, N., MacDonald, G., & Yang, J. (2011). The economics of super managers. *The Review of Financial Studies, 24*(10), 3321–3368.
Beaudoin, C., Chandar, N., & Werner, E. M. (2010). Are potential effects of SFAS 158 associated with firms' decisions to freeze their defined benefit pension plans? *Review of Accounting and Finance, 9*(4), 424–451.
Bebchuk, L. A., Cremers, K. J. M., & Peyer, U. C. (2011). The CEO pay slice. *Journal of Financial Economics, 102*(1), 199–221.
Bebchuk, L. A., & Fried, J. M. (2004). Stealth compensation via retirement benefits. In *National Bureau of Economic Research Working Paper Series No. 10742*.
Bebchuk, L. A., & Jackson, R. J., Jr. (2005). Executive pensions. In *National Bureau of Economic Research Working Paper Series No. 11907*.
Begley, J., Chamberlain, S., Yang, S., & Zhang, J. L. (2015). CEO incentives and the health of defined benefit pension plans. *Review of Accounting Studies, 20*(3), 1013–1058.
von Beschwitz, B. (2018). Cash windfalls and acquisitions. *Journal of Financial Economics, 128*(2), 287–319.
Bhagat, S., & Welch, I. (1995). Corporate research & development investments international comparisons. *Journal of Accounting and Economics, 19*(2), 443–470.
Black, F., & Scholes, M. (1973). The pricing of options and corporate liabilities. *Journal of Political Economy, 81*(3), 637–654.
Blanchard, O. J., Lopez-de-Silanes, F., & Shleifer, A. (1994). What do firms do with cash windfalls? *Journal of Financial Economics, 36*(3), 337–360.
Cadman, B., & Vincent, L. (2015). The role of defined benefit pension plans in executive compensation. *European Accounting Review, 24*(4), 779–800.
Caliendo, M., & Kopeinig, S. (2008). Some practical guidance for the implementation of propensity score matching. *Journal of Economic Surveys, 22*(1), 31–72.
Caliskan, D., & Doukas, J. A. (2015). CEO risk preferences and dividend policy decisions. *Journal of Corporate Finance, 35*, 18–42.
Cameron, A. C., & Trivedi, P. K. (2005). *Microeconometrics: Methods and applications*. Cambridge university press.
Campbell, J. Y., Hilscher, J., & Szilagyi, J. (2008). In search of distress risk. *The Journal of Finance, 63*(6), 2899–2939.
Cassell, C. A., Huang, S. X., Manuel Sanchez, J., & Stuart, M. D. (2012). Seeking safety: The relation between CEO inside debt holdings and the riskiness of firm investment and financial policies. *Journal of Financial Economics, 103*(3), 588–610.
Chen, Z., Huang, Y., & Wei, J. (2013). Executive pay disparity and the cost of equity capital. *The Journal of Financial and Quantitative Analysis, 48*(3), 849–885.
Choy, H., Lin, J., & Officer, M. S. (2014). Does freezing a defined benefit pension plan affect firm risk? *Journal of Accounting and Economics, 57*(1), 1–21.
Coles, J. L., Daniel, N. D., & Naveen, L. (2006). Managerial incentives and risk-taking. *Journal of Financial Economics, 79*(2), 431–468.
Coles, J. L., Daniel, N. D., & Naveen, L. (2013). Calculation of compensation incentives and firm-related wealth using Execucomp: Data, program, and explanation. Available at SSRN: https://ssrn.com/abstract=2296381.
Colvin, G. (2001). The great CEO pay heist. *Fortune, 143*(14), 64.
Comprix, J., & Muller, K. A. (2011). Pension plan accounting estimates and the freezing of defined benefit pension plans. *Journal of Accounting and Economics, 51*(1), 115–133.
Cornwell, C., Dorsey, S., & Mehrzad, N. (1991). Opportunistic behavior by firms in implicit pension contracts. *The Journal of Human Resources, 26*(4), 704–725.
Cremers, K. J. M., & Grinstein, Y. (2014). Does the market for CEO talent explain controversial CEO pay practices? *Review of Finance, 18*(3), 921–960.
Custódio, C., & Metzger, D. (2014). Financial expert CEOs: CEO'S work experience and firm's financial policies. *Journal of Financial Economics, 114*(1), 125–154.
Dambra, M. J. (2018). Stakeholder conflicts and cash flow shocks: Evidence from changes in ERISA pension funding rules. *The Accounting Review, 93*(1), 131–159.
De Angelis, D., & Grinstein, Y. (2020). Relative performance evaluation in CEO compensation: A talent-retention explanation. *Journal of Financial and Quantitative Analysis, 55*(7), 2099–2123.
Demerjian, P., Lev, B., & McVay, S. (2012). Quantifying managerial ability: A new measure and validity tests. *Management Science, 58*(7), 1229–1248.
Den Uyl, J., & Frederick, D. (2006). A best-practice strategy for disclosure. *Journal of Pension Benefits, 13*, 24–29.
Dorsey, S. (1995). Pension portability and labor market efficiency: A survey of the literature. *ILR Review, 48*(2), 276–292.
Edmans, A., & Gabaix, X. (2009). Is CEO pay really inefficient? A survey of new optimal contracting theories. *European Financial Management, 15*(3), 486–496.
Edmans, A., & Liu, Q. (2011). Inside Debt. *Review of Finance, 15*(1), 75–102.
Eisdorfer, A., Giaccotto, C., & White, R. (2013). Capital structure, executive compensation, and investment efficiency. *Journal of Banking & Finance, 37*(2), 549–562.
Eisdorfer, A., Giaccotto, C., & White, R. (2015). Do corporate managers skimp on shareholders' dividends to protect their own retirement funds? *Journal of Corporate Finance, 30*, 257–277.
Fama, E. F., & French, K. R. (2001). Disappearing dividends: Changing firm characteristics or lower propensity to pay? *Journal of Financial Economics, 60*(1), 3–43.
Finkelstein, S., & D'aveni, R. A. (1994). CEO duality as a double-edged sword: How boards of directors balance entrenchment avoidance and unity of command. *Academy of Management Journal, 37*(5), 1079–1108.
Franzoni, F. (2009). Underinvestment vs. overinvestment: Evidence from price reactions to pension contributions. *Journal of Financial Economics, 92*(3), 491–518.
Frydman, C., & Jenter, D. (2010). CEO compensation. In *National Bureau of Economic Research Working Paper Series No. 16585*.
Gao, H., Luo, J., & Tang, T. (2015). Effects of managerial labor market on executive compensation: Evidence from job-hopping. *Journal of Accounting and Economics, 59*(2), 203–220.
Garmaise, M. J. (2009). Ties that truly bind: Noncompetition agreements, executive compensation, and firm investment. *The Journal of Law, Economics, and Organization, 27*(2), 376–425.
Gerakos, J. (2010). Chief executive officers and the pay–pension tradeoff. *Journal of Pension Economics and Finance, 9*(2), 303–319.
Giroud, X., & Mueller, H. M. (2010). Does corporate governance matter in competitive industries? *Journal of Financial Economics, 95*(3), 312–331.
Graham, J. R., Harvey, C. R., & Puri, M. (2013). Managerial attitudes and corporate actions. *Journal of Financial Economics, 109*(1), 103–121.
Grantham, R. (2009). Pension cuts miss executives: Freezes often don't extend to top brass. Companies say different treatment helps retain top talent. In *The Atlanta journal-constitution (2001):D1*.
Greene, W. H. (2018). *Econometric analysis* (8th ed.). Pearson Education.
Gustman, A. L., Mitchell, O. S., & Steinmeier, T. L. (1994). The role of pensions in the labor market: A survey of the literature. *ILR Review, 47*(3), 417–438.
Hadlock, C. J., & Pierce, J. R. (2010). New evidence on measuring financial constraints: Moving beyond the KZ index. *The Review of Financial Studies, 23*(5), 1909–1940.
Hainmueller, J. (2012). Entropy balancing for causal effects: A multivariate reweighting method to produce balanced samples in observational studies. *Political Analysis, 20*(1), 25–46.
Heckman, J. J. (1979). Sample selection bias as a specification error. *Econometrica, 47*(1), 153–161.
Hoberg, G., & Phillips, G. (2010). Real and financial industry booms and busts. *The Journal of Finance, 65*(1), 45–86.
Hodgson, P. (2004). Poor disclosure and elitism: The problems with executive benefits. *Ivey Business Journal*. Online Sep/Oct:1–8.
Horton, J., Kiosse, P. V., Koumenta, M., & Mitrou, E. (2021). The role of CEOs in the sustainability of defined benefit pension plans. *Human Resource Management Journal, 31*(3), 603–618.
Ippolito, R. A. (1987). Why federal workers don't quit. *The Journal of Human Resources, 22*(2), 281–299.
Ippolito, R. A., & Thompson, J. W. (2000). The survival rate of defined-benefit plans, 1987-1995. *Industrial Relations: A Journal of Economy and Society, 39*(2), 228–245.
Jackson, R. J., & Honigsberg, C. (2014). The hidden nature of executive retirement pay. *Virginia Law Review, 100*(3), 479–522.
Jacquemin, A. P., & Berry, C. H. (1979). Entropy measure of diversification and corporate growth. *The Journal of Industrial Economics, 27*(4), 359–369.
Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance, and takeovers. *The American Economic Review, 76*(2), 323–329.
Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics, 3*(4), 305–360.
Kalyta, P. (2009). Accounting discretion, horizon problem, and CEO retirement benefits. *The Accounting Review, 84*(5), 1553–1573.
Kalyta, P., & Magnan, M. (2008). Executive pensions, disclosure quality, and rent extraction. *Journal of Accounting and Public Policy, 27*(2), 133–166.
Kim, J.-B., Wang, Z., & Zhang, L. (2016). CEO overconfidence and stock price crash risk. *Contemporary Accounting Research, 33*(4), 1720–1749.
Kothari, S. P., Laguerre, T. E., & Leone, A. J. (2002). Capitalization versus expensing: Evidence on the uncertainty of future earnings from capital expenditures versus R&D outlays. *Review of Accounting Studies, 7*(4), 355–382.
Kruse, D. L. (1995). Pension substitution in the 1980s: Why the shift toward defined contribution? *Industrial Relations: A Journal of Economy and Society, 34*(2), 218–241.
Kubick, T. R., Lockhart, G. B., & Robinson, J. R. (2021). Internal capital and investment: Evidence from 2012 pension relief. *Contemporary Accounting Research, 38*(3), 2034–2070.
Lewellen, W. G. (1971). A pure financial rationale for the conglomerate merger. *The Journal of Finance, 26*(2), 521–537.
Li, H., & Zhao, J. (2020). Inside debt and firm risk-taking: Evidence from the UK pension reform. *Journal of Business Finance & Accounting, 47*(9–10), 1316–1364.
Li, Z., & Kara, A. (2022). Pension de-risking choice and firm risk: Traditional versus innovative strategies. *International Review of Financial Analysis, 81*, Article 102064.
Liu, Y., Mauer, D. C., & Zhang, Y. (2014). Firm cash holdings and CEO inside debt. *Journal of Banking & Finance, 42*, 83–100.
Malmendier, U., & Tate, G. (2005). CEO overconfidence and corporate investment. *The Journal of Finance, 60*(6), 2661–2700.

Malmendier, U., Tate, G., & Yan, J. (2011). Overconfidence and early-life experiences: The effect of managerial traits on corporate financial policies. *The Journal of Finance, 66*(5), 1687–1733.
Martijn Cremers, K. J., & Grinstein, Y. (2013). Does the market for CEO talent explain controversial CEO pay practices? *Review of Finance, 18*(3), 921–960.
McMullin, J. L., & Schonberger, B. (2020). Entropy-balanced accruals. *Review of Accounting Studies, 25*(1), 84–119.
Meng, C.-L., & Schmidt, P. (1985). On the cost of partial observability in the bivariate probit model. *International Economic Review, 26*(1), 71–85.
Merton, R. C. (1974). On the pricing of corporate debt: The risk structure of interest rates. *The Journal of Finance, 29*(2), 449–470.
Mitchell, O. S. (1982). Fringe benefits and labor mobility. *The Journal of Human Resources, 17*(2), 286–298.
Munnell, A. H., Haverstick, K., & Sanzenbacher, G. (2006). *Job tenure and pension coverage*. Center for Retirement Research.
Munnell, A. H., & Soto, M. (2007). *Why are companies freezing their pensions: Center for Retirement Research*. Boston, MA: Boston College.
Murphy, K. J. (2013). Chapter 4 - executive compensation: Where we are, and how we got there. In G. M. Constantinides, M. Harris, & R. M. Stulz (Eds.), *Handbook of the economics of finance* (pp. 211–356). Elsevier.
Parrino, R. (1997). CEO turnover and outside succession a cross-sectional analysis. *Journal of Financial Economics, 46*(2), 165–197.
Phan, H. V. (2014). Inside debt and mergers and acquisitions. *Journal of Financial and Quantitative Analysis, 49*(5–6), 1365–1401.
Phan, H. V., & Hegde, S. P. (2013). Pension contributions and firm performance: Evidence from frozen defined benefit plans. *Financial Management, 42*(2), 373–411.
Rauh, J. D. (2006). Investment and financing constraints: Evidence from the funding of corporate pension plans. *The Journal of Finance, 61*(1), 33–71.
Rauh, J. D., Stefanescu, I., & Zeldes, S. P. (2020). Cost saving and the freezing of corporate pension plans. *Journal of Public Economics, 188*, Article 104211.
Richardson, S. (2006). Over-investment of free cash flow. *Review of Accounting Studies, 11*(2), 159–189.
Rosen, S. (1981). The economics of superstars. *The American Economic Review, 71*(5), 845–858.
Rosenbaum, P. R., & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika, 70*(1), 41–55.
Scannell, K., & Lublin, J. (2006). SEC issues rules on executive pay, options grants; backdating scandal leads agency to force increased disclosure; other perks will see light of day. *Wall Street Journal* (July 27) C 1 https://www.wsj.com/articles/SB115393013589617921.
Sheikh, S. (2021). CEO inside debt, market structure and payout policy. *International Review of Financial Analysis, 76*, Article 101755.
Shipman, J. E., Swanquist, Q. T., & Whited, R. L. (2017). Propensity score matching in accounting research. *The Accounting Review, 92*(1), 213–244.
Shivdasani, A., & Stefanescu, I. (2009). How do pensions affect corporate capital structure decisions? *The Review of Financial Studies, 23*(3), 1287–1323.
Skinner, D. J. (2008). The evolving relation between earnings, dividends, and stock repurchases. *Journal of Financial Economics, 87*(3), 582–609.
Srivastav, A., Armitage, S., & Hagendorff, J. (2014). CEO inside debt holdings and risk-shifting: Evidence from bank payout policies. *Journal of Banking & Finance, 47*, 41–53.
Stefanescu, I., Wang, Y., Xie, K., & Yang, J. (2018). Pay me now (and later): Pension benefit manipulation before plan freezes and executive retirement. *Journal of Financial Economics, 127*(1), 152–173.
Sundaram, R. K. (2001). The Merton/KMV approach to pricing credit risk. *Extra Credit* (January/February).
Sundaram, R. K., & Yermack, D. L. (2007). Pay me later: Inside debt and its role in managerial compensation. *The Journal of Finance, 62*(4), 1551–1588.
Tunali, I. (1986). A general structure for models of double-selection and an application to a joint migration/earnings process with remigration. *Research in Labor Economics, 8* (Part B), 235–282.
Tung, F., & Wang, X. (2012). Bank CEOs, inside debt compensation, and the global financial crisis. In *Boston Univ. School of law Working Paper (11-49)*.
Vafeas, N., & Vlittis, A. (2018). Independent directors and defined benefit pension plan freezes. *Journal of Corporate Finance, 50*, 505–518.
VanDerhei, J. (2006). Defined benefit plan freezes: Who's affected, how much, and replacing lost accruals. *EBRI Issue Brief, 291*, 1–18.
Vanguard Group. (2016). *Survey of defined benefit plan sponsors*.
Watson, T. (2014). *Executive retirement benefits in the wake of qualified plan changes*.
Wei, C., & Yermack, D. (2011). Investor reactions to CEOs' inside debt incentives. *The Review of Financial Studies, 24*(11), 3813–3840.
Whited, T. M., & Wu, G. (2006). Financial constraints risk. *The Review of Financial Studies, 19*(2), 531–559.
Yermack, D. (1996). Higher market valuation of companies with a small board of directors. *Journal of Financial Economics, 40*(2), 185–211.