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The Impact of Pension Fund Freezes on Firms' Systematic and Specific Risk

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This paper studies the impact of pension plan freeze announcements on firm beta and specific risk using an event study methodology based on the conditional approach. Results for a sample of 96 U.S. firms with an announcement date between 2003 and 2009 show that freezes decrease specific risk for a significant number of firms, indicating that the market views them as part of a solution to financial problems. Freeze announcements have no significant effect on firm beta once the economic context is controlled for.

JEL Codes: G14, G23

1. Introduction

Pension funds are a major part of the financial sector in most developed countries and, along with social security and personal savings, typically represent one of the pillars of retirement income for the population. However, in the private sector, where the company decides to initiate and sponsor such a fund, firms appear to shirk from the commitment. Specifically, in recent years, defined benefit (DB) plans, which are associated with the most financial commitment and risk for the employer, are either cancelled or frozen by corporations which feel they are too expensive and too risky to maintain (Butrica et al., 2009). McFarland and Kummernuss (2010) show that between 2004 and 2009, the percentage of pension fund freezes in the largest American companies has increased from 7% to 31%.

However troubling, this trend is not surprising. The market risks of DB plans are borne by the company and, with the increasing market volatility and very low interest rates, the risks and costs associated with pension plans have increased. If companies can reduce or completely eliminate these risks through the cancellation, freezing or replacement of their DB plan without consequences, the decision may seem obvious. By doing so, they are effectively transferring the risks to the beneficiaries (their employees). Further, the longer term impact of ending a DB plan may not only be positive for the firm if recruiting or retaining (best) employees is affected. In the end, the net impact for the firm is not clear.

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Although the effect of pension plan freezes on firm value has been studied recently with mixed results, the effect on risk is still largely unknown. One exception is Jin et al. (2006) who study the link between a company's beta and its pension fund's risk, observing a strong positive relationship between the two. However, they do not study the change in the company's risk following a change in the plan's conditions. Further, they focus solely on the firm's systematic risk.

To fill this gap in the literature, this paper studies the impact of a pension plan freeze on the risk of the firm, both systematic and specific. To this end, a novel and sophisticated event study methodology based on the conditional approach proposed by Ferson and Schadt (1996) is used, which allows for the conditioning of risk parameters on macro-economic information available at the time of the announcement. Although conditional methods are fairly standard in many strands of the financial literature, notably when evaluating portfolio performance, most financial management event studies were and are still conducted with unconditional methods. Even if results from these traditional methods are statistically valid and robust, their interpretation may be misleading as they do not take into account the macro-economic or financial context surrounding the event. These conditions are not only important control variables but may also be related to the event itself, as firms typically time important financial management decisions.

Our contribution to the literature is twofold. Firstly, we focus on the impact of pension fund freezes on the firm risk, both specific and systematic, which has not yet been studied. We provide evidence that the company's conditional residual risk decreases for a significant number of firms following a freeze announcement, implying that investors view the freeze as a way to reduce specific firm risk, a part of a solution to the firm's financial problems. Firm beta also slightly varies around the announcement date, more specifically when its unconditional form is estimated. When beta is conditioned on macro-economic variables, the variability is negligible. The second contribution of the paper is to verify if results and their interpretations vary when more sophisticated valuation methods are used. We find that the effect of pension fund freezes on beta can mostly be attributable to the timing of the freeze, which coincides with difficult market conditions. In other words, it appears the fact that plan freezes typically occur in periods of market turmoil or economic downturns is perhaps responsible for the change in company's risk and not the announcement of the pension plan freeze itself.

The remainder of the paper is divided as follows. Section two reviews the literature on the determinants of pension plan freezes and their impact on firm value and risk. Section three describes the conditional methodology and the sample that is used. Section four analyses the results and section five concludes the paper.

2. Literature Review

2.1 Determinants of Freezes

Pension fund freezes are generally caused by either supply-side (firm) or demand-side (employee) factors. On the supply side, Gustman and Steinmeier (1992) mention that regulation reforms have both increased management costs of DB plans and reduce their

benefits in favour of defined contribution (DC) plans. Munnell and Soto (2007) explain freezes by the rise of demographic risk, as well as the development of new plans like the 401(k) in the U.S., or hybrid plans. Further, the authors also report that rising health care costs may encourage employers to reduce pension costs as an offset. Coronado and Hewitz (2005) highlight the financial markets, specifically lower yields and the 2000 technological bubble, as the main explanation for the reduced supply of DB plans.

For the demand side, the structural change from a manufacturing-dominant economy to a service economy has played an important role (Wiatrowski, 2004; Munnell and Soto, 2007; Coronado and Hewitz, 2005). The presence of a union or employee mobility can also play an important role in the company's decision to freeze its pension fund (Gustman and Steinmeier, 1992). Finally, as stated by Munnell and Soto (2007), employees want to become more involved in managing their assets, which can only be obtained with a DC plan.

2.2 Impact of a Pension Freeze

The empirical literature shows that the management of pension funds affects both the performance and the risk of companies. Bulow et al. (1987) are among the first to notice that the firm's market value reflects the status of its pension fund. Rubin (2007), using a sample of 14 companies, studies the impact of pension contribution breaks on corporate value and notes that firm value increases by almost 10%, 50 days following the freeze announcement. Milevsky and Song (2010), using a larger sample of 80 firms, observe an insignificant increase of 3.8% in the corporate value. On the other hand, McFarland et al. (2009) find that the 82 firms in their sample that froze their pension fund have a lower financial performance, which can be explained by a lower productivity from affected employees. Indeed, the authors show that the efficiency of companies that have frozen their DB plans is lower. Jin et al. (2006) go further by showing that the risk of the pension fund is included in the company's systematic risk. Specifically, as mentioned above, they show that the beta of the firm is a positive linear function of the fund beta.

Changes in pension plans also directly affect employees. When their DB plan is frozen, employees are not only left with new risk exposures but they can also lose their motivation and quit their job in order to get more attractive work conditions (Boivie and Almeida, 2008). In addition, the authors find that frozen-plan firms become less attractive relative to their competitors. The consequences of pension plan changes can also vary according to the employee's situation. Vanderhei (2006) shows that younger workers are relatively indifferent to freezes while employees closer to retirement are more affected. Butrica et al. (2009), on the other hand, find evidence that mid-career employees are more exposed.

Overall, it is not clear a priori what the impact of a pension plan freeze will have on the risk of a corporation. On the one hand, if investors anticipate the negative consequences of freezing a pension plan on employee's morale and recruitment, an increase in risk can be expected. Further, if the freeze announcement serves as a signal that the firm is in financial trouble and cannot afford its DB plan any longer, risk can also be expected to increase. On the other hand, if investors evaluate the benefits to the firm (e.g., lower financial risks) to be greater than the costs and risks for the employees, then firm risk is

expected to decrease. Finally, even if freezes can be a bad sign, the market can still consider them as a viable solution to the firm's financial troubles or a way to reduce risk.

3. Methodology

To test simultaneously the impact of the company's decision to freeze its DB plan on its beta and residual risk, we use a new event-study methodology based on the conditional approach proposed by Ferson and Schadt (1996). This allows us to condition the impact on return and risk on the macro-economic and financial context. In the same vein, a GARCH model is used to define the error terms' conditional variance, as suggested by Engle (1982) and Bollerslev (1986).

The return diffusion process for firm *j* is defined as follows:

$$r_{j,t} = \alpha_{j,t}\,(Z_{t-1}) + \beta_{j,t}\,(Z_{t-1}) r_{m,t} + \beta_{2,j} SMB_t + \beta_{3,j} HML_t + \beta_{4,j} Jan_t + \beta_{5,j}\, Mon_t + \varepsilon_{j,t} \qquad (1)$$

The variable $r_{j,t}$ is the excess return for firm *j* at time *t* and $r_{m,t}$ is the excess market index return, or market risk premium, at time *t*. Following Fama and French's (1993) three-factor model, we include a book-to-market or value premium measured by HML_t, and a size premium measured by SMB_t. To control for the January and the Monday effects, two binary variables are added. Z_{t-1} is a vector of *N* macroeconomic variables that can influence returns through the conditional alpha, $\alpha_{j,t}(Z_{t-1})$, and beta, $\beta_{j,t}\,(Z_{t-1})$. Finally, $\varepsilon_{j,t}$ is an error term that follows a normal distribution, $\varepsilon_{j,t} \sim N(0, \sigma^2_{j,t})$, where $\sigma^2_{j,t}$ is the conditional residual risk defined by a GARCH model.

In equation (1), the conditional alpha is defined as follows:

$$\alpha_{j,t}(Z_{t-1}) = a_{o,j} + a_{E,j} \times P_{E,t} + \sum_{n=1}^{N} a_{n,j} \times Z_{n,t-1} \qquad (2)$$

To isolate the freeze announcement period, $P_{E,t}$ is a binary variable that is equal to 1 in the event window studied and 0 otherwise. Since all $Z_{n,t-1}$ are demeaned variables, $a_{o,j}$ measures the average conditional alpha for the entire period, $a_{E,j}$ is the average daily abnormal return attributable to the pension plan freeze announcement, and $a_{n,j}$ measures the sensibility of the conditional alpha to the n^{th} conditioning variable ($Z_{n,t-1}$). Information variables that are commonly identified in the literature are used: the 1-month T-bill yield, the slope of the yield curve as measured by the difference between 10-year and 3-month government bond yields, and the credit spread measured by the difference between BAA- and AAA-rated corporate bond yields. These conditioning variables are taken with a one-period lag and centered at zero.

Similarly, we can define the conditional beta and residual variance from equation (1), respectively, as follows:

$$\beta_{j,t}(Z_{t-1}) = b_{o,j} + b_{E,j} \times P_{E,t} + \sum_{n=1}^{N} b_{n,j} \times Z_{n,t-1} \quad (3)$$

$$\sigma^2{}_{j,t} = \omega_{o,j} + \omega_{1,j} \times P_{E,t} + \omega_{2,j} \times \varepsilon^2{}_{j,t-1} + \omega_{3,j} \times \sigma^2{}_{j,t-1} \quad (4)$$

As above, $b_{o,j}$ and $\omega_{o,j}$ are related respectively to conditional averages of beta and residual risk measures over the entire sample, $b_{E,j}$ and $\omega_{1,j}$ represent the variation of beta and residual risk, respectively, associated with the freeze announcement, and the terms $\sum_{n=1}^{N} b_{n,j} \times Z_{n,t-1}$ measure the part of beta that varies conditional on the information variables Z_{t-1}. In equation (4), $\omega_{2,j} \times \varepsilon^2{}_{j,t-1}$ is related to the ARCH effect, where $\omega_{2,j}$ is associated with the previous period's error term, and $\omega_{3,j} \times \sigma^2{}_{j,t-1}$ is related to the GARCH effect, where $\omega_{3,j}$ is associated with the previous period's variance.

A sample of 96 U.S. firms that announced a pension plan freeze between January 2003 and December 2009 is identified. Although the sample size is relatively small due to the unavailability of firm data, it is greater than the ones used in previous studies. Announcement dates are collected from financial newspapers, such as the *Wall Street Journal*, or directly from the companies' financial statements. *Bloomberg* is used to collect stock returns and macro-economic variables. Market, HML and SMB premiums are taken from Kenneth French's website, where their definition can be found.

Table 1 provides some descriptive statistics regarding the firms in our sample. Daily company returns in the year prior to the freeze announcement range from -15.23% to 18.74% with a volatility of 2.74%, a much larger range and volatility than for the market returns.[1] For the information variables, low 1-month yields and yield curve slopes, or high credit spreads, are generally signs of market turmoil or economic downturns, which again motivates their use to control the impact of pension freeze on risk for macro-economic conditions.

Table 1: Descriptive statistics

Variables	Minimum	Average	Maximum	Std. Dev.
Market capitalisation ($ millions)	1.08	17,782.39	273,598.07	40,510.16
Number of employees	101	46,200	337,000	73,432
Pension fund assets ($ millions)	5.036	5,464.55	90,545.00	13,506.04
R_j	-0.1523	-0.0001	0.1874	0.0274
R_m	-0.0426	-0.0002	0.0430	0.0105
SMB	-0.0214	0.0001	0.0212	0.0053
HML	-0.0182	0.0002	0.0188	0.0045
Information variables Z_{t-1}*:*				
1-month yield	0.0085	0.0294	0.0487	0.0121
Yield curve slope	0.0066	0.0105	0.0171	0.0028
Credit spread	-0.0025	0.0123	0.0318	0.0092

4. Analysis of Results

Results for the estimation of equation (1) are available in Table 2, where only the results pertaining to the two risk parameters are shown. (All results are available upon request.) The Table first shows the average across firms, denoted average sensitivity, of the coefficients associated with the freeze announcement period variable $P_{E,t}$ in equations (3) and (4), along with its standard deviation and *t*-statistic. However, because pension freezes can occur for a variety of reasons, as discussed above, which can lead to different effects and a potentially asymmetrical distribution of coefficients across firms, the sample average can be misleading or, worse, cancel out the effects. To avoid this problem, we also report in Table 2 the results of a binomial test on the observed proportions of significantly positive or negative coefficients.

Specifically, the probability of observing *k* significant coefficients in a sample size of *J* firms is:

$$Prob(k; a, J) = \binom{k}{J} a^k (1-a)^{J-k} \quad (5)$$

With a 95% confidence level for an individual two-tail test, the theoretical probability of randomly obtaining a significantly negative (or positive) coefficient is a =2.5%. The binomial test consists of formally comparing this probability with the observed in-sample proportion ($\hat{a} = k/J$) of significantly negative (or positive) coefficients by forming the following likelihood ratio statistic:

$$LR = 2\log[\hat{a}^k(1-\hat{a})^{J-k}/a^k(1-a)^{J-k}] \sim \chi^2(1) \quad (6)$$

Such binomial test (Kupiec, 1995; Christoffersen, 1998) can thus assess if the observed proportions are significantly greater than what is expected under random circumstances.

The results in Table 2 show that, on average, the firm beta increases slightly around the freeze announcement for the [-1; +1] and [0; +1] event windows, with average sensitivities of 0.706 and 0.359, respectively. The average impact is only significant for one of the three event windows, [-1; +1]. However, the last 2 columns of Table 2 show no abnormal number of firms experiencing a significant change in beta due to the announcement. This mixed result is consistent with the fact that firm beta is related to undiversifiable risk and should not be affected by company-specific pension fund freezes.

In terms of residual risk, the average sensitivity to freeze announcements is also close to zero, with a negatively significant average impact for one of the three event windows, [-1; +1]. However, looking at the distribution of the coefficients, between 15.63% and 29.17% of the firms, depending on the event window, experience a significant decrease in specific risk. The binomial test of proportions confirms that these percentages are significantly greater than what is normally and randomly expected. For these firms, results are consistent with investors viewing a pension plan freeze as a way to decrease the firms' risk or as part of a solution to their specific financial problems.

Table 2: Impact of freeze announcement on firm beta and residual risk

Type of announcement impact	Event window	Average sensitivity	Std. dev.	t-stat	% of firms with significant and negative coefficient[1]	% of firms with significant and positive coefficient[1]	Binomial test statistic (sign. and neg. cases)	Binomial test statistic (sign. and pos. cases)
Systematic risk	[-5; +5]	-0.100	1.085	-0.899	2.08%	5.21%	0.072	2.213
	[-1; +1]	0.706	3.268	2.117**	2.08%	2.08%	0.072	0.072
	[0; +1]	0.359	9.191	0.383	0.00%	1.04%	0.000	1.070
Residual risk	[-5; +5]	0.000	0.001	-0.877	29.17%	2.08%	94.122***	0.072
	[-1; +1]	-0.001	0.003	-2.177**	21.88%	1.04%	57.868***	1.070
	[0; +1]	0.000	0.004	-1.116	15.63%	1.04%	31.555***	1.070

[1] Significant at the 95% level of confidence according to a Student test.
** and *** indicate significance at the 95 and 99% level of confidence, respectively.

The fact that pension plan freezes do not seem to have a clear impact on firm beta is not consistent with previous results in the literature (i.e., Jin et al., 2006). The explanation may lie in the use of conditional modelling to measure the announcement effect. If the pension freeze coincides with difficult economic or financial market conditions, which are directly related to the pension fund's financial risks, the change in beta following an announcement could be wrongly attributed to the event instead of the macro-economic context related to the information variables. A conditional model, such as the one used in this paper, would properly assign the marginal effect of a fund freeze.

Table 3 below shows some evidence that supports this case. Even if both conditional and unconditional event study frameworks show a significantly positive average impact for one of the three event windows, [-1; +1], the freeze announcement itself does not affect a significant number of firm betas with the conditional model. For example, for the [0; +1] event window, an unconditional beta model would lead to the conclusion that a significantly abnormal 7.29% of firms in the sample experience a significant increase in beta following a freeze announcement. However, using a conditional model, the effect on the beta seems to be captured by the information variables since only an insignificant 1.04% of firms see a significant increase in beta once the macro-economic controls are included. Further, the unconditional model shows a significantly abnormal proportion of beta changes in each event window. We observe a significant number of increases for the [-1; +1] and the [0; +1] event windows and a significant number of decreases for the [-5; +5] event window. These mixed results using the unconditional model are not observed with the conditional model. Specifically, for the conditional model, none of the proportions are significantly different from what is expected under an assumption of normal distribution for beta changes.

Moreover, the information variables do not seem to affect firm betas, on average, but they have a significant effect on individual betas for a large number of firms. The number of significant coefficients is higher than expected, under a normal distribution assumption, for all information variables and event windows. For instance, the proportions of (negatively or positively) significant coefficients are 24%, 18% and 26% for the 1-month interest rate, yield curve rate and credit spread, respectively. In many cases, the impact on the beta

should therefore be mostly attributable to the timing of the freeze, which coincides with specific market conditions.

In economic downturns with decreasing interest rates or flattening yield curves, which are particularly difficult to manage for pension funds, a significant number of firms may experience an increase in beta around their pension plan freeze announcement. In conclusion, pension fund freezes affect specific risk for a large number of firms but do not seem to impact their systematic risk, particularly when the economic context is controlled for.

Table 3: Change in firm beta around freeze announcement dates

Type of impact on systematic risk	Event window	Average sensitivity	Std. dev.	t-stat [1]	% of firms with significant negative impact[2]	% of firms with significant positive impact [2]	Binomial Test statistic (sign. and neg. cases)[3]	Binomial Test statistic (sign. and pos. cases)[3]
Announcement effect:								
On systematic risk (in unconditional model)		-0.060	1.006	-0.584	6,25%	4,17%	3.936**	0.914
On systematic risk (in conditional model)		-0.100	1.085	-0.903	2,08%	5,21%	0.072	2.213
Conditioning effects on systematic risk of information variables:	[-5;+5]							
1-month interest rate		0.012	0.969	0.121	13,54%	10,42%	23.975***	13.977***
Yield curve slope		0.075	1.631	0.451	12,50%	5,21%	20.447***	2.213
Credit spread		-0.250	2.895	-0.846	13,54%	13,54%	23.975***	23.975***
Announcement effect:								
On systematic risk (in unconditional model)		0.715	3.472	2.019**	4,17%	6,25%	0.914	3.936**
On systematic risk (in conditional model)		0.706	3.268	2.117**	2,08%	2,08%	0.072	0.072
Conditioning effects on systematic risk of information variables:	[-1; +1]							
1-month interest rate		-0.071	0.513	-1.353	11,46%	6,25%	17.109***	3.936**
Yield curve slope		-0.121	0.578	-2.049**	10,42%	1,04%	13.977***	1.070
Credit spread		-0.220	1.823	-1.184	8,33%	7,29%	8.405***	6.016***
Announcement effect:								
On systematic risk (in unconditional model)		0.202	9.695	0.204	5,21%	7,29%	2.213	6.016**
On systematic risk (in conditional model)		0.359	9.191	0.383	0,00%	1,04%	0,000	1.070
Conditioning effects on systematic risk of information variables:	[0; +1]							
1-month interest rate		-0.057	0.505	-1.106	9,38%	5,21%	11.068***	2.213
Yield curve slope		-0.121	0.607	-1.953*	8,33%	1,04%	8.405***	1.070
Credit spread		-0.194	1.888	-1.007	8,33%	8,33%	8.405***	8.405***

[1] *, ** and *** indicate significance at the 90%, 95% and 99% level of confidence according to t-stat test

[2] Significant at the 95% level of confidance according to the Student test

[3] *, ** and *** indicate significance at the 90%, 95% and 99% level of confidence according to Bernouilli proportions test

5. Conclusion

This paper studies the impact of pension plan freeze announcements on firm beta and specific risk. We find that pension plan freezes decrease specific firm risk for a significant proportion of the firms in the sample. Although the termination of a pension plan is not good news, it appears to be seen by investors as part of a solution to the firm's financial problems and a credible way to reduce firm specific risk. Also, the impact of a pension fund freeze is not unequivocally established as it is significant for only one event window.

Further, although our small sample size of 96 cases warrants caution in the interpretation of our results, it is still the largest sample used in the pension fund freeze announcement

literature. We believe that our results also provide an indication that standard (unconditional) event study methodology may, for certain firms, wrongly attribute beta (or return) variation to announcement effects. If the announcement coincides with a period of turmoil, such as is typically the case for pension plan freezes, effects could be erroneously attributed to the event. A similar warning applies for other corporate decisions that are influenced by market conditions, good or bad: dividend cuts, mergers and acquisitions, etc.

In light of these results, it would be interesting to study further cross-sectionally the firms in the sample in order to determine the common characteristics of those that are significantly affected by the announcement. We leave this issue for future research.

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Endnotes

[1] All the regressions and tests are also conducted on a sample of winsorized data (at the 1% and 5% levels) to ensure that outliers are not driving the results. Results are similar and are available upon request.

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