The Impact of Pension Freezes on Firm Value

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Abstract

Many large corporations have recently announced that they are freezing their defined benefit plans, which generally means that no new accruals are permitted. We examine whether the announcement of such pension freezes contribute to company value creation. Results show that freezes do enhance underlying firm value, but market valuation lags in responding to this increase. In this regard, our results corroborate recent work of other researchers who find various market inefficiencies related to defined benefit pensions.

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Since 2001, pension freezes have surged in popularity, representing the latest development in a long-term shift from defined benefit (DB) to defined contribution (DC) plans. Competitive pressures and an increasingly mobile workforce have driven the 25-year shift to DC plans, away from the less flexible, more volatile, and often higher-cost DB programs. A recent confluence of market and regulatory events has further boosted the popularity of freezes relative to outright terminations. This paper seeks to answer whether pension freezes increase firm value, as the managers who enact them often proclaim. In addition, we study the market's efficiency in recognizing this potential value change. These research questions are assessed with an event study using a sample of recent pension freezes from 2003 through 2006. The results address issues important to the managers who execute freezes and to the investors who price their effect on firm value.

Background and Prior Literature

Private-sector US workers have long received retirement benefits as a component of their total compensation. Traditionally, larger corporations have provided for their employees' retirement through defined benefit pension programs. DB plans guarantee an annuity payment upon retirement equal to a formula that includes the employee's level of compensation and years of service to the firm; for instance, a retired worker's benefit might be computed according to a formula such as:

Benefit = (2%)*(Years of Service)*(Final 3 Years' Average Salary)*(Inflation Index)

DB plans insure the retiree against longevity and investment risk, leaving the plan sponsor to fund and manage the plan responsibly. Providing for a workforce's retirement creates substantial long-term liabilities for the sponsor. Unlike social security, DB obligations

are not paid for from operating revenue. Rather, the Employee Retirement Income Security Act of 1974 (ERISA) requires plan sponsors to fund an investment trust for the benefit of plan participants. Annually, firms are required to contribute a minimum amount to the fund. By law, companies must contribute to their plan each year an amount equal to the present value of the benefits earned by employees that year. Additionally, the Pension Protection Act of 2006 requires firms to make up for funding shortfalls generally amortized over a seven-year period.[1] If managed incorrectly, these post retirement liabilities may have a crushing effect on the firm's solvency and profitability.

A case in point is the struggling domestic auto industry. In 2005, General Motors' legacy costs including health care benefits came to $1,600 per vehicle (Welch et al., 2005). Competitor Toyota offers no DB plan; and, on a unit of production basis, pays 90% less in health care costs than GM (Sloan 2006). Despite an allegedly over-funded DB plan, mounting benefit cost pressure forced GM to freeze its pension in Q1 2006 (GMC 2006). Besides the expense burden, long-term DB liabilities[2] increase the plan sponsor's risk (market, legislative, accounting standard and actuarial), as GM outlines in its 2006 10K (GMC 2006:21):

> Our future funding obligations for our IRS-qualified U.S. defined benefit pension plans and our estimated liability related to OPEB [Other Post Employment Benefits][3] plans depend upon changes in health-care inflation trend rates, the level of benefits provided for by the plans, the future performance of assets set aside in trusts for these plans, the level of interest rates used to determine funding levels, actuarial data and experience, and any changes in government laws and regulations.

In addition to increasing the sponsor's financial risk and worsening its competitive position, DB pensions also make the financial statements inscrutable. Pension accounting is exceptional in its complexity, opacity, and discretion. This challenges analysts assessing the economic impact of a firm's DB plan. As such, there is debate in the literature regarding investors' ability to account properly for DB plans in firm valuation.

Any discussion on pension valuation must begin with an explanation of the DB pension liability.[4] Actuaries and accountants measure pension liability using two approaches:

- Accumulated Benefit Obligation (ABO): Includes benefits for vested and non-vested employees at current salaries
- Projected Benefit Obligation (PBO): Includes benefits for vested and non-vested employees at future salaries.

As of 2008, both must be discounted at a corporate bond rate.[5] In measuring the above, managers are given wide discretion in their assumptions, such as future salary increases and retirement ages. As for plan assets, they are valued at an average of fair market value over the past two years, so long as this value compared to current fair value does not fall outside a 90%-110% corridor. Ignoring the smoothing and manipulation possible in asset and liability measurements, the general economic state of the plan is measured as its funded status which is defined as the PBO minus Plan Assets.

Prior to December 2006, a DB plan's funded status had little relevance for the income statement and balance sheet aside from footnote disclosure. Even now, if investors concentrate on pension items disclosed on income statements and balance sheets, it is all but certain they will err in their valuations. The income statement reflects pension expense, which is a heavily smoothed figure. The rationale for this smoothing is to insulate earnings from such erratic events as plan amendments and investment portfolio returns. The components of pension expense include:

- Service cost: Increase in PBO due to employees' labor
- Interest Cost: Accrued increase in liability due to time value of money
- Actual Return: Plan asset gains/losses
- Amortization of Prior Service Cost: Amortization of plan amendments

- Gain/Loss: Difference between expected and actual investment return plus recognition of unrecognized gains or losses (determined by a corridor test).

Such smoothing divorces reported financials from market reality. For example, management's expected return assumptions, not actual market conditions, determine the rate of return on plan assets. Given current rules, management can dramatically boost pension income, by selecting an expected rate of return on plan which exceeds the liability discount rate. As for the balance sheet, a DB pension is recognized through accrual of the aforementioned smoothed pension expense figure. As a safeguard, firms must carry a minimum liability (ABO-Plan Assets) to ensure the balance sheet does not vary too greatly from economic reality.

Reform recently came in December 2006 with SFAS No. 158; this new accounting standard requires firms to indicate their DB pension funded status on the plan sponsor's balance sheet. Yet this only goes so far, as the additional disclosure is made through adjusting Accumulated Other Comprehensive Income rather than sponsor assets or liabilities. As a result, DB financial statement presentations continue to challenge the valuation skills of even sophisticated outsiders. It is possible that this difficulty produces confusion over not only how to assess plans restructuring by freeze or termination, but also how to value ongoing DB plans.

A prominent alternative to DB plans are DC plans such as 401(k)'s. Under this model, the plan sponsor is responsible only for an annual contribution to each employee's tax deferred retirement account; the participant is responsible for managing his own portfolio. This latter type of plan is popular among employees because it is transferable across employers, reduces the problem of job lock, and diminishes dependence on employer solvency. The US Department of Labor has noted that the percent of firms offering only DC plans has tripled since 1981 (see Figure 1). A recent Watson Wyatt study of the Fortune

1000 demonstrates that this trend has accelerated since early this decade (see Figure 2). VanDerhei (2006) shows that 168,725 DB plans terminated since 1975 (98% of which were fully funded at termination), leaving 29,000 DB plans surviving.[6] Of the surviving plans, PBGC (2005) shows that 9.4% were hard frozen in 2003, the first year the PBGC collected freeze data. This freeze statistic is somewhat overstated, since hard frozen plans represent only 1.8% of active participants. A Towers Perrin study (2004) of multinational firms demonstrates the global nature of this trend: 20% of respondents, mostly foreign firms, had completed a freeze or termination with 29% considering such action in the near future.

Figures 1 and 2 here

In general, healthy firms have sought to reduce DB liabilities in one of two ways: Freeze or Standard Termination. In a standard (or fully funded) termination, the plan sponsor settles its pension liability by either purchasing an annuity from an insurer that roughly matches the plan's ABO (Harper et al. (2007) suggest that conservative actuarial assumptions make the actual termination liability larger than the ABO), or by dispersing trust assets to beneficiaries in a lump sum. Terminations are generally feasible only for plans with assets that exceed the termination liability. In such a case, the firm can capture surplus assets subject to a 50% excise tax (Latter 2006). Alternatively, the sponsor can freeze the plan: in this case, plan participants cease to accrue benefits. Freezes may be grouped into three main categories (Vanderhei 2006):

- Hard Freeze: All plan participants stop accruing service benefits;
- Partial Plan Freeze: A portion of participants stops accruing service benefits;
- Soft Freeze: All plan participants stop accruing service benefits but benefit accruals based on salary increases continue to be earned.

The Gain/Loss on a hard freeze is the difference between the PBO and ABO, as the freeze eliminates future salary increases, less Unrecognized Prior Service Cost and Unrecognized Gain/Loss.[7]

Sponsors seeking eventual termination will sometimes freeze their plan first, in order to slow the rate of liability growth and to allow assets to catch up to liabilities. PBGC (2005) found that, of plans frozen in 2003, 20% were slated for termination versus 7% for non-frozen plans. Periods of low long-term interest rates, such as now, make terminations especially costly. Low interest rates elevate pension liabilities and boost the cost of termination. Conversely, low discount rates increase the freeze accounting gain, by widening the difference between ABO and PBO, making freezes relatively more attractive.

Freezes have grown in popularity since 2001, influenced by falling interest rates and declining stock prices. Unfortunately, data on pension freezes are limited. The Department of Labor did not inquire firms about plan freezes on its Form 5500 until 2002, and there is a five-year lag in data publication. Nevertheless, several benefit consultancies have produced studies on the issue using client data. Aon (2003) discovered in a study of 1000 clients that 2% of the sample plans had implemented a freeze before 2001, while 21% had taken action to freeze or were actively considering a freeze post-January 2001. In late 2006, 10% of surveyed Hewitt Associates' (2007) DB clients said they were "somewhat or very likely" to freeze their plans.

What have been the factors driving DB plans' long decline and the recent popularity of freezes? Munnell et al. (2006) propose four primary causes: compensation reduction, increasing health care costs, financial risk, and the rise of non-qualified plans. We agree with those authors that, of these four, the most important appears to be financial risk and compensation reduction. Certainly rising health care costs and the creation of executive only, non-qualified plans have contributed to the decline. Yet Munnell et al. (2006) note that

nations without these issues, Canada and the United Kingdom, have also experienced an increase in freezes. In separate surveys, Mercer (2006) (see Figure 3) and Aon (2003) found that managers who had recently changed their DB plan design cited "Long Term Cost Savings" and "Reduced Cost Volatility" as top reasons for their decision.

Figure 3 here

It has been widely noted that firms laden with DB liabilities are finding themselves at a disadvantage when competing with global rivals and start-ups who do not bear similar cost burdens. Mercer (2006) has pointed out that firms with low profit margins are more apt to freeze their plans. Often, management elects to reduce benefits, as opposed to cutting employees' take home pay. A DB pension freeze can enhance the plan sponsor's financial position substantially, inasmuch as the average funding requirement for DB plans is 8% of payroll while the standard matching rate for 401(k) plans is only 3% (Munnell et al. 2006). This cost differential between DB and DC plans widens substantially for sponsors obliged to pay costly catch up contributions because of underfunding.

In practice, of course, converting from a DB to a DC plan will often involve some additional 401(k) contributions to indemnify the employees' freeze losses. Full indemnification estimates are sensitive to return assumptions, but this additional contribution has been estimated to range from <2% of pay for workers in their early 30s, to >18% for workers their early 60s.[8]

Prior studies have suggested that sponsors choosing to freeze their plan tend to be those which face the most burdensome pension obligations. Mercer (2006) found that a sample of 15 S&P 500 firms recently freezing their DB plans carried a greater contribution requirement as a percent of operating cash flow (2 to 3 times higher), than the median S&P 500 DB sponsor. The study conjectured that this was due to low historical returns on plan assets: their sample plans had a pre-freeze pension liability 118% larger than that of a typical

S&P 500 sponsor (as a percent of total liabilities). That research corroborates preliminary results from 2003 Form 5500 data which found that 48% of frozen plans had a funding ratio (Plan Assets/ABO) below 80%, compared to 35% for non-frozen plans (PBGC 2005). In other respects, these firms are healthy; Mercer (2006) found their median credit rating exceeded that of the median S&P 500 sponsor. This led VanDerhei (2006: 6) to observe that "some of the companies undertaking a pension freeze are doing so more out of a strategic corporate redesign than in response to immediate financial difficulties."

Besides cost pressure, another important freeze rationale is risk reduction. Harper et al. (2007) identify three sources of financial risk: that due to interest rate changes, investment changes, and demographic changes. Investors, not simply risk averse managers, should care about these risks because they all appear to be non-diversifiable or systematic. Interest rate fluctuations are clearly important in the context of pensions due to the long dated discounting of future cash flows: a 100bp decline in long-term interest rates increases plan liabilities by between 15% and 20% (Harper et al. 2007). Investment risk and the impact of fluctuating capital markets have been especially apparent in the past decade. With a large percentage of plan assets invested in equities, many plans in fact required no contributions in the late 1990s. But as stock prices and interest rates fell in 2001, plan liabilities rose just as asset values deteriorated. This resulted in a surge in contributions (see Figure 4) and brought to light the systematic risk DB plans create for their sponsors. GMC (2006:21) outlined in its 2006 10K the investment and interest rate risk it faces as one of the nation's largest plan sponsors:

> …[O]ur employee benefit plans hold a significant amount of equity securities. If the values of these securities decline, our pension and OPEB expenses would increase and, as a result, could materially adversely affect our business. Any decreases in interest rates, if and to the extent not offset by contributions and asset returns, could increase our obligation under such plans. We may be legally required to make contributions to the pension plans in the future, and those contributions could be material.

Figure 4 here

A freeze reduces investment and rate risk in several ways. First, a freeze shrinks the size of plan liabilities. The liability will now be the ABO instead of the larger PBO. In addition, liabilities will grow more slowly, as benefit accruals cease and interest costs decline. Second, with improved plan solvency, restructuring plan investments to asset/liability match is more likely (Harper et al. 2007). Asset/liability matching in this case means that the firm uses low volatility fixed-income investments to hedge rate risk and to lower investment risk (see Figure 5). Harper et al. (2007) argue that freezes make matching more likely because post-freeze plans are more solvent, reducing the need to take on high risk/high return investments. A fully funded plan benefits little from high risk/high return investments because overfunding is restricted to being applied to future obligations or will be subject to a 50% excise tax at termination. Finally, many plans freeze simply as a prelude to termination, the ultimate risk reduction, perhaps waiting for the investment cycle to turn.

Figure 5 here

Demographic risk is an additional problem for plan sponsors. This risk principally includes the accuracy of actuarial assumptions which Harper et al. (2007) place as well below that of interest rate and investment risk. On the other hand, Munnell et al. (2006) suggest that long-term actuarial assumptions may be less accurate with the risk to the downside (e.g. life span estimations could be too low). Even so, this problem will be slow to impact the pension system and is an unlikely motivation for today's managers. More relevant to current sponsors is the risk of changing pension legislation or accounting rules. Unfortunately for sponsors, the political pressure for these changes is often highest when DB plans are financially weak. The Pension Protection Act of 2006 and FASB No. 158 are recent examples of rule-making risk (Munnell et al. 2006). Firms most exposed to this problem are those with the least solvent plans, providing additional motivation for them to freeze in advance of any new regulation.

Mercer (2006) found that its sample of S&P 500 freeze firms stood to lose 7% of Shareholder's Equity under FASB No. 158 versus 2% for the median S&P 500 plan sponsor.

If, as argued above, a desire to reduce systematic risk and improve cost structure motivates pension freezes, then it is reasonable to believe that freezes might create value. Below, we test the hypothesis that healthy firms experience an increase in firm value as a result of freezing their DB pensions. We focus on healthy firms, since changes in their value will be concentrated in equity and because market model parameter estimates will be more accurate. We focus on all three of the freeze types defined above (hard, partial, and soft), including those plans closed to new employees. Many of the sample freezes incorporate the introduction of a revised retirement plan, typically a 401(k) plan with some indemnification properties (Munnell et al. 2006).

In what follows, when we use market values to see how pension freezes influence firm value, it is necessary to recognize that this raises questions of market efficiency. Ross et al. (2005) define a semi-strong efficient market as one where prices fully reflect all publicly-available information; in turn, this implies that prices adjust instantaneously to incorporate the release of new public information. On this view, investors would be expected to incorporate immediately and accurately the effect of DB plan freezes into the market value of the sponsoring firm. In such a case, one can interpret unexplained market value changes on the announcement date as "freeze-created" value. Yet, as we have seen, pensions are complex, so that investors might not accurately account for their impact on firm value. In the latter case, markets may be inefficient and it may take some time until a freeze creates value. In this case, investors would delay pricing freeze-generated value. In other words, it may be necessary to track a long period post-announcement to detect such value creation.

The literature is unsettled in assessing the market efficiency of pension valuation. Coronado and Sharpe (2003) come down on the side of inefficient pricing and conclude that

investors err in pension valuation by capitalizing plans' contribution to accounting earnings, as opposed to examining funded status. Those authors claim the effect resulted in investors overvaluing firms by as much as 5% after the technology bubble burst, when expense smoothing protected pension earnings from asset losses. Picconi (2006) also finds evidence of inefficiencies. He shows that investors fail to properly value both changes in plan assumptions, as well as the off balance sheet pension liability. On the other side of the debate, Brown (2004) argues that the market properly discounts firm value when managements make unrealistic pension assumptions; evidence from the 1980s also suggested that share prices did faithfully reflect unfunded pension liabilities (c.f. Bulow et al. 1985). Accordingly, the academic debate over efficient pricing broadens the interest of this study beyond testing for an increase in firm value, to observing how long it takes for the DB freeze to influence market valuation.

Methodology

To test the value-creation hypothesis, we employ an event study. We hypothesize that the abnormal return measured after the event date should equal the economic impact of the event, under the efficient market assumption. MacKinlay (1997) notes that event studies are often preferred to an examination of operational data that can take years to reflect any given corporate action. To perform the analysis, we used the Eventus software and the CRSP database, and evaluate how values respond over a long test interval. Gathering a list of DB pension freezes proved difficult, since freezes are too recent to be included in available DOL Form 5500 data, and announcement mechanisms vary by company. Most existing freeze studies have relied upon private consulting firm data (PBGC 2006). Fortunately, a database of healthy company freezes from aggregating publicly available information is available from CRR (2007); [9] that list of 20 or so freezes covers the period 2003-06.

We examine the freeze-generated value hypothesis over both long and short-term test intervals, due to uncertainty regarding market efficiency. Separate portfolios are generated for both the long and short-term analysis (see Table 1); we exclude from the sample foreign firms, private firms, and firms with a merger that occurred during the test or estimation interval.[10] In addition, the long-term portfolio excludes freezes occurring in late 2006, to ensure that each firm has at least 200 trading days of post-announcement returns. The short-term portfolio includes the late 2006 freezes but excludes freezes announced within one day of an earnings release date. We define the event date as the first trading day on or after the announcement date.[11]

Table 1 here

Calculating abnormal returns requires a return estimation model; and in this analysis, we rely upon the familiar single-factor market model:[12]

$$R_{jt} = \alpha_j + \beta_{mt} + \varepsilon_{jt} .$$

Here, R_{jt} is the return of the j[th] sample on day t and the error term is assumed to have expected value zero. Parameters are estimated using ordinary least squares regression. The event date is t=0, while the estimation interval, t = [-31, -286] is approximately one year and does not overlap the test interval. The market portfolio is defined as the CRSP Equal Weighted Index. In this framework, the daily abnormal returns or prediction error is A_{jt}:

$$A_{jt} = R_{jt} - (\alpha_j + \beta_j R_{mt}) .$$

Eventus reports two abnormal return statistics for the sample firms over the test interval $[T_1,T_2]$: Cumulative Abnormal Average Return (CAAR) and the Average Compound Abnormal Return (ACAR). The CAAR calculation begins with determining each sample's Average Abnormal Return (AAR) over N trading days:

$$AAR_{T_1,T_2} = \sum_{j=1}^{N} A_{jt} / N .$$

These AARs are then aggregated across all, N, samples to form the CAAR:

$$CAAR_{T_1,T_2} = (\sum_{j=1}^{N} \sum_{t=T_1}^{T_2} A_{jt}) / N .$$

To calculate the ACAR, we need to first determine the daily buy and hold abnormal return (BHAR) for each sample:

$$BHAR_{j,T_1,T_2} = [\prod_{t=T1}^{T2} (1+R_{jt}) - 1] - [(1+\alpha_j)^{(T_2-T_1+1)} - 1] - \beta_j [\prod_{t=T_1}^{T_2} (1+R_{jt}) - 1] .$$

These BHARs are then aggregated across all samples to form the CAAR:

$$ACAR_{T_1,T_2} = (\sum_{j=1}^{N} BHAR_{j,T_1,T_2}) / N .$$

CAAR is the most reasonable method for aggregating returns and calculating test statistics but Eventus reports the ACAR to simulate the return an investor would realize implementing this strategy. The test statistics calculated for the returns are a Patell *–Z* Test and a Generalized Sign Test.[13] The Patell *–Z* Test standardizes each security's standard error and assumes cross sectional independence among the samples. The null hypothesis for the Patell-*Z* Test is $CAAR_{T_1,T_2} = 0$, while the Generalized Sign Test compares the percent of samples with positive AAR in the estimation and test intervals. The expected abnormal return is positive; therefore, all *Z*-scores are converted to p-values on a one-tailed basis

Our analysis examines three sets of test intervals, or windows: Pre-Announcement, Event Straddle, and Post-Announcement. The Pre-Announcement window, t = [-30, -1], tests the state of the firm pre-announcement and for information leakage. The Event Straddle, t =

[-1, +1], tests for short term announcement reaction and controls for information leakage and announcement date uncertainty. The Post-Announcement intervals, t = [+1, +50], [+1, +150], [+1, +200] and [+1, +250], test for long-term announcement reaction and possible market inefficiency.

Empirical Findings

Table 2 summarizes results. What we see is that abnormal returns eventually move upward after the freeze, as anticipated, the reaction is both prolonged and delayed. Even if we control for announcement method (press release/news report or SEC filling) and include an announced projected financial improvement dummy variable, the short-term results are insignificant. Accordingly, using the short-term portfolio, we fail to disprove the null hypothesis.

Table 2 here

Interestingly, after flat performance 50 days post-freeze, the CAAR then jumps almost 10% over the next 50 days [+51, +100]; it then continues to rise at a decreasing rate over the next seven months (see Tables 3 and 4). Through day 250, the sample generates a CAAR that is significantly positive (25.60%, $p<.0001$). Not only is this return positive, but the results reflect wide breadth across the sample (12 of 14 are positive), indicating the analysis does not hinge on one particular case. In addition, the chronology of stock price reaction is fairly uniform across samples, demonstrated by the breadth of stability and strength in the [+1, +50] (50% positive) and [+51, +100] (79% positive) periods, respectively.

Tables 3 and 4 here

It is possible that the lagged price effect represents market inefficiency. That is, if the freeze effect is properly measured, the fact that the market delays in pricing the pension freeze supports prior research questioning investor ability to incorporate complex pension

data accurately. In the freeze case in particular, the lagged response may be a result of the accounting rules governing freeze gain and loss recognition. Under SFAS No. 88, curtailment gains are recognized as realized (freeze effective date), while losses are recognized at commitment date (announcement date). In our sample, the average difference between the effective and announcement dates is 152 calendar days. And taking into account the 10K/Q publication delay, the accounting rule results in a nearly 6-month lag in potential gain recognition. In addition, annual, not quarterly, disclosure of detailed pension data in the financial statement notes allows sponsors to delay publication of the freeze impact for a substantial period. Thus our findings are supportive of Picconi (2004), who finds that investors and analysts take time to incorporate new and complex pension information. His work specifically focuses on changes in pension plan rate assumptions, and he concludes that investors and analysts alike wait many months, until the change in assumptions impacts quarterly earnings, to modify financial expectations (Picconi 2004: 26):

> Rather than specifically gleaning the information by referring to the disclosed information, both investors and analysts seem to gradually incorporate this information by observing its effects on earnings. Since all this information is publicly available, information assimilation would appear to drive this inefficiency.

This explanation may be weaker with respect to freezes, which are widely covered in the financial press and analyst community, but the same mechanisms may be responsible for our results.

It is possible that the observed delayed response to the DB freeze enhances the possibility that some confounding variable could be at least partially responsible for the reaction. Undertaking a pension freeze could be a leading indicator for another, more causal variable, making the correlation discovered above spurious. For example, pension freezes could be positively correlated with the introduction of better management practices. For instance, in the case of Hewlett-Packard, CEO Mark Hurd froze the pension plan three months into the job, having come to HP after an acclaimed stint at another sample firm, NCR,

where he also froze the DB plan. Perhaps competent managers today must freeze their DB plans to create value, yet some of the observed value creation could be the result of their other actions. As an aside, the Mark Hurd example introduces another potential problem: HP's freeze was widely anticipated when Hurd was hired as CEO, given his history at NCR (CNN/Money.com 2005). Yet we there is no evidence that the market expected DB freezes in other sample firms; insignificant abnormal returns over the [-30, -1] window support this assumption.

Another potential explanation could be the influence of other restructuring activity. Almost all of the sample firms were in the midst of a broader restructuring and the pension freeze could have been just one component of a larger overhaul (see Table 5). In this case, a DB freeze could simply be coincidental, but might not itself create much value. For example, having a freeze might indicate that the firm has a weak or non-existent union, allowing for deeper and more significant cost-cutting measures. In fact, PBGC (2005) found that 7% of union plans reported a hard frozen status in 2003 compared to 10% for non-union plans. Alternatively, freezes could designate a willingness on management's behalf to take unpopular but necessary actions to cut costs. Eight of the 13 firms in our sample reporting a restructuring made a major restructuring announcement after or on the freeze date, creating considerable risk that restructuring announcements contaminated the test interval. And restructurings announced before the freeze event could also influence our results. Unfortunately, layoffs and plant closings are more uncertain than pension freezes and investors may wait for realization of firms' initial restructuring plans before capitalizing their projected effects.

Table 5 here

We have tested for evidence of these factors, on the grounds that if freezes are value-enhancing, results ought to be sensitive to variables that would influence the economic

impact of the freeze (e.g. type of freeze, funded status, size of plan). Unfortunately, including these factors offers no further insight on the long or short-term results. Of course the latter are very imperfect measures of a freeze's financial impact because they are subject to substantial accounting smoothing and may be unrealistic. We have also asked whether market model parameter values changed between the estimation and test periods. Practitioners sometimes use a rolling beta estimate to overcome this problem. Eventus offers a methodology entitled Event Parameter Approach to allow joint estimation of model parameters and abnormal returns; this test yields a $CAAR_{(0, +200)}$ of 22.98% (.009% p-value), implying the results of the original study are robust to joint estimation. Another statistical concern might be the assumption of independence of abnormal returns and the event date (Dwyer 2001). We find that abnormal returns several hundred days before the event date are not statistically significant in either direction, supporting the independence assumption. A last potential problem we note is the possibility that the sample CAARs may not have zero covariance. While the Patell-*Z* test makes the assumption that covariance among the samples CAARs is zero, several of the long term test intervals overlap. One solution would be to examine each of the sample CAARs independently, without aggregation (MacKinlay 1997), who also suggests categorizing the events by date to form non-overlapping portfolios. We leave this for future research.

In sum, some of the observed value creation may derive from activities separate from the pension freeze, but we conclude that DB freezes were both value-enhancing and unexpected. The fact that we find freeze value creation and market inefficiency is also supportive of prior findings.

Discussion and Conclusion

We have detected a powerful lagged relationship between excess positive returns and DB freezes by plan sponsors. Our results confirm expectations and existing literature, leading to the observation that the relationship is causal. The fact that the impact takes a long time to be seen may disappoint executives hoping a DB freeze will result in a clear and immediate boost in market value. In any case, we show that the market eventually shows a benefit from switching from a DB to DC regime through the freeze mechanism. Investors' verdict on this issue will only hasten the decline of DB plans.

Replication of this work in a few years may give some indication of whether modifications to accounting standards have the effect of correcting pension related market distortions. Future research could also delve further into whether the freeze has an impact *per se,* or whether it proxies for good management and restructuring. Management's non-freeze activity might be studied by observing changes in operating margins (ex. pension expense) relative to peers. Or one could estimate the present value of the freeze directly, instead of inferring it from market data. The estimation could be carried out using firms' financial projections often released with a freeze announcement. Expanding the sample size would increase power and possibly allow for separate, non-over lapping portfolios to address clustering.

It is worth noting that, irrespective of the precise causal relationship, the substantial and consistent delayed price reaction presents an investment opportunity. This inefficiency may not persist in the future, however, in view of recent regulatory changes aimed at improving pension transparency and financial statement recognition.

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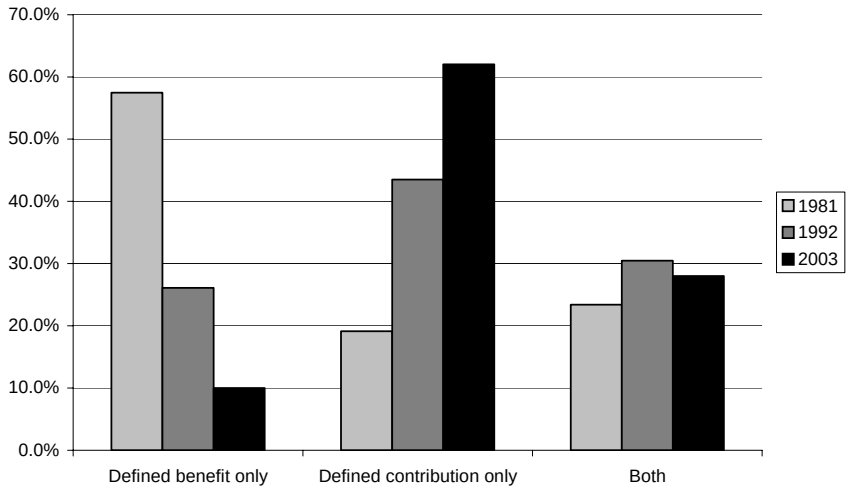
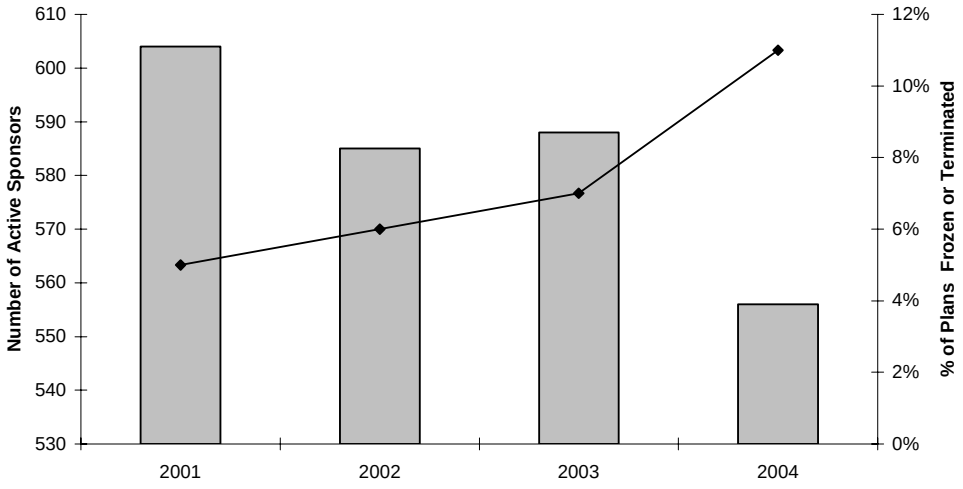
Figure 1. Percentage of Wage and Salary Workers with Pension Coverage by Type of Plan*



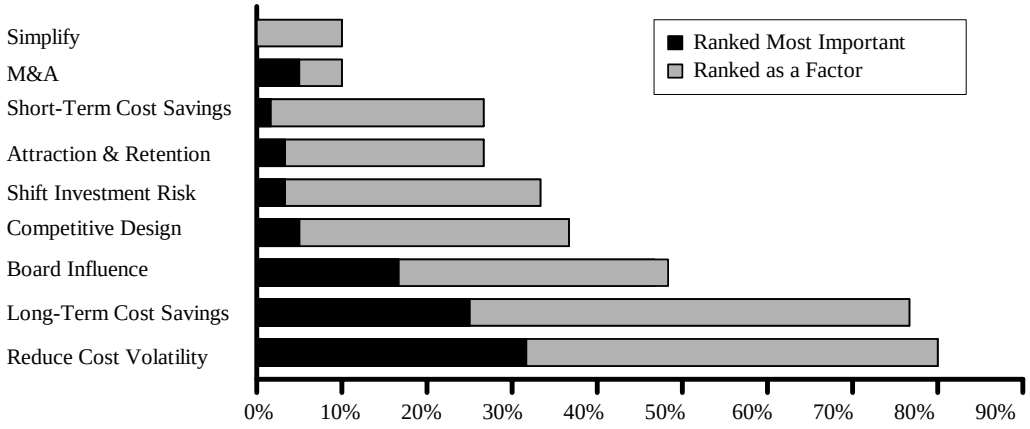
*Note: Includes plans with 100 or more participants
Source: Graphic recreated from Buessing and Soto. (2006). 3.
Data: 1981 and 1992 from Department of Labor tabulations, 2003 from CRR calculations

Figure 2. The Accelerating Decline of DB plans among the Fortune 1000



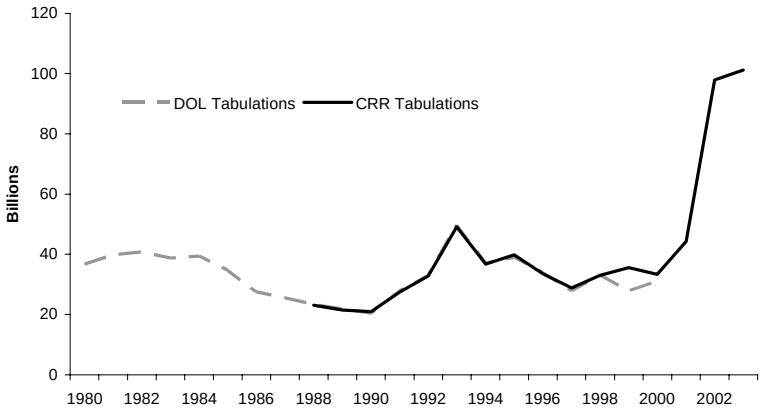
Source: Data from Watson and Wyatt. (2005).

Figure 3. Management's Most Important Factors for Plan Design Change



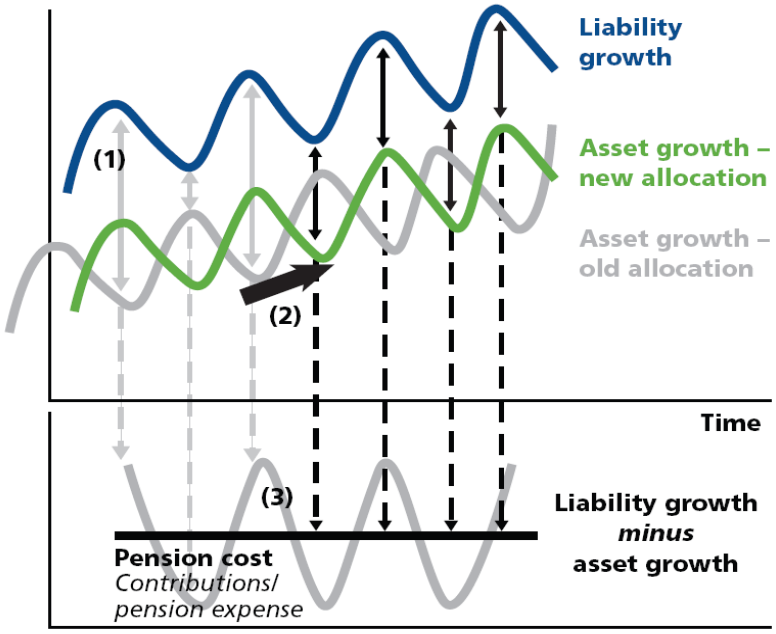
Source: Graphic recreated from Mercer (2006)

Figure 4. Pension Plan Contributions to Defined Benefit Plans*



*Note: Plans with 100 or more participants.
Source: Graphic recreated from Buessing and Soto. (2006). 2.
(Identical graphic cited in Munnell et al.)

Figure 5. Asset/Liability Matching Illustration



(1) Pension cost is the net of liability growth and asset growth. The difference in the growth rates is represented by the solid gray vertical arrows, which vary in length due to poor correlation between assets and liabilities. The result is pension cost volatility (gray pension cost curve at bottom).

(2) Change in portfolio mix improves correlation of liability growth and asset growth.

(3) Improved correlation results in pension cost stability. Net of liability and asset growth is shown by the solid black vertical arrows, which are of equal length due to change in portfolio mix.

Source: Graphic taken from Harper et al. (2007). 4.

Figure 6. Comparison of the CAAR across the Test Periods – Long Term Portfolio

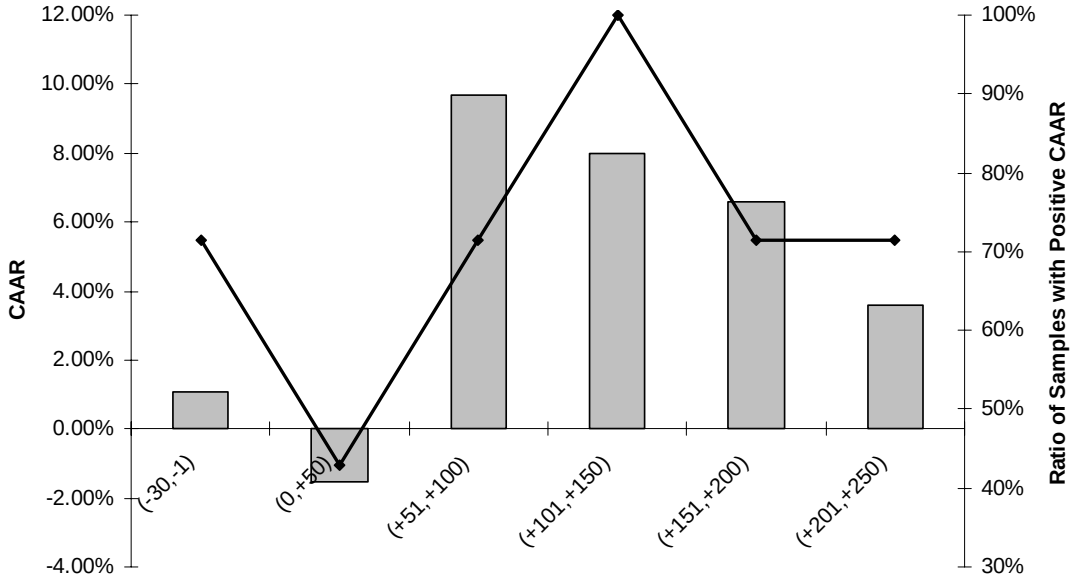


Figure 7. Growth of the CAAR over the Test Period – Long Term Portfolio

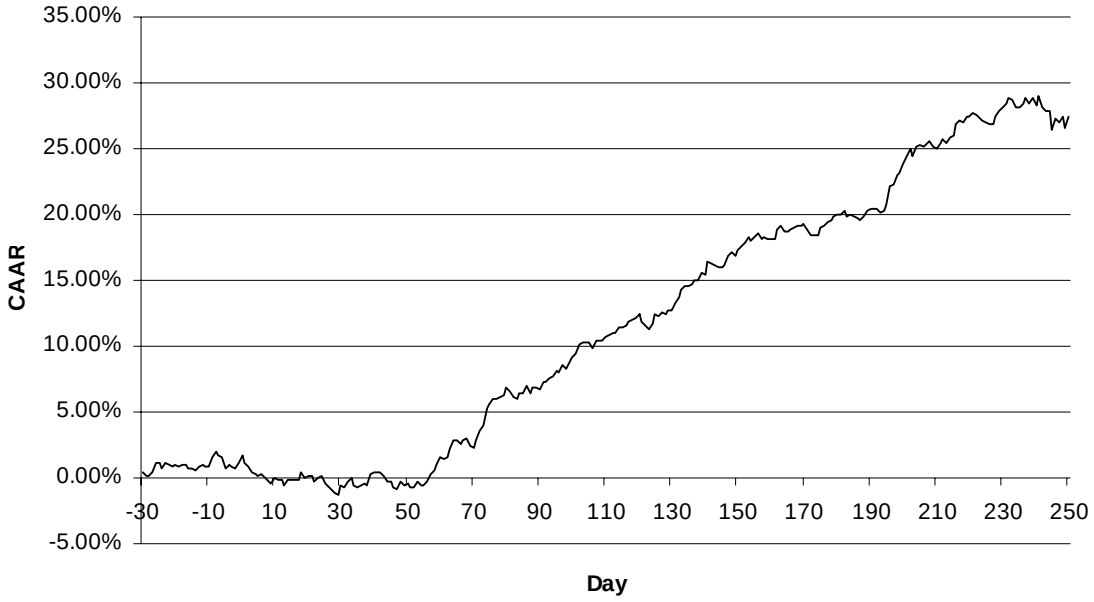


Table 1. DB Pension Freezes Considered for Inclusion in Event Study

Included Events

Firm	Freeze Date	Effective Date	Freeze Type	LT Port.	ST Port.
Aon	10/28/2003	1/1/2004	New Empl.	Yes	Yes
Sears Roebuck	1/28/2004	1/1/2005	Partial	Yes	No (Earnings)
NCR	5/26/2004	9/1/2004	Partial	Yes	Yes
Circuit City Stores	10/29/2004	2/28/2005	Total	Yes	Yes
IBM	12/9/2004	1/1/2005	Partial	Yes	Yes
Motorola	12/17/2004	1/1/2005	New Empl.	Yes	Yes
Hewlett-Packard	7/19/2005	1/1/2006	Partial	Yes	Yes
Lockheed Martin	10/6/2005	1/1/2006	New Empl.	Yes	Yes
Verizon	12/6/2005	6/30/2006	Partial	Yes	Yes
IBM	1/6/2006	1/1/2008	Total	Yes	Yes
ALCOA	1/17/2006	3/1/2006	New Empl.	Yes	Yes
Lexmark International	1/24/2006	4/2/2006	Total	Yes	No (Earnings)
Ferro	2/16/2006	4/1/2006	Total	Yes	Yes
Coca-cola Bottling	2/27/2006	6/30/2006	Total	Yes	Yes
DuPont	8/28/2006	1/1/2007	Partial	No (Date)	Yes
Hershey	10/10/2006	1/1/2007	Partial	No (Date)	Yes
Citigroup	11/3/2006	1/1/2008	Partial	No (Date)	Yes

LT Port. = Portfolio used to test long term reaction; ST Port. = Portfolio used to test short term reaction

Excluded Events

Firm	Freeze Date	Reason for Exclusion
Sprint Nextel	Nov. 2005	Estimation period is pre Nextel purchase (12/15/2005, announced 8/15/2005)
Hospira	Q2 2004	Freeze was in association with spin-off from Abbott
Sears Holdings	5/9/2005	Estimation security is K-mart, which was emerging from Ch.11 at the time

Sources: Center for Retirement Research (2007), news articles, SEC filings, and press releases.

Table 2. Short Term Portfolio Results

Windows	Events	ACAR	CAAR	Patell Z-Score	p-value	CAAR Pos:Neg	Sign Z-Score	p-value
(-30,-1)	15	1.68%	1.82%	0.757	0.2244	9:06	0.928	0.1767
(-1,+1)	15	-0.06%	-0.05%	-0.107	0.4575	9:06	0.928	0.1767
(+1,+50)	15	-0.65%	-0.33%	0.818	0.2068	8:07	0.411	0.3404

Table 3. Long Term Portfolio Results

Windows	Events	ACAR	CAAR	Patell Z-Score	p-value	CAAR Pos:Neg	Sign Z-Score	p-value
(-30,-1)	14	0.82%	1.07%	0.671	0.2511	9:05	1.183	0.1185
(-1,+1)	14	0.40%	0.43%	0.284	0.3883	8:06	0.648	0.2585
(+1,+50)	14	-2.68%	-2.22%	-0.011	0.4957	6:08	-0.422	0.3367
(+1,+150)	14	14.38%	15.44%	3.104	0.001	11:03	2.252	0.0122
(+1,+200)	14	20.04%	22.03%	3.986	<.0001	12:02	2.787	0.0027
(+1,+250)	14	21.90%	25.60%	4.423	<.0001	12:02	2.787	0.0027

Windows	Events	ACAR	CAAR	Patell Z-Score	p-value	CAAR Pos:Neg	Sign Z-Score	p-value
(-30,-1)	14	0.82%	1.07%	0.671	0.2511	9:05	1.183	0.1185
(0,+50)	14	-2.11%	-1.54%	0.21	0.4167	7:07	0.113	0.4549
(+51,+100)	14	9.70%	9.66%	2.655	0.004	10:04	1.718	0.0429
(+101,+150)	14	7.90%	8.00%	2.733	0.0031	14:00	3.857	<.0001
(+151,+200)	14	6.20%	6.58%	2.596	0.0047	10:04	1.718	0.0429
(+201,+250)	14	2.90%	3.57%	1.923	0.0272	10:04	1.718	0.0429

=Significant at 5%

Table 4. Sample Level CAAR - Long Term Portfolio

	Window							
Event	(+0,+250)	(0,+50)	(+51,+100)	(+101,+150)	(+151,+200)	(+201,+250)	(-30,-1)	Trading Days
Lexmark International	94.05%	8.23%	33.38%	16.18%	19.29%	16.96%	-0.96%	236
Coca-cola Bottling	56.94%	3.24%	28.67%	15.01%	4.76%	5.26%	7.12%	213
Verizon	43.18%	12.78%	-1.18%	11.14%	20.47%	-0.03%	7.64%	250
Aon	39.50%	2.27%	23.00%	18.05%	9.31%	-13.13%	0.45%	250
Lockheed Martin	29.82%	4.04%	8.50%	0.09%	8.74%	8.44%	-4.82%	250
ALCOA	22.52%	5.51%	11.84%	2.95%	-1.85%	4.08%	2.15%	241
NCR	21.28%	-3.69%	10.66%	1.68%	12.24%	0.39%	9.21%	250
IBM (2006)	21.22%	-0.20%	-0.53%	2.13%	14.95%	4.87%	-7.00%	247
Hewlett-Packard	20.35%	12.82%	0.61%	5.07%	-3.13%	4.98%	4.50%	250
Motorola	18.76%	-11.79%	17.65%	5.71%	7.49%	-0.30%	-1.81%	250
Sears Roebuck	17.26%	-9.94%	3.87%	8.21%	9.30%	5.82%	-14.79%	250
Ferro	9.13%	-8.87%	-2.15%	17.29%	5.59%	-2.73%	0.63%	219
IBM (2004)	-4.59%	-4.12%	-12.60%	2.96%	-5.48%	14.65%	3.63%	250
Circuit City Stores	-21.59%	-31.90%	13.51%	5.59%	-9.50%	0.71%	9.11%	250
CAAR	**26.27%**	**-1.54%**	**9.66%**	**8.00%**	**6.58%**	**3.57%**	**1.08%**	

Table 5. Non-Freeze Restructuring Activity Summary – Long Term Portfolio

	Announcement Dates		
Firm	Freeze	Restructuring	Restructuing Summary
ALCOA	1/17/2006	Jan-05	Layoff 8100 workers by mid 2006
Aon	10/28/2003	Feb-04	Cut Overhead: 600 IT jobs outsourced, reduce regional offices
Circuit City Stores	10/29/2004	Feb-05	Close 19 stores and 1 distribution center
Coca-cola Bottling	2/27/2006	NA	NA
Ferro	2/16/2006	Jul-06	Reduce costs $40-$60 million per year by 2009, asset write-offs, layoffs
Hewlett-Packard	7/19/2005	Jul-05	14,500 employees laidoff, considered "expected"
IBM	1/6/2006	May-05	Layoff 10,000-13,000 workers (4% of labor force), reorganize european ops.
IBM	12/9/2004	May-05	Layoff 10,000-13,000 workers, reorganize European management
Lockheed Martin	10/6/2005	Apr-04	Layoff 800 to 1,000 workers
Motorola	12/17/2004	Oct-05	Layoff 1,900 workers, improve material procurement
NCR	5/26/2004	Nov-02	Layoff 1,500 workers (5% of labor force), reduce expenses by $100 million
Verizon	12/6/2005	Feb-05	Layoff 7,000 workers post MCI Inc. acquisition
Sears Roebuck	1/28/2004	Jul-04	Layoff 3,300 workers (2% of labor force), cut 64,000 jobs since 2000
Lexmark International	1/24/2006	Jan-06	Layoff 275 workers

Restructuring information was gathered from press releases, SEC filings, and news articles.

[1] Deloitte (2006) provides a comprehensive overview of the PPA of 2006 and a review of existing funding and valuation requirements.
[2] Munnell et al. (2006) identify these as the four key risks firms face as DB sponsors.
[3] OPEB includes post retirement health care and life insurance benefits.
[4] Kieso et al. (2005) offer a summary of basic pension accounting, and we rely on this text for our income statement and balance sheet discussion.
[5] Deloitte (2006) explains that firms may choose between a segmented or blended rate.
[6] VanDerhei (2006) and PBGC (2005) offer summaries and analysis of many freeze and termination studies including Aon (2003), Mercer (2006), Towers Perrin HR Services (2004), Watson Wyatt (2005) and the 2006 version of Hewitt Associates LLC (2007).
[7] Latter (2006) offers an illustration of the freeze gain/loss calculation.
[8] VanDerhei (2006) calculates these contributions based upon an 8% asset return assumption and a Final Average annuity formula.
[9] Center for Retirement Research (CRR 2007) maintains an on going database of major healthy company freezes including fact sheets on each freeze with basic information such as plan type, number of participants affected, description of freeze, plan solvency, financial implications, dates (announced and effective) and background.
[10] One exception on the M&A criterion was Sears which announced a merger with K-Mart late in the test interval (Nov. 2004).
[11] We determine the event date by analyzing the CRR pension fact sheets, company press releases, and filings, as well as media reports.
[12] Cowan (2005) is our source for market model and Eventus return formulas.
[13] See Cowan (2005) for details on test statistic calculations.