Erasmus University Rotterdam

Erasmus School of Economics

Master thesis Financial Economics

Freezes of Defined Benefit Pension Plans by US Corporations

Name: Cristina Curie

Student number: 372314

Supervisor: Dr A. Andonov

Second reader: Dr O.W. Steenbeek

Date: 22-07-2016

ERASMUS UNIVERSITEIT ROTTERDAM

Abstract

The objectives of this study are firstly, to investigate which type of US companies decide to freeze their defined benefit pension plans and secondly, to examine if freezing results in improvements in firm performance afterwards. This study examines hard freezes that took place during the 2002-2014 period in the United States. The results of this study show that hard freezes are most likely executed by US companies that are cash constrained, companies that have a higher likelihood of facing bankruptcy and/ or companies that perform poorly. In addition, the empirical results unveil that freezing results in improvements in the return on equity and the return on assets of sponsors with non-investment grade rating three years after the freeze. The results imply that hard freezes are most likely conducted by sponsors that are financially unhealthy. These companies cannot keep sponsoring DB pension plans for their employees because doing so goes at the expense of firm continuity. As a results of this study the rationale for the higher freezing likelihood under non-investment grade sponsors is also evident: freezing results in improvements in firm performance afterwards, which gives these companies further incentive to freeze.

Contents

Introduction 4
2 Theoretical Background 8
2.1 Structure of the Pension System in the United States 8
2.1.1 Defined Benefit Pension Plans 8
2.1.2 Defined Contribution Pension Plans 9
2.2 Shift from Defined Benefit to Defined Contribution Pension Plans 10
2.3 Freezing of DB Pension Plans as an Alternative to Termination 12
2.4 Hypotheses 14
3 Research design 18
3.1 Sample and Data Gathering 18
3.2 Independent Variables 19
3.3 Control Variables 22
3.4 Methodology 23
3.4.1 Probit Regression 24
3.4.2 Cox Proportional Hazard Model 25
3.4.3 Paired T- test 25
3.4.4 Matching Process 26
4 Empirical Results and Analysis 27
4.1 Preliminary Results 27
4.1.1 Descriptive Statistics 27
4.1.2 Correlation Matrix 28
4.2 Main Results 28
4.2.1 Main Results: Probit Model 28
4.2.2 Main Results: Cox Proportional Hazard Model 32
4.2.3 Main Results: Paired T- test 33
5 Conclusion 35
Bibliography 39
Appendix 42

Introduction

Pension funds form a crucial part of the financial sector in most countries and are an important source of retirement income for the population. However, in the private sector, where firms are not obligated to provide pension benefit plans, many firms seem to avoid such commitments. More specifically, the U.S. pension system is experiencing a dramatic shift from defined benefit (DB) towards defined contribution(DC) (Copeland, 2006; Buessing and Soto, 2006; Wiatrowski, 2004) This phenomenon started in the early 1980s and it still prevails in the present day.

Prior to the shift, defined benefit pension arrangements were the most popular type of pension plan. DB plans in the U.S. covered roughly 30 million active participants in the 1980s[1]. Since the shift DB plans became less popular and nowadays it only represents 15 million active pension plan participants. DC pension plans, nonetheless became more popular and represent almost 77 million active participants in the U.S. Furthermore, In the late 1990s private sector DB and DC plan assets amounted to 2 trillion each. By the end of 2013 total pension assets in the private sector amounted to 2.9 trillion for DB plans and 5 trillion for DC plans.

The shift is the aggregate result of different factors. First, a lot of DB pension plans were being terminated in the late 1980s (Munnell & Soto, 2007). Second, workers became more mobile and developed a preference for the flexible DC plans (Iams et al., 2009). Third, there was an increasing demand for workers in high tech and service sectors that did not offer traditional DB pension arrangements (Wiatrowski, 2004). Fourth, the costs and risks for the plan sponsors increased over time because of the low interest rate and longevity of participants (Rauh et al., 2013). Fifth, pension legislations became stricter about contribution and funding requirements (Munnell & Soto, 2007).

By terminating their DB pension plan sponsors stop being accountable for all the risks involved in DB pension schemes. Nonetheless, terminating a fully funded pension plan is very costly. Fully funded pension plans are subject to an excise tax of 50 percent and corporate income taxes (Rauh et al., 2013). Thus, termination is only viable if the firm is facing bankruptcy. As an alternative to termination DB plan sponsors can instead choose to freeze their DB pension plan. By freezing the pension plan the participants stop accruing future pension benefits.

In the past plan sponsors terminated their pension plans if their company was going bankrupt or if they were engaged in mergers and acquisitions (Munnell & Soto, 2007; Choy et al., 2014). Enron and WorldCom are two examples of U.S. corporations that went bankrupt around 2002 and as a result

[1] Source: Form 5500 fillings with the U.S. Department of labor.

terminated their pension plans. Yet, pension freezes became ill-famed and well known (financially sound) companies, such as IBM, Verizon and General Motors, voluntarily chose to freeze their DB pension plans. IBM's rationale for the freeze was "to better control retirement plan expenses, position the company for business growth and competitive strength, and preserve employees' earned retirement benefits"[2]. For General Motors the freeze aims "to reduce the risk it faces in its massive pension plan, which is a top concern among investors"[3]. Moreover, Verizon chairman stated that "This restructuring reflects the realities of our changing world. Companies today, including many we are competing with, are not implementing defined benefit pension plans"[4]. If companies as large as IBM, Verizon and General Motors are all freezing their DB pension plans it could encourage other companies to do the same. This topic is relevant and interesting due to the number of employees that are covered by DB pension plans in the US and because such decisions harm the retirement income of millions of American workers. In addition, the pace at which US corporations freeze their DB pension plans and then switch to DC plans is concerning.

Freezing DB plans and subsequently switching to a DC pension plan would not be a problem if pension plan participants would end up with the same amount of retirement income. Yet, previous research shows that DC plan participants are unable to save enough money for an adequate retirement income (Munnell & Sundén, 2006). In 2004 a typical U.S. individual aged 55-64 had actual accrued benefits of $60,000, whereas this individual was expected to have $314,600 (figure 1). Furthermore, due to the differences in benefit accruals in DB and DC pension plans employees covered by DC schemes are left with no choice but to postpone their retirement (Friedberg & Webb, 2005). DC pension plan participants retire almost 2 years later. For other stakeholders such as the pension benefit Guarantee corporation(PBGC)[5] freezes of DB are viewed as favorable because freezes help strengthen the PBGC's long term financial position. It is therefore of crucial importance for the American workers and pension authorities to be well informed about the freezes of DB pension plans. The aim of this papers is therefore to provide more information on which companies decide to freeze their DB pension plans[6]. Accordingly, the first research question is as follows:

What are the financial characteristics of U.S. corporations that decide to freeze their DB pension plans?

---

[2] Retrieved from http://www-03.ibm.com/press/us/en/pressrelease/19090.wss
[3] Retrieved from http://www.wsj.com/articles/SB10001424052970204792404577225202499659404
[4] Retrieved from https://www.wsws.org/en/articles/2005/12/veri-d08.html
[5] PBGC is a US pension government agency that insures DB pension liabilities.
[6] This study only focuses on hard freezes. Pension plans with other types of freezes are considered as open pension plans.

This paper seeks to investigate this question by examining the relation between the freezing decision and financial variables, such as capital expenditures, return on assets, book to market ratio etc. After analyzing the first research question this thesis subsequently proceeds to analyze if there are any changes in the post freeze performance of these companies. In order to examine this, this study compares the financials of sponsors with frozen DB pension plans before and after the freeze. Hereby, the second research question is as follows:

Are there any improvements in firm performance after the freeze?

Although the characteristics of freeze sponsors has been studied in the past, the association between various other sponsor characteristics and the freezing decision is still largely unknown. It is also unknown if these relations are robust to the passage of time. To this paper's knowledge Munnell and Soto (2007) and Atanasova and Hrazdil (2010) are the only ones that analyze the characteristics of freeze sponsors in the US. This study contributes to the literature by investigating the characteristics of sponsors with frozen DB pension plans between 2002 and 2014 in the US. This paper attempts to provide additional and more comprehensive understanding of this topic by analyzing a longer time period than in the previous studies, by adding additional sponsor characteristics, which were not used in the previous two studies, and by conducting additional analyses, which were not utilized in prior studies.

With regard to the first research question, this study employs two methods: The Probit model and the Cox proportional hazard model. Both models estimate the relation that various sponsor characteristics have with the probability of freezing. Sponsor level variables are acquired from Compustat, while plan level variables, which serve as control variables, are acquired from the department of labor's form 5500s. For the second research question this study applies a paired t test on four company financials of a treatment group as well as a control group. A paired t-test is used to analyze if the difference between two groups measured at two different points in time is significantly different from zero. The variables return on equity, return on assets, cash flow and leverage are acquired from Compustat and CRSP. For each variable this study collects data for three years before as well as three years after the freeze of DB pension plans that were frozen between 2002 and 2012.

The empirical results show that sponsors that are cash constrained are more likely to freeze their DB pension plans. Cash need is manifested by lower investments in capital expenditures and less acquisitions. The results also reveal that companies that are more vulnerable to bankruptcy, in terms of low credit rating, are more likely to execute a hard freeze. Additionally, this study finds that sponsors that are less profitable, that is low return on assets and low cash flow from operations, are more likely

to implement a hard freeze. Finally, the empirical results reveal that freezing gives rise to higher return on equity and return on assets for sponsors with non-investment grade rating three years after the freeze, while sponsors with investment grade rating does not experience any significant changes in their financials three years after the freeze.

The findings of this study contribute to the existing body of knowledge in the corporate and pension literature by providing a better understanding on whether U.S. DB pension plans are sponsored at the expense of firms' financial health. The empirical findings indicate that hard freezes of U.S. DB pension plans are most likely to be executed by sponsors that have financial difficulties. Sponsoring DB pension plans is a heavy financial responsibility that these types of companies cannot afford. In addition, the empirical results provide awareness of why sponsors with non-investment grade rating are more than twice as likely to implement a hard freeze (in comparison with investment grade sponsors). Freezing gives rise to improvements in the return on equity and the return on assets of these types of companies. The outcomes of freezing encourage the freeze decision by non-investment grade sponsors even more.

The findings of this paper have crucial implications for employees of DB plans and pension authorities. Employees of DB plans and pension authorities are now more knowledgeable about the driving forces behind the freeze decision. Employees should become more informed about the financials of their company as well as their DB pension plans. A pension freeze should not come as an unexpected surprise anymore for employees covered by a DB pension plan. low investments in capital expenditures, low credit rating or/and bad performance are all red flags that informed employees should recognize in advance. Furthermore, pension authorities should consider the possibility of monitoring the financial health of companies with such characteristics so as to detect on time when DB pension plans start to become a financial burden and to implement pension policies that may help sponsor companies recover rather than choosing for a hard freeze.

The remainder of this paper is structured as follows. Section 2 provides background information on the shift from DB to DC pension plans, the freezing of DB plans and the formulated hypotheses for both research questions. Section 3 provides Information about the research design. This section contains detailed description of the data gathering process, the variables that are used and the applied methodology. Section 4 presents the empirical results executed with the Probit model, Cox proportional hazard model and the paired t-test. Finally, section 5 provides a summary and conclusion of this paper.

2 Theoretical Background

2.1 Structure of the Pension System in the United States

With 22,117 billion in pension fund assets, the United States is known to have one of the biggest pension fund markets in term of asset size (Watson Wyatt, 2015). In spite of this, its net replacement rate[7], which gives an indication of the post retirement standard of living, is hardly 45 percent (OECD, 2016). This means that retirees in the United States have a retirement income that is less than half of what they used to earn before they retired. A low net replacement rate is not the only problem the United States has to deal with. Since 1950 the demographic old age dependency (ratio of population aged 65 and over per 100 people of working age) ratio has been rising and is projected to increase further in the future reaching 33.1 percent in 2025(OECD, 2015).

The structure of the private pension system in the United States can be divided into two channels: 1) voluntary, occupational and 2) voluntary, personal. Voluntary occupational plans cover 41.6 percent of the working population in the United States, while personal voluntary plans cover 47.1 percent of the working population (OECD, 2015). Employers in the United States have different channels through which they may offer pension provisions to their employees. Generally, they may choose between defined benefit and defined contribution.

2.1.1 Defined Benefit Pension Plans

Defined benefit pension schemes are characterized by an employer that promises a fixed retirement income to its employees based on years of service and final wage (Ippolito, 1985). Both employers and employees are exposed to different kinds of risks that arise from DB pension schemes (Broadbent et al., 2006). Table 1 lists all the types of risks that arise in DB plans and who bears such risks. Besides the risk of providing pension provision to their retired employees for an unknown amount of years, employers are also exposed to investment risk, which encompasses the overall financial risk corresponding to DB schemes. This risk arises when the return on the pension fund's assets, which are intended to finance pension benefits, does not meet expectations. Additionally, employers are exposed to longevity risk (Shivdasani & Stefanescu, 2009). Longevity risk is the risk related to an increase in the life expectancy of pensioners, that is, on average pensioners live longer than expected.

[7] The net replacement rate is defined as the net retirement income divided by the net pre-retirement income of an individual.

Employees of DB pension schemes bear inflation risk because private DB pension plans do not index the benefit payments of current retirees for increases in inflation (Broadbent et al., 2006). Besides inflation risk employees are exposed to accrual risk. Initially, one of the main purposes of DB pension plans was to acquire and retain human capital (Rauh et al., 2013; Shivdasani & Stefanescu, 2009). With this in mind, benefit payments were strategically structured as the product of the employee's salary and tenure. Both salary and tenure increase with the passage of each year. As a consequence, much of the pension benefits are accrued in the final years before the employee retires. This implies that any changes that may take place during the final years of work, such as termination of employment or changes in the computation of benefit payments, can result in employees receiving benefit payments that are much lower than what they initially expected.

2.1.2 Defined Contribution Pension Plans

By contrast, DC participants contribute to their retirement savings by allocating a fix percentage of their salary to an individual account where they accrue future retirement savings (Broadbent et al., 2006). These accounts are administered by the employer and contributions made by employees are usually matched by the plan sponsor. Unlike in a DB, it is the contributions paid by employees in a DC pension scheme that are fixed rather than the pension benefits that they will receive in the future. The retirement income that employees receive in the future is unknown ahead of time. This is because the retirement income that future retirees receive is determined by the total contributions paid by employees and the returns earned by investments made in asset classes.

The assets a DC pension plan owns belongs to the employees (Broadbent et al., 2006). Therefore, employees have the right to transfer their accrued benefits to another employer, to an individual retirement savings accounts or they can choose to leave their accrued benefits under the administration of the previous employer. Employees also have the flexibility to withdraw their retirement savings before they reach the retirement age. Although, these withdrawals are taxable and tied to certain conditions and penalties.

In terms of risk employers in a DC plan bear little to no risk. A DC scheme only specifies the amount of contribution employers have to comply with to their employees' retirement accounts (Shivdasani & Stefanescu, 2009). After the employer pays the initial contribution he/ she has no obligation to sponsor any potential future deficit between funds available in their employees' accounts and their employees' expectations. As can be seen in table 2, it is the employees in a DC scheme that bear all of the risks. They must pay their own contributions, make financial decisions and take

responsibility for the investment risk (Broadbent et al., 2006; Comprix & Muller, 2011). They also bear the risk that their salary can change, which affects their contributions negatively if their salary decreased. lastly, the employees also bear longevity risk.

2.2 Shift from Defined Benefit to Defined Contribution Pension Plans

Figure 2 presents the pension coverage of private sector workers between 1980 and 2004. As can be seen from figure 2 DB pension plan decreased during this period, while DC plans increased during this period. Figure 3 displays the number of active participants per type of pension plan between 1975 and 2013. Since the early 1980s there is a clear decline in the number of active participants in DB pension plans. Figure 4 exhibits pension plan assets by type of plan during 1975-2013. By 1997 total assets owned by private sector DC plans amounted to 51.2 percent of the total assets owned by private sector pension funds, whereas DB pension plans owned 48,8 percent of all the assets. According to the latest numbers of the department of labor in 2013 there were 44,163 DB pension plans and 636,991 DC plans. Furthermore, DB plans managed 2.87 trillion worth of assets, while DC plans managed 5 trillion worth of assets in 2013. The shift from DB to DC pension plans can be attributed to a number of factors.

First, there were large amounts of terminations of overfunded DB plans during the late 1980s and the early 1990s (Munnell & Soto, 2007). One possible explanation for these mass terminations is the strong correlation between management compensation package and the decision to terminate overfunded pension plans (Hamdallah & Ruland, 1986). Managers are more likely to terminate an overfunded plan if they expect to receive a significant portion of the excess assets that revert to the firm once the plan is terminated. According to stone (1987) sponsor firms are more likely to terminate their overfunded pension plans if the firm is less able to generate its resources internally, if the market valuation of the firm's cash flow is low and if the firm has a high leverage. Mittelstaedt (1989), Petersen (1992) and Thomas (1989) also find similar financial explanations for the termination of overfunded pension plans in the late 1980s. Another motive for the terminations of overfunded pension plans in the 1980s is related to the abnormal returns that sponsor firms experience upon termination. These terminations are beneficial for shareholders of the sponsoring company (Alderson & Chen, 1986; Mittelstaedt & Regier, 1990; Mitchell & Mulherin, 1989; Alderson & VanDerHei, 1992).

In addition, employees developed a preference for DC plans instead of DB plans because the former gives employees more discretion to transfer their assets across jobs and to decide how and in which asset classes to invest their money (Iams et al., 2009). In comparison with 30 years ago worker mobility also increased, which made DC more attractive due to the portability of assets. Employees also

had a preference for DC plan because of the bull market after the introduction of 401(k) plans (Munnell & Soto, 2007). Stock prices rose with 16.9 percent between 1982 and 2000. This led to growing accrued benefits, which made employees overconfident. They believed that they could manage their retirements savings better than their DB plan sponsors.

There was also an increasing demand for employees in the service, high tech and trade sector and less demand in the manufacturing sector. DB plans are usually offered in large unionized manufacturing firms. The employers in the service, high tech and trade sector offered DC pension plans instead of DB because these type of sectors are volatile and can stop operations unexpectedly (Wiatrowski, 2004). Still, this change in sector demand can only offer a partial explanation for the shift.

Furthermore, the pension costs and risks that the employers bear increased over time (Rauh et al., 2013). More specifically, employers became more vulnerable to the interest rate risk and longevity risk. The present value of future pension obligations is calculated by discounting the future pension obligations by the interest rate. A lower interest rate necessitates obligatory funding payments by the employer due to the higher pension obligations and lower assets value. The longer life span of retirees also leads to additional pension payments. By freezing their DB plan and subsequently switching to a DC plan sponsors experience costs savings equal to 0.40 percent of their firm's assets in the first year and 3.1 percent of total firm's assets over 10 years (Rauh et al., 2013).

Changes in the pension legislation also provide a partial explanation of why employers shifted from DB to DC (Munnell & Soto, 2007). The employee income security act of 1974 established a minimum funding requirement to protect the future pension benefit of employees and a maximum amount on tax exempt contributions to secure tax revenues. In addition to these requirements the employee retirement income security act of 1974 also enforced premium payments to the pension benefit guarantee corporation(PBGC) to insure pension benefits. Moreover, with the introduction of the pension protection act of 2006 plan sponsor had 7 years instead of 30 years to eliminate the funds deficit (Beaudoin et al., 2010). The financial accounting standards board also introduced in 2006 a statement of accounting standards no.158, which requires companies to identify DB pension plan funding status on their balance sheet[8]. Prior literature shows that sponsor firms that are negatively affected by the full fair value recognition of DB pension plan's funding status on their balance sheet (SFAS 158) are more likely to freeze their DB pension plan (Beaudoin et al., 2010).

[8] Sponsor firms report their pension plan's funding status by adjusting accumulated other comprehensive income and not corporate assets or liabilities.

2.3 Freezing of DB Pension Plans as an Alternative to Termination

Due to the above mentioned factors DC pension plans became more and more beneficial in comparison with DB pension plans. This made it more attractive for sponsor of DB plans to consider terminating their current DB pension plan. Yet, it is very costly and almost impossible for plan sponsors to terminate one or more of their pension plans. In the case that the pension plan is underfunded it can only be terminated if the sponsor files for bankruptcy (Rauh et al., 2013). In that case the liabilities of the pension plan are paid by the pension benefit guarantee corporation. In the case that the sponsor company is not going bankrupt the only way the pension can be terminated is If its fully funded (the pension fund has enough assets to pay the total accrued benefits). Nevertheless, this method of termination is costly because the excess assets available to the employer are subject to 50 percent excise tax. Subsequently, the excess assets are once again taxed with corporate income taxes. If a sponsor opts for termination the pension obligations must be dealt with by either purchasing annuities or distributing the plan assets to future retirees in a lump sum.

For the sake of reducing the risks and costs associated with DB plans, sponsor can decide to freeze instead of terminating their DB pension plans. Freezing is beneficial for employers because they are only obligated by the law to pay pension benefits that employees already earned through their years of service (Comprix & Muller,2011). Thus, pension benefits that can be earned with future service are not guaranteed. Figure 5 displays a Mercer survey. Mercer (2006) finds that the most popular reasons for freezing DB pension plan are “long term cost savings” and “reduced cost volatility”. The main objective of a pension freeze is that pension plan participants stop accruing future pension benefits (Phan & Hedge, 2013; Rubin, 2007). A plan sponsor can choose between three kinds of freezes:

1. Hard freeze
2. Soft freeze
3. Closed freeze

A hard freeze stops the additional accrual of pension benefits for all current participants (VanDerhei, 2006; Phan & Hedge, 2013). In other words, the pension benefits of all the plan participants will not grow anymore and will remain at the same amount as they were at the time of the freeze. However, under a soft freeze current participants are allowed to accrue additional pension benefits only for salary increases (VanDerhei, 2006; Phan & Hedge, 2013). Additional years of service, as with the hard freeze, has no influence on the accrued pension benefits. Lastly, under a closed freeze current

participants keep accruing additional pension benefits but the plan sponsor closes the plan to new participants (Munnell & Soto, 2007). The most common type of freeze is a hard freeze (Broadbent et al., 2006). In 85 percent of the cases employers choose for a hard freeze and in 13 of the cases for a closed freeze. In comparison with a hard freeze and a closed freeze, plan sponsors hardly choose for a soft freeze. According to a study by Watson Wyatt (2013) 22 percent of fortune 100 firms froze their DB pension plans since 1998 (hard/soft freeze) and 18 percent chose for a closed freeze.

The pension benefit guarantee corporation (PBGC, 2005) study found that small plans have a higher likelihood of implementing a hard freeze. Among pension plans with fewer than 100 participants, 10.1 percent were hard frozen, whereas among plans with more than 5000 participants only 2.2 were hard frozen. Furthermore, the study finds that frozen plans have a higher likelihood of being underfunded than open plans. According to figure 6 only 18 percent of frozen plans in 2003 had current liability funded ratio in excess of 100 percent, while 32 percent of open plans had current liability funded ratio in excess of 100 percent. Moreover, 15 percent of frozen plans had current liability funded ratios of less than 60 percent, whereas only 9 percent of open plans were less than 60 percent funded. Mercer (2006) studied the financials of 15 S&P 500 companies considering to freeze their DB pension plans. Their findings imply that companies considering a freeze have a modest superior median credit rating than the median S&P 500 company. Nevertheless, these companies have a required cash contribution (relative to revenue or operating cash flow) that is two to three times higher than that of other S&P 500 companies. This implies that companies freeze their DB pension plans due to a “strategic corporate redesign” and not due to “immediate financial difficulties”.

Usually employers are the ones that mostly benefit from pension freezes. In a hard freeze the pension lability stays at the same rate and does not increase with additional years of service (Comprix & Muller, 2011). In a soft freeze the pension liability increases with salary increases, still the increase is much less than otherwise. Thus, in general, employers reduce their pension costs when freezing. Freezing also improves the funding status of the plan immediately. This is because the expected future pension benefits that are already included in the pension liability are subtracted from the pension liability because the sponsor firm is no longer obligated to provide these benefits in the future. Nonetheless, plan sponsors are still required to pay premiums to the pension benefit guarantee corporation and to make funding contributions to the pension plan if the plan is underfunded (Munnell & Soto, 2007). Nonetheless, if a frozen plan is underfunded sponsor firms can even avoid paying additional contributions if the plan assets grow at a faster rate than the frozen pension obligation (Comprix & Muller, 2011). Freezing a pension plan influences the firms funding requirements and

financial reporting. The current pension liability of the plan declines each year as the plan sponsor pays pension benefits to retirees. Therefore, the funding requirement decreases, which improves the balance sheet of the sponsor firm (Munnell & Soto, 2007).

Rubin (2007) argues that besides the balance sheet improvements freezing DB pension plans may result in value creation for the sponsor firm but with a lag. This implies that the market only takes into account the short-run cost savings, while long run cost savings are not taken into account until they are evident from the cash flows. Nonetheless, McFarland et al. (2009) finds that freezing a DB pension plan has no effect on the plan sponsors market value. Enhancements of 401(k) plans and the negative effects of a freeze on employee moral may outweigh any potential cost savings.

From the participants' perspective the freeze reduces their future pension benefits. To ensure that employees have enough pension benefits when they retire, plan sponsor establish a new 401(k) plan or upgrade their current DC pension plan. For younger employees the termination of DB pension plan and replacement with a 401(k) plan has no significant effect. These employees end up with a similar replacement rate if they had not experienced a freeze. It is the older employees that suffer the most from a plan freeze. Their replacements rate declines with almost 65 percent if they experience e freeze followed by 401(k) replacement (Munnell & Soto, 2007; VanDerhei, 2006).

2.4 Hypotheses

One key reason for freezing is the increasing costs and risks for sponsors of DB pension plans. The financial contributions that sponsor firms must make to their DB plans depends on legally specified formulas. These mandatory pension contributions reduce the internal resources of a company (Rauh, 2006. This implies that sponsors on average are financially constrained firms and they invest less due to pension contribution requirements. Specifically, $1 of mandatory pension contributions reduce capital expenditures by $ 0.60. Additionally, mandatory pension contributions reduce the probability of making acquisitions and repurchasing own company stock. Thus, following this evidence this study formulates the following hypothesis:

- *Hypothesis 1: sponsor firms that are cash constrained are more likely to implement a hard freeze.*

Hamdallah and Ruland (1986) find that high leverage sponsor firms are more likely to terminate their overfunded DB plans. Additionally, leverage ratios of firms that sponsor a pension plan are on

average one third higher when taking pension assets and liabilities into account (Shivdasani & Stefanescu, 2009). It is expected that companies that have a high leverage will try to reduce their leverage so as to increase their borrowing capacity, reduce the probability of bankruptcy and credit downgrade (Hamdallah & Ruland, 1986). Atanasova and Hrazdil (2010) find that sponsor firms that freeze their pension plan are less likely to experience a credit downgrade. This is due to the reduction in expected future liabilities. Yet, this relationship is not symmetric: credit upgrade is not affected by the freeze decision. Additionally, Munnell and Soto (2007) find that a low credit rating increases the probability of freezing. A low credit rating increases the probability of bankruptcy which makes it more difficult for sponsor firms to borrow money. As a consequence, firms are willing to freeze their DB pension plan so as to reduce their financial obligations. Hereby, following these arguments I hypothesize that:

- *Hypothesis 2: sponsor firms that are susceptible to bankruptcy are more likely to implement a hard freeze.*

McFarland et al. (2009) suggest that it may be possible that freezing firms were performing poorly in comparison with their competitors and thought that by freezing their pension funds they could match the financial results of their competitors. Atanasova and Hrazdil (2009) find that companies that freeze their DB pension plans experience an increase in the next period's equity return. The next period's equity returns increases because investors perceive corporate pension freezes as good news Moreover, Beaudoin et al. (2010) finds that sponsor firms with higher return on assets are less likely to freeze. Firms with lower profitability are viewed as performing poorly which may cause their competitive position to deteriorate. As suggested by McFarland et al. (2009), management may then decide to freeze the pension plan. The study of Beaudoin et al. (2010) also finds that freeze firms have a significantly lower cash flow from operations than non- freeze firms. Thus, the following hypothesis is that:

- *Hypothesis 3: sponsor firms with poor performance are more likely to implement a hard freeze.*

Beaudoin et al. (2010) also include book to market ratio in their analysis. The book to market ratio is often used as a proxy for firm growth (Beaudoin et al., 2010). Firms with high growth opportunities are more likely to freeze their DB pension plans. Sponsor firms need cash to realize their

growth opportunities. Thus, cash is a scarce resource for sponsor firms with high book to market ratio. Beaudoin et al. (2010) find an insignificant relationship between book to market ratio and the freezing decision. Nonetheless, this study takes into account the book to market ratio of the sponsor firms. The reason for this is that the statistical insignificance in Beaudoin et al. (2010) does not necessarily imply that the book to market ratio is an unimportant factor in the firms freezing decision. Hereby, the following hypothesis is formulated:

- *Hypothesis 4: sponsor firms with more growth opportunities are more likely to implement a hard freeze.*

Comprix and Muller (2011) report that the number of employees plays a crucial role in the freeze decision. Freezing a pension plan is more difficult for large sponsor firms with a relatively large number of employees than for small sponsor with a relatively small number of employees. Hamdallah and Ruland (1986) argue that large firms are more vulnerable to public scrutiny in the event of bad news. Pension plan terminations frequently result in adverse publicity and as a consequence large firms are more reluctant to implement a pension freeze. Following these findings, the following hypothesis is formulated:

- *Hypothesis 5: sponsor firms with less employees are more likely to implement a hard freeze.*

Rauh (2006) finds that the investment of firms with credit ratings worse than BBB+ are the most vulnerable to mandatory pension contributions. These types of firms have no choice but to reduce their investments drastically due to the mandatory pension contributions, whereas corporations with credit ratings no worse than A- are not significantly affected by the mandatory pension contribution. Based on this finding this study argues that freezes of DB pension plans have different effects on the financials of Sponsors based on the sponsor's credit rating. As already mentioned firms that freeze their pension plan experience an increase in their return on equity afterwards (Atanasova & Hrazdil, 2010; Choy et al., 2014). By freezing their pension plans firms with low credit rating are left with more internal resources to use for investments, whereas firms with high credit rating do not experience any significant changes. This study predicts that, as a results of the larger impact of the freezing decision on the internal

resources, non- investment grade companies experience a higher increase in their returns. Thus, for the second research question the following hypothesis is formulated:

- *Hypothesis 1: non-investment grade sponsors experience a higher increase in their return on equity after freezing than investment grade sponsors.*

After freezing the pension plan the balance sheet of the sponsor improves. This is viewed by investors as good news and as a consequence the competitive position of the sponsor firm improves. A stronger competitive position can be manifested through higher profitability. This study expects that non-investment grade sponsors experience a higher increase in their profitability measures because they are the ones that are most affected by the mandatory pension contribution. Based on this reasoning the following hypotheses are formulated:

- *Hypothesis 2: non-investment grade sponsors experience a higher increase in their return on assets after freezing than investment grade sponsors.*

- *Hypothesis 3: non-investment grade sponsors experience a higher increase in their cash flow after freezing than investment grade sponsors.*

Lastly, Shivdasani and Stefanescu (2009) find that when determining their leverage ratio firms always take their pension assets and liabilities into account. More specifically, one percentage point decrease in the projected benefit obligation is associated with an increase in leverage ratio equal to 0.36 percentage points (Shivdasani & Stefanescu, 2009). Because borrowing is costly and risky for firms with non- investment grade rating this study expects that this group of sponsors increases their leverage ratio less than investment grade companies after the freeze. Therefore, the fourth hypothesis is as follows:

- *Hypothesis 4: non-investment grade sponsors experience a smaller increase in their leverage ratio after freezing than investment grade sponsors.*

3 Research design

3.1 Sample and Data Gathering

This study examines which sponsors decide to freeze their DB pension plan during the 2002 to 2014 period. This paper retrieves plan information from the department of labor's form 5500s. Each company that sponsors a tax qualified defined benefit pension plan must file the form 5500 annually with the department of labor (DOL), internal revenue services (IRS) and the pension benefit guarantee corporation. Hard frozen defined benefit plans are identified in the form 5500 by a features code for DB pension plans. Sponsors of DB pension plans use this code if "as of the last day of the plan year, the plan provides that no participant will get any new benefit accrual (whether because of service or compensation)". In other words, plan sponsors apply this code if their plan is hard frozen. This code was added to the form 5500 in 2002. Accordingly, the sample period of this study starts in 2002. Analyzing data in years prior to 2002 makes the identification of hard frozen plans difficult and almost impossible.

Table 3 contains the total number of hard freezes for each year during the 2002 -2014 period. During the 2002 - 2014 period there were a total of 1279 hard freezes. Most of the pension freezes took place after 2008. More specifically, 2012 accounts for the most pension freezes. In the year 2012 155 pension funds froze their pension plans. In order to analyze the first research question, I extract information of all DB pension plans that filed the form 5500 for each filing year between 2002 and 2014. Due to the difficulty in identifying DB pension plans from the form 5500, this study uses the following rule of thumb: every pension plan that has a liability equal to zero is categorized as a DC pension plan and is left out of the sample data. Financial information, such as balance sheet and income statement line items, of every plan is available from" schedule H" of the form 5500. Merging the information from schedule H with general information from form 5500 by using the employer identification number (EIN) allows all the plan information to be included in one data set.

In addition to plan information from form 5500, I proceed to gather sponsor information from Compustat and CRSP. For each fiscal year between 2002 and 2014 I download sponsor information for all companies on Compustat and monthly holding period return from CRSP and merge these two data sets together. The Employer identification number serves as a common identifier to merge plan level information from form 5500s with their corresponding sponsor level information from Compustat and CRSP. Not all sponsors of the pension plans that file the form 5500 are available in Compustat or CRSP. Therefore, pension plans of sponsor companies that cannot be identified in Compustat and CRSP are left out of the analysis. A firm can sponsor several pension funds. In that case the sample data then contains

sponsor firms that are present more than once in a given year. This is also the case in this dataset. However, because Compustat variables are quantified at the sponsor level I also adjust the pension plan variables. For each sponsor and year, I compute aggregate values for each pension plan variable.

For the second research question I first download the leverage, return on equity, return on assets and cash flow from operations data from Compustat three years before the freeze and then three years after the freeze for each sponsor and a matched control firm. Subsequently, similar steps are taken for the monthly holding period return from CRSP. After calculating the needed variables and merging the before and after financials for Compustat and CRSP individually, I then merge the Compustat with CRSP data. The treatment group is further divided into two subgroups based on the sponsor's credit rating. The treatment group contains 112 sponsor firms, of which 35 sponsor have a non-investment grade rating and 77 have an investment grade rating[9]. The control group consists of 76 matched firms[10].

3.2 Independent Variables

Capital expenditures:

This variable is a numerical variable that outlines the annual dollar amount of expenses to property, plant and equipment (in millions). It measures the annual capital expenditures scaled by total assets. Capital expenditures is a proxy for cash needs and Is used to test hypothesis 1.

Acquisition:

The variable acquisition includes the following items:

- Acquisition of additional ownership (that is, decrease in minority interest)
- Additional investment in a company if the company is consolidated

[9] The number of sponsor was initially 204. The years 2013 and 2014 are excluded because their financials three years after the freeze decision are not available yet. After exclusion of these two years the number of sponsors decreased to 176. However, after downloading and merging the data 64 companies are left out because some of them cannot be found in Compustat/CRSP and some of them do not have the required information.

[10] The control group consists of less firms than the treatment group because a lot of control firms were left out in the matching and data gathering process. No match was found for 14 of the 176 sponsors, thus they were left out of the analysis. Financial data for the control firm three years before and three years after the freeze of the matched sponsor was not completely available for each control firm. For some firms Compustat/CRSP had data three years before the freeze of their matched sponsor but no data for the third year after the freeze and vice versa. When merging the before and after financials of the control firms, firms with lack of data were automatically left out of the examination. More data was lost when merging Compustat data with CRSP. After all these steps only 76 control firms were left over.

- Costs in excess of net assets of businesses acquired (goodwill)
- Long-term debt assumed in an acquisition
- Net assets of businesses acquired
- Property, plant, and equipment of acquired companies
- Acquisition of assets, if the company mentions they acquired a business in the notes
- Purchase of business, net of cash acquired
- Additional cost of an acquisition
- Amounts associated with the "consolidation of an investment previously carried at equity"

The annual acquisition related amounts are scaled by total assets of the sponsor. Acquisition proxies for cash needs and is used to test hypothesis 1.

Stock repurchase:

Stock repurchase proxies for cash needs and includes:

- Conversion of Class A, Class B, special stock, and others, into Common/Ordinary Stock (Capital)
- Conversion of preferred stock into Common/Ordinary Stock (Capital)
- Purchase of treasury stock
- Retirement or redemption of common/ordinary stock
- Retirement or redemption of preferred stock
- Retirement or redemption of redeemable preferred stock

Stock repurchase assesses the annual dollars spent on repurchase of common and preferred stock scaled by total assets. Stock repurchase is also used to test hypothesis 1.

Leverage:

Leverage is numerical variable that represents the annual total debt (in millions) scaled by total assets of the sponsoring firm. Total debt consists of long term debt and short term debt. It is costly and risky for sponsor firms with high leverage to borrow money because they have a higher chance of facing bankruptcy. Leverage, thus proxies for vulnerability to bankruptcy and is used to test hypothesis 2 (also used to test hypothesis 4 of the second research question).

Credit risk:

Credit risk is a categorical variable that represents the Standard & Poor's long term credit rating for each plan sponsor at the end of each fiscal year. I code the Standard and Poor's credit ratings into 3 categories as follows: investment grade high quality "AAA" – "AA" (the reference category), investment grade

medium quality "A"- "BBB" (value 1) and junk bonds "BB" and lower (value 2)[11]. Firms with a high credit risk have a low credit rating and vice versa. Credit risk is also used as a proxy for vulnerability to bankruptcy.

Return on equity (ROE):

Return on equity is a measure of performance and is calculated by annualizing the monthly return for each sponsor (in percentages). Companies with a low or negative annual return perform poorly which increases their likelihood of freezing their pension funds. Return on equity is used to test hypothesis 3 (also used to test hypothesis 1 of the second research question).

Return on assets (ROA):

ROA is a profitability measure and it determines how much profit can be generated with the assets invested. It is calculated as the ratio of annual net income of the sponsor to total assets of the sponsor. Sponsors with a low ROA are considered to be less efficient and less profitable. ROA is used to test hypothesis 3 and proxies for firm performance (also used to test hypothesis 2 of the second research question).

Cash flow:

Cash flow is a numerical variable that represents only cash from operating activities (CFO). Thus, the net change in cash from all items classified as "operating activities" in the cash flow statements of the sponsor firms. It quantifies the annual cash flow from operations scaled by total assets of the sponsor. Cash flow from operations is also a proxy for firm performance and is used to test hypothesis 3 (also used to test hypothesis 3 of the second research question).

Book to market ratio:

This variable is calculated as the ratio of annual book value of common equity to the annual market value of common equity. The book to market ratio is often used as a proxy for firm growth (Beaudoin et al., 2010). Sponsor firms with a high book to market ratio have a lot of growth opportunities, while companies with a low book to market have little growth opportunities. Book to market ratio is used to test hypothesis 4.

[11] More specifically, the variable credit risk is coded as follows: AAA=0, AA+=0, AA=0, AA-=0, A+=1, A=1, A-=1, BBB+=1, BBB=1, BBB-=1, BB+=2, BB=2, BB-=2, B+=2, B=2 B-=2, CCC+=2, CCC=2, CC=2, DS=2 and D=2.

Employees:

This variable is transformed to quantify the annual percentage change in the number of employees. It includes annual percentage change in all part-time and seasonal employees and all employees of consolidated subsidiaries, both domestic and foreign. This item excludes: consultants, contract workers and employees of unconsolidated subsidiaries. It is used to test hypothesis 5.

3.3 Control Variables

As control variables this study makes use of the following plan level variables: retired participants, sponsor contribution, fund expenses, funding ratio and plan size.

Retired participants:

This variable is a numerical variable expressed in percentages. It is calculated as a percentage of total participants. Retired participants consist of retired or separated participants receiving benefit or retired or separated participants entitled to future benefits. Total participants consist of active participants, retired or separated participants receiving benefits and retired or separated participants entitled to future benefits. This variable encompasses the aggregated total retired participants for all the pension funds sponsored by each company. It measures the extent to which current sponsor contributions are allocated to provide pension benefits for past workers. It is included as a control variable because a higher percentage makes it more likely that the sponsor freezes its pension plan. Munnell and Soto (2007) find that a 1 percentage point increase in retired participants increases the probability of a freezing by 13.6 percentage points.

Sponsor contribution:

Sponsor contribution is a numerical variable and it represents the annual aggregated pension contribution of sponsors to their pension plans. It is calculated as the sum of cash and non-cash contributions from the sponsor to all its pension plans and it is scaled by total assets of the sponsor. This variable is included in the model to control for the possibility that high pension contributions motivate sponsors to freeze their pension plans.

Fund expenses:

Fund expenses is a numerical variable that represents total expenses of pension plans in a year. It is calculated as the sum of administrative expenses and total benefits payments directly to participants, beneficiaries, insurance companies and others. It is aggregated at the sponsor level and scaled by total

aggregated assets of the pension funds for each sponsor. By including fund expenses this study controls for the possibility that DB pension funds with increasing expenses are frozen because it becomes costly for the sponsor to maintain such a pension plan. Atanasova and Hrazdil (2010) find that a 1 percentage point increase in the ratio of pension expense to assets increases the probability of a freeze by 2.74 percentage points.

Funding ratio:

This ratio gives an indication of the degree to which the pension fund assets cover the pension benefits that are paid out now and in the future (Siegmann, 2011). In calculating the funding ratio this study follows the same approach as in Rauh et al. (2013). The funding ratio is calculated as the fair value of plan assets minus plan liabilities divided by plan liabilities. Plan liabilities here refers to the projected benefit obligation(PBO). PBO is the "actuarial present value of all benefits earned by an employee as of a specified date for service rendered prior to that date plus projected benefits attributable to future salary increases". The funding ratio is aggregated at the sponsor level. Thus, it gives the total funding ratio of all plans sponsored by a given company. Funding ratio is included as a control variable to control for the probability that a high funding ratio motives sponsors to freeze their pension plans. Atanasova and Hrazdil (2010) find that a 1 percentage point increase in the funding ratio increases the probability of a freeze by 0.37 percentage points.

Plan size:

Plan size is calculated as the natural logarithm of the aggregated pension plan assets for each sponsor. Plan assets consist of all items on the asset side of the balance sheet as described in the department of labor's form 5500. Plan size is included as a control variable to control for the size of the pension plans. Atanasova and Hrazdil (2010) find that a one percentage point decrease in the size of the pension plan increases the probability of freezing by 0.21 percentage points.

3.4 Methodology

In order to analyze the characteristics of sponsors that decide to freeze their DB pension plans (first research question), this study uses two types of techniques: The Probit model and the Cox proportional hazard model. In both models the dependent variable is a binary variable with a value of 1 if the plan is hard frozen and 0 if the plan is still open. For the second research question this study applies a paired t-test on a treatment and control group.

3.4.1 Probit Regression

The Probit model calculates the probability of an event occurring, that is, it calculates the probability that sponsor firms freeze their pension plans. This study calculates the marginal effect of each variable. The marginal effect estimates the average increase or decrease in the probability of freezing due to an increase in one of the financial variables. A positive (negative) coefficient indicates that if the variable of interest increases, while all other variables are held constant, the probability of freezing increases (decreases).

In previous years many well-known companies in the US announced that they are freezing their DB pension plan. For example, Verizon communication Inc. announced on December 5, 2005 that as of July 2006 it will end defined-benefit pensions. General Motors Co. announced in January 2012 that as of October 2012 it is freezing its DB pension plan. Boeing announced on march 6, 2104 that as of January 2016 it is freezing its traditional defined-benefit pensions. Based on these news announcements the average period between the freezing announcement and the execution is approximately 6 months to 1 year. Therefore, the first 3 set of regressions with the Probit model estimates the probability of freezing with only contemporaneous variables, while the second set of regressions with the Probit model includes only 1 year lagged variables.

The first specification includes the capital expenditures, credit risk and annual return. The second specification includes acquisition, leverage and return on assets, while the last specification includes stock repurchase, cash flow, book to market and employees. The predicted sign on Capital expenditures, acquisitions and stock repurchase is negative: sponsor firms that have less cash to spent on such investments due to mandatory pension contributions are more motivated to freeze their DB pension plans. Moreover, the predicted sign on credit risk and leverage is positive: Sponsor firms with high credit risk and high leverage are more vulnerable to bankruptcy and it becomes costlier and riskier for them to borrow money. The predicted sign on return on equity, ROA and cash flow from operations is negative: a lower value for these variables indicates that the sponsor firms are less profitable, they generate less cash and they perform poorly. The predicted sign on book to market is positive: the higher the book to market ratio to more growth opportunities sponsor firms have the more likely they are to freeze their DB pension plan. The predicted sign on employees is negative: sponsors with less employees face less employee resistance and less public scrutiny when freezing. Following prior literature, the predicted sign for the first four control variables is positive, while the predicted sign for plan size is negative.

3.4.2 Cox Proportional Hazard Model

Cox regression calculates the hazard rates for the independent variables. The hazard rate is the probability that a subject will experience an event at time t, while that subject is at risk for having an event. Thus, in this study the hazard rate is the probability that a DB pension plan is frozen, while the pension plan is at risk for being frozen. Hazard ratios greater than one entails that a unit increase in the variable of interest, while all other variables are held constant, increases the probability of the event occurring. To the contrary a hazard ratio of less than 1 entails that a unit increase in the variable of interest, while all other variables are held constant, decreases the probability of the event occurring. This study predicts hazard ratios of less one for capital expenditures, stock repurchase, acquisition, ROA, cash flow from operations, return on equity and employees. For book to market ratio, credit risk and leverage the predicted hazard ratio is greater than one. For the control variables: percentage retired participants, sponsor contribution, fund expenses and funding ratio, this study expects hazard ratios greater than one. For the last control variable, plan size, this study predicts a hazard ratio of less than one.

3.4.3 Paired T- test

After analyzing the first research question this study proceeds to inspect if the financials of sponsors with frozen DB plans improve after the freeze. In order to examine this, this paper performs a paired t test on four variables: return on equity, return on assets, cash flow from operations and leverage ratio. A paired t test is used, among other things, to test if the mean difference between two groups, that are measured at two different points in time, is statistically significantly different from zero. The null hypothesis is that the difference between the mean of two groups is equal to zero, whereas the alternative hypothesis is that the difference between the mean of two groups is bigger or smaller than 0 (two tailed). More precisely, this study uses the paired t-test to examine if the return on equity, return on assets, cash flow and leverage three years before the freeze are the same as the return on equity, return on assets, cash flow and leverage three years after the freeze. This study applies this method for a treatment group as well as a control group. The treatment group consists of sponsors that froze a pension plan during this study's sample period. The treatment group is divided into sponsors with investment grade and sponsors with non-investment grade credit rating. Before conducting the t-test there is one important assumption that needs to be met. The t test assumes that the distribution of the difference between the two groups is normally distributed. A variable is considered to be normally

distributed if it has more than 30 observations. Both the treatment group and the control group have more than 30 observations. Thus, the normality assumption is not violated.

3.4.4 Matching Process

In order to assess if improvements or deteriorations in sponsors' financials three years after the freeze are caused by the freeze decision, this study creates a control group. The control is created by matching the sponsor firms in this study's dataset with US corporations based on industry and size. For each year I first download the standard industry classification code (SIC code) and market value of equity of the sponsors (treatment group) one year before they freeze their first DB pension plan. I then gather SIC code and market value of equity for all companies listed on Compustat north America. So, for sponsors that froze a DB plan in 2002 I gather their SIC code and market value of equity in 2001 and the SIC code and market value of equity of all corporations listed on Compustat in 2001 and try to find a match. The algorithm that this study uses first looks for a match by using the 4-digit SIC code. If no match is found than it proceeds to find a match by using the 3-digit SIC code and if still no match is found than it uses the 2- digit SIC code. This first step provides this study with a group of control firms in the same industry for each sponsor. The second step involves choosing one control firm in the group with a market value of equity similar to that of the sponsor firm. These two steps ensure that sponsors are first matched on industry and then on the smallest difference in market value of equity. This study's sample of control firms includes control firms that are matched to more than one sponsor firm. To ensure that the control group does not consist of sponsors that froze a plan, I first remove all sponsors that I have in my data set (sponsors with open as well as frozen DB plan) from the data set of potential matches acquired from Compustat for each year. This ensures that no sponsor is matched to a company already included in this study's data set. Still, even after this approach it is not one hundred percent guaranteed that the sample of control firms only consists of sponsors with open DB plans or DC plans.

4 Empirical Results and Analysis

4.1 Preliminary Results

4.1.1 Descriptive Statistics

As a preliminary step in studying the characteristics of sponsor firms that freeze their DB pension funds, this section examines descriptive statistics of freeze and non- freeze firms. Table 4 presents means, standard deviations, minimums and maximums of key variables used in this study. To account for potential outliers this study winsorizes all variables at the 1th and 99th percentiles. The observations of frozen firms are gathered in the right panel and the observations of firms with open DB plans are gathered in the left panel. The Freeze and non-freeze firms in the United States differ on a variety of observable aspects. Firms that freeze their DB pension plans spent less on capital expenditures and acquisitions. The mean amount of capital expenditures and acquisitions scaled by total sponsor assets of freeze firms is 0.036 and 0.017 compared to 0.040 and 0.021 for non- freeze firms. Freeze firms appear to have a higher leverage and seem to perform better, as indicated by the higher average leverage ratio and yearly return. Additionally, freeze firms appear to be more profitable, as they have return on assets (0.037) that are on average higher than those of non- freeze firms. It also appears that freeze firms have lower cash flows (from operations) on average. In addition, freeze firms have less growth opportunities than firms that do not freeze. This is indicated by the lower average book to market ratio. They also have less change in their annual number of employees. The mean annual percentage change in employees is 1.5% for freeze firms compared to 3.9 % for non- freeze firms.

When looking at the control variables it is observable that freeze firms have a higher percentage retired participants to total participants. This implies that less of the liability is coming from benefit promises to active employees. Freeze firms also pay higher contributions to their pension plans. The pension fund expenditures of freeze firms are lower than non-freeze firms. Fund expenses of freeze firms scaled by total plan assets amount to an average of 0.19, while non freeze firms have an average value of 0.71. When looking at the funding ratio, it is observable that both freeze and non- freeze firms are underfunded. However, freeze firms are less underfunded than non-freeze firms. Additionally, freeze firms have bigger pension plans in terms of assets size. Finally, it appears that freeze firms do not differ much from non-freeze firms in the following aspects: credit risk and stock repurchase. Freeze firms and non-freeze firms have on average a similar credit rating (as indicated by credit risk) and they appear to spent similar amounts on stock repurchases on average.

4.1.2 Correlation Matrix

To analyze the correlation between the independent variables this study uses the Spearman correlation test. The correlations are estimated so as to examine if there are high correlations between the independent variables. High correlations are a problem because they may lead to multicollinearity (that is, the independent variables predict each other). Table 5 presents the correlation matrix. The highest correlation is between cash flows from operations and return on assets (ROA). This correlation is respectively 0.47. This implies that sponsor firms with more cash flows from operations have high ROA as well. Furthermore, percentage change in employees has a correlation of 0.45 with acquisition scaled by total sponsor assets. This indicates that sponsor firms with high changes in their number of employees also conduct more acquisitions. Cash flow from operations scaled by total assets further has a moderate correlation with capital expenditures and stock repurchase scaled by total assets. The correlation of cash flow from operations with capital expenditures and stock repurchase is respectively, 0.32 and 0.39. It is expected that firms with more cash can spent more on investments, such as capital expenditures and stock repurchase. Moreover, stock repurchase scaled by total assets has a correlation of 0.37 with return on assets. Sponsor firms with high return on assets are additionally firms that repurchase more stocks. Sponsor firms with high return on assets also have a low credit risk, as indicated by the correlation of -0.32. Finally, credit risk and leverage have a correlation of 0.40. This positive relation is not unexpected. As leverage increases it is reasonable that the credit risk of the corresponding firm also increases. The correlations between the other variables are low (<0.30). The correlations between the independent variables do not appear to indicate any multicollinearity problems[12].

4.2 Main Results

4.2.1 Main Results: Probit Model

Table 6 presents empirical results on the contemporaneous relation between sponsor level characteristics and the decision of sponsors to freeze their DB pension plan, while table 7 presents

[12] Control variables are excluded from the correlation matrix for visibility purposes. Most of the control variables, with the exception of the correlation between the pension plan size and credit risk (0.40) and the correlation between plan size and fund expenses (0.40), have a correlation of less than 0.30.

results on the relation between 1 year lagged sponsor level characteristics and the freeze decision[13]. All standard errors are clustered by year. The coefficients should be interpreted as the marginal effect: A positive (negative) coefficient indicates that if the variable of interest increases(decreases), while all other variables are held constant, the probability of freezing increases (decreases).

The first hypothesis states that sponsor firms that are cash constrained are more likely to implement a hard freeze. Capital expenditures, acquisitions and stock repurchase proxy for cash needs. Table 6 (model 1) reveals that capital expenditure has a p-value of 0 and is thus significantly different from zero at the one percent significance level. Both the sign and the significance are in line with expectations. For each 1 percentage point increase in capital expenditures scaled by total assets at time T, while all other variables are held constant, there is a 0.50 percentage point lower probability of the plan freezing at time T. Capital expenditures scaled by total assets of the previous year is also significant at the 1 percent significance level. A one percentage point increase in capital expenditures scaled by total assets at time T-1 decreases the probability of freezing at time T by 0.76 percentage points. Thus, capital expenditures of the previous year and the current year have a negative association with the freeze decision.

Model 2 shows that acquisition scaled by total assets has a p-value of 0.098 and is therefore significantly different from zero at the 10 percent significance level. A one percentage point increase in acquisitions scaled by total assets at time T decreases the probability of freezing by 0.14 percentage points, all else equal. In this case the results are also in line with expectations. Nonetheless, when considering if the acquisitions in the previous year also influences the freeze decision at time T this study finds no such evidence. Thus, only acquisitions conducted in the current year influence the freezing decision.

Nevertheless, neither the contemporaneous nor the 1 year lagged stock repurchase are significant. Atanasova and Hrazdil (2010) also find a positive and insignificant relation. From table 4 it appears that freeze firms and non-freeze firms spent on average similar amounts on stock repurchase. This may explain the insignificant relationship between stock repurchase and the probability of freezing. Based on the significance of capital expenditures and acquisition, this study does not reject the first hypothesis.

[13] The variance inflation factor (VIF) is used as an indicator of multicollinearity. If the VIF is lower than 10 than there is no multicollinearity present (Hair et al., 2006). The variance inflation factor is less than 10 for al variables. Thus, based on the VIF this paper concludes that there is no multicollinearity problem.

The second hypothesis predicts that sponsor firms that are more vulnerable to bankruptcy are more likely to implement a hard freeze. To test this hypothesis, I use credit risk and leverage as proxies for susceptibility to bankruptcy. Table 6 (model 1) shows that both the medium investment grade rating and junk bond rating are significant. This implies that sponsor companies with medium quality Standard & Poor's credit rating (i.e., between "A" and "BBB") at time T have a probability of freezing at time T that is 3.2 percentage points higher than companies with high quality credit rating (i.e., "AAA"- "AA"). Moreover, companies with junk bond credit rating have a probability of freezing that is 8.3 percentage points higher than companies with high quality credit rating. Almost similar results are found when looking at the credit rating of the previous year. Yet, the contemporaneous and the one year lagged leverage ratio are not significant. Choy et al. (2014) also find an insignificant coefficient for the leverage ratio. The credit rating results are in agreement with this study's expectations, thus following these findings the second hypothesis is not rejected.

The third hypothesis suggests that sponsor firms with poor performance are more likely to implement a hard freeze. Using return on equity as a proxy for firm performance does not reveal any association between this variable and the freezing decision. Both the contemporaneous and 1 year lagged variables are insignificantly different from zero. The results are not as expected. The idea of freezing pension plans so as to increase/ improve return on equity seems very lucrative, still in practice it may be very difficult and the costs of freezing the pension plan may outweigh the benefit, which is the increase in return on equity (McFarland et al., 2009). This offers a possible explanation for the insignificant results.

On the contrary return on assets displays a negative and significant relationship with the freezing decision. Return on assets (contemporaneous) is significant at the one percent significance level. This relation is observable with both contemporaneous as with the return on assets of the previous year. A one percentage point decrease in return on assets at time T increases the probability of freezing by 0.13 percentage points, all else equal. Whereas, a one percentage point decrease in return on assets of the previous year increases the probability of freezing by 0.20 percentage points, all else equal. This result is in line with this study's expectations and with Beaudoin et al. (2010).

Finally, cash flow from operating activities is also significantly different from zero. Both the contemporaneous and the 1 year lagged cash flows display a negative association with the freezing decision. A one percentage point decrease in cash flow from operations scaled by total assets at time T, while all other variables are held constant, increases the probability of freezing by 0.28 percentage points. Moreover, a one percentage point decrease in the cash flow from operations of the previous

year, while all other variables are held constant, increases the probability of freezing by 0.38 percentage points. This is in agreement with expectations and with the findings of Comprix and Muller (2011). Hereby, the third hypothesis is not rejected.

According to the fourth hypothesis sponsor firms with more growth opportunities are more likely to implement a hard freeze. To test the fourth hypothesis, this study uses the book to market ratio as a proxy for growth opportunities. The results reveal that the book to market has no significant relation with the freezing decision. The contemporaneous and the 1 year lagged book to market ratio are not significantly different from zero. This finding is in line with Beaudoin et al. (2010). They also find a negative and insignificant relationship between the book to market and the probability of freezing. The results are not according to this study's expectations. Hence, the fourth hypothesis is rejected.

The fifth hypothesis states that sponsor firms with less employees are more likely to implement a hard freeze. The annual percentage change in employees at time T has a p-value of 0.726 which renders it as statistically insignificant. This result is not according to expectations. The annual percentage change in the number of employees in the previous year is also statistically insignificant. This study on that account rejects hypothesis 5. The results are not as expected because it is possible that the presence of a union may be more relevant for the freezing decision than the number of employees.

The contemporaneous and one year lagged Probit regression models also include control variables and year dummies. Regarding the control variables: The percentage retired participants at time T and T-1 are statistically significant at the one percent significance level. A one percentage point increase in retired participants at time T increases the probability of freezing by 0.2 percentage points (table 6) and a one percentage point increase in retired participants at time T-1 increases the probability of freezing by approximately 0.1 percentage points (table 7: model 5&6). Neither sponsor contribution at time T nor sponsor contribution at time T-1 are statistically significantly different from zero. Both fund expenditures scaled by total plan assets at time T and at T-1 are statistically significant. Yet, the sign of both coefficients is the opposite of what is expected. If the fund expenditures scaled by sponsor assets at time T increases by one percentage point the probability of freezing at time T decreases by approximately 0.006 percentage points and if the fund expenditures scaled by total plan assets at time T-1 increases by one percentage point the probability of freezing decreases by approximately 0.003/0.007 percentage points. Both the contemporaneous (table 6: model 3) and the one year lagged funding ratio (table 7) is statistically significant. Despite the significant results the probability of freezing increases with 0 percentage points if the funding ratio of the current /previous year increases. Finally, plan size is also significant. A one percentage point increase in the size of pension plans at time T

increases the probability of freezing by 0.5 percentage points (table 6: model 2&3). A one percentage point increase in the size of the pension plans in the previous year increases the probability of freezing by 1.1 percentage points (table 7: model 4).

4.2.2 Main Results: Cox Proportional Hazard Model

Table 8 presents empirical results on the relation between sponsor level characteristics and the probability of freezing estimated with the Cox proportional hazard model[14]. As can be seen from table 8 (model 1) capital expenditures scaled by total assets is significant at the 5 percent significance level. This variable has a hazard ratio equal to 0.000. This means that a one-unit increase in capital expenditures scaled by total assets, while holding all other variables constant, decreases the probability of freezing by 100 percent. This finding is in agreement with expectations. Acquisition, the second proxy for cash needs, is also significant at the 5 percent significance level. Acquisition has a hazard ratio of 0.111. A one-unit increase in capital expenditures scaled by total assets decreases the probability of freezing by 88.9 percent. Nonetheless, stock repurchase is not significant. Based on the findings of the first two proxy variables this study does not reject hypothesis 1.

According to table 8 (model 1) credit risk is not significant. Both the medium quality investment grade rating and the junk bonds are not significantly different from zero. This is not surprising, despite getting significant results with the Probit model the descriptive statistics show that freeze and non-freeze firms in this sample have similar credit rating on average. Leverage also seems to have no relation with the freezing decision. Thus, hypothesis 2 is rejected. Although on average freeze firms have a higher leverage than non- freeze firms in our sample the difference is so small that it may not be enough to acquire a significant result.

Return on equity and return on assets are also not statistically significantly different from zero (table 8: model 1 & 2)). Cash flow from operations is the only significant variable (at the one percent significance level) that proxies for firm performance. Cash flow from operations has a hazard ratio of 0.065. A one-unit increase in cash flow from operations scaled by total assets, while holding all other variables constant, decreases the probability of freezing by 93.5 percent. This finding is in agreement

[14] When using the Cox proportional hazards model the variables must satisfy the proportional hazard assumption. This assumption implies that the hazards ratios are constant over time (Jadwiga, 2014). Thus, the influence of the variables on the hazard level is the same through time. However, violation of this assumption is not truly problematic. The hazard ratio for variables that do not satisfy this assumption can be interpreted as the 'average effect' over time (Allison, 1995). Only the first model violates the proportional hazard assumption.

with this study's expectations. Therefore, based on the findings of cash flow from operations this study does not reject the third hypothesis.

As is the case with the Probit model, table 8 (model 3) reveals that the book to market ratio and the percentage change in employees are both not statistically significantly different from zero. This is why hypothesis 4 and 5 are rejected. With respect to the control variables, this study finds that only the percentage retired participants is significantly different from zero at the 1 percent significance level. The corresponding hazard ratio is 1.02. Thus, a one-unit increase in percentage retired participants, while holding all other variables constant, increases the probability of freezing by 2 percent.

4.2.3 Main Results: Paired T- test

This section reports the results for the second research question. Table 9 contains the results of the paired t-test on investment grade sponsors, non-investment grade sponsors and a control group. The first hypothesis states that sponsors with non- investment grade rating experience a higher increase in their return on equity after the freeze than sponsors with investment grade rating. The group of sponsors with non-investment grade rating has a p-value of 0.021. The null hypothesis is, thus rejected and this means that the mean return three years after the freeze is significantly different from the mean return three years before the freeze. As can be seen in table 9 the sponsors with non-investment grade rating experience a significant increase in their annual return on equity equal to 36.7 percent. This is according to this study's expectations. Nevertheless, the p-value of investment grade sponsors is 0.151. This implies that the difference between the average return on equity three years before and three years after the freeze is not significantly different from zero. Based on these findings this study does not reject the first hypothesis.

The second hypothesis predicts that sponsors with non-investment grade credit rating experience a higher increase in their return on assets after the freeze than sponsors with investment grade credit rating. With a p-value of 0.029, the difference between the average return on assets three years before and three years after the freeze is significantly different from zero at the 5 percent significance level (Table 9). Sponsors with non-investment grade rating experience a significant increase in their return on assets equal to 0.069. As is the case with the return on equity, the difference in the mean return on assets of investment grade sponsors is also not significantly different from zero. The second hypothesis is not rejected.

According to the third hypothesis sponsors with non-investment grade credit rating experience a higher increase in their cash flow after the freeze than sponsors with investment grade credit rating. The p-value of 0.252 is above the 10 percent significance level and is therefore not significant. Sponsors with non-investment grade credit rating experience no significant changes in their annual cash flow from operations three years after freezing. Sponsors with investment grade credit rating also do not experience any significant changes in their cash flow from operations (p-value :0.778). The results indicate that cash flow from operations does not change at all three years after the freeze. The fourth hypothesis is thus rejected.

Lastly, the fourth hypothesis states that sponsors with non-investment grade credit rating experience a smaller increase in their leverage ratio after the freeze than firms with investment grade credit rating. Surprisingly, the change in the leverage ratio is not significant. The p-value of 0.394 renders the result as not significantly different from zero. A similar outcome is also found for sponsors with investment grade rating. On this account the fourth hypothesis is rejected. These results are not in line with expectations. Choy et al. (2014) do find a significant increase in leverage ratio after freezing. However, their examination is conducted one year instead of three years after the freeze. The timing of the investigation can play a crucial role in the results that can be obtained.

After applying the paired t-test on the treatment group this study uses the same methodology on a control group. The control group consists of firms matched first on SIC code and then on market value of equity. The purpose of the control group is to determine whether changes in sponsor financials after the freeze are attributable to the freeze or other industry specific factors. The results in table 9 show that the mean difference in returns three years before and three years after the freeze of the matched sponsors is not significantly different from zero. With a p-value of 0.286, the change in Return on assets of the control group is also not significantly different from zero at the 10 percent significance level. Similar conclusions arise when performing the t-test on cash flow from operations and leverage ratio. Thus, sponsors with non-investment grade credit rating that freeze their DB pension plan experience a significant increase in their return on equity and return on assets afterwards, while non-investment grade sponsors and the matched firms do not experience any significant changes.

5 Conclusion

The purpose of this research is to get a better understanding of the increasing trend in the United States of freezing DB pension plans and to find out which companies (in terms of company financials) are behind this trend. The two questions that this study tries to answer are firstly, what are the characteristics of U.S. corporations that decide to freeze their DB pension plans and secondly, if the performance of sponsors improve after freezing. Looking at prior literature it is clear that empirical research on the relation between company financials and the freeze decision is scarce. To this paper's knowledge little is known about this topic. Hence, this study aims to analyze the relation between company financials and the probability of a hard freeze and to examine if freezing is followed by an improvement in performance. The study ranges from 2002 to 2014 and only includes companies for which plan level and sponsor level information are available from form 5500s, Compustat and CRSP.

Different results arise when using the Probit model and the Cox proportional hazard model. by looking exclusively at the Probit model it can be concluded that sponsor companies that are cash constrained, that is, they invest less in capital expenditures and conduct less acquisitions, are the ones that are most likely to implement a hard freeze. It is also evident from the results that hard freezes are more common for companies with non- investment grade rating than for companies with investment grade rating. Lastly, U.S corporations that are unprofitable in terms of low (negative) returns on assets and low (negative) cash flows from operations are also at risk for implementing a hard freeze. Because most of these results are also significant when estimating the results with the variables of the previous year (except for acquisition) this study is able to interpret the results in terms of causality. Thus, it appears that cash needs, low profitability and high risk of bankruptcy are the driving forces behind the pension freezes in the U.S. If companies in a given year are confronted with such characteristics they most likely end up freezing one or more DB plans in the following year.

Unfortunately, when looking at the results acquired with the Cox proportional hazard model different conclusions arise. The empirical estimations with this technique also show that hard freezes are more likely for companies with low capital expenditures and for companies that conduct less acquisitions. Sponsor companies with low profitability in terms of low cash flow from operations are also more likely to implement a hard freeze. In contrast to the Probit model, the Cox proportional hazard model does not find any significant relations between the freeze decision and the other sponsor level variables.

With regard to the second research question, the results show that sponsor firms experience an increase in their return on equity and return on assets three years after the freeze. Nevertheless, this increase depends on the sponsor's credit rating at the end of the freezing year. Companies with a non-investment grade credit rating experience a significant increase in their return on equity and return on assets three years after the freeze, while investment grade companies do not experience any significant changes. Additionally, this paper performs the same technique on a control group matched first on SIC code and then on market value of equity. By using a control group inferences can be made about causality. It appears that the freeze decision causes the return on equity and return on assets of non-investment grade sponsors to increase afterwards (three years after).

This study contributes to the pension and corporate finance literature by shedding light on whether U.S. DB pension plans are sponsored at the expense of firms' financial health. As a result of this study, there is empirical evidence that freezes of U.S. DB pension plans are most likely to be implemented by sponsors that are financially unhealthy. Pensions are thus a financial burden for these types of companies. In addition, the empirical results provide insight of why sponsors with non-investment grade credit rating are more than twice as likely to implement a hard freeze. For these types of sponsors freezing goes hand in hand with an improvement in performance (higher return on assets and return on equity), thus they have a bigger incentive to freeze than sponsors with investment grade credit rating.

Freezes of DB pension plans by unhealthy companies have implications for employees of DB plans and pension authorities. Employees of DB plans and pension authorities are now aware that pension freezes by healthy companies nowadays seems to be the exception rather than the rule. Employees should become more informed about the financials of their company as well as their DB pension plans. A pension freeze should not come as an unexpected surprise anymore for employees covered by a DB pension plan. low investments in capital expenditures, a low credit rating and/or bad performance are all red flags that informed employees should recognize in advance. American workers covered by DB plans should start looking into other ways of saving more for their retirement. Furthermore, pension authorities should consider the possibility of monitoring the financial health of companies with such characteristics in order to detect on time when DB pension plans start to become a financial burden and to then implement pension policies that may help sponsor companies recover rather than choosing for a hard freeze.

Most of the difficulties in this study lie at the data gathering process. The website of the department of labor provides two types of datasets for a particular filing year. One data set is named

“all”, while the other is named “latest”. Datasets named “All” include all filings attempts made by pension plans in that particular year. Thus, a lot of pension plans reappear more than once in the same dataset. As mentioned on the website “The dataset latest, includes only the latest most correct filling for a plan”. However, this feature was introduced in 2009. The website mentions that datasets prior to 2009 are complete. Nevertheless, in this study’s opinion the datasets before 2009 are not well organized. Some datasets before 2009 include duplicates for a lot of pension plans in the same year. This made the merging process lengthy. Furthermore, some of the datasets on the website of the department of labor are huge. They provide their datasets in excel files. To import the data in Stata, I first had to split most of the datasets in two separate excel files and then import them separately in Stata. Subsequently I then proceeded to putting them back together and create one file for each year by using the append command in Stata. This on top of the duplicates problem made the process of gathering the data and importing it into Stata very lengthy and challenging. Moreover, before 2009 the form 5500 had a code that helps identify defined benefit pension plans. Unfortunately, since 2009 this code is no longer available. This code distinguishes a DB from other types of plans. As a solution this study introduced the rule of thumb mentioned in the data section. However, the drawback of this solution is that it does not guarantee that sample will only consist of DB pension. The possibility exists that other pension types are also included in this data set or that not all DB pension plans are included in the data set. Moreover, merging Compustat data and DOL data proved to be a challenge. A lot of sponsors that file the form 5500 are left out of the study because they cannot be found in Compustat. Even after successfully merging the DOL data with Compustat data this study had to leave variables, such as foreign exchange income/ loss, outside of the examination because the number of observations was not enough. Lastly, gathering data for the second research question from Compustat and CRSP also limited the size of the treatment group and the matched control group. This study had to draw conclusions from results estimated with a smaller group than originally anticipated.

Finally, further research on this topic can always focus on incorporating other variables in the study. Since the variable ‘Employees’ is not significant an alternative categorical variable (dummy variable) that indicates if the employees of a Sponsor firm are represented by a labor union can be an interesting addition to this study. freezing pension plans of workers represented by a labor union is assumed to be much more difficult, thus this variable has added value. Furthermore, this study only focuses on sponsors with DB pension plans. As mentioned in the introduction Verizon chose to freeze mainly because of their competitors that are not providing DB to their employees. It is therefore also intriguing to include a numerical variable that can measure the percentage of competitors in the same

industry that have DC pension plans. It is expected that the higher the percentage the higher the probability of freezing. This study only focuses on hard freezes because it is the most popular type of freeze. Nonetheless, it is compelling to investigate the driving forces behind soft freezes and closed freezes separately and also perform a broad investigation, which includes all types of freezes. Moreover, the method conducted in the second research question can also be used in a similar fashion for other company financials. For example, further research can focus on analyzing if the credit rating of Sponsors with frozen DB plans improve or deteriorate after the freeze.

Bibliography

Alderson, M. J., & Chen, K. C. (1986). Excess asset reversions and shareholder wealth. The Journal of Finance, 41(1), 225-241.

Alderson, M. J., & VanDerhei, J. L. (1992). Additional evidence on the reaction of shareholders to the reversion of surplus pension assets. Journal of Risk and Insurance, 262-274.

Allison, P. D. (1995). Survival analysis using SAS: A practical guide. Cary, NC: SAS Institute.

Atanasova, C., & Hrazdil, K. (2010). Why do healthy firms freeze their defined-benefit pension plans? Global Finance Journal, 21(3), 293-303.

Beaudoin, C., Chandar, N., & Werner, E. M. (2010). Are potential effects of SFAS 158 associated with firms' decisions to freeze their defined benefit pension plans? Review of Accounting and Finance, 9(4), 424-451.

Broadbent, J., Palumbo, M., & Woodman, E. (2006). The shift from defined benefit to defined contribution pension plans–implications for asset allocation and risk management. Reserve Bank of Australia, Board of Governors of the Federal Reserve System and Bank of Canada.

Buessing, M., & Soto, M. (2006). The state of private pensions: Current 5500 data. Issue in Brief, 42.

Choy, H., Lin, J., & Officer, M. S. (2014). Does freezing a defined benefit pension plan affect firm risk? *Journal of Accounting and Economics*, *57*(1), 1-21.

Comprix, J., & Muller, K. A. (2011). Pension plan accounting estimates and the freezing of defined benefit pension plans. Journal of Accounting and Economics, 51(1), 115-133.

Copeland, C. (2006). Retirement plan participation and retirees' perception of their standard of living. EBRI Issue Brief, (289).

Friedberg, L., & Webb, A. (2005). Retirement and the evolution of pension structure. *Journal of Human Resources*, *40*(2), 281-308.

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). Multivariate data analysis (Vol. 6). Upper Saddle River, NJ: Pearson Prentice Hall.’0p

Hamdallah, A. E. S., & Ruland, W. (1986). The decision to terminate overfunded pension plans. Journal of Accounting and Public Policy, 5(2), 77-91.

Iams, H., Butrica, B. A., Smith, K. E., & Toder, E. J. (2009). The disappearing defined benefit pension and its potential impact on the retirement incomes of baby boomers. Social security bulletin, 69(3), 1-28.

Ippolito, R. A. (1985). The economic function of underfunded pension plans. The Journal of Law & Economics, 28(3), 611-651.

Jadwiga, B. (2014). Extensions of cox model for non-proportional hazards purpose. Ekonometria, (3 (45)), 85-101.

McFarland, B., Pang, G., & Warshawsky, M. (2009). Does freezing a defined-benefit pension plan increase company value? Empirical evidence. Financial Analysts Journal, 65(4), 47-59.

Mercer Human Resource Consulting. A Closer Look at Recent High Profile Pension Plan "Freezes. New York: February 2006 Update.

Mitchell, M. L., & Mulherin, J. H. (1989). The stock price response to pension terminations and the relation of terminations with corporate takeovers. Financial Management, 41-56.

Mittelstaedt, H. F. (1989). An empirical analysis of the factors underlying the decision to remove excess assets from overfunded pension plans. Journal of Accounting and Economics, 11(4), 399-418.

Mittelstaedt, H. F., & Regier, P. R. (1990). Further evidence on excess asset reversions and shareholder wealth. Journal of Risk and Insurance, 471-486.

Munnell, A. H., & Soto, M. (2007). Why are companies freezing their pensions? Available at SSRN 1294772.

Munnell, A. H., & Sundén, A. E. (2006). 401 (k) plans are still coming up short. Available at SSRN 908264.

OECD (2015), "Coverage of private pensions", in Pensions at a Glance 2015: OECD and G20 indicators, OECD Publishing, Paris. DOI: http://dx.doi.org/10.1787/pension_glance-2015-34-en

OECD (2016), Net pension replacement rates (indicator). doi: 10.1787/4b03f028-en (Accessed on 10 May 2016)

OECD (2015), "Old-age dependency ratio", in Pensions at a Glance 2015: OECD and G20 indicators, OECD Publishing, Paris. DOI: http://dx.doi.org/10.1787/pension_glance-2015-23-en

Pension Benefit Guaranty Corporation (December 21, 2005). An Analysis of Frozen Defined Benefit Plans. Washington, DC: Pension Benefit Guaranty Corporation.

Petersen, M. A. (1992). Pension reversions and worker-stockholder wealth transfers. The Quarterly Journal of Economics, 1033-1056.

Phan, H. V., & Hegde, S. P. (2013). Pension contributions and firm performance: evidence from frozen defined benefit plans. Financial Management, 42(2), 373-411.

Rauh, J. D. (2006). Investment and financing constraints: Evidence from the funding of corporate pension plans. The Journal of Finance, 61(1), 33-71.

Rauh, J. D., Stefanescu, I., & Zeldes, S. P. (2013). Cost shifting and the freezing of corporate pension plans.

Rubin, J. (2007). The impact of pension freezes on firm value. Wharton Research Scholars Journal, 39.

Siegmann, A. (2011). Minimum funding ratios for defined-benefit pension funds. Journal of Pension Economics and Finance, 10(03), 417-434.

Shivdasani, A., & Stefanescu, I. (2009). How do pensions affect corporate capital structure decisions? Review of Financial Studies, hhp094.

Stone, M. (1987). A financing explanation for overfunded pension plan terminations. Journal of Accounting Research, 317-326.

Thomas, J. K. (1989). Why do firms terminate their overfunded pension plans? Journal of Accounting and Economics, 11(4), 361-398.

VanDerhei, J. (2006). Defined benefit plan freezes: Who's affected, how much, and replacing lost accruals. EBRI Issue Brief, (291).

Watson Wyatt. “Global pension asset study 2015.” Insider (February 2015).

Watson Wyatt. “Retirement plans offered by 2013 fortune 100 companies.” Insider (November 2013).

Wiatrowski, W. J. (2004). Medical and Retirement Plan Coverage Exploring the Decline in Recent Years. Monthly Lab. Rev., 127, 29.

Appendix

Table 1: Risk distribution in DB pension plans.

This table contains all the types of risks involved in defined benefit pension plans and who bears each type of risk.

TYPE OF RISK	***WHO ASSUMES IT?***
INVESTMENT	employer
INFLATION	Employer/ employee
LONGEVITY	Employer
MARKET TIMING	Employer
ACCRUAL	employee
VESTING	employee
EMPLOYER INSOLVENCY	Employee/ taxpayers
SALARY REPLACEMENT RISK	employer

Table 2: Risk distribution in DC pension plans.

This table contains all the types of risks involved in defined benefit pension plans and who bears each type of risk.

TYPE OF RISK	***WHO ASSUMES IT?***
INVESTMENT	employee
INFLATION	employee
LONGEVITY	employee
MARKET TIMING	employee
ACCRUAL	DC plans are portable
VESTING	employee
EMPLOYER INSOLVENCY	DC plans always fully funded
SALARY REPLACEMENT RISK	employee
FIDUCIARY / LEGAL RISK	Employer

Figure 1: 401(k) actual and simulated accumulations, by age group, 2001 and 2004.

This figure contains the actual and simulated pension benefit accumulations of US households by age group in 2001 and 2004. Source: Munnell & Sundén (2006).

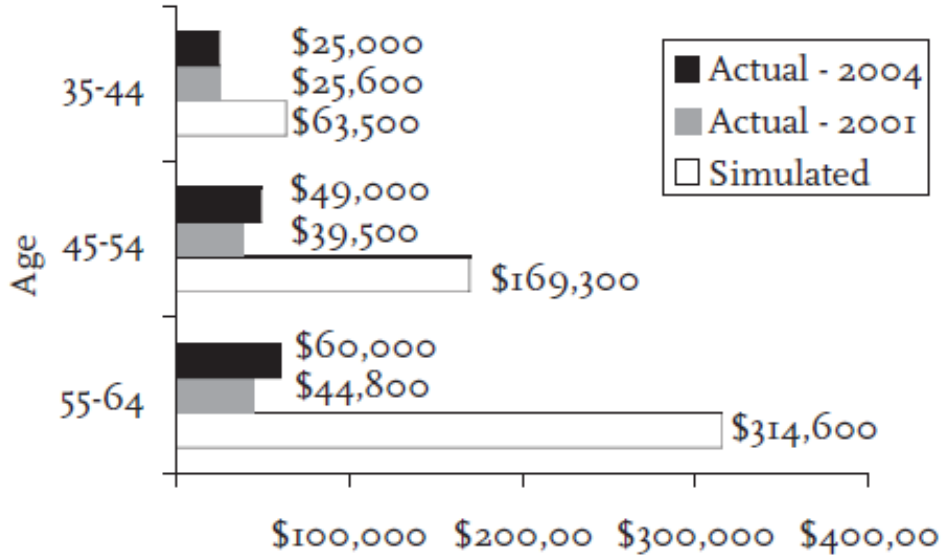

Figure 2: Private sector workers with pension coverage, by pension type, 1980-2004. Source: Munnel and Soto (2007).

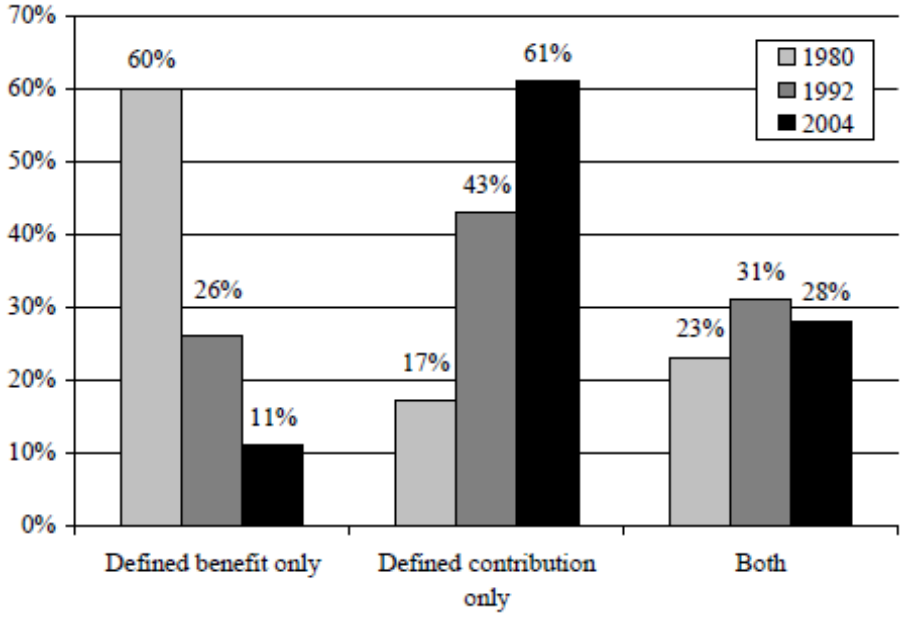

Figure 3: Number of Active Participants in Pension Plans by type of plan, 1975-2013 (in millions).

Source: Form 5500 fillings with the US department of labor.

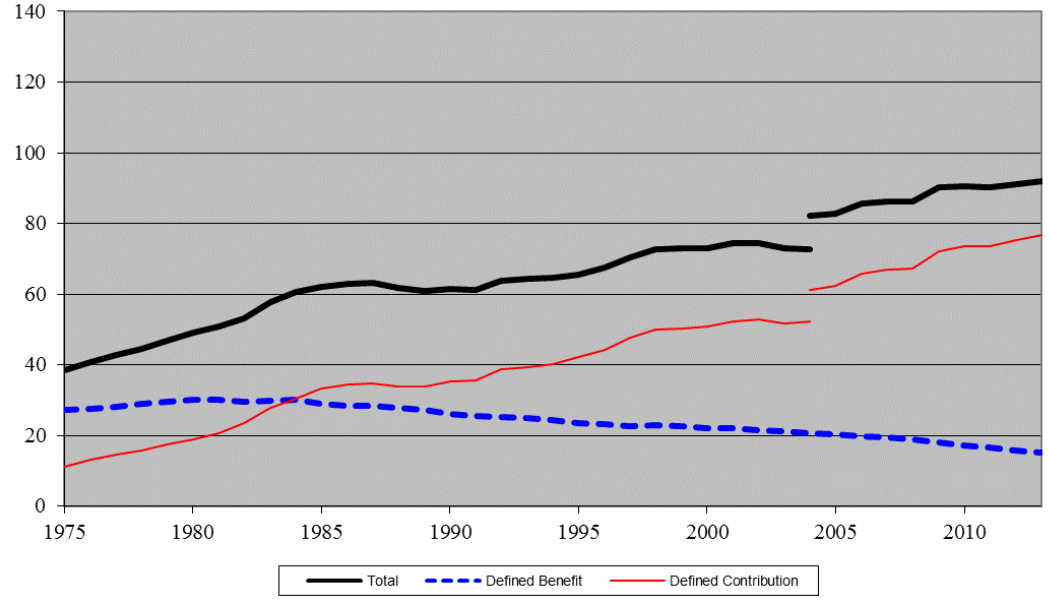

Figure 4: Pension Plan Assets by type of plan, 1975-2013 (in trillions).

Source: form 5500 filings with the US department of labor.

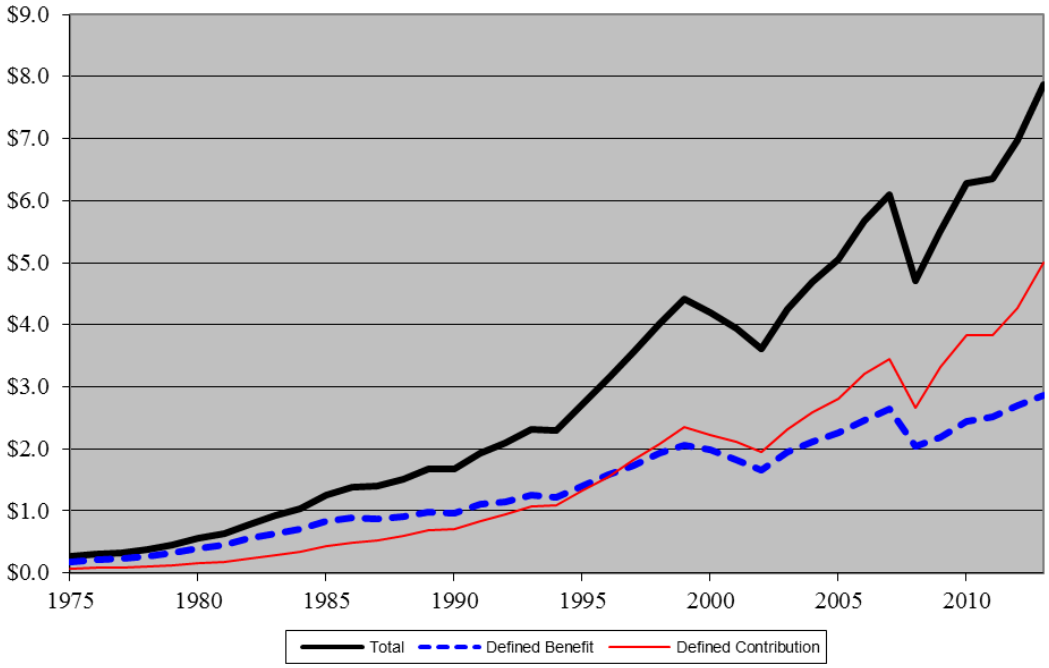

Figure 5: Mercer Survey regarding motives for pension freezes.

Source: Rubin (2007), graph recreated from Mercer (2006).

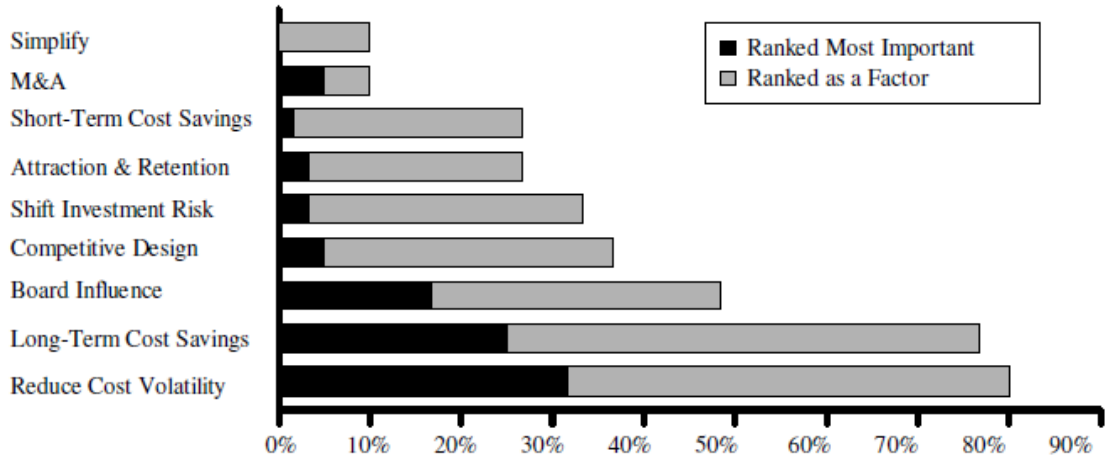

Figure 6: Current- lability - funded ratios of frozen and unfrozen plans, 2003.

Source: Pension Benefit Guarantee Corporation, "An analysis of Frozen Defined benefit plans", Dec. 21, 2005.

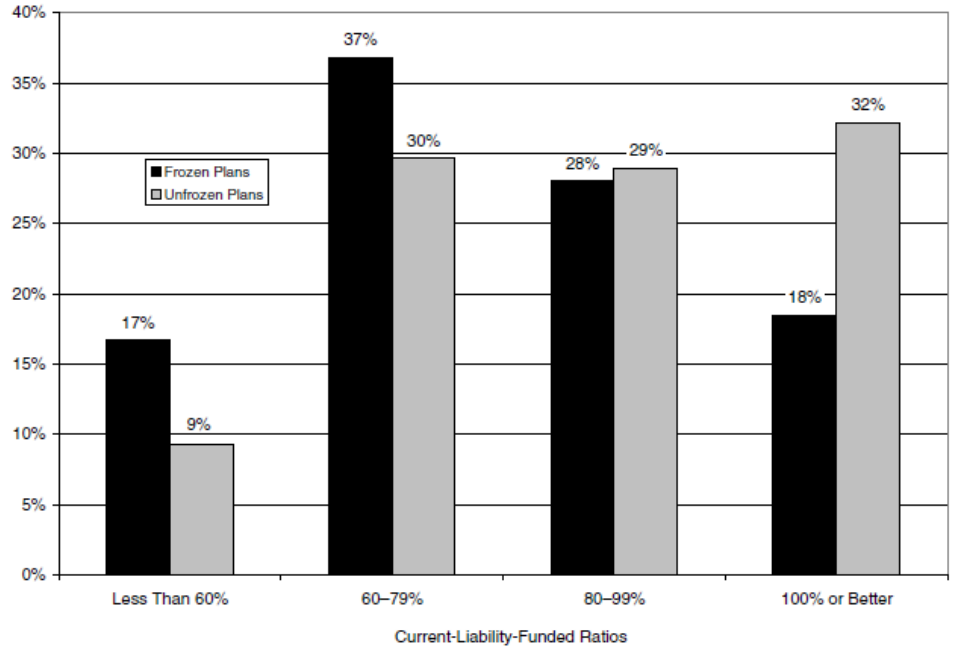

Table 3: Number of hard freezes in the U.S., 2002-2014.

Source: Form 5500 fillings with the U.S. Department of labor.

YEAR	***HARD FREEZE***
2002	6
2003	40
2004	68
2005	71
2006	120
2007	104
2008	4
2009	146
2010	152
2011	149
2012	155
2013	148
2014	116
TOTAL	***1279***

Table 4: Descriptive statistics of freeze and non-freeze firms.

This table presents mean, standard deviation (sd), minimum (min) and maximum (max) of sponsor level and plan level characteristics calculated from 2002 to 2014. Sponsor level variables are retrieved from Compustat, while plan level variables are retrieved from form 5500s. Employees, return on equity, retired participants and funding ratio are the only variables expressed in percentages. Employees is calculated as the percentage change relative to the prior year. Credit risk a categorical variable with" AAA"- "AA" as the reference category, a value of 1 for "A"- "BBB" credit ratings and a value of 2 for junk bonds. Return on equity is calculated by annualizing monthly return. Book to market is the ratio of book value of equity to market value of equity. Return on assets is calculated as net income of sponsor divided by total sponsor assets. Capital expenditures, acquisition, stock repurchase, leverage, cash flow (from operations) and sponsor contributions are scaled by total sponsor assets. Retired participants is calculated as number of retired or separated participants divided by total participants. Fund expenses is total pension fund expenses scaled by total plan assets. The funding ratio is calculated as the fair value of plan assets minus plan liabilities divided by plan liabilities. Plan size is measured as the log of the aggregated pension plan assets for each sponsor. All variables are winsorized at the 1th and 99th percentiles.

	Non-Freeze Firms				**Freeze Firms**			
	mean	sd	min	max	mean	sd	min	max
Sponsor level								
Employees (%)	3.871	18.921	-45.667	101.919	1.492	16.051	-45.667	101.920
Credit risk	2.355	0.555	1	3	2.343	0.536	1	3
Return on equity (%)	13.569	36.834	-61.095	88.137	19.463	31.982	-61.095	88.137
Book to market	.598	.500	-.543	3.035	.530	.462	-.543	3.035
Capital expenditures	.040	.044	0	.246	.036	.038	0	.246
Return on assets	.019	.116	-.567	.254	.037	.065	-.472	.254
Acquisition	.021	.053	-.005	.314	.017	.042	-.005	.314
Stock repurchase	.021	.046	0	.255	.021	.041	0	.255
leverage	.207	.199	0	.914	.228	.173	0	.914
Cash flow	.076	.094	-.318	.320	.074	.062	-.235	.320
Plan level								
Retired participants (%)	18.490	17.318	0	89.269	32.848	22.784	0	89.269
Sponsor contribution	.016	.027	0	.169	.020	.030	0	.169
Fund expenses	.714	3.524	.003	29.186	.191	1.157	.003	29.186
Funding ratio (%)	-24.305	24.953	-100	42.341	-21.486	18.839	-100	42.341
Plan size	5.251	2.572	-1.726	11.092	6.760	2.222	-1.726	11.092
observations	18501				985			

Table 5: Correlation Matrix.

This table contains correlations of sponsor level characteristics calculated from 2002 to 2014. Sponsor level variables are retrieved from Compustat. Employees and return on equity are the only variables expressed in percentages. Employees is calculated as the percentage change relative to the prior year. Credit risk a categorical variable with" AAA"- "AA" as the reference category, a value of 1 for "A"- "BBB" credit rating and a value of 2 for junk bonds. Return on equity is calculated by annualizing monthly return. Book to market is the ratio of book value of equity to market value of equity. Return on assets is calculated as net income of sponsor divided by total sponsor assets. Capital expenditures, acquisition, stock repurchase, leverage and cash flow (from operations) are scaled by total sponsor assets. All variables are winsorized at the 1th and 99th percentiles. Significance level is *<0.1, **<0.05, ***<0.001.

	Capital expenditures	Acquisition	Stock repurchase	leverage	Credit risk	Return on equity	Return on assets	Cash flow	Book to market	Employees
Capital expenditures	1									
Acquisition	-0.089***	1								
Stock repurchase	0.003	-0.056***	1							
leverage	0.142***	0.041**	-0.119***	1						
Credit risk	0.079***	0.052***	-0.278***	0.402***	1					
Return on equity	-0.067***	-0.019	-0.067***	-0.011	0.051***	1				
Return on assets	0.041**	0.045***	0.365***	-0.242***	-0.326***	0.150***	1			
Cash flow	0.322***	0.007	0.388***	-0.081***	-0.248***	0.066***	0.474***	1		
Book to market	-0.066***	-0.026*	-0.233***	-0.125***	0.205***	-0.269***	-0.289***	-0.295***	1	
Employees	0.031*	0.451***	-0.010	-0.025	0.021	0.043**	0.124***	0.008	-0.057***	1

Table 6: Empirical results with the Probit model

This table presents the results with the Probit regression. The dependent variable is a binary variable with the value of 1 if frozen and 0 otherwise. All variables are contemporaneous. Sponsor level and plan level characteristics are estimated from 2002 to 2014. Sponsor level variables are retrieved from Compustat, while plan level variables are retrieved from form 5500s. Credit risk a categorical variable with" AAA"- "AA" as the reference category, a value of 1 for "A"- "BBB" credit ratings and a value of 2 for junk bonds. Return on equity is calculated by annualizing monthly return. Capital expenditures, acquisition, stock repurchase, leverage, return on assets, cash flow and sponsor contribution are scaled by total sponsor assets. Retired participants is calculated as the total number of retired and separated participants divided by total participants. Fund expenses is measured as total pension fund expenses scaled by total plan assets. The funding ratio is calculated as the fair value of plan assets minus plan liabilities divided by plan liabilities. Plan size is calculated as the natural logarithm of aggregated pension fund assets for each sponsor. All variables are winsorized at the 1th and 99th percentiles. P-values are in parentheses. Significance level is *<0.1, **<0.05, ***<0.001.

	Model 1	Model 2	Model 3
Capital expenditures	-0.499***		
	(0.000)		
Acquisition		-0.140*	
		(0.098)	
Stock repurchase			0.048
			(0.599)
Investment grade - medium quality	0.032*		
	(0.092)		
Non-investment grade	0.083***		
	(0.000)		
leverage		0.016	
		(0.386)	
Return on equity	-0.000		
	(0.571)		
Return on assets		-0.125***	
		(0.009)	
Cash flow			-0.275***
			(0.000)
Book to market			-0.001
			(0.920)
Employees			-0.000
			(0.726)
Retired participants	0.002***	0.002***	0.002***
	(0.000)	(0.000)	(0.000)
Sponsor contribution	0.156	0.232	0.320
	(0.457)	(0.263)	(0.114)
Fund expenses	-0.006**	-0.006***	-0.007***
	(0.035)	(0.008)	(0.006)
Funding ratio	0.000	0.000	0.000*
	(0.361)	(0.318)	(0.093)
Plan size	0.011***	0.005***	0.005***
	(0.000)	(0.001)	(0.001)
Year Dummies	Yes	Yes	Yes
Pseudo R^2	0.097	0.105	0.107
N	5345	6236	7207

Table 7: Empirical results with the Probit model

This table presents the results with the Probit regression. The dependent variable is a binary variable with the value of 1 if frozen and 0 otherwise. All variables are lagged with one year: [L] stands for lagged. Sponsor level and plan level characteristics are estimated from 2002 to 2014. Sponsor level variables are retrieved from Compustat, while plan level variables are retrieved from form 5500s. Credit risk a categorical variable with" AAA"- "AA" as the reference category, a value of 1 for "A"- "BBB" credit ratings and a value of 2 for junk bonds. Return on equity is calculated by annualizing monthly return. Capital expenditures, acquisition, stock repurchase, leverage, return on assets, cash flow and sponsor contribution are scaled by total sponsor assets. Retired participants is calculated as the total number of retired and separated participants divided by total participants. Fund expenses is measured as total pension fund expenses scaled by total plan assets. The funding ratio is calculated as the fair value of plan assets minus plan liabilities divided by plan liabilities. Plan size is calculated as the natural logarithm of aggregated pension fund assets for each sponsor. All variables are winsorized at the 1th and 99th percentiles. Significance level is *<0.1, **<0.05, ***<0.001. p-values are in parentheses.

	Model 4	Model 5	Model 6
Capital expenditures [L]	-0.762***		
	(0.000)		
Acquisition [L]		0.050	
		(0.635)	
Stock repurchase [L]			0.076
			(0.622)
Investment grade - medium quality [L]	0.037**		
	(0.041)		
Non-investment grade [L]	0.096***		
	(0.000)		
Leverage [L]		0.020	
		(0.377)	
Return on equity [L]	0.000		
	(0.525)		
Return on assets [L]		-0.203***	
		(0.001)	
Cash flow [L]			-0.379***
			(0.000)
Book to market [L]			-0.012
			(0.295)
Employees [L]			-0.000
			(0.913)
Retired participants [L]	0.000*	0.001***	0.001***
	(0.069)	(0.000)	(0.000)
Sponsor contribution [L]	-0.119	-0.075	0.015
	(0.574)	(0.761)	(0.948)
Fund expenses [L]	-0.007*	-0.003	-0.003*
	(0.090)	(0.120)	(0.069)
Funding ratio [L]	0.000**	0.000***	0.000**
	(0.031)	(0.004)	(0.028)
Plan size [L]	0.011***	0.003	0.003
	(0.000)	(0.128)	(0.106)
Year dummies	Yes	Yes	Yes
Pseudo R^2	0.085	0.078	0.079
N	4671	5330	6183

Table 8: Empirical results with Cox Proportional Hazard Model

The dependent variable is a binary variable with the value of 1 if frozen and 0 otherwise. All variables are contemporaneous. Sponsor level and plan level characteristics are estimated from 2002 to 2014. Sponsor level variables are retrieved from Compustat, while plan level variables are retrieved from form 5500s. Credit risk a categorical variable with" AAA"- "AA" as the reference category, a value of 1 for "A"- "BBB" credit ratings and a value of 2 for junk bonds. Return on equity is by annualizing monthly return. Capital expenditures, acquisition, stock repurchase, leverage return on assets, cash flow and sponsor contribution are scaled by total sponsor assets. Retired participants is calculated as the total number of retired and separated participants divided by total participants. Fund expenses is measured as total pension fund expenses scaled by total plan assets. The funding ratio is calculated as the fair value of plan assets minus plan liabilities divided by plan liabilities. Plan size is calculated as the natural logarithm of aggregated pension fund assets for each sponsor. All variables are winsorized at the 1th and 99th percentiles. Significance level is *<0.1, **<0.05, ***<0.001. p-values are in parentheses.

	Model 1	Model 2	Model 3
Capital expenditures	0.000**		
	(0.014)		
Acquisition		0.111**	
		(0.049)	
Stock repurchase			12.199
			(0.164)
Investment grade - medium quality	1.386		
	(0.454)		
Non-investment grade	1.824		
	(0.165)		
leverage		1.046	
		(0.892)	
Return on equity	0.996		
	(0.233)		
Return on assets		0.427	
		(0.181)	
Cash flow			0.065***
			(0.008)
Book to market			1.111
			(0.536)
Employees			1.000
			(0.930)
Retired participants	1.021***	1.022***	1.023***
	(0.000)	(0.000)	(0.000)
Sponsor contribution	5.345	1.311	4.108
	(0.482)	(0.899)	(0.473)
Fund expenses	0.920	0.913	0.906
	(0.169)	(0.196)	(0.261)
Funding ratio	1.000	0.999	1.000
	(0.987)	(0.792)	(0.886)
Plan size	1.023	0.990	0.985
	(0.468)	(0.640)	(0.594)
N	4512	5294	6108

Table 9: Paired t-test results

This table presents the results from paired t-test on the treatment group and a control group. The treatment group is divided into two sub groups: non-investment grade sponsors and investment grade sponsors. Each variable is calculated three years before freezing and three years after freezing. The increase (+) or decrease (-) in financials three years after the freeze is reported in the table for sponsors and the control group. Investment grade sponsors have a credit rating of "AAA"-BBB" and non -investment grade sponsors have a credit rating of "BB or worse. Information on all variables is retrieved from Compustat and CRSP from 1999 to 2015. Return on equity is calculated by annualizing monthly returns from CRSP. Return on assets, cash flow and debt are normalized by total sponsor assets. The control group is created by matching each sponsor with a firm based on SIC code and market value of equity. Significance level is *<0.1, **<0.05, ***<0.001. p-values are in parentheses.

	Non-investment grade	**Investment grade**	**Control group**
Variable			
Return on equity	36.669**	6.499	3.882
	(0.021)	(0.151)	(0.561)
Return on assets	0.069**	-0.009	0.041
	(0.029)	(0.513)	(0.286)
Cash flow	0.013	-0.002	0.018
	(0.252)	(0.778)	(0.651)
Leverage	-0.026	0.011	0.029
	(0.394)	(0.442)	(0.140)
N	35	77	76