

**THE FREEZING OF CORPORATE PENSION PLANS:  
CAUSES AND CONSEQUENCES**

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## 1. INTRODUCTION

Despite their general demise in favor of defined contribution (DC) plans in more recent years, defined benefit (DB) pension plans play an important role in the private sector retirement landscape. At the end of 2007, these plans accounted for 44% of the total value of all private retirement assets (2.7 trillion dollars).<sup>1</sup> They cover 20 million active participants and provide benefits to millions of retirees.

The shift towards DC plans has occurred through several channels. A small group of large sponsors of DB pension plans (but highly publicized) have failed and terminated their plans in bankruptcy, transferring underfunded pension liabilities to the Pension Benefit Guarantee Corporation (PBGC), the Federal agency that insures DB plans. Another group of sponsors has chosen to voluntarily terminate their pension plans but this process has generally been limited due to costly legal and financial constraints.<sup>2</sup> In the meantime, the majority of new firms have favored DC arrangements. Perhaps the largest shift has occurred within the group of sponsors who have retained but changed their DB plans. In particular, growing number of healthy companies (e.g. IBM, Verizon, Sears and Alcoa) have chosen to fully or partially freeze some of their plans, which means that they have limited or stopped new benefit accruals.

Although the reasons and consequences behind this shift have been discussed and debated in the media, there is still substantial disagreement. There is a growing concern over retirement security in general and over the inadequate coverage and risk exposure associated with DC plans in particular.<sup>3</sup> Survey data shows that DC plans have become increasingly a supplement to DB coverage. Pension coverage, defined as the proportion of workers whose employers sponsor a

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<sup>1</sup> U.S. Board of Governors of the Federal Reserve System (2008)

<sup>2</sup> Standard or voluntary terminations are allowed only if the plan is fully funded. Excess assets in overfunded plans are subject an excise tax up to 50% of these assets.

<sup>3</sup> See for example the cover page of Time Magazine “Why is time to retire the 401(k)” (October 19, 2009)

pension plan (DC or/and DB) has been falling for recent years, reaching 51% in 2005 (Ghilarducci, 2008).<sup>4</sup> The apparent abrupt increase in the DC plan offering mostly comes from firms with DB plans in place. In other words, the predominant trend in the last twenty years was for DC plans to be complements and not substitutes to DB plans.

The extent to which participants have been compensated in their transition from a DB plan into a DC plan is an empirical question. This inquiry becomes even more relevant in the wake of the financial crisis, when the risk differences between the two arrangements became so noticeable. In a DB plan employees are promised benefits based on years of service and final year earnings, and these benefits must be paid independent of the performance of the DB plan assets. By contrast, in a DC plan participants bear all the risk of invested plan assets. In the event of a market collapse, their retirement savings immediately take a hit and individuals about to retire suffer the most. The value of DC assets decreased by 1.1 trillion within one year from the market peak (October 9, 2007) while the value of DB assets has decreased by 0.9 trillion. The loss in the DC accounts has been completely absorbed by participants. At the same time, the loss in DB accounts has been assimilated by sponsors who have the ability to smooth losses and gains over long periods of time and face unlimited horizons (Munnell and Muldoon, 2008).<sup>5</sup>

Pension freezes provide the perfect microeconomic framework to examine this question because age- service- average compensation matrices are generally disclosed pre and post the conversion decision. These matrices enable us to measure the intertemporal distribution of the employee compensation around the pension conversion. If employer costs are curtailed through

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<sup>4</sup> Pension participation, defined as the proportion of workers who were contributed to or were credited with pension benefits has been falling even more, reaching 51% in 2005. Coverage is always higher than participation because employers can exempt employees from participating.

<sup>5</sup> Benefits accrued under DB plans are not riskless, although the existence of the PBGC insurance up to federally mandated limits considerably limits the risks to which participants are exposed. The fact that DC plans are generally more portable than DB plans (from one job to another) also limits the extent to which participants might demand compensation.

pension freezes, then one interpretation is that the freeze is the cheapest mechanism to bring employee compensation in line with actual productivity, a renegotiation tool of implicit contracts. Alternatively, it is possible that workers value DB benefits less than the employers cost of providing them, in which case there is a surplus that can be beneficially shared among sponsor and participants. If this is the case, we should observe a low incidence of plan separations (employees' departures).

We examine these issues in a sample of 139 "hard" freezes which we identify from Form 5500 filed with the Department of Labor. In these freezes, all benefit accruals within the plan are brought to a halt, so that participants in the DB plan receive only what they were owed under the benefit formula at the time of the freeze. We find that freezes reduce total firm service costs (the annual increase of the pension benefits during the year) dramatically, from 0.41% to 0.20% of sales at the mean (0.18% to 0.02% at the median) in the year following the freeze.<sup>6</sup> However, sponsors increase their contributions to 401(k) plans almost immediately. The net result is that we find that the median sponsor of a frozen plan generates essentially zero dollars of saving in the short-term. We perform a similar calculation based on assets and EBITDA. However, we also note a substantial decrease in benefit accruals, which we measure by PBO (the projected benefit obligation). Therefore, long-term savings appear to be significant. If the firms with the largest prospective accruals were the ones to freeze, costs would have risen even more in the absence of the freeze. While most employees should expect less benefits after the conversion (same contribution but significantly more risk), mid-career employees located at the middle of a convex shape benefit accrual function are incrementally worse off (Munnell, Golub-Sass, Soto and Vitagliano, 2007).

Our inquiry into the costs and benefits of this shift toward DC plans is unavoidably linked to the question of why DB sponsors change the composition of their retirement plans. The typically

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<sup>6</sup> The reduction is not to zero because firms sponsor multiple plans and may only freeze one at a time.

stated reason for pension plan conversion is the financial viability. In many instances, the pension plan becomes a competing interest for cash within the organization.<sup>7</sup> DB plans imposed large costs on many employers during the first half of this decade, as poor asset market returns combined with low interest rates led to large cash funding requirements. Yet, companies wishing to terminate their pension plans outside of bankruptcy needed to have enough assets to cover liabilities. This raises the question of whether the conversion is primarily driven by the financial condition of the sponsor or the financial condition of the pension plan.

The incidence of plan changes towards plans that may be cheaper for the employer also informs on the issue of agency conflicts between management (or shareholders) and employees. If firms switch to cheaper plans and the surplus goes to employees in the form of higher wages and salaries, then the institutions involved are sufficient to mitigate the agency problem between managers/shareholders and employees. If firms switch to cheaper plans and the surplus goes into profits, then this is evidence that management used the switch to shift resources from employees to the shareholders and that the agency conflict is more severe.

We organize the paper as follows. In section 2 we describe the institutional background and the evolution of different forms of private pensions. In section 3 we present the theoretical considerations. In section 4 we describe our empirical strategy. In section 5 we describe our data collection and the sample. In section 6 we present and discuss our results. Section 7 concludes.

## **2. BACKGROUND**

### **2.1. Institutional background**

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<sup>7</sup> Shivdasani and Stefanescu (2009) document that the average DB contribution is around 57% of the interest payment on debt, although the distribution appears to be skewed towards large employers. In our sample of freezes the average DB contribution exceeds the interest payment on debt.

DB plans were the predominant vehicle for retirement two decades ago. Encouraged by the tax deductibility of pension contributions in times when corporate tax rates reached historical highs, these plans were an effective tool to built and retain human capital. Their importance has steadily declined with the introduction of DC plans (ex. 401(k) plans) in the early 1980s. There are many differences between the DB and the DC plans but perhaps the most important revolves around the amount of risk born by the employee.

DB plan sponsors promise fixed retirement income to their employees, with employers bearing all the investment risk to meet the pension liability. The risk born by the employee under a DB plan is limited to risk of job change and risk that the pension will be reduced if their employer becomes financially insolvent. DC and hybrid plans typically give some or all responsibility to the employee for making contribution decisions, taking investment risk, and making financial decisions. The sponsor responsibility in a DC plan arrangement ends after the contribution is made.

Almost two thirds of the largest companies in the U.S. sponsor one or more DB plans, but the shift towards DC plans and hybrid plans has been remarkable. A number of papers document the decline of DB pensions in general, including early work by Clark and McDermed (1990) and Gustman and Steinmeier (1992). According to figures by Buessing and Soto (2006), the number of individuals with only a DB plan fell from 9.6 million in 1990 to 6.6 million in 2003, whereas the number of individuals with only a DC plan rose from 11.5 million to 30.1 million over the same time period. However, Gheralducci (2008) finds that most DC plans are supplements to DB plans and that pension coverage has in fact deteriorated in the last few years.

The most cited reason behind the shift is the significant increase in pension costs and risks.<sup>8</sup> The employer bears the risk of the plan investments. It also bears the interest rate risk, which affects the present value of the pension liability and therefore the mandatory funding requirements. The

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<sup>8</sup> For a more detailed discussion see Munnell, Golub-Sass, Soto and Vitagliano (2007)

sponsor faces larger life expectancy rates compared with 20-30 years ago when the plans were adopted. The change in legislation has also changed the expectations about costs. The Pension Protection Act (PPA) of 2006 has tightened the funding requirement and the new accounting standards (FASB 158) have moved some of the liabilities on the balance sheet while contemplating to remove any smoothing of the pension expense.<sup>9</sup> Another reason for the shift is the desire to align the employees compensation with the lower labor cost of the global competitors. In an equilibrium framework the sum between cash wages and fringe benefits has to go down, and employers find it easier to cut pension benefits.

Facing all these challenges, corporate DB sponsors find it hard to resist to the less costly and more manageable structure of DC plans. Still, the termination of a DB plan is difficult. Unfunded pension liabilities can be taken over by PBGC only when the sponsor has filed for bankruptcy and reorganization is unavoidable in the absence of the pension takeover. Under normal business conditions, plans can only be terminated if they are fully funded and any excess assets are heavily taxed at a 50% rate. If they decide to proceed, sponsors pay off beneficiaries by purchasing annuities. Most of these “standard terminations” have been implemented for small single employer plans.<sup>10</sup> The number of “distress terminations” is also small, but the large ones have been highly publicized (ex. United Airlines).

The most common strategy implemented by sponsor was the freeze of the pension plan. While there are several types of freezes all involve the reduction or the cessation of new accruals. A “hard” freeze eliminates all future accruals, the benefits will not grow from the level they reached at the time of the freeze. A “soft” freeze typically eliminates new accruals based on years of service, for

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<sup>9</sup> For a more detailed discussion on pension accounting and funding requirements see Rauh (2006) and Shivdasani and al. (2009).

<sup>10</sup> According to Belt (2005), during the 1986-1994 period, 99,000 of the 101,000 single-employer plan terminations fell into the category of a standard termination, with only 2,000 being distress terminations.

example stopping benefit accruals for new employees. Most often, sponsoring companies compensate workers by allowing them to participate into the old or a new 401(k) plans.<sup>11</sup> Many large companies sponsor more than one plan (ex. for unionized/unionized workers, taken over as part of an acquisition or merger) and the decision to freeze can be very selective.

## 2.2. Literature overview

While the benefits and the costs of sponsoring defined benefit plans are relatively well understood in isolation, the reasons behind terminating a DB plan under normal business conditions (no financial distress) remains an open question. Previous literature has focused either on work incentives (Ippolito (1985)), tax benefits (Black (1980), Tepper (1981), Petersen (1992), Shivdasani and Stefanescu (2009)), earnings manipulation incentives (Bergstresser, Desai, and Rauh (2005)) or financial slack (Ballester, Fried and Livnat (2002)). Corporate pension plans have a significant impact on the investment policy of the company (Rauh (2006)) and in some pension systems, significant agency conflicts could exist between the insider trustees and plan members (Cocco and Volpin (2006)). The literature has also succeeded in modeling some of the potential macroeconomic forces behind the DB to DC shift, such as declines in the value of existing jobs relative to new jobs (Friedberg and Owyang (2004)) and reduced search costs (Friedberg et al (2006)).

Studies by Kruse (1995) and Ippolito and Thompson (2000) examine the periods 1980-1986 and 1987-2005 and generally find that the growth in DC plans over those periods was more the result of compositional effects than the result of terminating DB plans and DC conversions. However, these studies came before the hybrid conversions and pension freezes of very large employers. Pension freezes became common in the early part of the current decade. In 2005,

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<sup>11</sup> The PBGC has calculated that as of 2003, 9.4% of DB plans were frozen (PBGC (2005)), and other studies have calculated that the occurrence of plans being frozen to new participants is even more prevalent than the PBGC suggests (VanDerhei (2006)).



pension freezes were announced by IBM, Hewlett Packard, Sears Holding, and Verizon. Reports issued by the Pension Benefit Corporation (2008) and Government Accountability Office (2008) show that the majority of the freezes affect small plans. They show that about 21 percent of all active participants are affected by a freeze and that almost half of all sponsors have at least one frozen plan. The incidence of freezes is less likely in collectively bargained firms.

Given the relatively recent wave of freezes (and the lag with which this information becomes available at the plan level), the decision to freeze the DB plan has not been completely understood and the cost savings and the implications hardly have been quantified. To our knowledge, Munnell and Soto (2007) is the only paper that carries out an analysis that combines both the sponsor and the plan level characteristics. Their analysis covers only year 2005 and therefore explores cross sectional differences. In contrast, our analysis has a time dimension to the pension liability that allows us to estimate the actual cost savings at the plan level, in absolute value and also relative to a sample of control plans. They find the plan characteristics (underfunding level, size, large credit balances, bargaining power) play a role in the firm decision to freeze, although some of the coefficients are only marginally significant. They also find that the financial health of the company has a small economic impact on the decision to freeze. In contrast, Beaudoin and al. (2009) find that that profitability of sponsor is important. In addition, they show that the balance sheet impact of SFAS 158 is associated with the decision to freeze.

### **3.THEORETICAL CONSIDERATIONS**

In a competitive, frictionless labor market equilibrium, a worker's total compensation must equal his or her marginal product of labor. Economic theory has posited a number of reasons why compensation may deviate from a worker's outside option. For example, efficiency wages may be paid to encourage effort (Shapiro and Stiglitz (1984)). Implicit contracts in which workers are paid

less than their marginal product at the beginning of their career, and more than their marginal product late in the career, may discourage worker shirking (Lazear (1979)).

In most DB pension plans, accruals are larger for older workers than for younger workers. This arrangement may arise because a firm's older workers are more productive than younger workers, or it may be that the firm is using the implicit contract of the pension plan to reduce turnover or agency problems.

A freeze of DB pension accruals can be thought of as having three sets of effects. First, the freeze by itself represents a cut in employee compensation; this cut is larger for longer-tenured employees whose annual accruals are larger. Hence, when considered in isolation, freezes lower DB pension accruals to zero and reduce the pattern of seniority compensation. Second, the firm may need to compensate employees affected by the freeze. The firm may do this by raising salaries or contributions to other benefit plans, including defined contribution pension arrangements. In a perfectly competitive labor market in which employees and employers valued the pension benefits identically, the change in non-pension compensation should exactly offset the reduction in pension benefit accruals. All potential cost savings for the firm would be offset, and relative total compensation among young and old workers would be the same as they had been before the freeze. In contrast, these offsets will be small if workers were compensated more than their marginal products before the freeze. Alternatively, if workers had valued the pension benefits at an amount less than the cost to the employer of providing those benefits, freezing the pension plan would generate a surplus over which employers and employees could bargain. Third, workers themselves may respond to the changed compensation package by pursuing outside options. If the total compensation of some workers relative to their outside options has decreased, then turnover would be expected to increase.

#### 4. EMPIRICAL STRATEGY

In this paper, we begin by considering the *consequences* of DB pension plan freezes. We estimate the magnitude of workers' accrual loss that arises from the freezes, for the firm's workers as a whole and for workers who have worked at the firm for different lengths of time. This would equal the firm's cost savings in the absence of any offsets. We then measure the changes in wage and salary compensation for the firm as a whole and for workers with different tenures at the firm, relative to workers at similar firms that did not freeze their pension plans. This allows us to measure the extent of offsets to the firm's total potential cost savings from freezing the plan. Finally, we examine the effect of the freeze on estimated employee turnover, to shed light on how the pension freeze changed worker compensation relative to their outside options.

Based on the discussion above, if overall employer costs are saved through DB plan freezes, there are several possible explanations. It is possible that DB arrangements set long ago led to some workers being overpaid relative to their marginal product in the time leading up to the freeze. Freezes may be a way of bringing worker compensation back in line with actual productivity, in a renegotiation of implicit contracts. Alternatively, it may be the case that the cost for the firm to provide the benefits had become larger than the value that the workers attach to the benefits. In this case where there is a cost-benefit differential, there is a surplus to be divided: firms could save costs while workers also benefit.

In order to further understand the role of DB freezes, we test whether some workers gained at the expense of others. An additional prediction of the efficient labor market model is that longer-tenured workers, who accrue DB benefits relatively quickly, should receive larger offsets through non-DB compensation than recent hires, when the employer freezes the DB plan. We examine whether this is true in the data. If total costs are unchanged but the distribution of compensation

changes from longer-tenured workers to recent hires, then pension freezes might be best seen as a way to realign compensation with productivity among workers within the firm. Furthermore, if the distribution of compensation changes in any non-trivial way, then the cost-benefit differential explanation of DB freezes is at best incomplete, as it seems unlikely that the benefits are valued less by older workers. Finally, if there is heterogeneity of worker productivity, workers who are more productive and for whom DB accruals were a substantial part of their compensation would be more likely to leave the firm.

We then examine the *causes* of DB freezes by focusing on cross-sectional variation in the potential gains to freezing plans. If there were no offsets, firms with the greatest expected DB accruals would have the greatest incentive to freeze plans to save costs. If labor markets are competitive, however, it may be the case that firms with greater expected DB accruals cannot on average save more than firms with smaller expected DB accruals, as the firm with greater accruals would have to provide greater compensation to workers. We therefore (intend to) calculate expected net gains to freezing for non-freeze firms based on the offsets provided by comparable freeze firms. This net measure accounts for differences in labor market conditions faced by firms, which may make cost-saving freeze more feasible for one firm than another.

If firms with expected total or net gains to freezing DB plans are in fact the firms that freeze, then there are several implications. First, other literature has not found cost saving to be a primary determinant of plan choice. These papers have not measured prospective accruals. Our data allow us to test whether firms with the most potential cost saving are the ones that freeze. Second, an ability of firms to save costs by freezing plans suggests that workers are indeed earning more than their outside option.

We also investigate other potential determinants of the decision to freeze. Regardless of whether variation in potential cost saving explains cross-sectional variation in decisions to freeze,

our cost calculations (presumably) will show substantial cost savings from freezes. The question is therefore what limitations or additional costs firms face in the implementation of pension freezes. We examine factors such as extent of unionization, compensation relative to other firms in the industry, and size of DB costs relative to total firm costs on the freeze decision.

## **5. DATA COLLECTION AND SAMPLE DESCRIPTION**

We collect our sample of plan freezes from IRS Form 5500 filed at plan level with the Department of Labor (DOL). Starting with 2002, the form requires the sponsor to disclose whether the plan was frozen or not during the reporting year. The disclosures apply only to “hard freezes”. Starting from the first year when the plan is frozen, all subsequent filings will have this annotation. We note that most freezes that were implemented prior to 2002 clustered during this first year of the disclosure. In order to insure that we capture the year of the announcement we only allow in our sample those freezes that were first disclosed in 2004. The only instance when the year of the freeze is 2002 or 2003 is when we are able to identify the event in Factiva news. Our sample of plan freezes spans therefore the period 2002-2006.

Electronic versions of IRS 5500 filings are available from 1991 to 2007. However, starting with 1999, Form 5500 is missing key information (the CUSIP identifier of the parent company). The only variables that allow us to link the plan to the actual sponsor is the employer identifier number (EIN) and the plan stated sponsor name (which in most cases is the name of a subsidiary). The CUSIP identifier of the parent was therefore critical for automatic matching. The EIN (also referred to as the IRS identification number) of the subsidiary is in many cases different from the EIN of the parent. Subsidiaries that are at least 80% owned by the parent have the option to file for taxes separately, while still remaining consolidated with the parent company for financial purposes.

Identifying plans is further complicated when plan sponsors are acquired, sold, or merged. Tracking the plan over time can be challenging.

These difficulties are all documented by other researchers in the area (see for ex. Munnell and Soto, 2007). To overcome these problems we manually collect the list of subsidiaries for all sponsoring companies during this time period (10-k filings, Exhibit 21). We identify sponsors in COMPUSTAT based on the availability of data on pension assets and liabilities. We then match Form 5500 with the list of subsidiaries on several dimensions: EIN numbers, sponsor names, subsidiaries names. This process allows us to obtain a very close match between sponsors and plans. A more detailed description of our final matching is included in Appendix 1. We identify about 9600 plan freezes in Form 5500 but most of them are very small plans, with less than 50 active employees. Only 719 plans are reliably matched with COMPUSTAT. We further eliminate from this sample all plans for which information is not available in the three years surrounding the freeze. This procedure automatically eliminates year 2007 freezes. Our final sample has 139 plan freezes.

Table 1 describes our sample by year and industry. For expositional purposes we classify the firms here based on 2-digit SIC code. We note that that freezes occur across many industries and there is no clustering in any particular sector or calendar year.

Our empirical strategy is designed to identify cost differences for the sponsor of the frozen plan, pre and post the event relative to a set of control sponsors. This strategy allows us to eliminate the effect of the change in regulation during the period. In particular, in anticipation of the Pension Protection Act of 2006, sponsoring companies could have changed their behavior in a way that would be hard for us to capture empirically. On the presumption that the reaction was similar across similar plans, a matched- pair research design will allow us to separate the effects of the freeze.

Our matching relies on a matching of propensity scores, originally developed by Rosenbaum and Rubin (1983, 1985) and Heckman et al. (2007). The propensity score is the conditional probability of treatment assignment given ex-ante variables. We limit the set of potential control plans to plans in the same industry as the firm undertaking the freeze. Industry is measured at the narrowest SIC level for which a set of at least two possible control plans exist, up to 4 digits. We then calculate propensity scores based on the size of the individual plan liabilities (accumulated benefit obligation), and the number of participants, using only plans with sponsors in the same industry as possible controls.<sup>12</sup> We focus on plan level variables, based on the intuition that pension related changes in regulation and accounting will impact these plans in a similar way.

Additionally, we manually collect the age- service- compensation matrices that are filed as paper attachments to Form 5500 with the DOL. An example of such a matrix, for one of the Verizon pension plans, is provided in Appendix 2. For this part of the analysis, we re-run the propensity matching limiting the possible control plans to those with 1000 participants or more, as the salary part of the age-service matrix is only required to be disclosed for these plans.

## **6. EMPIRICAL RESULTS**

In Table II and III we examine the characteristics of our sample of frozen plans and their controls in calendar time, and event time respectively. Naturally, the control and the frozen plans are similar in size (asset, liabilities and participants) in the year preceding the freeze, this is part of the selection criteria. The typical frozen plan in our sample has assets valued at \$257 million, liabilities (as measured by the ABO) valued at \$289 million, receives an annual contribution from the employer equal to \$7 million and covers 6,511 employees out of which about one third are still

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<sup>12</sup> Operationally this means that we run the propensity score matching four times: once at the four-digit SIC level, once at the three-digit level, once at the two-digit, and once at the one-digit. Where a plan has sufficient control plan candidates at the four-digit level, we use the result of the four-digit match. If not, we look at the three-digit match, and so on.

active. In Table II we note that, for any particular freeze year, the size of pension liabilities decrease significantly in subsequent years for frozen plans, but they generally increase the control plans. For example, if we follow the 43 plans frozen in 2004, we note that in the year preceding the freeze (2003), the average pension liability for frozen and control plans was \$108 million and \$183 million, respectively. In the year following the freeze (2005), the pension liability was \$50 million and \$229 million, respectively.

In Table III we follow the characteristics of the frozen and control plans in event time. This analysis is constraint by the time series availability of data. First, we note that the total number of participants remains stable in frozen plans in the three years following the freeze. Few separated or retired employees prefer “cash-out” distributions through insurance companies. Also, the number of active participants in active plans decreases significantly (high turnover). Active participants include individuals who are currently in employment covered by the plans and who are earning or retaining credited service under the plan, according to the DOL. While some employees might have naturally reached the retirement age and moved into the category of retired participants, the abrupt decrease in the number of active participants is unlikely to be fully explained by age. This is preliminary evidence that the employees outside options are likely better than the contracts offered by their current employers after the freeze and that the pension freeze was in fact the cheapest way for employers to renegotiate implicit contracts. The age-service-compensation matrices will allow us to refine this exercise by age and years of service groups. Second, the benefit accruals drop to zero for frozen plans, confirming our expectations and the prior sponsor disclosures that these are “hard” freezes. Third, we note that expected benefits to be paid during the year for frozen plans are significantly larger for frozen plans, suggesting that the age distributions of the participants is likely to be important. Fourth, accrued pension liabilities substantially decrease in the years following the freeze for frozen plans but not for control plans.



The decision to freeze will most likely depend on the sponsor characteristics as well. In Table IV we describe the financial position of the firms that have taken the decision to freeze one DB plan. Most firms offer different pension plans to different groups of employees, based on their employment contract (salaried or hourly workers), unionizations status or location. The typical firm sponsors an three DB plans. In Table V we describe the financial position of the firm sponsoring the control pension plans. While differences among sponsors will be important in explaining the freeze decision, they will have to be scaled by the firm sales, assets or income in our subsequent cost differential analysis.

We note that the sponsors of the frozen plans have higher leverage ratios, are less profitable and consequently have lower interest coverage ratios during the years leading to the freeze. About two-thirds of them have frozen the only plan sponsored by the firm. Control firms are more likely to sponsor several plans. Overall, companies freezing a DB plan experienced higher expected benefit accruals and higher disbursements of benefits in the years following the freeze.

Next, we examine the consequences of DB plan freezes. In Table VI we restrict the analysis to all plan freezes which can be successful tracked one year before and one year after the freeze in Form 5500. We also restrict the data based on the availability of control plan information during the same period. In addition, we require sponsor level information from COMPUSTAT. We collect three variables: (1) Service Cost, defined as the annual increase in pension benefits due to the additional years of service and increase in salary, as disclosed in the 10-K annual financial statements (2) Service Cost accruals as disclosed in Form 5500<sup>13</sup> (3) annual contributions to DC plans (here 401(k) arrangements). We focus on service cost rather than DB contributions to capture the actual cost of carrying DB plans as contributions to DB plans are subject to the sponsor discretion (within

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<sup>13</sup> Ideally, Form 5500 data should aggregate to the level of the service pension cost reported in the annual statements. In practice, some plans are either missing from the electronic version of Form 5500 or are simply impossible to be linked to the parent company.

certain limits). We note that for the sponsors of frozen plans service cost components decrease both in absolute value and also relative to firm sales, assets or EBITDA. We observe the opposite trend for DC plan contributions. Employers improve the access or the terms of the contract in 401(k) arrangements to compensate workers for lost benefits. To control for labor market characteristics during the period, we calculate similar cost components for the sponsors of the control firms.

We find that the sponsors of the frozen plans experience an increase of 0.58% (relative to total sales) in total retirement costs after the pension freeze. We perform a similar calculation based on assets and EBITDA. Simultaneously, we examine the increase of benefit accruals of the freeze firms relative to their controls. Table VII presents the results of this analysis for two different subsamples while Table VIII shows these same statistics in event time. We note substantial decreases in benefit accruals, suggesting that costs would have raised a lot more in the absence of the freeze. Our calculations so far quantify cost savings in the absence of wage differentials. Naturally, the next step is the age-service-wage analysis based on our hancollected matrices in the year preceding and following the event. Preliminary analysis (Figure 1 and 2) shows that freeze firms have more density in workers who are middle-aged and/or with more than 10 years experience with the firm or before retirement and less density in the youngest and least tenured workers.

## **7.CONCLUSION**

In this paper we examine the causes and the consequences of the shift away from defined benefit (DB) retirement plans and into defined contribution (DC) retirement plan schemes. We examine this question from both the employer and the employee perspective. Our study is motivated by a recent wave of DB plan freezes which have significantly reduced or even terminated the accrual of benefits for the participants. An important advantage of using pension freezes (as opposed to pension terminations) in our analysis is the mandatory disclosure of the age-service-

compensation matrices before and after the freeze. The data allows us to quantify the workers' accrual loss for the firm's workers as a whole and for workers who have worked at the firm for different lengths of time. It also allows us to measure the changes in wage and salary compensation for the firm as a whole and for workers with different tenures at the firm, relative to workers at similar firms that did not freeze their pension plans. Our preliminary results suggest that sponsoring companies save on retirement costs and that plan participants are worse off following the freeze.

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## Appendix 1

### Data collection

Year	Unique COMPUSTAT sponsors	Unique FORM5500 sponsors	Unique FORM5500 DB plans	DB plans linked to COMPUSTAT	Frozen plans	Frozen plans (counted in the first year of the freeze)	Sample plans (time series available)
2000	2,199	1,256	39,555	3,603	0		
2001	2,213	1,263	39,466	3,556	0		
2002	2,226	1,244	39,063	3,368	35	34	2
2003	2,229	1,231	38,693	3,129	220	189	8
2004	2,187	1,070	28,574	2,489	197	73	44
2005	2,152	1,153	37,170	2,648	333	137	42
2006	2,090	1,162	35,544	2,786	387	122	43
2007	1,964	1,040	35,280	2,277	384	117	

## Appendix 2

Example of an age –service- compensation matrix, collected from the paper attachments to Form 5500.

Attained Age	Years of Service									
	<1	1-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40+
<25	157	297	38							
25-29	\$37,272	\$47,783	\$46,381							
30-34	290	1,877	1,113	28						
35-39	\$45,609	\$62,874	\$64,188	\$64,280						
40-44	268	2,037	2,704	678	69					
45-49	\$48,594	\$70,739	\$71,797	\$73,889	\$70,838					
50-54	221	1,367	2,094	1,437	1,369	70				
55-59	\$49,442	\$74,445	\$75,538	\$82,468	\$83,476	\$77,843				
60-64	205	1,047	1,624	1,049	2,007	2,373	355			
65-69	\$53,620	\$75,557	\$77,173	\$85,723	\$90,267	\$85,715	\$78,478			
70+	145	638	1,092	690	1,289	3,410	1,999	406		
	\$49,954	\$71,965	\$75,501	\$83,525	\$91,437	\$90,855	\$87,143	\$86,384		
	103	428	651	432	806	1,060	1,224	1,696	114	
	\$51,393	\$72,208	\$73,844	\$80,177	\$87,100	\$89,129	\$91,712	\$93,062	\$88,210	
	45	248	351	239	286	271	281	564	312	21
	\$51,026	\$71,141	\$77,044	\$75,080	\$82,843	\$87,265	\$91,771	\$93,768	\$91,462	\$93,106
	13	76	120	66	50	54	52	73	96	36
		\$66,371	\$73,213	\$68,061	\$77,637	\$70,217	\$66,673	\$87,677	\$86,666	\$86,447
	3	12	15	5	4	3	3	7	5	14
		1	1	6		1		2	1	2

**Plan Name:** Verizon Management Pension Plan

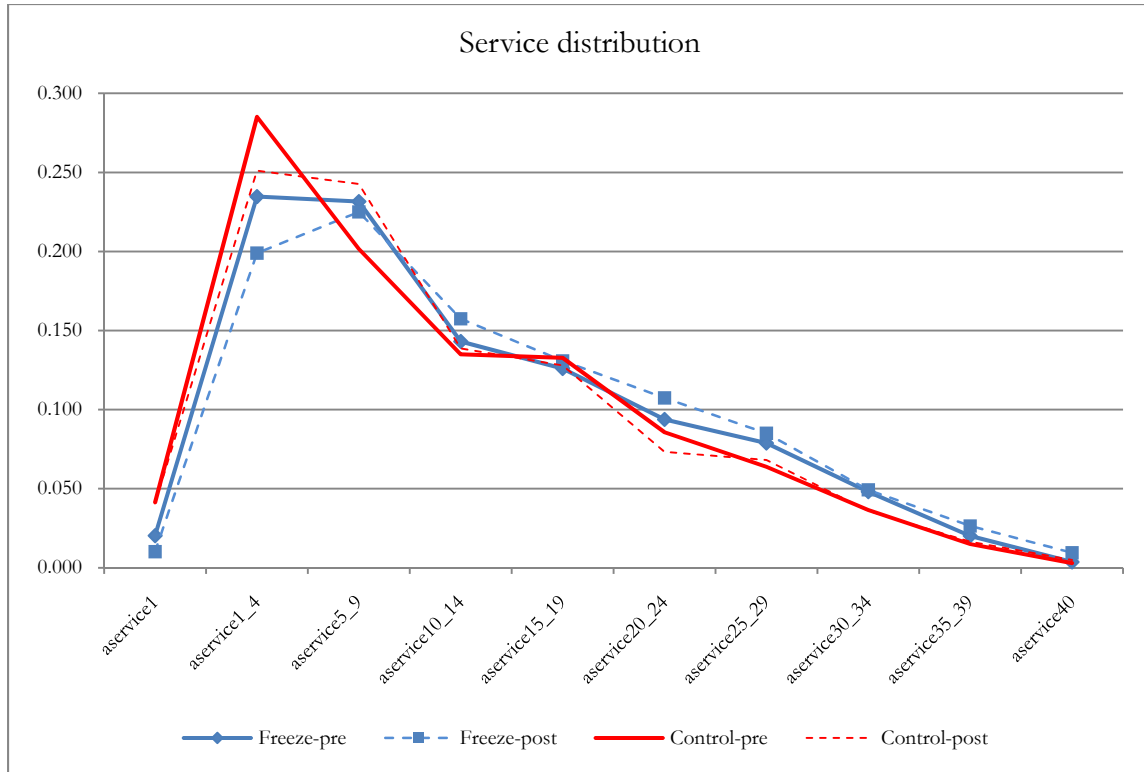
**EIN:** 131675522

**PIN:** 001

**Year:** 2004

**FIGURE 1**

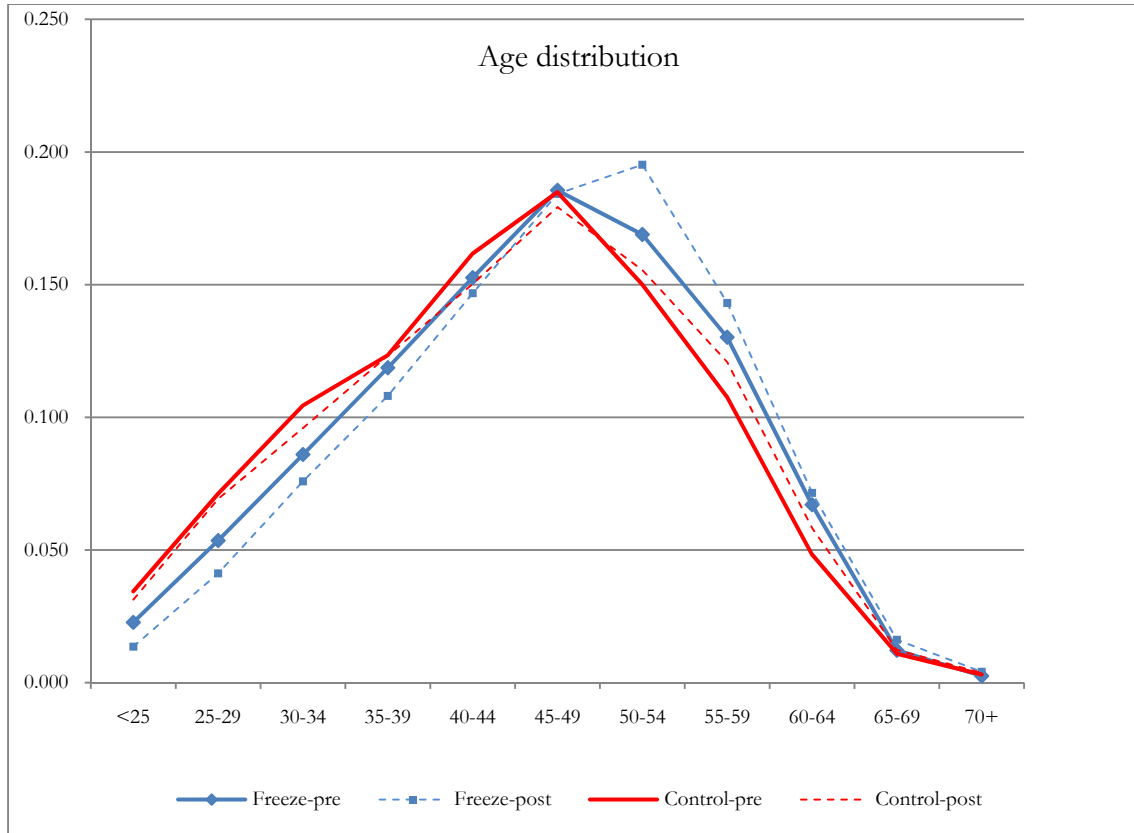
This table shows the service (tenure) distribution for the plan participants in the frozen and control plans before and after the freeze.





**FIGURE 2**

This table shows the age distribution for the plan participants in the frozen and control plans before and after the freeze.



**TABLE I**

This table shows the industry and the yearly distribution of our sample of 139 “hard” freezes. Industry is defined at a 2-digit SIC code. Freezes are identified from Form 5500 form filed at the plan level with the Department of Labor. The sample is constrained by the availability of data on the plan for the 3 years surrounding the freeze.

SIC code		2002	2003	2004	2005	2006	Total
13	Oil and gas extraction			1	1	1	3
15	General building contractors			1			1
16	Heavy construction, except building			1		1	2
20	Food and kindred products			1		1	2
23	Apparel and other textile products		1				1
25	Furniture and fixtures					3	3
26	Paper and allied products					1	1
27	Printing and publishing			1		2	3
28	Chemicals and allied products			3	4	1	8
30	Rubber and misc. Plastics products					2	2
32	Stone, clay, and glass products			1		1	2
33	Primary metal industries			2	1	2	5
34	Fabricated metal products			4	1	1	6
35	Industrial machinery and equipment			2	1	2	5
36	Electronic & other electric equipment		1	4	1	1	7
37	Transportation equipment			5	2	1	8
38	Instruments and related products		1	2		1	4
39	Misc. Manufacturing industries				1	1	2
41	Local and interurban passenger transit				1		1
45	Transportation by air				3	2	5
47	Transportation services				1		1
48	Communication			1	3		4
49	Electric, gas, and sanitary services			1	1		2
50	Wholesale trade - durable goods			2	1		3
51	Wholesale trade - nondurable goods		1	2	1	2	6
53	General merchandise stores			1			1
54	Food stores					1	1
56	Apparel and accessory stores					1	1
57	Furniture and homefurnishings stores				1		1
58	Eating and drinking places			1		1	2
59	Miscellaneous retail			1	1		2
60	Depository institutions		2	2	4	6	14
62	Security and commodity brokers				1		1
63	Insurance carriers		1	2	3	2	8
65	Real Estate				1		1
67	Holding and other investment offices				1		1
72	Personal services					1	1
73	Business services	2	1	1	3	3	10
75	Auto repair, services, and parking				1	1	2
78	Motion pictures					1	1
87	Engineering & management services				3		3
99	Nonclassifiable establishments			2			2
		2	8	44	42	43	139

**TABLE II**

This table shows the characteristics of the frozen plans and also the characteristics of the control plan in calendar time. ‘Active participants’ refer to the number of salaried employees currently employed by the firm and participating in the plan. ‘Total participants’ refer to the sum of retired and active participants in the plan. The pension liability is the accumulated benefit obligation (ABO) as disclosed by sponsors in Form 5500. It is the present value of the pension liability based on current salary and years and employment. ‘Pension assets’ refer to the market value of the plan assets and the ‘pension contribution’ is the cash contribution of the sponsor into the plan for year.

<i>Frozen plan PRE (means)</i>							<i>Control plan PRE (means)</i>						
Year	N	Active participants	Total participants	Pension Liability (ABO)	Pension Assets	Pension Contribution	Year	N	Active participants	Total participants	Pension Liability (ABO)	Pension Assets	Pension Contribution
2001	2	531	6427	286	261	0	2001	2	14211	18889	242	255	17
2002	8	2686	6445	119	109	3	2002	7	2573	8932	246	276	3
2003	43	1974	6860	108	74	5	2003	45	5029	7875	183	163	15
2004	38	2291	7671	511	500	9	2004	41	2781	8269	324	323	19
2005	43	2618	5153	306	252	7	2005	41	2570	4866	172	167	7
Total	134	2292	6511	289	257	7	Total	136	3619	7303	226	219	13

<i>Frozen plan POST</i>							<i>Control plan POST</i>						
Year	N	Active participants	Total participants	Pension Liability (ABO)	Pension Assets	Pension Contribution	Year	N	Active participants	Total participants	Pension Liability (ABO)	Pension Assets	Pension Contribution
2004	10	2120	7225	185	177	1	2004	10	4530	10537	246	265	8
2005	26	735	1977	50	43	2	2005	29	2465	6033	229	240	8
2006	41	1623	10948	454	520	6	2006	47	5246	9370	263	266	8
2007	44	1502	4062	236	196	1	2007	46	2822	7179	329	325	5
Total	121	1429	6209	266	271	3	Total	132	3736	7962	277	281	7

**TABLE III**

This table shows the characteristics of the frozen plans and also the characteristics of the control plan in *event time*. ‘Active participants’ refer to the number of salaried employees currently employed by the firm and participating in the plan. ‘Total participants’ refer to the sum of retired and active participants in the plan. The pension liability is the accumulated benefit obligation (ABO) as disclosed by sponsors in Form 5500. It is the present value of the pension liability based on current salary and years and employment. ‘Pension assets’ refer to the market value of the plan assets and the ‘pension contribution’ is the cash contribution of the sponsor into the plan for year.

*Frozen plan (means)*

Time to freeze	Active participants	Total Participants	Pension liability (ABO)	Pension assets	Pension contribution	Plan service cost	Plan benefits to be paid	N
-3	2719	6094	332	373	5	10	23	100
-2	2451	5943	324	336	8	8	26	102
-1	2292	6511	289	257	7	5	22	134
0	1625	4874	271	270	4	2	19	118
1	1613	6433	266	271	5	0	22	123
2	1435	6034	185	136	3	0	11	71
3	1393	8498	183	153	6	0	11	37
Total	2007	6134	277	273	5	4	20	685

*Control plan (means)*

Time to freeze	Active participants	Total Participants	Pension liability (ABO)	Pension assets	Pension contribution	Plan service cost	Plan benefits to be paid	N
-3	3064	6242	188	187	7	6	11	102
-2	3588	7345	232	215	14	7	14	113
-1	3619	7303	226	219	13	9	14	136
0	3730	7715	249	248	10	8	15	130
1	3650	7881	274	275	7	9	16	131
2	4894	10591	362	374	8	8	23	78
3	3370	8031	291	306	9	9	20	35
Total	3687	7727	252	250	10	8	15	725

**TABLE IV**

The table shows the event time firm level characteristics of the 139 sponsoring companies choosing to freeze at least one of their DB plans. Time “0” is the year of the plan freeze while “-2”, “-1”, “+1”, “+2” refers to the years preceding or succeeding the freeze. All variables are described in Appendix 3.

FREEZES	MEDIAN					MEAN					N				
	-2	-1	0	1	2	-2	-1	0	1	2	-2	-1	0	1	2
<b><i>Sponsor variables</i></b>															
Total Assets - \$mil	2060	2449	2386	3475	2566	13419	17457	9993	22760	27480	102	132	116	112	67
Total debt - \$mil	613	594	556	717	595	3517	5306	2203	7373	10678	101	131	116	112	67
BLEV	0.48	0.45	0.35	0.37	0.35	0.53	0.6	0.42	0.31	0.43	101	131	116	112	67
MLEV	0.32	0.26	0.23	0.23	0.24	0.39	0.32	0.29	0.3	0.29	96	122	108	107	65
MB	1.2	1.28	1.3	1.27	1.36	1.42	1.49	1.53	1.49	1.57	97	123	108	107	65
DEBT to CF	2.79	2.42	2.49	2.26	2.61	1.18	15.09	46.45	0.26	7.87	101	131	115	111	67
EBITDA to SALES	0.12	0.12	0.13	0.12	0.15	0.16	0.16	0.16	-0.65	0.18	102	132	115	111	67
INTEREST COVERAGE	3.5	3.6	4.27	4.75	4.72	15.64	7.85	14.09	10.21	11.68	87	113	98	97	62
<b><i>Pension plan variables</i></b>															
Plan assets (Form 5500) - \$mil	62	66	69	81	72	1349	1154	1152	1961	2116	102	132	116	112	67
Plan liabilities ABO (Form 5500) - \$mil	75	82	80	91	92	1455	1301	1215	1837	1904	102	132	116	112	67
Plan assets (FASB) - \$mil	97	107	95	125	147	1841	1947	1639	2422	2556	99	130	112	111	67
Plan liabilities PBO (FASB) - \$mil	77	79	76	110	97	1423	1656	1454	2323	2582	99	130	112	111	67
Active participants	1312	1344	1095	873	731	11068	9620	8259	10760	10505	102	132	116	112	67
Total participants	3134	3497	3208	3132	2075	24111	23978	20391	30394	32447	102	132	116	112	67
<b><i>Relative size of the pension plan</i></b>															
ABO to total debt	0.15	0.22	0.24	0.2	0.17	2.88	5.05	8.22	7.75	0.72	95	126	112	109	65
PA (Form 5500) to total assets	0.04	0.04	0.05	0.04	0.03	0.14	0.12	0.14	0.12	0.08	102	132	116	112	67
ABO <i>frozen plan</i> to total ABO	1	0.98	0.99	1	1	0.71	0.69	0.7	0.73	0.72	102	132	116	112	67
PA <i>frozen plan</i> to total PA (Form 5500)	1	0.99	0.99	1	1	0.71	0.69	0.7	0.71	0.72	102	132	116	112	67
<b><i>Pension plan cost variables</i></b>															
DB contribution (FASB) - \$mil	4.83	3.75	3.75	5.00	3.94	44.57	58.43	60.07	60.34	41.37	102	132	116	112	67
DB contribution (Form 5500)	2.05	1.91	1.94	1.19	1.01	40.31	46.13	43.22	34	18.28	98	129	111	109	65
DC contribution (Form 5500)	4.80	4.03	3.71	6.59	4.90	25.28	24.91	23.7	40.95	50.95	98	129	110	111	66
Service cost (FASB)	2.66	2.00	1.77	0.96	1.18	40.64	45.26	34.34	55.07	64.44	97	129	111	111	65
Interest cost (FASB)	5.8	6.2	5.27	7.48	8.66	112.03	109.92	92.99	132.56	139.64	97	129	111	111	65
Expected benefits (Form 5500)	3.45	3.39	3.96	4.95	4.93	95.96	80.46	71.89	120.59	116.91	102	132	116	112	67
DC +DB Contribution (Form 5500)	7.30	8.10	7.95	10.22	9.76	67.14	72.11	69.22	75.23	69.48	98	129	110	111	66
Service cost +DC Contribution	9.06	8.88	6.98	9.96	7.87	67.86	71.15	60.25	96.78	117.65	93	126	105	110	64
DB Contribution to Interest on debt	0.10	0.05	0.05	0.05	0.03	1.10	0.77	1.16	0.26	0.50	87	113	98	97	62

TABLE V

The table shows the event time firm level characteristics of the 139 sponsoring companies used as *controls* for our sample of freezes. The control plan is selected based on a matching of propensity scores, originally developed by Rosenbaum and Rubin (1983, 1985) and Heckman et al. (2007). The propensity score is the conditional probability of treatment assignment given ex-ante variables. We calculate propensity scores based on the size of the individual plan liabilities (accumulated benefit obligation), the number of participants and industry. Time “0” is the year of the plan freeze while “-2”, “-1”, “+1”, “+2” refers to the years preceding or succeeding the freeze. All variables are described in Appendix 3.

CONTROLS	MEDIAN					MEAN					MEAN				
	-2	-1	0	1	2	-2	-1	0	1	2	-2	-1	0	1	2
<b><i>Sponsor variables</i></b>															
Total Assets	2168	2511	2534	2625	2655	17153	17927	20983	23096	8598	113	136	130	125	75
Total Debt	441	501	490	561	606	4237	5078	5633	6728	1886	113	136	130	124	74
BLEV	0.43	0.42	0.42	0.43	0.39	0.46	0.46	0.46	0.46	0.43	113	136	130	124	74
MLEV	0.25	0.23	0.21	0.22	0.2	0.3	0.29	0.27	0.27	0.25	104	128	122	117	71
MB	1.27	1.29	1.35	1.39	1.48	1.55	1.5	1.55	1.58	1.77	104	128	122	118	72
DEBT to CF	3.22	3.25	2.63	2.7	2.67	5.39	5.11	3.63	8	6.69	112	135	129	123	73
EBITDA to SALES	0.13	0.13	0.15	0.14	0.14	-0.08	0.18	0.18	0.17	0.19	112	135	129	124	74
INTEREST COVERAGE	4.93	5.11	5.45	6.56	7.8	19.32	13.01	11.53	22.43	25.89	100	120	114	111	69
<b><i>Pension plan variables</i></b>															
Plan assets (Form 5500)	81	93	96	114	138	481	530	497	716	641	113	136	130	125	75
Plan liabilities ABO (Form 5500)	83	93	100	124	153	484	526	478	656	601	113	136	130	125	75
Plan assets (FASB)	96	111	131	161	229	780	881	1043	1145	822	113	136	130	125	75
Plan liabilities PBO (FASB)	127	166	181	207	285	906	1015	1146	1186	869	113	136	130	125	75
Active participants	2272	2351	2190	2245	2743	7489	8015	6721	8197	6967	113	136	130	125	75
Total participants	3942	4754	4155	4138	5229	15434	16280	14343	17698	15502	113	136	130	125	75
<b><i>Relative size of the pension plan</i></b>															
ABO to total debt	0.28	0.30	0.24	0.31	0.43	1.64	0.73	0.99	2.60	3.69	110	133	128	121	74
PA (Form 5500) to total assets	0.06	0.06	0.06	0.06	0.08	0.12	0.12	0.11	0.14	0.16	113	136	130	125	75
ABO <i>control plan</i> to total ABO	0.92	0.96	0.96	0.96	0.95	0.72	0.71	0.73	0.71	0.73	113	136	130	125	75
PA <i>control plan</i> to total PA (Form 5500)	0.94	0.96	0.97	0.97	0.97	0.72	0.70	0.73	0.71	0.72	113	136	130	125	75
<b><i>Pension plan cost variables</i></b>															
DB contribution (FASB)	4.82	7.25	8.71	9.29	11.31	34.34	50.64	59.60	31.32	22.80	113	136	130	125	75
DB contribution (Form 5500)	3.50	4.02	4.48	3.54	5.90	24.72	40.35	24.10	19.73	14.68	110	136	130	125	75
DC contribution (Form 5500)	3.50	4.04	5.40	4.77	6.05	13.93	14.76	16.70	17.70	14.57	105	128	123	118	71
Service cost (FASB)	5.35	5.73	6.46	6.81	10.00	22.62	25.11	27.90	28.58	22.64	110	135	130	125	75
Interest cost (FASB)	7.33	8.1	9.09	10.46	13.1	52.87	54.72	59.29	62.65	47.69	110	135	130	125	75
Expected benefits (Form 5500)	3.96	4.88	4.95	5.86	9.2	30.75	34.66	28.9	42.2	35.95	113	136	130	125	75
DC +DB Contribution (Form 5500)	10.99	11.54	13.31	12.14	13.36	40.51	57.50	42.16	38.45	29.47	105	128	123	118	71
Service cost +DC Contribution	10.89	9.80	11.65	13.45	15.22	38.38	41.21	46.09	47.94	37.97	102	127	123	118	71
DB Contribution to Interest on debt	0.20	0.21	0.20	0.17	0.21	1.53	1.02	0.85	3.97	4.75	100	120	114	111	69

**TABLE VI**

This table shows the estimated cost savings associated the freeze of a DB plan. We present here the difference in difference of total retirement costs between the sponsors of the frozen plans and their controls, pre- and post- freeze [-1 year; +1year]. Total retirement cost is calculated as the sum between total service cost and the total contribution to DC plans.

	Millions of Dollars									Scaled by Sales									
	Freezes				Controls					Diff in diff (freeze-control, post-pre)	Freezes				Controls				
	DB Service cost (FASB)	DB Accruals F5500	DC Contrib	Total cost	DB Service cost (FASB)	DB Accruals F5500	DC Contrib	Total cost	DB Service cost (FASB)		DB Accruals F5500	DC Contrib	Total cost	DB Service cost (FASB)	DB Accruals F5500	DC Contrib	Total cost	Diff in diff (freeze-control, post-pre)	
<b>Mean</b>																			
-1	69.41	58.27	36.79	95.06	30.7	24.16	16.7	40.86		0.45	0.41	0.43	0.84	0.69	0.65	0.35	0.99		
0	69.46	51.12	38.5	89.62	33.34	20.38	18.94	39.33		0.36	0.29	0.44	0.73	0.67	0.52	0.34	0.86		
1	64.84	54.4	63.04	117.44	34.17	26.29	19.83	46.12	17.12	0.24	0.20	1.07	1.27	0.63	0.52	0.32	0.84	0.58	
<b>SE (mean)</b>																			
-1	21.13	20.57	9.81	28.66	7.8	6.47	4.9	11.16		0.06	0.07	0.05	0.09	0.07	0.07	0.03	0.09		
0	23.44	18.79	9.75	27.25	8.29	4.76	5.42	9.34		0.05	0.05	0.04	0.07	0.07	0.06	0.03	0.07		
1	25.25	21.34	17.53	31.86	8.87	7.35	6.08	13.05	14.99	0.04	0.05	0.44	0.44	0.07	0.06	0.03	0.07	0.48	
<b>Median</b>																			
-1	3.3	1.75	4.78	11.52	6.45	6.01	4.61	10.92		0.29	0.18	0.30	0.64	0.44	0.36	0.27	0.8		
0	2.6	0.63	5.4	8.44	7.2	5.06	6.6	10.57		0.23	0.13	0.35	0.6	0.43	0.28	0.31	0.69		
1	1.3	0.15	8.63	11.87	7.7	6.37	6.45	11.71	0.33	0.06	0.02	0.46	0.56	0.40	0.34	0.31	0.67	-0.11	
<b>25th PERC</b>																			
-1	0.38	0.18	1.02	2	1.55	1.12	1.45	2.84		0.05	0.01	0.15	0.25	0.25	0.16	0.15	0.44		
0	0.2	0	1.61	2.03	1.75	1.06	1.42	2.99		0.02	0.00	0.13	0.24	0.26	0.14	0.14	0.41		
1	0	0	1.88	2.33	1.67	1.1	1.07	3.47	-2.96	0.00	0.00	0.20	0.31	0.19	0.16	0.17	0.44	-0.26	
<b>75th PERC</b>																			
-1	20	17.6	24.43	47.14	25.5	17.54	13.49	49.07		0.53	0.53	0.51	1.08	0.95	0.90	0.48	1.26		
0	21.18	16.87	24.68	62.24	33.6	17.86	15.5	45.17		0.42	0.41	0.61	1.06	0.83	0.81	0.46	1.19		
1	17.9	7.14	37.09	68.22	26.2	22.79	14.63	42.32	9.51	0.32	0.19	0.71	0.95	0.82	0.73	0.44	1.17	0.28	

**TABLE VII**

This table shows the reduction in benefit accruals associated with the freeze. These changes are presented relative to the group of control sponsors, and therefore the numbers in the table are differences in differences between the sponsors of the frozen plans and their controls, pre- and post- freeze [-1 year; +1year]. Dollar values are expressed in thousands.

PBO (firm level)	Difference in differences*				Difference in differences**				
	\$dollars	to Assets	to Sales	to EBITDA	\$dollar	to Assets	to Sales	to EBITDA	
mean	-280.78	-2.71	1.6	-537.08	-97.93	-2.04	1.72	-295.98	
se(mean)	242.88	1.44	4.48	352.8	239.74	1.31	3.2	259.93	
p50	-17.17	-0.27	-1.33	-12.53	-11.31	-0.18	-0.99	-8.88	
p25	-79.79	-3.19	-6.58	-162.86	-75	-3.19	-5.1	-64.95	
p75	6.26	0.93	1.14	11.49	6.26	1.25	1.88	14.7	
N	61	61	61	60	87	87	87	86	
A BO (plan level)	mean	-30.17	-0.54	3.73	-91.92	-31.82	-0.63	3.08	-26.24
	se(mean)	23.18	0.65	3.56	74.12	16.73	0.79	2.51	63.95
	p50	-2.8	0.01	-0.27	-0.46	-2.9	-0.01	-0.06	-0.11
	p25	-15.71	-0.88	-2.55	-20.5	-19.94	-0.88	-1.98	-15.71
	p75	3.5	0.56	0.77	9.79	1.23	1.04	1.21	10.65
	N	61	61	61	60	87	87	87	86
A BO (firm level)	mean	384.33	1.91	6.65	-234.44	301.3	1.87	6.01	-81.94
	se(mean)	342.37	1.68	4.71	133.98	242.05	1.45	3.36	117.08
	p50	-4.16	0.05	0.13	-2.96	-3.7	0.08	0.36	0.28
	p25	-25.19	-1.77	-4.42	-86.01	-29.06	-1.75	-3.29	-37.92
	p75	33.33	1.72	2.65	21.92	31.81	2.65	3.89	25.21
	N	61	61	61	60	87	87	87	86
NOTES	*Restricted on (-1,0,1): PBO, ABO (f/c plan), ABO (firm level), Service Cost (firm level), Service cost (f/c plan), 401k contrib				**Restricted on (-1,0,1): PBO, ABO (f/c plan), ABO (firm level)				



**TABLE VIII**

This table shows the evolution of DB accruals in event time. -1, 0, +1 refers to the years surrounding the freeze. ABO is the Frozen/control plan accumulated benefit obligation. SC is the frozen/control plan expected service cost. SABO is the firm level accumulated benefit obligation. PBO is the firm level projected benefit obligation.

		Millions of Dollars								Scaled by sales								
		Freezes				Controls				Freezes				Controls				
		ABO	SC	SABO	PBO	ABO	SC	SABO	PBO	ABO	SC	SABO	PBO	ABO	SC	SABO	PBO	
MEAN	-1	313.2	2.9	1438.1	2504.9	268.3	8.1	700.0	1457.3	-1	11.1	0.1	17.1	26.3	14.1	0.4	19.1	28.1
	0	322.5	2.2	1760.0	2390.3	288.3	8.2	568.2	1596.5	0	10.2	0.1	16.9	23.1	12.9	0.4	16.8	27.0
	1	326.8	0.2	1962.7	2413.9	312.1	9.1	840.2	1647.1	1	12.6	0.0	21.5	25.3	12.0	0.4	16.9	25.5
SEMEAN	-1	198.2	0.9	695.2	957.8	94.0	3.2	219.6	453.5	-1	2.8	0.0	3.2	6.2	3.7	0.1	3.7	4.5
	0	195.5	0.9	699.2	974.0	102.1	3.6	132.1	487.2	0	2.6	0.0	3.1	5.9	2.7	0.1	2.7	3.5
	1	195.7	0.1	844.5	988.2	111.2	4.0	257.1	500.2	1	3.6	0.0	6.0	6.6	2.1	0.1	2.1	3.1
MEDIAN	-1	27.8	0.3	61.3	109.3	47.8	2.1	91.4	172.9	-1	3.7	0.0	6.8	10.6	7.4	0.2	13.2	18.8
	0	30.3	0.1	85.7	114.0	53.1	1.9	99.6	194.8	0	3.5	0.0	7.8	10.4	7.1	0.2	10.2	19.1
	1	29.9	0.0	74.9	121.3	55.4	1.7	119.7	244.7	1	3.9	0.0	7.2	9.8	5.8	0.2	11.7	17.9
P25	-1	13.6	0.0	21.1	39.2	20.3	0.7	41.5	62.7	-1	0.7	0.0	2.9	4.7	1.5	0.0	5.6	10.2
	0	14.9	0.0	22.5	40.0	22.0	0.5	37.5	72.7	0	0.7	0.0	3.5	4.2	1.5	0.0	5.2	8.2
	1	15.3	0.0	25.0	38.8	23.2	0.5	52.6	82.7	1	0.6	0.0	4.0	4.4	1.4	0.0	6.0	8.4
P75	-1	84.2	2.3	203.9	494.9	109.7	4.4	584.1	944.4	-1	9.7	0.2	20.2	25.2	15.4	0.6	23.6	35.6
	0	91.7	0.8	303.7	526.2	120.2	4.7	638.9	1026.8	0	9.7	0.1	19.1	21.8	15.4	0.5	22.7	36.4
	1	102.0	0.1	339.6	571.1	133.8	5.0	711.8	1085.9	1	9.9	0.0	17.9	21.9	16.9	0.5	23.5	35.6

**TABLE IX**

This table presents the estimated coefficients of the probability that the plan is frozen (probit). The sample includes plan level information. ‘Funding ratio’ is defined as the difference between plan assets and pension liabilities as a percentage of plan liabilities. The measure of pension liabilities is the accumulated benefit obligation (ABO), estimated based on the current years of service and salary and disregarding any future benefit accruals. ‘Union’ is a dummy variable equal to 1 if the plan is collectively bargained. This information is disclosed in Form 5500. All remaining variables are described in the Appendix 3.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
FUNDING RATIO	-0.138** (0.01)	-0.489*** (0.00)	-0.489*** (0.00)	-0.270*** (0.00)	-0.127*** (0.00)	-0.303*** (0.00)
UNION	-0.189*** (0.00)	-0.387*** (0.00)	-0.387*** (0.00)	-0.374*** (0.00)	-0.236*** (0.00)	-0.370*** (0.00)
PLAN SERVICE COST	0.043*** (0.00)					
LEVERAGE (MV)	0.132 (0.11)	-0.056 (0.44)	-0.056 (0.44)	0.027 (0.70)	-0.019 (0.80)	0.027 (0.70)
MB	-0.078** (0.01)	-0.044* (0.05)	-0.044* (0.05)	-0.043* (0.05)	-0.052* (0.06)	-0.045** (0.05)
TOTAL ASSETS	-0.072*** (0.00)	-0.069*** (0.00)	-0.069*** (0.00)	-0.071*** (0.00)	0.071*** (0.00)	-0.073*** (0.00)
EBITDA TO SALES	-0.039 (0.41)	-0.034* (0.09)	-0.034* (0.09)	-0.030** (0.05)	-0.085** (0.02)	-0.029* (0.05)
ACTIVE PARTICIPANTS		0.066*** (0.00)	0.066*** (0.00)			
BENEFITS TO BE PAID				0.079*** (0.00)		0.049** (0.03)
SPONSOR TOTAL SERVICE COST					-0.111*** (0.00)	
PENSION ASSETS						0.035 (0.16)
Constant	-1.837*** (0.00)	-1.482*** (0.00)	-1.482*** (0.00)	-2.187*** (0.00)	-2.058*** (0.00)	-1.858*** (0.00)
Observations	21070	22810	22810	23472	23253	23378