EARNINGS MANAGEMEN STRATEGY OF PENSION PLAN CHANGING FIRMS

BY

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ABSTRACT

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This study investigates the earnings management strategy of defined benefit pension plan changing firms. I provide the evidence that managers engage in cash conservation activities and real earnings management in response to the changes in funding status and pension income through the manipulation of pension assumptions before and after pension freezing. These results suggest that earnings management through pension assumptions affects the normal operations of the firm through real activities during the defined benefit plan pension freezing. I also provide evidence that pension termination firms exhibit a lower level of discretionary accruals after the termination, suggesting the downsizing of a pension plan serves as a tool for earnings management. These findings provide evidence that firms alter earnings management strategy and engage in cash saving activities in response to the changes in pension assumptions during the pension freezing and the changes in the pension structure during the pension termination.

Keywords: Pension freezing; Pension assumption estimates; Earnings management; Cash conservation.

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1. Introduction

Prior studies have found evidence that managers manipulate earnings through pension assumptions and pension assets allocations (eg. Bergstresser et al. 2006; Asthana 2008; Comprix and Muller 2010, Chuck 2012;). Due to the complexity of pension assumptions and the discretionary power of managers regarding the pension assets allocation, the Defined Benefit plan (DB plan hereafter) is frequently used by managers to engage in earnings management when the earnings can't meet the expectations (Asthana, 2008), to gain an advantage in negotiating pension freeze with unions (Comprix and Muller 2010), and to meet the specific accounting regulation requirement (Chuck 2012). In this study, I investigate how earnings management through pensions alter firms' daily operation and how managers respond to the pension freezing by adjusting earnings management strategy towards other earnings management methods, such as accrual-based earnings management or real-activities earnings management. Although empirical evidence about earnings management through DB plan is well documented, surprisingly little is known about how the firms with DB plans adjust the earnings management strategy when they opt out of the DB plans. In this paper, I investigate this issue in three stages. First, I examine how the firms manage earnings through pension plans before the freezing. Comprix and Muller 2010 find that firms with a labor union intentionally choose a lower expected rate of return (ERR) and discount rate (DR) before the hard freezing. Such manipulation understates financial returns from the pension plans and exaggerates pension obligations which managers

can use as a bargain to negotiate pension freezing with a union. Following their study, I examine whether the motivation of adopting a lower ERR and DR holds in all the firms who freeze DB plans instead of just firms with a labor union. Second, I investigate whether the manipulation of ERR and DR, if it does exist in all the pension freezing firms, produces motivation for cash conservation because of the downward manipulated pension funding status brought by downward manipulated DR before the hard freezing. Finally, I investigate how the firms adjust earnings management strategies surrounding pension hard freezing when the firms' fundamental financial condition changes because of the decision of hard freezing.

My study contributes to several aspects of recent research. First, it extends the growing literature on the earnings management vs. pension relationship. Pension hard freezing impacts a firm's net income and cash flows and changes the pension plan's structure significantly. The context and motivation for earnings management are different for firms who want to hard freeze pension plans. The ordinary motivation for earnings management, such as meeting/beating earnings target as shown in Asthana 2008, could still exist in the hard freezing firms but could be achieved differently due to the special financial condition and the change in the pension plan structure during the hard freezing. While empirical evidence about earnings management through DB plans is well documented, little is known about the economic consequences of earnings management through pension plans. This paper sheds some light on how the firms alter behavior in response to earnings management through pension plans.

Second, my study is a supplement to the current earning management literature. Previous literature, such as Cohen et al. (2008) and Jiang et al. (2010), find a decrease in accrual and an increase in real activities earnings management after the passage of the Sarbanes-Oxley Act (SOX). Chuk (2012) also finds evidence that the managers will adjust inflated pension assumptions or relocate pension assets to a riskier portfolio to respond to the passage of SFAS 132R, which requires firms to report more information about their pension plans. In this study, I show that the firms not only adjust the earnings management strategy due to the exogeneous regulatory changes but also respond quickly to the endogenous financial changes brought by the pension freezing. This study enriches our understanding of how firms alter their behavior based on their specific financial situations and needs in the event of pension freezing, instead of under pressure from higher outside scrutiny.

Third, this study provides reference meanings to the regulators, investors, analysts, and managers themselves. My paper is an extension study of continuing controversial income smoothing technique, in this paper, which is pension income smoothing. My paper is meaningful for investors and analysts because it helps better estimate the underlying performance of the firms during the DB plan-changing period. The earnings management activities during the pension freezing add noise to firms' earnings and one of the goals of my research is trying to strip the disturbance of earnings management in earnings quality. I hope my research could help prevent investors and analysts from being misled by the compromised financial statement during the DB plan changing

periods. As a discussion of earnings management and earnings quality, my study will provide managers with some clues about the earnings management activities they should avoid during pension freezing to reveal more accurate firms' information to the public. Moreover, I wish this study could help regulators have a better insight into the potential earnings management strategy that may be adopted by the pension freezing firms and take actions to better regulate the financial reporting of pension freezing firms.

Last but not least, my paper raises a new research direction for pension plan-earnings management interface research. To the best of my knowledge, this paper is the first one investigating the earnings management strategy adjustment surrounding the DB plan hard freezing. My study links the real and accrual-based earnings management research and the pension assumption earnings management research and suggests a new aspect that we can look through when conducting similar studies.

The remaining parts of this paper are organized as follows. In Section 2 I provide background information and previous literature findings, and I develop the hypotheses. In Section 3, I discuss the sample selection process and data cleaning process. In Section 4, I introduce the research method and empirical models. In Section 5, I present the empirical results. Finally, Section 6 concludes the study.

2. Background, literature review, and hypothesis development

2.1 Background

2.1.1 How do the firms manage earnings through pension accounting

Employers with DB plans follow Accounting Standards Codification (ASC) 715 in reporting their net periodic pension costs and net pension obligation (pension funding status). The net periodic pension costs (NPPC) are the sum of current service cost, the interest cost, amortization of prior service cost, amortization of existing net obligation or net assets, and amortization of deferred gains and losses less the expected or actual[1] return on pension plan assets. The net pension obligation is measured as the difference between PBO and the fair value of pensioni plan assets. The plan assets include the contribution from firms and investment outcomes earned by investing the contributions, less the benefits paid. According to ASC 715, the PBO is "the present value of vested and non-vested benefits earned by an employee for services rendered to date plus projected benefits attributable to salary increases".

Transparency and complexity of pension accounting are two key elements concerning the market since the 1970s. ERISA 1974 set regulations to protect employees' pension benefits, but it did not address any rules about pension accounting treatment. Also, ERISA 1974 does not set a common standard for setting actuarial assumptions used by firms to calculate pension obligations. The pension assets and liabilities obtained by DB firms with different actuarial assumptions are not comparable. Firms can choose their own actuarial assumptions to determine the return from the plan assets and the present value of liabilities. The market value of plan assets and pension liabilities are

[1] ASC 715 allows the firms to use either expected return or actual return to calculate NPPC. When the firms choose expected return, the difference between expected return and actual return will be first recognized in comprehensive income and then the actuarial gains or losses will be amortized to pension expense over time. Most of the firms will choose expected return because it smooths earnings.

disclosed by firms inconsistently and inadequately. Other than net pension assets and periodic pension costs, firms were not required to report other pension-related information in their financial statements.

SFAS 87 was issued under such circumstances in 1985 and became effective in late 1986. It requires the firm to disclose pension information within the footnotes of financial statements and sets guidelines for choosing appropriate assumptions in pension expense calculations. It also sets a standard for firms' reference to determine the market value of pension assets. However, the standard set by SFAS 87 still leaves much discretion for firms to manipulate their desired pension information reported in the financial statements. Zion and Carcache (2002) show that the pension expense reported in the income statement cannot properly reflect the concurrent funding status. Instead, it represents the pension plan's real funding status with a lag. Expected return on plan assets, one of the major components of NPPC, offsets the NPPC. It is calculated as a product of the assumed expected rate of return (ERR) and the market-related value of the plan assets. Before 2011, ASC 715-30-20 indicates that market-related value can either be "fair value or a calculated value that recognizes the changes in fair value in a systematic and rational manner over not more than five years." The calculated value smoothed plan value whereby unexpected returns can be amortized into plan value over a period of as much as five years. Zion and Carcache 2002 find that the actual market value of plan assets will be reflected in the expected return of plan assets in NPPC but with a substantial lag because most firms choose the calculated value of plan assets as

a base to calculate NPPC. In 2010, an update of ASC 715-30-35 requires the firms to use the fair value of plan assets to determine the expected return on plan assets. By doing so, the changes in expected return and the changes in the actual return on plan assets will be more closely inline. However, when firms change from using the calculated value to using the fair value in the calculation of expected return on plan assets, the firm needs to recognize the unrecognized unexpected returns in plan assets that could be previously amortized in five years. And this could result in volatility in earnings and might lead the company to manipulate ERR further to avoid the volatility in earnings because the update in ASC does not constrain the discretions in pension assumptions, such as ERR.

In general, none of the previous accounting standard updates specifically target the issue of the firm's discretion over the choice of pension accounting assumptions. Companies have discretions over the assumptions which are used to estimate the future salary increase, the expected rate of return of pension plan assets to determine the NPPC, and the discount rate which is used to calculate the present value of PBO. Previous literature has fully documented the evidence that the managers of DB Plan firms engage in earnings management through pension assumptions, especially the expected rate of return. As stated in an analysis report issued by the Pension Committee of the American Academy of Actuaries in 2004, companies usually choose the hurdle rate of plan assets investment and use this rate as the discount rate (DR) to get PBO. The pension liabilities are valued based on a yield curve of investment portfolio which includes corporate

bonds with different ratings and varying maturities. Different interest rates should be established based on the maturities: liabilities due in 5 or fewer years, between 5 and 20 years, and those longer than 20 years. The discount rate chosen must be consistent with either the current market rates practicable to fulfilling the benefit obligation or the rates of return on high-quality fixed-income securities at the measurement date. Company can select a specific date as the measurement date, but it is generally the last day of the company's fiscal year. The discount rate should be related to an applicable external interest rate at the measurement date, but the companies have the discretionary power to choose it – and can use this discretion for earnings management. Prior research has investigated the balance sheet effect of a manipulated DR. DR is directly related to the PBO, which is used to determine the pension funding status. Feldstein and Morck 1982, Kwon 1994, Asthana 1999, and Brown 2004 document that firms discretionally choose the DR to minimize PBO and improve pension funding status on the book. Naughton 2019 investigates the income effect of a manipulated DR. He argues that when the power of manipulating the expected return of plan assets through ERR decreases because of higher scrutiny from the regulation (the adoption of SFAS 132R), the plan sponsors turn to DR and salary inflation rate (SIR) to continue to manage earnings. He found that the discretion in ERR decreases and discretions in DR and SIR increase after the adoption of SFAS 132R.

2.1.2 Why do the firms close their DB plans?

Maintaining a DB plan is complicated and costly because DB plan sponsors are

responsible for the guaranteed future benefit for the employees. The increase in workers' lifespan makes pension annuities increasingly expensive. DB plans sponsors usually invest a significant portion of their assets in equities, which are risky and produce significant volatility in company earnings and cash flow, especially in a financial crisis (Soto 2008). The pension funding status is determined by the fair value of plan assets and PBO. Poor performance of pension plan assets in the equity market will damage pension funding status and impose significant pressure on firms for additional contributions needed to the pension plans. The volatility of the equity market requires the firms to frequently adjust their plan ERR and DR, two of the major components of NPPC. The volatility of plan assets performance in the equity market is directly related to the changes in NPPC of the next period and the amount of cash needed for contribution.

Also, establishing and maintaining a retirement plan is not required by ERISA. ERISA enforce the sponsors who have established the retirement plans meet certain minimum standards. Employers can choose to discontinue their DB plans as long as they have sufficient funds in the plan assets to pay out pension obligations earlier, or, for the underfunded pension plans, the employers need to make additional contributions to make it sufficient. Although it seems that the firms are under pressure to pay out the whole pension obligations right away, because the firms are no longer liable for the future benefits which continue to grow without termination, the discontinuation of DB plans still is less costly than letting the plans continue to accrue. By terminating or

freezing DB plans, the employers reduce or eliminate the significant demographic risks involved in funding DB plans (Soto 2008). By converting DB plans to DC plans, the employers transfer three risks to the employees: how much should be invested in newly established DC plans, how to manage the plans, and how to withdraw the lump-sum money when the employees retire. The survey conducted by Aon Consulting in 2003 supports that the major motivation of the manager's decision to freeze DB plans is to mitigate the impact of pension contributions on sponsor cash flow and to reduce future funding volatility. Several prior studies (Andrews 1992, Gustman and Steinmeier 1992, and Ippolito 1995) also find that half of the termination of DB plans are due to changes in industry structure and unionization. Firm size is also an attribute for termination.

2.1.3 Pension freezing currently

DB plan once was the only pension plan provided by most firms before 1982. With the introduction of the DC plan—401 (k) in 1982, it gradually became the major type of pension plan in the U.S. In 1983, among the workers with pension coverage, forty percent of workers were enrolled in DB plans only, forty five percent were enrolled in the combination plans of DB and DC but only fifteen percent participated in the DC plan only (Friedberg and Owyang, 2001). By 1998 the workers covered by DC plans increased significantly. Fifty nine percent were enrolled in a DC plan only, twenty percent were enrolled in a combination plan and only twenty percent had a DB plan only. The total number of DB plans dropped from 170,000 in 1985 to 42,000 in 1999 (Salisbury 2000). As illustrated in Figure 1, there is a clear trend of DB decreasing from

1985 to 2018. In 1985, 89 of the Fortune 100 companies offered a DB plan to their employees, and just 10 introduced a DC plan. In 2011, only 13 offered a DB plan, and 70 offered only a DC plan (Maurer et al. 2012). A report released by *Willis Towers Watson* in 2012 revealed that in 1998, 236 companies of the Fortune 500 firms provided their new hires a traditional DB plan, compared with only 16 in 2012.

[Insert Figure 1 here]

Companies have a variety of ways to transit the traditional DB plans to account-based plans. Pension plan sponsors can close or freeze their traditional DB plans and then move workers into hybrid plans, such as cash balance plan, or a pure DC plan, such as 401(k). Many companies now design pension plans into multilayers to accommodate different workforce segments, and most of these companies still manage assets and liabilities for these various plans. Closing a DB plan and replacing it immediately with an account-based plan such as a 401(k) plan was not common. The plan termination process is administratively complex and costly if the plan is underfunded. Freezing a pension plan is more often chosen as an alternative to terminate it. There are three ways a plan sponsors can choose to freeze. First, a hard freeze stops all active participants from receiving new pension benefits and forbids new entrants to the plan. The hard freeze might be followed by another plan, depending on the negotiation clause between the managers and the labor union. In contrast, a soft freeze closes the DB plan to new entrants but the plan continues to accrue benefits for active participants who are already in the plan. There is also another type of soft freeze that stops benefit accruals for all active participants, but the benefits will continue to be

adjusted with the growth of participants' wage levels. A partial freeze means that the firms stop accruing benefits for part of the participants. These participants are selected based on their age, tenure, job classification, plant location, etc. The other participants' benefits continue to accrue.

2.2 Literature review and Hypotheses development

Early pension-related research focuses on pension plan structure (Friedberg and Owyang (2001), the determinants of choice between DB and DC plans (Childs et al. 2000), and the outcome difference between DB and DC plans (Fore, 2001). Recent research investigates the earnings management strategy through the pension plan assumptions manipulations. Bergstresser et al. (2006) find that managers will use higher ERR, and then alter investment decisions to justify the manipulations during merge & acquisition, when they are close to earnings target, and when the managers exercise their stock options,. Comprix and Muller (2006) show that CEO cash compensation is relatively more sensitive to pension income than pension expense. As a result, CEO use relatively higher ERR estimates when reporting pension income because the compensation committee more emphasis on pension income rather than pension expense. Asthana (2008) finds that when firms are under threat of missing earnings expectations, managers may use the pension assumptions such as ERR to inflate earnings per share (EPS). Asthana (2008) conducts a sensitivity analysis of net income to ERR (i.e., the percentage change in net income due to a 1% change in ERR). He finds that when a firm reports the expected return on pension assets and pension

expenses as large as General Motors, a 1% change in the expected rate of return of plan assets can be translated into a 14.85% change in reported net income. In 2006, SFAS 132R requires the firms to report the composition of pension assets allocation which is not required in SFAS 87 or SFAS 132. Before the issuance of SFAS 132R, most firms are inflating pension assumptions, especially the ERR to facilitate earnings management through pension plans. Chuk (2012) shows that managers invest more in risky securities to justify the higher manipulated ERR or adjust ERR downward in response to the release of SFAS 132R.

In summary, these previous pension-related earnings management literature either investigates the earnings management through the pension assumptions or the coping behavior in response to the pension-related accounting standard change. However, no matter how these previous literature set up their research angle, they all examine earnings management through the DB plans. Litter is known about the relationship between earnings management through pension plans and earnings management through accruals or real activities. In this paper, I use the events of freezing and termination of the DB plans to investigate this issue. Freezing and termination of the DB plans provide an endogeneous shock that changes the firms' pension plans structure and pension expense compositions. After the pension plan freezing, the firms slowly convert the DB plans to the DC plans. When firms discontinue the defined benefit plan, the firms lose their chance to use pension plan assumptions to manipulate earnings, because pension assumptions only are available in DB plans.

Before investigating the relationship between earnings management through pension plans and earnings management through accruals or real activities., I need to investigate the strategy of earnings management through pension plans of the firms that plan to freeze their plans. Comprix and Muller (2010) provide evidence that managers adjust pension assumptions downward before DB plans hard freezing to exaggerate the economic burden of their pension plans so they could have a negotiation advantage with the labor union to hard freeze the pension. A downward managed ERR decreases the expected return from the pension plans which is one major part of the pension expense. Expected return decreases pension expense. Thus, a downward managed ERR increases periodic pension expenses. A downward managed DR increases the PBO which is the pension liability for determining the pension status. Thus, a downward managed DR exaggerates the negative funding status of the pension plan. For most of the employees, the DB plans have a higher payoff in the future and are financially securer than the DC plans. When firms choose to freeze the DB plans and switch to DC plans, they will encounter resistance from the employees since the firms are transferring pension financial burden and uncertainty of pension benefits outcomes from the firms to the employees with the switching. By exaggerating the economic burden of the pension plans, the managers could gain a bargaining advantage during the negotiation with the labor union and reduce the resistance from the labor union and employees to freeze or terminate the DB plans. The context of Comprix and Muller's (2010) research is based on firms with the labor union. The question that arises from their research is whether

the resistance from employees against pension freezing or termination applies to all the firms who intend to change the DB plans. A pension plan is part of the employee's compensation package. A freeze of DB plans generally implies a reduction of future retirement income for employees. I can reasonably estimate that the employees would not easily accept the reduction of their future pension benefits due to the pension freezing, termination, or conversion to DC plans. To successfully push the freezing decision to get passed without strong resistance from their workers, employers have an incentive to overstate pension expenses and pension liabilities before DB plan conversions. In other words, employers are likely to manage earnings to show that the DB plans are quite a burden for the firms, no matter whether there is a union existing in the firm. The employees may fear a reduction of the value of their pensions if the pension plans are not managed well and thus less resistant to pension freezing.

H1: To make the pension plans look as costly as possible, firms with DB plans select downward biased ERR and DR pension assumptions before plan hard freezing and in the freezing year.

One significant unwelcomed outcome of adopting a lower DR is the increase in the projected pension benefit obligations (PBO), which is one of the components for determining funding status. A lower discount rate results in higher PBO and lower funding status. The minimum contributions required by law heavily rely on the funding status. Prior Pension Protection Act of 2006 (PPA 2006), the required

minimum contributions to single-employer DB plans were the greater of the amount required under the deficit reduction contribution ("DRC") rules, or the contributions required under the ERISA funding rules. The employers must contribute a specific portion of underfunded liabilities to the plan to improve the funding status a specified if the DRC applies. Contributions under DRC are required if the funding status is below 90% on a current liability basis or below 80% for plans that have been underfunded by 10% in two consecutive years during the past three years. Depending on the funding status, DRC contribution percentages range from 18% to 30% of the underfunded amount. PPA 2006 replaced the two-tiered system with a single funding standard. Beginning with plan years 2008, the minimum required funding is based on the plan's "normal cost" for the plan year and the differences between PBO and the fair value of the plan assets (shortfall contribution). The companies are allowed to amortize the underfunded amounts over 7 years. Normal cost refers to the present value of benefits of all active participants that a plan expects to pay in the future that accrues during the year. Under the new regimes, contributions are required for a plan year if the accumulated pension liabilities, including the plan's normal cost during the year and the present value of plan's liability on the measurement date, is more than the fair value of the plan's assets.

No matter which regimes the firms stay under, the required minimum contributions increase when the firms' underfunding status becomes worse, especially under the regime post-PPA 2006. Given the fact that most of the firms are underfunded (average

funding status is around 83% in descriptive statistic table 1), adopting a lower discount rate will increase the required minimum contribution. In other words, to push the plan for freezing pension plans, the firms need additional cash contributed to their plans prior to the freezing. Firms usually have three resources for cash inflows: operating, investing, and financing. Cash inflows from investing activities involve plan assets disposal which usually takes a long time to find the potential buyer and significantly impacts firms' future profit-generating ability. Obtaining cash from financing also takes a long time and increases firms' future financial burden. Neither of these two pipelines is likely used by managers for saving cash for short-term needs such as pension contributions. In this case, real earnings management, which involves realistic financial decisions which directly impact cash flows such as discretionary expenses cutting-off and production cost management, is a more practical and faster way to save cash to meet the short-term needs for the additional pension contributions.

Therefore, unlike real-earnings management which is investigated in prior literature for meeting/beating revenue benchmark (Dechow and Sloan 1991, Bartov 1993, Bushee 1998), career concern (Farrell and Whidbee 2003, Fent 2004, Francis et al 2004), or bond covenants concern (Watts and Zimmerman 1990 and Burgstahler and Dichev 1997), I hypothesize that the real-earnings management before pension hard-freeze focus on cash savings. Roychowdhury 2006 finds that suspect firms which slightly beat earnings benchmarks have a higher production cost if they are the

manufacturing firms. Most of the firms in my sample are manufacturing firms because the labor-intensive industry has more employees and holds a larger amount of pension assets and liabilities. They are more likely to freeze pension plans when the plans become burdensome. Overproduction in manufacturing firms will decrease the unit cost of the product, lower the cost of goods sold and increase current period earnings. When managers intentionally increase production more than necessary, they can amortize the fixed overhead cost over a larger amount of production units. "*As long as the reduction in the fixed costs per unit is not offset by any increase in marginal cost per unit, the total cost per unit declines" (Roychowdhury 2006).* However, if the firms want to save cash instead of beating the earnings benchmark, Underproduction is the right track to go because firms can save money by fewer materials purchased and less inventory that needs to be held. Hence, I hypothesize that firms will have a lower abnormal production cost prior to the pension freezing to save cash.

H2a: Ceteris paribus, pension freezing firms exhibit lower abnormal production costs than non-freezing firms in the year of freeze and the year immediately preceding the freeze.

Roychowdhury 2006 also finds that suspect firms which slightly beat earnings benchmarks have a lower abnormal discretionary cost. Reduction of discretionary expenditures, such as advertising expenses, maintenance expenses, administrative

expenses, and/or research & development expenses, will not only increase current period earnings but also save cash. Although a cut-off of discretionary expenditures lowers current cash expenditures and boosts current earnings, it will possibly decrease future cash flows and earnings. Because such manipulation sacrifices a firm's future growth by cutting down R&D costs, employee skill training, and necessary equipment maintenance. Graham et al. 2005 find that even though managers are aware of cutting R&D expenses will sacrifice the firm's future value, they will still do it to meet an earnings target. As one executive put it in the survey of Graham et al. 2005, "there is a constant tension between the short-term and long-term" objectives of the firm. This motivation should be also applied to the cash saving scenario before the pension freezing. The managers in pension freezing firms are likely to decrease discretionary expenses to meet the short-term needs of additional cash required for pension contributions.

H2b: Ceteris paribus, pension freezing firms exhibit lower discretionary expenses than non-freezing firms in the year of freeze and the year immediately preceding the freeze.

One main point that emerges from the preceding discussion is that the reduction of production and discretionary expenditures increase contemporaneous abnormal cash flow from operating (CFO). Price discounts and channel stuffing, which were discussed in Roychowdury 2006 as methods to manage earnings upward, are not

likely to be implemented by the managers during the pension freeze because taking such actions negatively impacts the cash flows. Instead, I expect the managers will increase the efforts to collect cash from customers and carry out stricter credit policies to bring in more cash. However, the pension contributions themselves are also cash-outflow. The increase in the legally required pension contribution brings down the CFO. It's ambiguous how the CFO changes in the pre-freezing period.

H2c: *Ceteris paribus, pension freezing firms will not exhibit a significant change in the abnormal CFO than non-freezing firms in the year of freeze and the year immediately preceding the freeze.*

Cohen et al. 2008 find a substitutional effect between real activities and accrual earnings management surrounding the passage of the Sarbanes-Oxley Act (SOX). They find accrual earnings management decreases and real-activities earnings management increases after the passage of SOX. Cohen and Zarowin (2010) finds that the frequency of real activities earnings management is positively related to the costs of accrual-based earnings management in the year of SEO. Zang 2012 finds that the firms choose accrual-based earnings management over the real activities earnings management if the latter is costly to them, due to the competition environment in the industry, the financial condition of the firm, the monitoring level of from the institutional investors, or the tax saving purpose. Her results also indicate that firms will choose real earnings management over accrual-based earnings management when accrual-based earnings

management is subject to a higher level of scrutiny in the post-SOX era, and accounting flexibility is limited because of accrual manipulation in prior years and shorter operating cycles. Overall, prior research confirms that accrual-based earnings management and real-activities earnings management substitute with each other when the ability to use one of them is constrained due to different factors.

According to the previous literature, the managers' incentives to manage earnings through pension plans are similar to the earnings management activities through traditional real and accrual-based earnings management (Asthana 2008, Chuk 2012, and Naughton 2019). Such incentives include beating analyst forecasts, increasing, compensation, avoiding earnings surprise, etc (Graham et al. 2005). The managers will take accrual-based earnings management or even sacrifice shareholder wealth to achieve certain earnings targets (Burgstahler and Dichev 1997, Brown 2001, Bartov et al 2002, Brown and Caylor 2005, Roychowdury 2006, Brown and Pinello 2007). When we consider earnings management strategy inside firms carrying DB plans. There are three types of earnings management: earnings management through pension assumptions, real activities, and accrual adjustment. In my setting for this paper, earnings management through pension assumptions is predicted to lower the net income because managers tend to adopt lower pension assumptions (lower ERR) for pushing DB plans to get frozen. After earnings are managed downward before the freezing, the managers might turn to accruals or real activities, or both as substitutions to smooth income. It is unclear which methods managers will use as a substitute for DB plan

assumptions for earnings management. For earnings management through real activities before the freezing, the impact of cash conservation through real activities on net income is ambiguous. On the one hand, decreasing production will result in higher unit costs and lower-income. On the other hand, decreasing discretionary expenses will result in lower total expenses and higher income. In other words, the overall effect of cash conservation through real activities on earnings is uncertain. The income-increasing earnings management through real activities is constrained because the target of real-activities earnings management becomes cash savings, instead of income boosting. Thus, the combined effect of earnings management through pension assumptions and real-activities cash savings on the earnings is uncertain in my setting. Even though the combined effect could potentially decrease reported income, it's questionable whether the managers have the incentive to smooth earnings by managing earnings upward through accruals as a substitution. Because reporting a lower income in the pre-freezing period also reduces the resistance against pension freezing from the employees. Hence, how the accrual-based earnings management changes prior to the pension freezing is a research question to investigate.

RQ1: Do the firms increase earnings management through accruals prior to the pension hard freeze?

Reducing the future cost associated with DB plans is often stated by the DB plan sponsors as the reason to freeze their pension plans. However, the sponsors'

responsibility for maintaining their pension plans to meet the legal requirement remains unchanged after the pension freeze. As stated in ERISA § 4041(c), sponsors are required to make minimum annual contributions to DB plans and freezing the pension plans won't remove the sponsors from making contribution. Also, after Pension Protection Act 2006 (PPA 2006) is passed 2006, the minimum required funding is enhanced, especially for underfunded firms. Considering these standards, employers' legal obligations to their DB plans remain as a major financial burden immediately after the pension freeze.

The same truth holds for the pension participants premium paid to Pension Benefit Guaranty Corporation (PBGC). PBGC is a government organization created by the ERISA in 1974. They are responsible for protecting retirement security and the retirement incomes for U.S. workers in the private sector. Pension sponsors must pay a flat-rate premium for each active participants in the plans and a variable-rate premium based on the level of the underfunded pension benefits. In other words, the premium paid to the PBGC depend on the number of participants and the funding status of the pension plans. The fact that the benefits stop accruing after the pension freezing won't change the required amount of premium paid to PBGC. Also, PBGC has recently increased the premium rates significantly since 2007 and there is no sign that the increase will stop in the near future, especially given the fact that the inflation rate is historically high at this moment.

Cost and risk are often cited by pension freezing firms as the main reason they freeze their pension plans. The pension freezing does reduce the cost and risks of supporting pension plans, but it does not mitigate these issues in the short term. First, pension freezing only reduces future costs by suspending the future accruals of pension benefits. Freezing plans stop accrue benefits for current participants but the sponsors are still responsible for vested benefits accrued before freeze. The already-accrued obligations, always in a large amount, are still a heavy burden for the freezing companies, especially under the scenario of most of the pension plans are underfunded now. The required contribution of fully funded plans is likely to be in a large amount for several years following a freeze. Second, employers often offer enhanced 401(k) matching or profit-sharing contributions after a freeze to compensate employees for pension freezing. These firms will face additional cash needs for the enhanced DC plans contributions. While the DB plan sponsors are allowed to amortize the required pension contributions over several years, they must make annual contributions to DC plans in full by the due date for the sponsors' income tax returns.

Overall, with so many uncertainties regarding firms' financial structure and pension plans forms, it is uncertain how the managers in the firms with DB plans react to pension freezing regarding cash management. How does the firm change the cash management strategy immediately after the pension freezing is a research question to

investigate:

RQ2: Do the firms continue to engage in cash conservation activities after the pension hard freeze?

The hard freezing of DB plans does not hamper the manager's ability to continue using DB plans to manipulate earnings because the freezing itself does not alter the pension plan structure. The freezing firms still hold pension plan assets and report relative pension expenses. Instead, the conversion from DB plans to DC plans after the freezing decrease the manager's ability to continue using DB plans to manage earnings. The managers may not have to find a substitution immediately after pension freezing.

For firms who freeze pension plans, their pension expense decreases dramatically because of the following reasons. First, pension benefit stops accruing. The service cost, one of the major components of net periodic pension cost, decreases to zero. Second, pension obligations stop growing because DB plans close to new employees. After the benefits are paid to the current retired employees, pension obligations in terms of PBO and interest costs associated with PBO gradually decrease. Third, pension assets do not stop generating returns. The expected return on plan assets, a negative item in pension expense calculation, will further bring down the periodic pension cost. The pension expense of the freezing firms decreases significantly after the freezing, especially for the firms that have large DB plans and relatively high pension expenses. The decrease

in reported expense for the pension termination/freeze companies will likely allow the firm to avoid reporting losses during the first several years after termination or freezing if the decrease in pension expense is higher than the increase in sponsors' contribution to DC plans. The underlying assumption for this assertion is that pension expenses decrease after the pension sponsors shift DB plans to DC plans. In theory, the contribution to the DC plan is the sole pension expense for pension sponsors after the shifting. I can reasonably estimate the pension expense decreases after the shift because the pension expense under the DC plan only involves the current pension benefit earned by the employees for the current period and take no responsibility for the future benefit accrual amount.

As stated in the previous chapter of this paper, the motivation for manipulating earnings in pension freezing firms is similar to the other firms, such as to avoid reporting losses (Ball and Brown 1968, Burgstahler and Dichev 1997), to meet/beat analyst forecasts (Burgstahler and Eames 1998, Ababanell and Lehavy 1998), or to meet/beat manager's forecast (Kasznik 1999). However, earnings management activities may not be necessary for achieving the managers' aim after the freezing. Because the earnings after the pension freezing improve by themselves for the reasons I mentioned previously. I can rationally expect these firms will not engage in income-increasing earnings management through other pipelines in the first few years of the post-pension frozen period. Instead, the decrease in pension expenses creates a cookie jar of earnings that the firms might engage in income decreasing earnings management immediately after

pension hard freezing. Overall, it is unclear how the managers will react to pension freeing regarding earnings management.

RQ3: Do the firms immediately engage in earnings management through pipelines other than pension plans after the pension hard freeze?

Previous research shows that pension plans have a payoff like inside debt. They function as inside debt to align the incentive between debtholders and shareholders (Sundaram and Yermack. 2007, Anatharaman et al. 2014, etc,) compared to DC plans, DB plans are more like an inside debt because they define the obligations which the companies are obligated to pay in the future. Instead, firms have no responsibility for assuring the future outcome of the DC plan. Ippolito 1986 states that firms with DB plans do not pay workers their marginal product of labor (MPL) each period. Instead, DB plans serve as a back-loaded compensation package, which implicitly promises to pay workers above their MPL in their latter years of employment in exchange for paying workers below their MPL in the early years of employment. In this sense, employees in firms with DB plans become long-term bondholders. However, in the event of plan switching from DB to DC plans, or the DB plans discontinued, the DB plans lose their inside debt incentive alignment function. Thus, managers will become more biased toward shareholders and more likely to make earnings management to maximize their equity-based compensation. Managers will likely alter the earnings management strategy after the DB plan termination because their financial role inside the firms as a

bondholder has gone. Choy et al. 2014 find that the freezing firms increase investment in more-risky R&D projects and increase the financial leverage after the freeze. They observe a decline in credit rating and an increase in investment return from pension assets for freezing firms after the freeze. Both the operating risk and financial risk increase after the freeze. Their findings are consistent with the theory that DB plans act as "inside debt" that aligns managers' interests with bondholders.

However, the anecdotal facts revealed by Wall Street Journal (WSJ hereafter) in 2006 and 2009 show different aspects that the top managers' pension plans are not affected by the freeze or termination. Two articles in WSJ, "As workers' pension wither, those for executives flourish" and "Pensions for executives on rise", mentioned that although the pensions for general employees get frozen or terminated, the pensions for top executives keep growing. As one article above states, quote "*Benefits for executives now account for a significant share of pension obligations in the U.S., an average of 8% at the companies above. Sometimes a company's obligation for a single executive's pension approaches $100 million.*". That said, the executives' pension plans are untouched after the pension freezing or termination and still act as "inside debt" that aligns the manager's interests with bondholders after the pension freeze or termination. In this sense, the managers may have less incentive to manage earnings to boost their equity-based earnings and be conservative regarding firms' investment decisions. The reason that the freezing firms take risky investment decisions which Choy et al. 2014 find after the freezing could not be the interests' alignment shifting but the financial

condition improvement by the freezing or termination. The freezing or termination companies have more resources available to invest in risky projects because the freezing/termination relieves some resources which need to be contributed to the pension plans without freezing/termination.

Moreover, as stated in the previous chapter of this paper, the freezing or termination itself decrease reported expenses dramatically, especially for the termination firms. The termination firms stop reporting all pension-related expenses after the termination. With already-boosted income from decreased pension expenses through pension termination, even though the termination firms lose the opportunity to continue to manage earnings through pension plans, the managers do not need to find alternatives to manage earnings immediately after the termination. Instead, the managers even would engage in income-decreasing earnings management to smooth earnings. Overall, based on all the arguments above, it's uncertain how the termination firms manage earnings after the freezing.

RQ4: Do the firms immediately engage in earnings management through pipelines other than pension plans after the pension hard freeze?

3. Sample selection and research design

3.1 sample selection

The first step of sample selection is identifying the pension hard freeze firms from the Compustat Pension database. Following Comprix and Muller (2010), I identify the hard freeze firms by checking whether the pension service cost goes from non-zero to zero.

This captures both the hard freeze firms and termination firms. I require that the pension assets and pension obligations are not changed to zero to separate the terminations firms from the sample. For hard freezing firms, the pension assets and PBO keep unchanged or change slightly. Any fiscal year with missing service cost, PBO, or plan assets is deleted. The above sample selection procedures identify 574 hard freeze firms in the dataset. All these firms are then merged back with the Compustat Annual database and I require all the variables in the empirical tests exist in the dataset. The number of hard freezing firms decreases to 372. The total available firm-year observations of hard freezing firms are 6,159 and the DB plan non-changing firm-year observations are 11,691. I matched the DB plan non-changing firms with the freezing firms based on the same industry, firm-year, and the closest funding status. This matching process produces 12,100 matched firm-year observations, with 6,050 freezing firm-years and 6,050 DB plan non-changing firm-years separately.

The termination firms are obtained from the dataset by requiring the pension service cost, the pension assets, and pension liabilities decreased to zero in the event year t. The number of termination firms is 167 and the total available firm-year observations are 5,779. I matched the DB plan non-changing firms with the termination firms based on the same industry, firm-year, and the closest firm assets. This matching process produces 9,062 firm-year observations, with 4,531 termination firm-years and 4,531 DB plan non-changing firm-years separately.

3.2 Research Design

3.2.1 Earnings management through pension assumptions

I follow Comprix and Muller 2010 to run the following regression models to test hypothesis 1.

$$ERR = \sum_{t=1990}^{2020} \alpha_{0,t} + \sum_{i=2}^{48} \alpha_{0,i} + \alpha_1 Freeze_0 + \alpha_2 Freeze_{-1} + \alpha_3 Freeze_{-2} + \alpha_4 Freeze_{-3} + \alpha_5 Funding + \alpha_6 SquareFunding + \alpha_7 ARR + \alpha_8 PensionIncome + \alpha_9 PensionSenstivity + \alpha_{10} Firmsize + \alpha_{11} Loss + \alpha_{12} SalesChange + \alpha_{13} Leverage + \epsilon_a \quad (1)$$

$$DR = \sum_{t=1990}^{2020} \alpha_{0,t} + \sum_{i=2}^{48} \alpha_{0,i} + \alpha_1 Freeze_0 + \alpha_2 Freeze_{-1} + \alpha_3 Freeze_{-2} + \alpha_4 Freeze_{-3} + \alpha_5 Funding + \alpha_6 SquareFunding + \alpha_7 ARR + \alpha_8 PensionIncome + \alpha_9 PensionSenstivity + \alpha_{10} TaxRate + \alpha_{11} Leverage + \epsilon_a \quad (2)$$

Following Comprix and Muller (2010), the samples in equation (1) and equation (2) are set to firm-year observations of hard freezing firms and all DB plan non-freezing firms. My main prediction is that employers carrying the DB plan chosse downward biased ERR and DR pension assumptions in the freeze year. Also, to avoid the dramatic decreases in the ERR and DR attracting additional scrutiny from auditors, managers are likely to adopt downward biased ERR and DR in the years immediately preceding the freeze year. Both regression models include control variables which capture the other determinants of the ERR and DR assumptions respectively. In equation (1), *Funding* and *SquareFunding* are included because the pension assets allocation is related to the pension funding level. *Funding* is the fair value of pension plan assets scaled by the

PBO. *SquareFunding* is the square of the variable *Funding.* Previous literature such as Bader 1991, Amir and Benartzi 1998, and Amir et al. 2010 find that there is a relationship between the funding status and pension assets allocation. Equities are less popular in the pension plans with extremely overfunded and underfunded funding status, while more popular in the moderately funded plans. Thus, I expect a positive relationship between *ERR* and *Funding* and a negative association between *ERR* and *SquareFunding*. *ARR* is included to capture the relationship between the ARR and the ERR. *ARR* is the actual rate of return of plan assets, calculated as the actual return of plan assets divided by the lagged value of total pension plan assets. *Firmsize*, *Loss,* and *SalesChange* are included to capture risk. *Firmsize* is the natural log of total pension assets. *Loss* is an indicator variable equal to 1 if the firms report losses. *Salechange* is the percentage change in sales. Smaller firms, loss firms, and firms with fewer sales growth opportunities typically are riskier. Friedman 1983, Bodie et al., 1987 and Amir et al. 2010 find that more risky firms tend to invest in less risky pension assets, such as bonds, in their investment portfolio. Thus, I predict a negative association between *ERR* and these control variables.

I also include control variables to capture managers' motivations to opportunistically choose specific pension assumptions. *PensionIncome* is included to capture the negative association between negative pension cost and ERR. *PensionIncome* is an indicator variable equal to 1 if the firm reports positive pension income (negative pension expenses) and 0 otherwise. Comprix and Muller 2006 find that compensation committees asymmetrically put more weight on pension income compared to pension

expenses in CEO cash compensation contracts and provide managers to choose upward biased ERR to report a pension income. *PensionSenstivity* and *leverage* are included to capture managers' incentive to opportunistically choose relatively higher ERR when plan sponsors' earnings are more sensitive to the total amount of pension assets and when the leverage is high. *PensionSensitivity* is the fair value of pension plan assets scaled by the absolute value of operating income. *Leverage* is the long-term liabilities scaled by total assets. Bergstresser et al. 2006 find a positive relationship between upward managed ERR and pension sensitivity of net income to pension cost. Thus, I predict a positive association between *ERR* and *PensionSenstivity*.

In equation (2), I exclude *Firmsize*, *loss*, *SalesChange*, *Funding,* and *SquareFunding* because these variables are not the determinants of the DR. A new variable *Underfunded* is included to capture the determinants of DR in addition to the control variables the same as the control variables in equation (1). Underfunded is the indicator variable equal to 1 if the firm's fair value of pension assets is less than the PBO, and 0 otherwise. *Underfunded* capture the managers' incentive to adopt a relatively higher DR when the firms are underfunded because a higher DR will improve pension funding status as it decreases the projected value of pension liabilities.

3.2.2 Accrual based earnings management

Modified Jones Model is used to estimate the discretionary accrual. I use cross-sectional data which requires at least 15 firm years available in an industry (two-digit SIC) to estimate the expected discretionary accrual. The model is as follows:

$$TAit = \delta 0/ASSETSit\text{-}1 + \delta 1 \Delta SALESit + \delta 2 PPEit + \upsilon it \quad (3)$$

Where *TAit = Total Accruals (Scaled)*
ASSETSit-1 = Total Assets of period t-1
SALESit = Change of sales scaled by lagged total asset
PPEit = Gross property, plant, and equipment scaled by lagged total assets

TA is defined as the differences between *EBXI* (earnings before extraordinary items and discontinued operations) and *CFO* (operating cash flows from continuing operations). *ASSETSTit-1* is the total assets of the previous period. *SALESit* represents the change in sales revenues from the last period. *PPEit* is the gross value of property, plant, and equipment. The industry-level normal accrual is estimated from equation (3), and the difference between total accruals of specific firms and fitted normal accruals is my measure of discretionary accruals *AM*.

3.2.2 Real-activities earnings management

I follow Roychowdhury 2006 to estimate the proxies of real-activities earnings management. Three metrics are used in Roychowdhury 2006 for real earnings management detection: the abnormal cash flow from operations, abnormal discretionary expenses, and abnormal production costs. The manipulation methods investigated by Roychowdhury 2006 impact the abnormal level of these three variables as follows:

1. The temporary manipulation of timing of sales induces the changes in the abnormal cash low from operations. By providing time sensitive sales discount and/or more

lenient credit terms, the managers temporarily boost the sales for a specific period. If the margins are positive, the boosted sales inflate current period reported earnings. However, the cash flows from operations will decrease since the company boosted sales by cutting prices and providing more lenient credit terms.

2. Reduction of discretionary expenditures, such as advertising expenses, maintenance expenses, administrative expenses, and/or research&development expenses, will increase current period earnings. Although a cut-off of discretionary expenditures lowers current cash expenditures and boosts current earnings, it will possibly decrease future cash flows and earnings. Because such manipulation sacrifices a firm's future growth by cutting down R&D costs, employee skill training, and necessary equipment maintenance.

3. Overproduction in manufacturing firms will decrease the unit cost of the product, lower the cost of goods sold and increase current period earnings. When managers intentionally increase production more than necessary, they can amortize the fixed overhead cost over a larger amount of production units. The unit cost of production will decrease if the increase in the marginal cost per unit is greater than the reduction in the fixed cost per unit *(*Roychowdhury 2006*)*. However, the increased inventory holding costs as a result of overproduction couldn't be recovered immediately in the same period through sales. Thus, cash flow from operations for such firms will be lower than normal given the sales level.

I estimate the normal CFO, discretionary expenses, and production costs using the model originally developed by Dechow et al. 1998 and modified by Roychodhury 2006. I express normal CFO as a linear function of sales and change in sales in the current period. To estimate this model, I run the following cross-sectional regression for each industry and year.

$$\frac{CFO_{it}}{Assets_{it-1}} = k_1 \frac{1}{Assets_{it-1}} + k_2 \frac{SALES_{it}}{Assets_{it-1}} + k_3 \frac{\Delta SALES_{it}}{Assets_{it-1}} + \epsilon_{it} \quad (4)$$

Where CFO_{it} *= Cash flow from operations at the end of period t*
$Assets_{it-1}$ *= Total Assets at the end of period t-1*
$SALES_{it}$ *= Sales at the period t*
$\Delta SALES_{it}$ *= The change in sales at the period t*

The abnormal cash flow from operations is the actual CFO minus the fitted normal CFO estimated from the equation (4).

The normal discretionary expenses could be expressed as a linear function of sales in the current period.

$$\frac{DISEXP_{it}}{Assets_{it-1}} = k_1 \frac{1}{Assets_{it-1}} + k_2 \frac{SALES_{it}}{Assets_{it-1}} + k_3 \frac{\Delta SALES_{it}}{Assets_{it-1}} + \epsilon_{it} \quad (5)$$

Where $DISEXP_{it}$ *= The discretionary expenditures of period t*
$Assets_{it-1}$ *= Total Assets at the end of period t-1*
$SALES_{it}$ *= Sales at the period t*
$\Delta SALES_{it}$ *= The change in sales at the period t*

However, as stated in Roychowdhury 2006 and Cohen and Zorawin 2010, if the managers manage sales upward to increase reported earnings in a certain year, the residual from equation (5) will be relatively low, even though the managers do not intentionally decrease discretionary expenses. Thus, the normal discretionary expenses are expressed as a linear function of sales in the lagged period.

$$\frac{DISEXP_{it}}{Assets_{it-1}} = k_1 \frac{1}{Assets_{it-1}} + k_2 \frac{SALES_{it-1}}{Assets_{it-1}} + \epsilon_{it} \quad (6)$$

Where $DISEXP_{it}$ *= The discretionary expenditures of period t*
$Assets_{it-1}$ *= Total Assets at the end of period t-1*
$SALES_{it}$ *= Sales at the period t*

The production costs are defined as the sum of COGS and changes in inventories during the year. The normal COGS could be expressed as a linear function of contemporaneous sales:

$$\frac{COGS_{it}}{Assets_{it-1}} = k_1 \frac{1}{Assets_{it-1}} + k_2 \frac{SALES_{it}}{Assets_{it-1}} + \epsilon_{it} \quad (7)$$

Where $COGS_{it}$ *= Cost of goods sold in period t*
$Assets_{it-1}$ *= Total Assets at the end of period t-1*
$SALES_{it}$ *= Sales at the period t*

The model of the normal level of change in inventory is estimated as:

$$\frac{\Delta INV_{it}}{Assets_{it-1}} = k_1 \frac{1}{Assets_{it-1}} + k_2 \frac{\Delta SALES_{it}}{Assets_{it-1}} + k_3 \frac{\Delta SALES_{it-1}}{Assets_{it-1}} + \epsilon_{it} \quad (8)$$

Where ΔINV_{it} *= The change of inventory in period t*
$Assets_{it-1}$ *= Total Assets at the end of period t-1*
$\Delta SALES_{it}$ *= The change in sales in period t*
$\Delta SALES_{it-1}$ *= The change in sales in period t-1*

To capture the total effects of real earnings management on the net income, I follow Cohen and Zorawin 2010 and Zang 2012 to compute an aggregate earnings management proxy *RM*. I multiply the abnormal discretionary expenses by -1 and add them to the abnormal production costs. The higher this aggregate measure, the more likely the managers are to manage earnings upwards through real earnings management. To capture the total effects of real earnings management on the cash, I create two cash management proxies CM_1 and CM_2. For CM_1, I multiply both abnormal discretionary

expenses and abnormal production costs by -1 and add them up. For CM_2, I multiply both abnormal discretionary expenses and abnormal production costs by -1 and add them with CFO. The higher these two aggregate measures, the more likely the managers are to save cash through real earnings management.

3.2.3 Regression models to test the cash conservation through real activities and the changes in earnings management through accruals and real activities

To test cash conservation through real activities and the changes in earnings management through accruals and real activities of the hard freezing firms, I follow the models developed by Roychowdury 2006 and used in Zang 2012.

$$Y_t = \alpha + \beta_1(SIZE)_{t-1} + \beta_2(MTB)_{t-1} + \beta_3(Net\_Income)_{t-1} + \beta_4(Funding)_{t-1} + \beta_5 Pre + \\ + \beta_6 Pre * Funding_{t-1} + \varepsilon_t \quad (9)$$

$$Y_t = \alpha + \beta_1(SIZE)_{t-1} + \beta_2(MTB)_{t-1} + \beta_3(Net\_Income)_{t-1} + \beta_4(Funding)_{t-1} + \beta_5 Post + \\ + \beta_6 Post * Funding_{t-1} + \varepsilon_t \quad (10)$$

$$Y_t = \alpha + \beta_1(SIZE)_{t-1} + \beta_2(MTB)_{t-1} + \beta_3(Net\_Income)_{t-1} + \beta_4(Funding)_{t-1} + \\ \beta_5 HFirms + \beta_6 Pre + \beta_7 Hfirms * Pre + \beta_8 HFirms * Pre * Funding_{t-1} + \beta_9 Post + \\ \beta_{10} Hfirms * Post + \beta_{11} HFirms * Post * Funding_{t-1} + \varepsilon_t \quad (11)$$

The control variables *SIZE, MTB, Net_Income* are included to control for the systematic variation in the production costs and discretionary expenses with growth opportunities, size, and current year firm performance. *SIZE* is the log value of the market value of the equity at the beginning of the year. *MTB* is the ratio of the market value of equity to the book value of the equity at the beginning of the year. *Net_Income* is the current year net income scaled by lagged total assets. *Pre* is an indicator variable that equals 1 if the firm years are the freeze year 0 and the year

immediately preceding the freeze year t-1. *Post* is an indicator variable that equals 1 if the firm years are the years immediately after the freeze year t+1 and t+2. *HFfirms* is an indicator variable equal to 1 if the firms are the pension freezing firms, and 0 otherwise. *HFfirms*Pre* is the interaction term between *HFfirms* and *Pre*. *HFfirms*Pre*Funding* is the three-way interaction term among *HFfirms*, *Pre*, and *Funding*. *HFfirms*Post* is the interaction term between *HFfirms* and *Post*. *HFfirms*Post*Funding* is the three-way interaction term among *HFfirms, Post*, and *Funding*. All the control variables are expressed as deviations from the respective industry-year means because the dependent variables are deviations from normal levels for a specific industry year.

To test the cash conservation through real activities during the hard freezing event (*Hypotheses H2a, H2b, H2c, and RQ2*), the dependent variable Y_t are set to the *abnormal production cost*, *abnormal discretionary expenses, abnormal CFO*, and aggregated cash management proxies CM_1 and CM_2 in equations (9), (10), and (11). To test the changes in the earnings management through the discretionary accrual and real activities during the hard freezing event (*Hypotheses RQ1 and RQ3*), the dependent variable Y_t are set to the discretionary accrual proxy *AM* and real-activity earnings management proxy *RM* in equations (9), (10), and (11).

In equation (9), to test the cash conservation through real activities and the changes in the earnings management through the discretionary accrual and real activities before the hard freezing event *(Hypotheses H2a, H2b, H2c, and RQ1),* the sample is set to

4,077 firm-year observations of hard freezing firms only. In equation (10), to test the cash conservation through real activities and the changes in the earnings management through the discretionary accrual and real activities immediately after the hard freezing event (*RQ2 and RQ3*), the sample is set to 2,082 firm-year observations of hard freezing firms only. In equation (11), to compare the hard freezing firms with the DB plan non-changing firms, the sample is set to 12,100 one-on-one matched firm-year observations of hard-freezing firms and the DB plan non-changing firms.

To test the changes in earnings management through accruals and real activities of the termination firms, I follow the models developed by Roychowdury 2006 and used in Zang 2012.

$$Y_t = \alpha + \beta_1(SIZE)_{t-1} + \beta_2(MTB)_{t-1} + \beta_3(Net\_Income)_{t-1} + \beta_4 Post + \varepsilon_t \quad (13)$$

$$Y_t = \alpha + \beta_1(SIZE)_{t-1} + \beta_2(MTB)_{t-1} + \beta_3(Net\_Income)_{t-1} + \beta_4 Terminations + \beta_5 Post + \beta_6 Terminations * Post + \varepsilon_t \quad (14)$$

Terminations is an indicator variable equal to 1 if the firms are the DB plan termination firms, and 0 otherwise. *Terminations *Post* is the interaction term between *Terminations* and *Post*. All the other variable definitions are the same as these in the equation (9), (10), and (11). The dependent variable Y_t are set to the *abnormal production cost*, *abnormal discretionary expenses, abnormal CFO*, the discretionary accrual proxy *AM,* and real-activity earnings management proxy *RM* for both equations (12) and (13). In equation (13), the sample is set to the firm-year observations of termination firms only, ends at year t+2 after the termination year. In equation (14), to compare the termination

firms with the DB plan non-changing firms, the sample is set to 9,062 one-on-one matched firm-year observations of termination firms and the DB plan non-changing firms.

4. Descriptive Statistics and Results

4.1 Descriptive Statistics

[Insert Table 1 here]

Table 1 reports the descriptive statistics of pension hard-freezing firms, termination firms, and matched DB plan non-changing firms. Panel A and Panel B report the time distribution and industry distribution of hard-freeze events, respectively. Panel A shows the yearly distribution of hard freezing events. In my dataset, hard freezing starts in 1992 and arises significantly in 1998. Interestingly, one huge jump in the numbers of hard freezing events happened in 2004, increasing from 13 in 2003 to 20 in 2004. This happened four years after the Internet Bubble Burst. Another peak was in 2011, three years after the 2008 Financial Crisis. According to this distribution, the firms are more likely to hard freeze pension plans after a recession in the performance of the financial market. Panel B reports the hard freezing events by industry. Not surprisingly, the hard-freezing clusters in labor-intensive industries, such as manufacturing, mining, sales, and services industries.

Panel C demonstrates that the hard freezing firms are relatively smaller size firms in terms of total assets but carry larger size pension plans. The hard freezing firms are less

profitable than matched DB plan non-changing firms in terms of lower ROA and CFO and are more likely to report a loss. The average pension funding status of the freezing firms and non-changing firms are 0.800 and 0.787 respectively. This suggests that overall, the firms underfund their pension plans. T-statistics show that the funding status between the two groups is indifferent because these two groups are matched with similar pension funding statuses. The *PensionIncome* of the hard freezing firms is 0.194, significantly higher than the 0.125 reported by the non-changing firms. The hard freezing firms are more likely to report pension income (negative pension cost) because of the decrease in the pension cost after the freezing. On average, both reported *ERR* and *DR* are higher for the hard freezing firms but the *ARR* is indifferent. the discretionary accrual earnings management proxy *AM* and real-earnings management *RM* are indifferent between the two groups. The cash conservation proxies *CM1* and *CM2* are lower in the hard freezing firms.

Panel D compares the pension assumptions of pension freezing firms and non-changing firms two years pre- and post-freeze. The sample size for this table decreases because I require there is exactly one firm-year observation for five continuous years for the freezing firm. The reported *ERR* is lower in the hard freezing firms in both the pre- and post-periods. The reported *DR* is lower in the hard freezing firms in the pre-periods and higher in the post-periods but the differences are not significant. Both the *ARR* and funding level of hard freezing firms are lower compared to the non-changing firms in the pre-freezing periods and the post-freezing periods. The meanings of the time

distribution of ERR, ARR, and funding level are two folded. First, this is consistent with the results of freezing events time distribution in Panel A that the pension freezing is more likely to happen when the financial markets perform badly. Second, the lower ARR and worse funding level could be two additional reasons beyond obtaining a negotiation bargain that the freezing firms choose lower ERR in the pre- and post-freezing periods. Overall, the time distributions of ERR and DR in panel D are partially consistent with the prediction and the result in Comprix and Muller 2010.

Panel E reports the descriptive statistics for termination firms and matched DB plan non-changing firms. The termination firms are relatively smaller size firms in terms of total assets. The *Plansize* is indifferent between the two groups with a t-value of 1.18. Consistent with the descriptives shown in Panel C, the termination firms are also less profitable than matched DB plan non-changing firms in terms of lower ROA and CFO and are more likely to report a loss. The average pension funding status of the termination firms and non-changing firms is indifferent with a t-value of -0.37. The *PensionIncome* of the termination firms is 0.220, significantly higher than the 0.128 reported by the non-changing firms. The termination firms are more likely to report pension income (negative pension cost) because the pension cost decreases to 0 after the termination. On average, both reported *ERR* and *DR* are indifferent between the two groups. The termination firms' actual return on pension assets is lower than the non-changing firms. The discretionary accrual earnings management proxy *AM* is lower in the termination firms and real-earnings management *RM* is higher.

4.2 Results

Table 2 reports the regression results of equation (1). Consistent with the prediction, the ERR in the freeze year is significantly negative at -0.281, suggesting the ERR managed downwards by 28.1 basis points in the freezing year compared to all other firm years. The *ERR* in the year immediately preceding the freezing year is significantly negative at -0.182, suggesting the ERR managed downward by 18.2 basis points. However, unlike the findings in Comprix and Muller 2010, the ERRs in -2 and -3 freeze years are negative but not statistically significant. Most of the control variables are statistically significant and some signs are as expected. *ARR* is significantly positive at 0.006, indicating that the firms with higher ARR are more likely to choose higher ERR. *Leverage* is significantly positive, indicating that the firms with more debt are more likely to choose higher ERR. *Pensionincome* is significantly positive at 0.226, consistent with the finding in Comprix and Muller 2006 that the managers opportunistically choose higher ERR when pension income is reported. *PensionSensitivity* is positively significant at 0.120, suggesting that firms tend to report higher ERR when the reported income is more sensitive to the total amount of pension assets. The signs of *Firmsize* and *Loss* are as expected. *Firmsize* is significantly positive at 0.080. *Loss* is significantly negative at -0.236. These results are consistent with the prediction that less risky firms tend to invest in less risky pension assets, such as equity. The coefficients of *Funding*, *SquareFunding*, and *SalesChange* are not highly significant.

[Insert Table 2 here]

Table 3 reports the regression results of equation (2). Similar to the results in table 2, the DR in the freeze year is negative and highly significant at -0.307, indicating the DR managed downward by 30.7 basis points in the freeze year. For a pension plan with a 30-year duration and a 5% unbiased discount rate, assuming this pension plan has a $1,000,000 future pension obligation, the projected benefit obligations with a 5% and 4.7% discount rate are $231,379 and $252,525 respectively. This means that the 30.7 basis points downward managed DR could translate into an increase in pension liabilities by almost 10%. The DR in the year immediately preceding the freeze year is significantly negative at -0.221, indicating the DR managed downward by 22.1 basis points in the year preceding the freeze year. The DRs in years -2 and -3 are positive but not significant. Most of the control variables are statistically significant and most of the signs are as predicted. However, contradictive to the prediction, underfunded is statistically negative at -1.141, indicating underfunded firms tend to choose a lower DR. This needs further investigation because it involves a reversal selection problem: whether the underfunded firms choose a lower DR or a lower DR is the reason the firms become underfunded.

Overall, the empirical results shown in table 2 and table 3 are consistent with the findings in Comprix and Muller 2010. The managers in the firms with DB plans opportunistically choose lower ERR and DR in the freeze year and the year immediately preceding the freeze year to make their plans appear more costly. This strategy reduces

the resistance from employees against the decision of pension freezing, with or without union appearance. However, such a strategy is costly because a lower ERR increases pension cost and decreases net income, and a lower DR increases pension liabilities and potentially increases the amount of required contributions to the pension plans.

[Insert Table 3 here]

Table 4 reports the results of the comparison of the cash conservation through real activities in the pre-freezing years -1 and 0 with the rest of the pre-freezing years in the hard freezing firms. Consistent with hypothesis *H2a*, the coefficient on *Pre* is negative at -0.235 and statistically significant at 1% confidence level with a t-value of -2.77 when the dependent variable is set to the *abnormal production cost*. This indicates that the hard freeze firms reduce the production immediately before the freezing. The interaction term of *Pre*Funding* suggests that the hard freeze firms engage in less cash conservation activities in the year -1 and 0 if the previous year's funding status is higher. For the result of hypothesis *H2b*, The coefficient on *Pre* is negative at -0.030 but not highly significant with a t-value of -1.43 when the dependent variable is set to *the abnormal discretionary expenses.* For the result of hypothesis *H2c*, the coefficient on *Abnormal CFO* is positive at 0.015 but not statistically significant. When the dependent variables are set to the aggregate cash conservation proxies *CM1* and *CM2,* the coefficients on *Pre* and interaction terms *Pre*Funding* are both significantly positive. These results indicate that the hard freezing firms engage in more cash conservation through real activities in the year -1

and 0 and would decrease the cash conservation if the previous year's funding status is better.

[Insert Table 4 here]

Table 5 reports the results for *RQ1*. To test *RQ1*, the dependent variable Y_t are set to the *AM* and *RM*. The coefficient on *Pre* is -0.025 and statistically significant at 5% confidence level with a t-value of -2.44 when the dependent variable is set to *RM*. This result suggests that the aggregate impact of cash conservation activities on the earnings is managing the earnings downward. Even though both the earnings management through pension assumptions and earnings management through activities manage earnings down downward in the pre-freezing years -1 and 0, there is no evidence that the managers manage earnings upward through accruals to smooth income. The coefficient on *Pre* is -0.007 but not statistically significant with a t-value of -0.35 when the dependent variable is set to *AM*. These results suggest that the pension freezing firms tend to report a lower income in the pre-freezing years -1 and 0 to demonstrate the financial difficulties in the firms and reduce the resistance against pension freezing from the employees.

[Insert Table 5 here]

Table 6 reports the results of the comparison of the cash conservation through real activities in the post-freezing years +1 and +2 with the rest of the post-freezing years in the hard freezing firms. I do not find evidence that the pension freezing firms exhibit a higher level of cash conservation activities in the post-freezing years +1 and

+2 compared to the other post-freezing years. None of the coefficients of *Post* on all specifications are statistically significant.

[Insert Table 6 here]

Table 7 reports the results of the comparison of the earnings management through accruals and real activities in the post-freezing years +1 and +2 with the rest of the post-freezing years in the hard freezing firms. Similar to the results reported in table 6, I do not find evidence that the pension freezing firms engage in earnings management through accruals or real activities in the post-freezing years +1 and +2 compared to the other post-freezing years. None of the coefficients of *Post* on all specifications are statistically significant.

[Insert Table 7 here]

Table 8 reports the results of the comparison of the cash conservation through real activities between the hard freezing firms and the DB plan non-changing firms in the pre- and post-freezing periods. Consistent with the hypothesis *H2a and H2b,* the coefficients of the interaction terms *HF*Pre* are statistically significant at -0.318 and -0.115, and the coefficients of the aggregate cash conservation proxies CM1 and CM2 are statistically significant at 0.433 and 0.521 when the dependent variables are set to *the abnormal production costs* and *the abnormal discretionary expenses* respectively. These results suggest that compared to the DB plan non-changing firms, the hard freezing firms engage in more cash conservation activities through less production and fewer investments in discretionary expenses in the pre-freezing years -1 and 0.

The coefficients of the interaction term *HF*Pre*Funding* is -0.318 and statistically significant at 1% confidence level with a t-value of -3.99. This indicates that compared to the non-changing firms, the hard freezing firms produce more when the lag funding status is higher. The signs of the coefficients of *HF*Pre*Funding* are as expected when the dependent variables are set to *the abnormal production costs*, *the abnormal discretionary expenses, CM1, and CM2* but not highly significant. None of the coefficients of the key interested variables for the dependent variable *the abnormal CFO* are significant.

The coefficient of the interaction terms *HF*Post* are -0.337, 0.435, and 0.484 and are statistically significant when the dependent variables are *the abnormal production costs*, *the abnormal discretionary expenses, CM1*, and *CM2* respectively. The coefficient of the interaction term *HF*Post* is -0.097 but is not highly significant when the dependent variable is the abnormal discretionary expenses. Overall, these results indicate that compared to the non-changing firms, the hard freezing firms still engage in cash conservation activities through less production and fewer investments in the discretionary expenses in the post-freezing years +1 and +2. These results suggest that the hard freezing firms still need additional cash for funding the DB plans and the enhanced DC plans immediately after the freezing. As I discussed in the development of *RQ2*, the hard freeze firms may be still under the pressure for high pension-related expenditures because they are legally mandated to contribute to the DB plans if the plans are underfunded and to the enhanced DC plans if the companies

introduce such plans after the freezing (most of the companies do). The coefficients of the interaction term *HF*Post*Funding* are 0.273, 0.058, -0.332, and -0.413 when the dependent variables are *the abnormal production costs*, *the abnormal discretionary expenses, CM1*, and *CM2* respectively. All the coefficients are statistically significant except for the dependent variable is the abnormal discretionary expenses. These results suggest that the cash conservation activities in the hard freezing firms immediately after the freezing are less pronounced when the lag funding status is better.

[Insert Table 8 here]

Table 9 reports the results of the comparison of the changes in the earnings management through accruals and real activities between the hard freezing firms and the DB plan non-changing firms in the pre- and post-freezing periods. Consistent with the previous literature which finds that managers manage earnings through real activities (Roychowdury 2006, Cohen et al. 2008, Cohen and Zorawin 2010, Zang 2012, etc.), when the dependent variable is *RM*, the coefficients on *HF*Pre* and *HF*Post* are -0.203 and -0.239 and statistically significant at 5% confidence level with a t-value -2.34 and -2.23, indicating the managers in the hard freeze firms manage earnings downward through real-activities in the pre- and post-freezing years. the coefficients on *HF*Pre* and *HF*Post* are not statistically significant when the dependent variable is the accrual earnings management proxy *AM*. This finding is consistent with the substitution relationship between accrual-based earnings management and real earnings management which are discussed in Cohen et al. 2010

and Zang 2012. When the earnings management through real activities is sufficient to achieve the earnings target, the managers do not need to manipulate earnings through accruals. The managers in the hard freeze firms manage earnings downward through real activities before the pension freezing because a lower reported income reduces the resistance from the employees against the pension freezing. The managers in the hard freeze firms manage earnings downward through real activities after the pension freezing because the managers want to smooth income after the freezing since the pension freezing itself increases the reported income.

[Insert Table 9 here]

Table 10 reports the results of the comparison of the changes in the earnings management through accruals and real activities in the termination firms between the pre- and post-freezing periods. None of the coefficients on the real earnings management proxies *RM, the abnormal production costs, the abnormal discretionary expenses,* or *the abnormal CFO* are significant. The coefficient on *Post* with the dependent variable of the accrual earnings management proxy *AM* is -0.014 and statistically significant at 5% confidence level with a t-value of -2.33. This suggests that the managers in the termination firms smooth earnings through downward managed accruals after the termination because the termination decreases reported total expenses.

[Insert Table 10 here]

Table 11 reports the results of the comparison of the changes in the earnings management through accruals and real activities between the termination firms and the DB plan non-changing firms in the post-freezing periods. None of the coefficients of the interested variable *Termination*Post* on the real earnings management proxies *RM, the abnormal production costs, the abnormal discretionary expenses,* or *the abnormal CFO* are significant. The coefficient on *Termination*Post* with the dependent variable of the accrual earnings management proxy *AM* is -0.018 and statistically significant at 10% confidence level with a t-value of -1.92. This suggests that compared to the non-changing firms, the managers in the termination firms smooth earnings through downward managed accruals after the termination because the termination decreases reported total expenses.

[Insert Table 11 here]

5. Future study

One of the main reasons that the DB sponsors freeze their plans is taking pension freeze as a pathway to close DB plans. Terminating a DB plan and replacing it with a DC plan was an extremely rare event among large sponsors. According to a recent study by Wills Towers Watson in 2020, "Retirement offerings in the Fortune 500:1998-2019", since 1998, only 5% of the fortune 500 firms have terminated their primary DB plan, meaning benefits were frozen and then settled via annuity purchases and/or lump-sum payments. The large size of pension obligations and severely underfunded funding status make the termination hard to conduct among the large

sponsors. Instead, a hard freeze provides a buffer period for these sponsors to gradually shift the pension coverage from DB plans to DC plans (401-k or cash balance plan for instance).

In a DB plan, the sponsors have considerable large discretions in determining pension assumptions, such as expected rate of return (ERR), discount rate (DR), and salary inflation rate (SIR). These pension assumptions are key determinants in calculating periodic pension expenses and pension funding status. Prior literature has documented plenty of evidence that the managers opportunistically manipulate these assumptions under various motivations, such as capital market, contracting, regulatory, and taxation motivations (Healy and Wahlen 1999). Amir and Benartzi 1998 investigate whether managers use ERR in biased or even opportunistic ways. They find that the cross-sectional variance in ERR could not be explained by the cross-sectional differences in pension fund investment strategies. The correlation between ERR and pension fund portfolios is weak. Their findings suggest that the managers manipulate ERR. However, they do not indicate why the managers manipulate ERR. Bergstresser et al. 2006 extend Amir and Benartzi's 1998 research and examine possible incentives for manipulating ERR. They find that companies with large amounts of pension assets and firms which engage in Mergers and Acquisitions adopt relatively higher ERR. Companies also set a higher ERR in a period of seasoned equity offering and the year of CEO stock options execution. Besides using ERR, DB sponsors also could manipulate earnings using high discretions over DR and SIR, especially when

regulations impose scrutiny on the ERR. Naughton 2019 finds that firms decrease discretion over ERR and pension discount rate (DR) presumably because these two pension accounting assumptions are subject to higher scrutiny after disclosure of pension assets allocation. At the same time, firms increase the discretion over salary inflation rate (SIR) which is not targeted by SFAS 132R.

Overall, the reason that managers of DB sponsors could achieve manipulate earnings through DB plans is the existence of large scope for discretions setting actuarial assumptions in pension accounting for DB plans. However, unlike DB plans, DC plans do not involve pension assumptions to determine contributions and pension expenses. In a DC plan, the sponsors make the cash contributions to the plans matching the portion from the employees. By shifting from DB plans to DC plans, the sponsors lose their opportunity to use pension assumptions to manipulate earnings through pensions. If the DB plans are intended to be converted into DC plans, the plan assets and pension obligations will phase out during the hard freeze period. This shifting will decrease the managers' power to manipulate earnings through pension plans and eventually lose the opportunity completely after the shifting. It is reasonable to predict that the managers need to find alternative earnings management tools to replace the DB plans in the transition periods. However, the challenges about this study are how to identify the firms with the conversion and the conversion period. Also, the types of DC plan which are replaced are needed to be confirmed because for some of the DC plans such as hybrid cash balance plans, the employers still hold plan

assets and make an investment from the assets. Hence, for such firms the managers will behave differently in terms of earnings management strategy compared to the firms who adopt a pure DC plan.

6. Conclusion

In this paper, I investigate whether the manipulations of pension assumptions such as expected rate of return and discount rate through pension plans affect the cash conservation activities and the earnings management through accruals and real activities during the DB plan hard freezing. Consistent with the findings in Comprix and Muller 2010, I find managers manage the expected rate of return estimate and discount rate estimate downward to make the pension plans look costly in the freeze year and the year preceding the freeze year. I provide the evidence that managers engage in cash conservation activities and real earnings management in response to the changes in funding status and pension income through the manipulation of pension assumptions before and after pension freezing. These results suggest that earnings management through pension assumptions affects the normal operations of the firm through real activities during the defined benefit plan pension freezing. I find that firms will engage in cash conservation through real activities to make an additional contribution to the DB plan when the funding status deteriorated due to a downward managed discount rate. I find that managers will continue to engage in cash conservation activities and manage earnings through real activities immediately following the hard freeze because the cost and risks of supporting pension plans are

still high. I confirm that there is a substitutional relationship between accrual-based earnings management and real earnings management during pension freezing. The managers in the freezing firms tend to manage earnings through real activities to reduce reported income to reduce the resistance against pension freezing from the employees before the pension freezing and manage earnings through real activities to reduce reported income to smooth the income after the pension freezing, with accrual earnings management untouched. The managers in the termination firms tend to manage earnings through accruals to reduce reported income to smooth the income after the pension termination, with the real activities earnings management untouched.

Appendix 1. Variable Descriptions

Abnormal accruals/AM	Measured as deviation from the predicted values from the corresponding industry-year regression $TA_{it} = \delta_0/ASSETS_{it-1} + \delta_1 \Delta SALES_{it} + \delta_2 PPE_{it} + \upsilon_{it}$
Abnormal CFO	Measured as deviation from the predicted values from the corresponding industry-year regression $\frac{CFO_{it}}{Assets_{it-1}} = k_1 \frac{1}{Assets_{it-1}} + k_2 \frac{SALES_{it}}{Assets_{it-1}} + k_3 \frac{\Delta SALES_{it}}{Assets_{it-1}} + \epsilon_{it}$
Abnormal discretionary expense	Measured as deviation from the predicted values from the corresponding industry-year regression $\frac{DISEXP_{it}}{Assets_{it-1}} = k_1 \frac{1}{Assets_{it-1}} + k_2 \frac{SALES_{it-1}}{Assets_{it-1}} + \epsilon_{it}$
Abnormal production costs	Measured as deviation from the predicted values from the corresponding industry-year regression $\frac{\Delta INV_{it}}{Assets_{it-1}} = k_1 \frac{1}{Assets_{it-1}} + k_2 \frac{\Delta SALES_{it}}{Assets_{it-1}} + k_3 \frac{\Delta SALES_{it-1}}{Assets_{it-1}} + \epsilon_{it}$
$ASSETS_{it-1}$	Total Assets of period t-1. Compustat data #6
ARR	The actual rate of return of pension plan assets. Compustat data # 246
CFO	Cash flow from operations. Compustat data #308
CM_1	-(Abnormal discretionary expenses + Abnormal production costs)
CM_2	-(Abnormal discretionary expenses + Abnormal production costs) + Abnormal CFO
COGS	Cost of goods sold. Compustat data #44
Debt	The ratio of long-term debt to total assets
Discretionary expenses/$DISEXP_{it}$	R&D (Compustat data #46) + Advertising (Compustat data #45) + SG&A (Compustat data #189), as long as SG&A is available, advertising and R&D are set to zero if they are missing
DR	The discount rate of pension liability. Compustat data #426
ERR	Expected rate of return of the pension assets. Compustat #333
Firmsize	The natural log of the total assets
Freeze	Indicator variable. 1 if the firm's defined benefit pension plans are hard frozen (subscripts indicate year relative to freeze decision), and 0 otherwise.
Funding	Funding status of the pension plan. Pension assets divided by the projected value of benefit obligations.

Hfirms	*HFfirms* is an indicator variable equal to 1 if the firms are the pension freezing firms, and 0 otherwise.
Leverage	The long-term debt divided by the sum of the market value of the equity and long-term debt.
Loss	Indicator variable. 1 if the firms report a loss, and 0 otherwise.
IBEI	Income before extraordinary items. Compustat data #18
ΔINV_{it}	The change of inventory.
MTB	Market-to-book ratio, Market value of the equity divided by the book value of the equity expressed as deviation from the corresponding industry-year mean
MVE	The market value of the equity. The closing price of the stock (Compustat data #199) multiplied by Common Share Outstanding (Compustat data #25)
Net Income	The income before extraordinary items (Compustat data #18) scaled by the lagged value of total assets (Compustat data #6), expressed as deviation from the corresponding industry-year mean
Pensionsize	Pension plan assets (Compustat data #287) divided by lagged total assets.
PensionIncome	Indicator variable. 1 if the firm reports pension income (i.e., negative pension cost), and 0 otherwise.
PensionSenstivity	Pension plan assets divided by the absolute value of operating income.
Post	Indicator variable that equals 1 if the firm years are the years immediately after the freeze year t+1 and t+2, and 0 otherwise.
PPE_{it}	Net property, plant, and equipment scaled by lagged total assets
Pre	Indicator variable that equals 1 if the firm-years are the freeze year 0 and the year immediately preceding the freeze year -1, and 0 otherwise.
Production costs	COGS (Compustat data #44) + change in inventory (Compustat data #3)
PSC	Pension service cost. Compustat data #331
RM	Abnormal production costs – Abnormal discretionary expenses
Net_Income/ROA	Return on Asset is net income scaled by the lagged value of total assets
$Sales/Sales_{it}$	Sales. Compustat data #12
SalesChange	The percentage change of sales amount from year t-1 to year t
$\Delta SALES_{it}$	The number change of sales amount from year t-1 to year t

SIZE	The natural log of the market value of the equity, expressed as deviation from the corresponding industry-year mean
SquareFunding	The square of the variable Funding.
SUSPECT_HF	Indicator variable. 1 if the firm freezes its pension plan, and 0 otherwise.
TA	Total Accruals: Non-cash current assets – change in current liabilities – current portion of long-term debt-depreciation and amortization.
TaxRate	Income taxes divided by the absolute value of pre-tax income.
Terminations	Indicator variable equal to 1 if the firms are the DB plan termination firms, and 0 otherwise.
Underfunded	Indicator variable. 1 if the firm's pension plan is underfunded (The market value of pension assets is less than the projected pension obligations)

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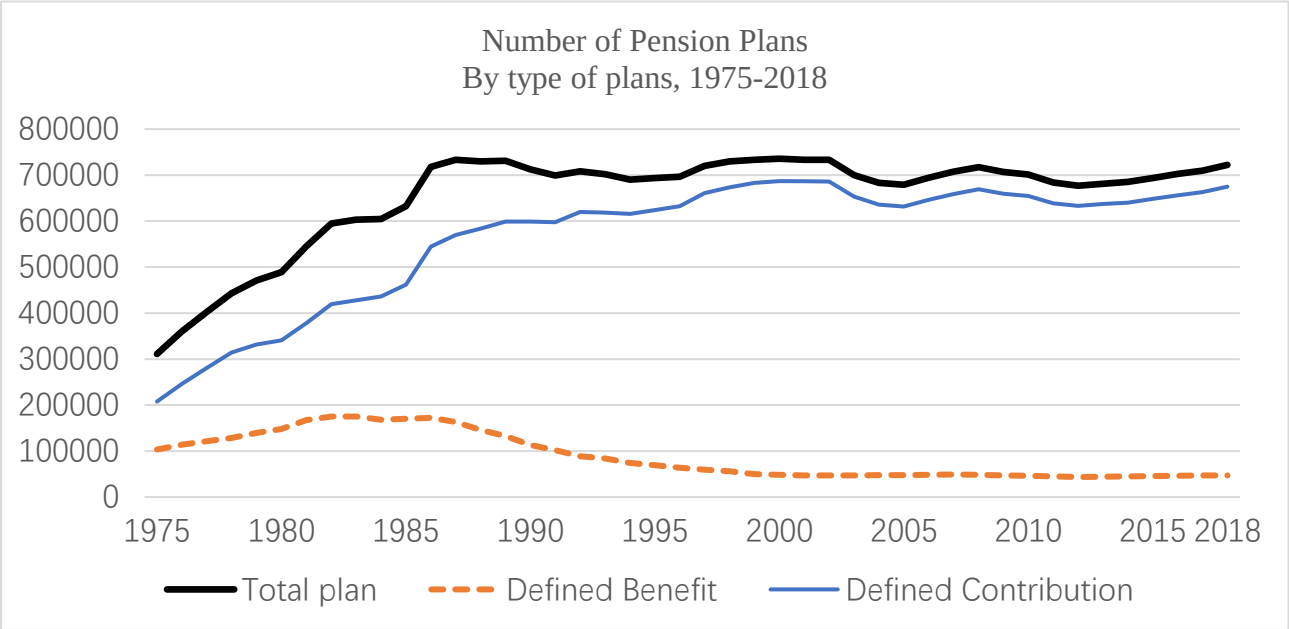
Figure 1: Number of Pension Plans By type of plans, 1975 – 2018



Source: Employee Benefits Security Administration of United States Department of Labor

Figure 2: Freezing Timeline

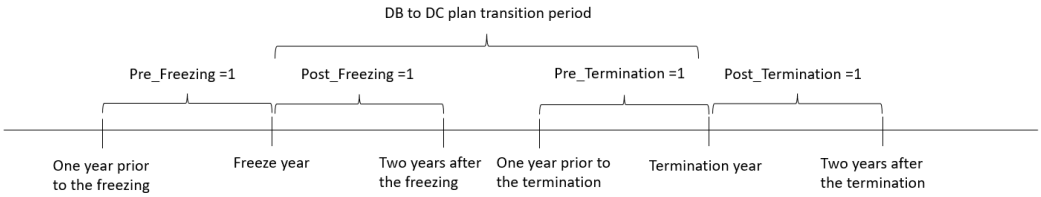


Table 1. Descriptive Statistics

Panel A: Hard-freezing time distribution

Data Year - Fiscal				
FYEAR	**Frequency**	**Percent**	**Cumulative Frequency**	**Cumulative Percent**
1992	3	0.81	3	0.81
1993	2	0.54	5	1.34
1994	5	1.34	10	2.69
1995	8	2.15	18	4.84
1996	9	2.42	27	7.26
1997	4	1.08	31	8.33
1998	14	3.76	45	12.10
1999	13	3.49	58	15.59
2000	16	4.30	74	19.89
2001	10	2.69	84	22.58
2002	9	2.42	93	25.00
2003	13	3.49	106	28.49
2004	20	5.38	126	33.87
2005	14	3.76	140	37.63
2006	11	2.96	151	40.59
2007	20	5.38	171	45.97
2008	20	5.38	191	51.34
2009	18	4.84	209	56.18
2010	22	5.91	231	62.10
2011	26	6.99	257	69.09
2012	18	4.84	275	73.92
2013	16	4.30	291	78.23
2014	14	3.76	305	81.99
2015	11	2.96	316	84.95
2016	12	3.23	328	88.17
2017	15	4.03	343	92.20

2018	15	4.03	358	96.24
2019	14	3.76	372	100.00

Panel B: Hard-freezing industry distribution

Industry	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agriculture, Forestry, & Fishing	3	0.81	3	0.81
Construction	4	1.08	7	1.88
Manufacturing	195	52.42	202	54.30
Mining	24	6.45	226	60.75
Nonclassifiable Establishments	3	0.81	229	61.56
Retail Trade	35	9.41	264	70.97
Services	52	13.98	316	84.95
Transportation & Public Utilities	35	9.41	351	94.35
Wholesale Trade	21	5.65	372	100.00

Panel C: DB Plan Freezing Firms vs. Matched DB Plan Non-Changing Firms

	DB Plan Hard-Freezing Firms N=6,050					Matched DB Plan Non-Changing Firms N=6,050					Difference t-statistic
	Mean	P25	Median	P75	Std Dev	Mean	P25	Median	P75	Std Dev	
Firmsize	6.477	5.426	6.625	7.635	1.754	7.649	6.380	7.682	8.887	1.799	-26.58***
Plansize	0.157	0.021	0.065	0.168	0.368	0.124	0.021	0.062	0.158	0.184	4.57***
MTB	2.560	0.957	1.665	2.781	3.506	2.747	1.108	1.906	3.169	3.301	-2.22**
ROA/Performance	0.013	-0.006	0.036	0.072	0.164	0.028	0.008	0.043	0.075	0.138	-4.16***
CFO	0.081	0.040	0.084	0.129	0.117	0.089	0.050	0.088	0.124	0.077	-3.54***
Loss	0.280	0.000	0.000	1.000	0.449	0.216	0.000	0.000	0.000	0.411	6.02***
Salechange	0.052	-0.052	0.040	0.138	0.217	0.059	-0.032	0.047	0.134	0.196	1.28
Leverage	0.257	0.053	0.190	0.391	0.248	0.248	0.072	0.193	0.363	0.227	1.53
Taxrate	0.123	0.021	0.237	0.356	1.654	0.180	0.091	0.255	0.357	1.209	-1.42
Funding	0.800	0.667	0.779	0.905	0.275	0.787	0.657	0.783	0.906	0.270	1.89*
PensionIncome	0.194	0.000	0.000	0.000	0.396	0.125	0.000	0.000	0.000	0.331	7.59***
PensionSensitivity	1.894	0.251	0.829	2.608	2.277	1.610	0.294	0.793	2.002	1.963	5.40***
ERR	7.323	6.600	7.700	8.250	1.552	7.170	6.500	7.600	8.500	1.857	3.59***
ARR	5.865	0.426	7.337	12.486	10.958	5.774	0.681	7.223	12.327	10.783	0.34
DR	5.366	4.250	5.550	6.250	1.412	5.271	4.200	5.500	6.250	1.586	2.57***
AM	0.005	-0.056	-0.002	0.054	0.174	0.005	-0.046	-0.001	0.048	0.153	0.07
RM	0.286	-0.295	0.202	0.811	1.221	0.305	-0.144	0.250	0.762	1.009	-0.71
CM1	0.003	-0.263	0.015	0.311	0.711	0.040	-0.202	0.046	0.320	0.646	-2.22**
CM2	0.064	-0.361	0.042	0.518	1.046	0.124	-0.275	0.104	0.544	0.945	-2.45**

Distributional statistics are presented for the variables used in my empirical analyses. The sample consists of all firms on Compustat having defined benefit pensions plans during the year 1991-2019 and also having data on Compustat for discretionary accrual and real-activites earnings management estimations. The sample period

starts at 1991 because pension assumptions are first massively reported in 1991. *Firmsize* is the natural log of total assets measured in million of dollars. *Plansize* is the fair value of plan assets divided by total assets. *MTB* is the market-to-book ratio of the firm. *ROA/Performance* is the net income divided by the total assets. *CFO* is the net operating cash flow scaled by total assets. *Loss* is an indicator variable if the firms report negative net income. *Salechange* is the percentage change in sales. *Leverage* is the long-term debt scaled by total assets. *TaxRate* is income taxes divided by the absolute value of pre-tax income. *Funding* is the fair value of pension plan assets scaled by the PBO. *PensionIncome* is an indicator variable equal to 1 if the firm reports pension income and 0 otherwise. *PensionSensitivity* is the defined benefit pension plan assets divided by the absolute value of operating income. *ERR* is the expected rate of return of plan assets. *ARR* is the actual rate of return of plan assets, calculated as the actual return of plan assets divided by the lagged value of total pension plan assets. *DR* is the discount rate for the PBO. *AM* is the discretionary accrual, calculated as the residual from the modified jones model. *RM* is the real-activities earning management proxy, calculated as the sum of abnormal production cost and the negative value of abnormal discretionary expenses which are estimated by the models developed in Roychowdhury 2006. *CM1* is the first proxy of cash conservation activities, calculated as the sum of the negative value of abnormal production cost and the negative value of abnormal discretionary expenses which are estimated by the models developed in Roychowdhury 2006. *CM2* is the second proxy of cash conservation activities, calculated as the sum of the abnormal cash flow from operating, the negative value of abnormal production cost and the negative value of abnormal discretionary expenses which are estimated by the models developed in Roychowdhury 2006. In the empirical study, all the above observations are winsorized at the top and bottom 1% to reduce the influence of extreme observations. *, **, *** indicate statistical significance at 10%, 5%, and 1% levels.

Panel D: Pension Assumptions of DB Plan Freezing Firms vs. Non-Freezing firms -2 year to +2 year

		ERR			DR			ARR			Funding Level		
Year	N	HF Firms	Non-Changing Firms	T-Statistic	HF Firms	Non-Changing Firms	T-Statistic	HF Firms	Non-Changing Firms	T-Statistic	HF Firms	Non-Changing Firms	T-Statistic
-2	248	0.0635	0.0715	2.99**	0.0531	0.0552	1.48	-0.0147	0.0064	1.52	0.6692	0.7799	4.54**
-1	248	0.0645	0.0757	3.00**	0.0501	0.0515	0.98	0.0041	0.0513	3.69**	0.7127	0.8189	4.28**
0	248	0.0609	0.0685	2.00*	0.0494	0.0494	0.01	0.0191	0.0565	2.87**	0.7246	0.8321	4.04**
1	248	0.0551	0.0677	3.90**	0.0471	0.0457	-0.94	0.0122	0.0370	2.05*	0.7087	0.7924	3.45**
2	248	0.0554	0.0631	2.16*	0.0463	0.0432	-2.05*	0.0216	0.0515	2.33*	0.7043	0.7946	3.71**

Sample size decreases because all firm-year observations with fiscal year-ends outside this range are excluded, so that there is exactly one firm-year observation for each firm in both the pre and post periods. ERR is the expected return of the plan assets. DR is the discount rate of the pension plans. ARR is the actual return of the plan assets. Funding Level is the total pension assets scaled by the total pension liabilities. Non-freezing firms are one-on-one matched with freezing firms by industry and fiscal year, and the closest propensity score.

Panel E: DB Plan Termination Firms vs. Matched DB Plan Non-Changing Firms

	DB Plan Termination Firms N = 4,531					Matched DB Plan Non-Changing Firms N = 4,531					Difference t-statistic
	Mean	P25	Median	P75	Std Dev	Mean	P25	Median	P75	Std Dev	
Firmsize	6.416	5.269	6.527	7.631	1.841	6.557	5.539	6.557	6.506	1.622	-3.88***
Plansize	0.139	0.017	0.054	0.156	0.323	0.146	0.030	0.146	0.079	0.192	1.18
MTB	2.479	0.850	1.595	2.697	3.408	2.678	1.036	2.678	1.750	3.384	-2.79***
ROA/Performance	0.012	-0.008	0.035	0.072	0.226	0.023	-0.002	0.023	0.041	0.129	-2.94***
CFO	0.076	0.039	0.083	0.129	0.136	0.082	0.044	0.082	0.082	0.087	-2.29**
Loss	0.288	0.000	0.000	1.000	0.453	0.260	0.000	0.260	0.000	0.438	3.02***
Salechange	0.058	-0.052	0.043	0.141	0.228	0.057	-0.043	0.057	0.048	0.210	0.18
Leverage	0.235	0.048	0.192	0.352	0.220	0.209	0.039	0.209	0.168	0.197	5.95***
Taxrate	0.031	-0.025	0.153	0.342	0.411	0.037	-0.012	0.037	0.187	0.422	0.61
Funding	0.814	0.675	0.805	0.974	0.306	0.816	0.666	0.816	0.800	0.297	-0.37
PensionIncome	0.220	0.000	0.000	0.000	0.414	0.128	0.000	0.128	0.000	0.334	11.58***
PensionSensitivity	1.725	0.198	0.694	2.231	2.208	1.939	0.365	1.939	0.990	2.174	-4.59***
ERR	7.344	6.750	7.750	8.500	1.637	7.290	6.560	7.290	7.960	1.946	1.39
ARR	5.818	0.433	7.195	12.409	11.208	6.398	1.325	6.398	7.493	10.640	-2.39**
DR	5.419	4.250	5.700	6.500	1.494	5.427	4.200	5.427	5.750	1.734	-0.23

AM	-0.001	-0.045	-0.004	0.039	0.130	0.012	-0.046	0.012	0.005	0.174	-3.99***
RM	0.293	-0.256	0.217	0.798	1.156	0.186	-0.306	0.186	0.195	1.188	4.34***

Distributional statistics are presented for the variables used in my empirical analyses. The sample consists of all firms on Compustat having defined benefit pensions plans during the year 1991-2019 and also having data on Compustat for discretionary accrual and real-activites earnings management estimations. The sample period starts at 1991 because pension assumptions are first massively reported in 1991. *Firmsize* is the natural log of total assets measured in million of dollars. *Plansize* is the fair value of plan assets divided by total assets. *MTB* is the market-to-book ratio of the firm. *ROA/Performance* is the net income divided by the total assets. *CFO* is the net operating cash flow scaled by total assets. *Loss* is an indicator variable if the firms report negative net income. *Salechange* is the percentage change in sales. *Leverage* is the long-term debt scaled by total assets. *TaxRate* is income taxes divided by the absolute value of pre-tax income. *Funding* is the fair value of pension plan assets scaled by the PBO. *PensionIncome* is an indicator variable equal to 1 if the firm reports pension income and 0 otherwise. *PensionSensitivity* is the defined benefit pension plan assets divided by the absolute value of operating income. *ERR* is the expected rate of return of plan assets. *ARR* is the actual rate of return of plan assets, calculated as the actual return of plan assets divided by the lagged value of total pension plan assets. *DR* is the discount rate for the PBO. *AM* is the accrual-based earnings management proxy, discretionary accrual, calculated as the residual from the estimation of modified jones model. *RM* is the real-activitiy earning management proxy, calculated as the sum of abnormal production cost and the negative value of abnormal discretionary expenses which are estimated by the models developed in Roychowdhury 2006. In the empirical study, all the above observations are winsorized at the top and bottom 1% to reduce the influence of extreme observations. *, **, *** indicate statistical significance at 10%, 5%, and 1% levels.

Table 2: Year and industry fixed-effects regression of employer's choice of ERR

$$ERR = \sum_{t=1990}^{2020} \alpha_{0,t} + \sum_{i=2}^{48} \alpha_{0,i} + \alpha_1 Freeze_0 + \alpha_2 Freeze_{-1} + \alpha_3 Freeze_{-2} + \alpha_4 Freeze_{-3} + \alpha_5 Funding + \alpha_6 SquareFunding + \alpha_7 ARR + \alpha_8 PensionIncome + \alpha_9 PensionSenstivity + \alpha_{10} Firmsize + \alpha_{11} Loss + \alpha_{12} SalesChange + \alpha_{13} Leverage + \epsilon_a$$

	(Exp. sign)	ERR (t-statistic)
Variables of interest		
$Freeze_0$	(-)	-0.281***
		(-2.76)
$Freeze_{-1}$	(-)	-0.182*
		(-1.80)
$Freeze_{-2}$	(-)	-0.065
		(-0.63)
$Freeze_{-3}$	(-)	0.022
		(0.84)
Control Variables		
Funding	(+)	-0.080
		(-0.51)
SquareFunding	(-)	0.026
		(0.33)
ARR	(+)	0.006**
		(2.07)
PensionIncome	(+)	0.226***
		(3.31)
PensionSenstivity	(+)	0.120***
		(10.61)
Firmsize	(+)	0.080***
		(5.40)
Loss	(-)	-0.236***
		(-3.86)
SalesChange	?	0.113
		(-0.90)
Leverage	(+)	0.442**
		(3.94)
Year Fixed Effects		Yes
Industry Fixed Effects		Yes
Adjusted R^2		0.549
N		17,850

ERR is the assumed expected rate of return of the pension plan assets. $Freeze_t$ is an indicator variable equal to 1 if the firm-year is the hard freezing year (subscripts indicate year relative to the freezing year 0), and 0 otherwise. *Funding* is the fair value of pension plan assets scaled by the PBO. *SquareFunding* is the square of the variable *Funding. ARR* is the actual rate of return of plan assets, calculated as the actual return of plan assets divided by the lagged value of total pension plan assets. *PensionIncome* is an indicator variable equal to 1 if the firm reports pension income and 0 otherwise. *PensionSensitivity* is the defined benefit pension plan assets divided by the absolute value of operating income. *Firmsize* is the natural log of total assets measured in million of dollars. *Loss* is an indicator variable if the firms report negative net income. *Salechange* is the percentage change in sales. *Leverage* is the long-term debt scaled by total assets. *, **, *** indicate statistical significance at 10%, 5%, and 1% levels.

Table 3 Year and industry fixed-effects regression of employers' choice of DR

$$DR = \sum_{t=1990}^{2020} \alpha_{0,t} + \sum_{i=2}^{48} \alpha_{0,i} + \alpha_1 Freeze_0 + \alpha_2 Freeze_{-1} + \alpha_3 Freeze_{-2} + \alpha_4 Freeze_{-3} + \alpha_5 Funding + \alpha_6 SquareFunding + \alpha_7 ARR + \alpha_8 PensionIncome + \alpha_9 PensionSenstivity + \alpha_{10} TaxRate + \alpha_{11} Leverage + \epsilon_a$$

	(Exp. sign)	DR (t-statistic)
Variables of interest		
$Freeze_0$	(-)	-0.307***
		(-3.81)
$Freeze_{-1}$	(-)	-0.221***
		(-2.72)
$Freeze_{-2}$	(-)	0.039
		(0.45)
$Freeze_{-3}$	(-)	0.698
		(0.79)
Control Variables		
Taxrate	(-)	0.0419
		(1.54)
Underfunded	(+)	-1.141***
		(-38.52)
ARR	(-)	-0.065***
		(-5.32)
PensionIncome	(+)	0.145***
		(4.87)
PensionSenstivity	(+)	-0. 379
		(-0.02)
Leverage	(+)	0.267***
		(3.72)
Year Fixed Effects	Yes	
Industry Fixed Effects	Yes	
Adjusted R^2	0.472	
N	17,850	

DR is the discount rate for the PBO. $Freeze_t$ is an indicator variable equal to 1 if the firm-year is the hard freezing year (subscripts indicate year relative to the freezing year 0), and 0 otherwise. *Taxrate* is the income taxes divided by the absolute value of pre-tax income. *Underfunded* is the indicator variable equal to 1 if the firm's fair value of pension assets is less than the PBO, and 0 otherwise. *ARR* is the actual rate of return of plan assets, calculated as the actual return of plan assets divided by the lagged value of total pension plan assets. *PensionIncome* is an indicator variable equal

to 1 if the firm reports pension income and 0 otherwise. *PensionSensitivity* is the defined benefit pension plan assets divided by the absolute value of operating income. *Leverage* is the long-term debt scaled by total assets. *, **, *** indicate statistical significance at 10%, 5%, and 1% levels.

Table 4 Cash Management: Comparison of pre-freezing firm years (-1 and 0 of the freeze year) with the rest of the pre-freezing firm years of the freezing firms

$$Y_t = \alpha + \beta_1(SIZE)_{t-1} + \beta_2(MTB)_{t-1} + \beta_3(Net\_Income)_{t-1} + \beta_4(Funding)_{t-1} + \beta_5 Pre + \beta_6 Pre * Funding_{t-1} + \varepsilon_t$$

	Abnormal CFO	Abnormal production costs	Abnormal discretionary expenses	CM_1	CM_2
SIZE	0.023**	-0.036**	-0.009**	0.046**	0.070**
	(12.95)	(-4.86)	(-5.04)	(5.70)	(8.44)
MTB	0.002**	0.0003	0.001*	-0.001	0.001
	(4.26)	(0.19)	(2.34)	(-0.72)	(0.24)
Net_Income	0.122**	0.161**	-0.018*	-0.143**	-0.021
	(13.65)	(4.39)	(-2.03)	(-3.62)	(-0.51)
Pre	0.015	-0.235**	-0.030	0.265**	0.281**
	(0.77)	(-2.77)	(-1.43)	(2.92)	(3.02)
Funding	0.020**	-0.190**	-0.059**	0.250**	0.271**
	(2.89)	(-6.55)	(-8.31)	(8.04)	(8.49)
Pre *Funding	-0.017	0.209*	0.018	-0.228*	-0.246*
	(-0.71)	(2.05)	(0.74)	(-2.09)	(-2.19)
Year Fixed Effects			Yes		
Industry Fixed Effects			Yes		
Adjusted R^2	0.331	0.534	0.447	0.536	0.534
N			4,077		

The sample is restricted to the firm-year observations of hard freezing firms in the pre-freezing years only. The dependent variable Y_t are set to *the abnormal production cost, abnormal discretionary expenses, abnormal CFO*, and aggregated cash management proxies CM_1 and CM_2. *The abnormal production cost, abnormal discretionary expenses, and abnormal CFO* are the proxies for real earnings management and cash conservation, calculated by following the model used in Roychowdury 2006. For CM_1, I multiply both abnormal discretionary expenses and abnormal production costs by -1 and add them up. For CM_2, I multiply both abnormal discretionary expenses and abnormal production costs by -1 and add them with CFO. The higher these two aggregate measures, the more likely the managers are to save cash through real earnings management. *SIZE* is the log value of the market value of the equity at the beginning of the year. *MTB* is the ratio of the market value of equity to the book value of the equity at the beginning of the year. *Net_Income* is the current year net income scaled by lagged total assets. *Pre* is an indicator variable that equals 1 if the firm-year is the freeze year 0 and the year immediately preceding the freeze year -1 for the hard freeze firms. *Funding* is the proxy for pension funding status, calculated as the lagged value of pension assets divided by the pension projected benefit obligation (PBO). *Pre *Funding* is the interaction term of *Pre* and *Funding*. All the above variables are winsorized at the top and bottom 1% to reduce the influence of extreme observations. *, **, *** indicate statistical significance at 10%, 5%, and 1% levels.

Table 5 Earnings Management: Comparison of pre-freezing firm years (-1 and 0 of the freeze year) with the rest of the pre-freezing firm years of the freezing firms

$Y_t = \alpha + \beta_1(SIZE)_{t-1} + \beta_2(MTB)_{t-1} + \beta_3(Net\_Income)_{t-1} + \beta_4(Funding)_{t-1} + \beta_5 Pre + \beta_6 Pre * Funding_{t-1} + \varepsilon_t$

	AM	RM
SIZE	-0.004*	-0.027**
	(-2.23)	(-3.65)
MTB	-0.0002	0.0007
	(-0.48)	(-0.39)
Net_Income	0.026**	0.179**
	(2.91)	(4.94)
Pre	-0.007	-0.205**
	(-0.35)	(-2.44)
Funding	0.002	-0.131**
	(0.29)	(-4.55)
Pre*Funding	-0.023	0.190
	(-0.95)	(1.88)
Year Fixed Effects	Yes	
Industry Fixed Effects	Yes	
Adjusted R^2	0.614	0.523
N	4,077	

The sample is restricted to the firm-year observations of hard freezing firms in the pre-freezing years only. The dependent variable Y_t are set to the accrual-based earnings management proxies *AM* and real earnings management proxy *RM*. *AM* is the accrual-based earnings management proxy, discretionary accrual, calculated as the residual from the estimation of the modified jones model. *RM* is the real-activity earning management proxy, calculated as the sum of abnormal production cost and the negative value of abnormal discretionary expenses which are estimated by the models developed in Roychowdhury 2006. *SIZE* is the log value of the market value of the equity at the beginning of the year. *MTB* is the ratio of the market value of equity to the book value of the equity at the beginning of the year. *Net_Income* is the current year net income scaled by lagged total assets. *Pre* is an indicator variable that equals 1 if the firm-year is the freeze year 0 and the year immediately preceding the freeze year -1 for the hard freeze firms. *Funding* is the proxy for pension funding status, calculated as the lagged value of pension assets divided by the pension projected benefit obligation (PBO). *Pre *Funding* is the interaction term of *Pre* and *Funding.* All the above variables are winsorized at the top and bottom 1% to reduce the influence of extreme observations. *, **, *** indicate statistical significance at 10%, 5%, and 1% levels.

Table 6 Cash Management: Comparison of post-freezing firm years (+1 and +2 of freeze year) with the rest of the post-freezing firm years of the freezing firms

$$Y_t = \alpha + \beta_1(SIZE)_{t-1} + \beta_2(MTB)_{t-1} + \beta_3(Net\_Income)_{t-1} + \beta_4(Funding)_{t-1} + \beta_5 Post + \beta_6 Post * Funding_{t-1} + \varepsilon_t$$

	Abnormal CFO	Abnormal production costs	Abnormal discretionary expenses	CM_1	CM_2
SIZE	0.024**	-0.105**	-0.037**	0.143	0.167**
	(8.01)	(-9.90)	(-7.64)	(10.91)	(12.20)
MTB	0.001	0.003	0.001	-0.0004	-0.003
	(1.52)	(1.33)	(0.60)	(-1.30)	(-0.91)
Net_Income	0.293**	0.130**	-0.218**	0.088	0.381**
	(22.97)	(2.89)	(-10.45)	(1.59)	(6.57)
Post	-0.034	-0.140	-0.077	0.218	0.183
	(-0.98)	(-1.12)	(-1.34)	(1.42)	(1.14)
Funding	0.003	0.166**	-0.061*	-0.105	-0.102
	(0.19)	(2.91)	(-2.32)	(-1.49)	(-1.38)
Post*Funding	0.019	0.117	0.057	-0.174	-0.155
	(0.42)	(0.72)	(0.75)	(-0.87	(-0.74)
Year Fixed Effects			Yes		
Industry Fixed Effects			Yes		
Adjusted R^2	0.538	0.540	0.365	0.494	0.510
N			2,082		

The sample is restricted to the firm-year observations of hard freezing firms in the post-freezing years only. The dependent variable Y_t are set to *the abnormal production cost, abnormal discretionary expenses, abnormal CFO*, and aggregated cash management proxies *CM_1* and *CM_2. The*

abnormal production cost, abnormal discretionary expenses, and abnormal CFO are the proxies for real earnings management and cash conservation, calculated by following the model used in Roychowdury 2006. For CM_1, I multiply both abnormal discretionary expenses and abnormal production costs by -1 and add them up. For CM_2, I multiply both abnormal discretionary expenses and abnormal production costs by -1 and add them with CFO. The higher these two aggregate measures, the more likely the managers are to save cash through real earnings management. *SIZE* is the log value of the market value of the equity at the beginning of the year. *MTB* is the ratio of the market value of equity to the book value of the equity at the beginning of the year. *Net_Income* is the current year net income scaled by lagged total assets. *Post* is an indicator variable that equals 1 if the firm years are the years immediately after the freeze year t+1 and t+2. *Funding* is the proxy for pension funding status, calculated as the lagged value of pension assets divided by the pension projected benefit obligation (PBO). *Post *Funding* is the interaction term of *Post* and *Funding.* All the above variables are winsorized at the top and bottom 1% to reduce the influence of extreme observations. *, **, *** indicate statistical significance at 10%, 5%, and 1% levels.

Table 7 Earnings Management: Comparison of post-freezing firm years (+1 and +2 of freeze year) with the rest of the post-freezing firm years of the freezing firms

$Y_t = \alpha + \beta_1(SIZE)_{t-1} + \beta_2(MTB)_{t-1} + \beta_3(Net\_Income)_{t-1} + \beta_4(Funding)_{t-1} + \beta_5 Post + \beta_6 Post * Funding_{t-1} + \varepsilon_t$

	AM	RM
SIZE	-0.004	-0.067
	(-1.38)	(-6.65)
MTB	0.001	0.003
	(0.60)	(1.10)
Net_Income	-0.011	0.348
	(-0.95)	(8.10)
Post	-0.012	-0.062
	(-0.37)	(-0.52)
Funding	0.011	0.228
	(0.69)	(4.17)
Post*Funding	0.015	0.060
	(0.34)	(0.39)
Year Fixed Effects	Yes	
Industry Fixed Effects	Yes	
Adjusted R^2	0.637	0.549
N	2,082	

The sample is restricted to the firm-year observations of hard freezing firms in the post-freezing years only. The dependent variable Y_t are set to the accrual-based earnings management proxies *AM* and real earnings management proxy *RM*. *AM* is the accrual-based earnings management proxy, discretionary accrual, calculated as the residual from the estimation of the modified jones model. *RM* is the real-activity earning management proxy, calculated as the sum of abnormal production cost and the negative value of abnormal discretionary expenses which are estimated by the models developed in Roychowdhury 2006. *SIZE* is the log value of the market value of the equity at the beginning of the year. *MTB* is the ratio of the market value of equity to the book value of the equity at the beginning of the year. *Net_Income* is the current year net income scaled by lagged total assets. *Post* is an indicator variable that equals 1 if the firm years are the years immediately after the freeze year t+1 and t+2. *Funding* is the proxy for pension funding status, calculated as the lagged value of pension assets divided by the pension projected benefit obligation (PBO). *Post *Funding* is the interaction term of *Post* and *Funding.* All the above variables are winsorized at the top and bottom 1% to reduce the influence of extreme observations. *, **, *** indicate statistical significance at 10%, 5%, and 1% levels.

Table 8 Cash Management: Comparison of hard freeze firms with the matched non-freezing firms

$$Y_t = \alpha + \beta_1(SIZE)_{t-1} + \beta_2(MTB)_{t-1} + \beta_3(Net\_Income)_{t-1} + \beta_4(Funding)_{t-1} + \beta_5 HFirms + \beta_6 Pre + \beta_7 Hfirms * Pre + \beta_8 HFirms * Pre * Funding_{t-1} + \beta_9 Post + \beta_{10} Hfirms * Post + \beta_{11} HFirms * Post * Funding_{t-1} + \varepsilon_t$$

	Abnormal CFO	Abnormal production costs	Abnormal discretionary expenses	CM_1	CM_2
SIZE	0.061***	-0.033***	-0.045***	0.078***	0.139***
	22.92	-8.34	-16.50	14.84	20.84
MTB	-0.003***	0.002***	0.006***	-0.009***	-0.012***
	-5.93	2.80	9.74	-7.18	-8.13
Net Income	0.211***	0.005	-0.190***	0.184***	0.395***
	65.11	1.2	-56.30	28.43	48.31
Funding	0.011	-0.098***	-0.032**	0.131***	0.143***
	0.81	-4.54	-216	4.53	3.91
HFirms	0.118***	0.198***	-0.044***	-0.154***	-0.036
	9.16	10.31	-3.34	-5.99	-1.11
Pre	-0.062***	0.030	0.065***	-0.096**	-0.159***
	-2.86	0.94	2.88	-2.20	-2.88
HFirms *Pre	0.079	-0.318***	-0.115**	0.433***	0.521***
	1.49	-3.99	-2.08	4.08	3.85
HFirms *Pre*Funding	0.071	0.256***	-0.067	-0.189	-0.117
	1.17	2.79	-1.05	-1.54	-0.76
Post	0.001	0.046	0.008	-0.054	-0.052
	0.08	1.31	0.34	-1.16	-0.88
HFirms *Post	0.048	-0.337***	-0.097	0.435***	0.484***

	0.74	-3.42	-1.43	3.31	2.91
HFirms *Post*Funding	-0.081	0.273**	0.058	-0.332**	-0.413**
	-1.08	2.43	0.75	-2.22	-2.18
Year Fixed Effects			Yes		
Industry Fixed Effects			Yes		
Adjusted R^2	0.675	0.514	0.631	0.544	0.610
N			12,100		

The sample is set to 12,100 one-on-one matched firm-year observations of hard-freezing firms and the DB plan non-changing firms. The dependent variable Y_t are set to *the abnormal production cost, abnormal discretionary expenses, abnormal CFO*, and aggregated cash management proxies CM_1 and CM_2. *The abnormal production cost, abnormal discretionary expenses, and abnormal CFO* are the proxies for real earnings management and cash conservation, calculated by following the model used in Roychowdury 2006. For CM_1, I multiply both abnormal discretionary expenses and abnormal production costs by -1 and add them up. For CM_2, I multiply both abnormal discretionary expenses and abnormal production costs by -1 and add them with CFO. The higher these two aggregate measures, the more likely the managers are to save cash through real earnings management. *SIZE* is the log value of the market value of the equity at the beginning of the year. *MTB* is the ratio of the market value of equity to the book value of the equity at the beginning of the year. *Net_Income* is the current year net income scaled by lagged total assets. *Funding* is the proxy for pension funding status, calculated as lagged pension assets divided by the lagged pension projected benefit obligation (PBO). *HFfirms* is an indicator variable equal to 1 if the firms are the pension freezing firms, and 0 otherwise. *Pre* is an indicator variable that equals 1 if the firm-year is the freeze year 0 and the year immediately preceding the freeze year -1 for the hard freeze firms. *HFfirms*Pre* is the interaction term between *HFfirms* and *Pre*. *HFfirms*Pre*Funding* is the three-way interaction term among *HFfirms*, *Pre*, and *Funding*. *Post* is an indicator variable that equals 1 if the firm years are the years immediately after the freeze year t+1 and t+2. *HFfirms*Post* is the interaction term between *HFfirms* and *Post*. *HFfirms*Post*Funding* is the three-way interaction term among *HFfirms, Post*, and *Funding*. *, **, *** indicate statistical significance at 10%, 5%, and 1% levels.

Table 9 Earnings Management: Comparison of hard freeze firms with the matched non-freezing firms

$$Y_t = \alpha + \beta_1(SIZE)_{t-1} + \beta_2(MTB)_{t-1} + \beta_3(Net\_Income)_{t-1} + \beta_4(Funding)_{t-1} + \beta_5 HFirms + \beta_6 Pre + \beta_7 Hfirms * Pre + \beta_8 HFirms * Pre * Funding_{t-1} + \beta_9 Post + \beta_{10} Hfirms * Post + \beta_{11} HFirms * Post * Funding_{t-1} + \varepsilon_t$$

	AM	RM
SIZE	0.002**	0.012***
	2.56	2.87
MTB	-0.0004	-0.003***
	-1.6	-3.65
Net Income	0.015***	0.195***
	11.50	37.01
Funding	-0.0005	-0.066***
	-0.10	-2.79
HFirms	-0.011**	0.243***
	-2.28	11.59
Pre	-0.004	-0.034
	-0.48	0.33
HFirms *Pre	-0.010	-0.203**
	-0.51	-2.34
HFirms *Pre *Funding	-0.004	0.323***
	-0.19	3.23
Post	0.002	0.038
	0.28	0.99
HFirms *Post	-0.026	-0.239**
	-0.99	-2.23
HFirms *Post *Funding	0.022	0.214
	0.73	1.75
Year Fixed Effects	Yes	
Industry Fixed Effects	Yes	
Adjusted R^2	0.610	0.582
N	12,100	

The sample is set to 12,100 one-on-one matched firm-year observations of hard-freezing firms and the DB plan non-changing firms. The dependent variable Y_t are set to the accrual-based earnings management proxies *AM* and real earnings management proxy *RM*. *AM* is the proxy for accrual-based earnings management, calculated by following the modified Jones model following Dechow et al. 1998. RM is the proxy for real earnings management, calculated by following the model used in Roychowdury 2006. *SIZE* is the log value of the market value of the equity at the beginning of the year. *MTB* is the ratio of the market value of equity to the book value of the equity at the beginning of the year. *Net_Income* is the current year net income scaled by lagged total assets. *Funding* is the proxy for pension funding status, calculated as lagged

pension assets divided by the lagged pension projected benefit obligation (PBO). *HFfirms* is an indicator variable equal to 1 if the firms are the pension freezing firms, and 0 otherwise. *Pre* is an indicator variable that equals 1 if the firm-year is the freeze year 0 and the year immediately preceding the freeze year -1 for the hard freeze firms. *HFfirms*Pre* is the interaction term between *HFfirms* and *Pre*. *HFfirms*Pre*Funding* is the three-way interaction term among *HFfirms*, *Pre*, and *Funding*. *Post* is an indicator variable that equals 1 if the firm years are the years immediately after the freeze year t+1 and t+2. *HFfirms*Post* is the interaction term between *HFfirms* and *Post*. *HFfirms*Post*Funding* is the three-way interaction term among *HFfirms, Post*, and *Funding*. *, **, *** indicate statistical significance at 10%, 5%, and 1% levels.

Table 10 Earnings Management: Comparison of post-termination firm years (+1 and +2 of freeze year) with the pre-termination firm years of the termination firms

$Y_t = \alpha + \beta_1(SIZE)_{t-1} + \beta_2(MTB)_{t-1} + \beta_3(Net\_Income)_{t-1} + \beta_4 Post + \varepsilon_t$

	AM	RM	Abnormal production costs	Abnormal discretionary expenses	Abnormal CFO
SIZE	0.001	0.066***	0.012***	-0.011***	0.007***
	1.06	5.20	5.17	-3.84	3.94
MTB	0.0006**	-0.0001	-0.0001	0.0005	0.0002
	2.12	-0.51	-0.20	0.92	0.70
Net_Income	0.056***	-0.262**	-0.139***	-0.149***	0.199***
	4.60	-2.21	-6.19	-5.39	10.90
Post	-0.014**	-0.031	-0.003	0.010	0.007
	-2.33	-0.52	-0.31	0.74	0.86
Year Fixed Effects			Yes		
Industry Fixed Effects			Yes		
Adjusted R^2	0.404	0.349	0.268	0.522	0.421
N			5,552		

The sample is set to the firm-year observations of termination firms only, ending at year t+2 after the termination year. The dependent variable Y_t are set to *the abnormal production cost, abnormal discretionary expenses, abnormal CFO,* the accrual-based earnings management proxies *AM,* and real earnings management proxy *RM*. *AM* is the proxy for accrual-based earnings management, calculated by following the modified Jones model following Dechow et al. 1998. *The abnormal production cost, abnormal discretionary expenses, abnormal CFO, and RM* are the proxies for real earnings management, calculated by following the model used in Roychowdury 2006. *SIZE* is the log value of the market value of the equity at the beginning of the year. *MTB* is the ratio of the market value of equity to the book value of the equity at the beginning of the year. *Net_Income* is the current year net income scaled by lagged total assets. *Post* is an indicator variable that equals 1 if the firm years are the years immediately after the termination year t+1 and t+2.*, **, *** indicate statistical significance at 10%, 5%, and 1% levels.

Table 11 Earnings Management: Comparison of termination firm with the matched pension non-changing firms

$$Y_t = \alpha + \beta_1(SIZE)_{t-1} + \beta_2(MTB)_{t-1} + \beta_3(Net\_Income)_{t-1} + \beta_4 Terminations + \beta_5 Post + \beta_6 Terminations * Post + \varepsilon_t$$

	AM	RM	Abnormal production costs	Abnormal discretionary expenses	Abnormal CFO
SIZE	-0.004***	0.077***	0.038***	-0.039***	0.044***
	-4.30	9.70	7.08	-10.74	6.61
MTB	0.0001	-0.0003	-0.0001	0.0002	-0.0003
	1.33	-0.48	-0.29	0.61	-0.45
Net Income	0.031***	-0.006	-0.098***	0.092***	0.174***
	7.40	-0.20	-4.46	-6.20	6.39
Terminations	-0.011***	0.121***	0.079***	-0.041***	-0.049**
	-3.58	5.10	4.94	-3.84	-2.47
Post	0.001	0.052	0.067*	0.014	-0.059
	0.15	0.99	1.86	0.60	-1.34
Terminations*Post	-0.018*	-0.062	-0.054	0.007	0.024
	-1.92	-0.20	-1.12	0.23	0.41
Year Fixed Effects			Yes		
Industry Fixed Effects			Yes		
Adjusted R^2	0.271	0.268	0.166	0.436	0.074
N			9,062		

The sample is set to 9,062 one-on-one matched firm-year observations of termination firms and the DB plan non-changing firms. The dependent variable Y_t are set to *the abnormal production cost, abnormal discretionary expenses, abnormal CFO,* the accrual-based earnings management

proxies *AM,* and real earnings management proxy *RM*. *AM* is the proxy for accrual-based earnings management, calculated by following the modified Jones model following Dechow et al. 1998. *The abnormal production cost, abnormal discretionary expenses, abnormal CFO, and RM* are the proxies for real earnings management, calculated by following the model used in Roychowdury 2006. *SIZE* is the log value of the market value of the equity at the beginning of the year. *MTB* is the ratio of the market value of equity to the book value of the equity at the beginning of the year. *Net_Income* is the current year net income scaled by lagged total assets. *Terminations* is an indicator variable equal to 1 if the firms are the DB plan termination firms, and 0 otherwise. *Post* is an indicator variable that equals 1 if the firm years are the years immediately after the termination year t+1 and t+2. *Terminations *Post* is the interaction term between *Terminations* and *Post*. *, **, *** indicate statistical significance at 10%, 5%, and 1% levels.