Les Cahiers de la Chaire / N°31

Familiarity Breeds Institutional Investment: Evidence from US Defined Benefit Pension Plans

Christina Atanasova & Gilles Chemla

CHAIRE

Finance & Développement Durable

Familiarity Breeds Institutional Investment:

Evidence from US Corporate Defined Benefit Pension Plans

by

Christina Atanasova

Faculty of Business Administration

Simon Fraser University

E-mail: cva3@sfu.ca

and

Gilles Chemla

Imperial College Business School, CNRS and CEPR

E-mail: g.chemla@imperial.ac.uk

Familiarity Breeds Institutional Investment:

Evidence from US Defined Benefit Pension Plans

Abstract

This paper provides new evidence that familiarity bias affects the portfolios of institutional investors. Using a sample of large US defined-benefit pension plans for the period 1992 to 2002, we show that the corporate focus of the sponsoring firm has an impact on the investment policy of the pension plan. Pension plans sponsored by firms with a high proportion of foreign sales are more likely to invest in international assets, plans sponsored by firms that are active in research and development are more likely to invest in private equity, and plans with sponsors that have more fixed assets are more likely to invest in real estate and mortgages. Comparing to existing explanations of why plans tilt their portfolios towards the sponsor's focus, familiarity bias is the most compelling one. The worse performance of pension plans with such portfolio allocation bias is consistent with pension managers being over-confident about familiar assets.

Key Words: Institutional investment, defined benefit pension plans, familiarity bias.

1. Introduction

Individual investors' preference for familiar assets has received a lot of attention recently. Empirical work by Grinblatt and Keloharju (2001), Huberman (2001), Massa and Simonov (2006) and Doskeland and Hvide, (2010) has shown that individuals appear to favor stocks of firms close to them geographically, culturally, and professionally. Studies by Coval and Moskowitz (1999) and Brown, Pollet and Weisbenner (2009) show that investment managers tend to invest more in stocks of firms whose headquarters are geographically close to them. Despite this little is known about the effect of familiarity bias on the portfolio choice of institutional investors. In this paper, we probe for familiarity bias in the investment decisions of large US corporate defined benefit (DB) pension plans. These institutional investors hold huge financial wealth[1] and if familiarity bias affects their investment decisions, then Merton (1987) has shown that it would have a substantial economic impact[2]. We find evidence that the sponsoring firms' corporate focus is an important determinant of the pension plan asset allocation. Firms with high international sales sponsor plans that are more likely to invest in international assets, firms with high R&D expenditures sponsor plans that are more likely to invest in private equity, and the pension plans sponsored by firms with large proportion of property, plant and equipment (PPE) are more likely to invest in real estate. We find that these effects are large and economically significant.

There may be several reasons for the link between the sponsoring firms' corporate focus and the pension plan asset allocation[3]. Funding shortfalls and asset liability mismatch, due in particular to increases in life expectancy and decreases in stock prices and interest rates, are important sources of risk for plan sponsors. Therefore, sponsoring firms may choose to

---

[1] According to the Investment Company Institute, in March 2007 the total amount of US retirement assets in private DB plans was 2.328 trillion.

[2] In Merton (1987) the key behavioural assumption is that an investor includes a security in his optimal portfolio only if he or she knows about it. The implication for equilibrium prices is that expected returns will tend to be lower on better-known firms with relatively larger investor bases.

[3] Since a DB pension fund is a separate legal entity, whether sponsor firms can influence plan trustees is an open question as trustees are required to act solely in the interests of plan beneficiaries. Previous studies, however, have documented evidence consistent with the ability of the sponsoring firm to influence the investment policy of the trustees. For example, Petersen (1996) shows that plan's risk taking increases when plans are better funded and when the sponsor firms' business risk is lower.

integrate pension liability risk into their overall corporate risk management policies[4]. Pension plan asset allocation may be used to hedge expected pension liability risks, e.g. an expected increase in labor cost. Alternatively, pension plan trustees may share the investment focus of the sponsoring firm or feel that they have value relevant information related to the core competencies of their sponsoring firms. Finally, they may be overconfident about investing in asset classes that they know well. This will generate a familiarity bias in the allocation of pension assets similar to the one observed for individual investors (Coval and Moskowitz, 1999, Huberman, 2001, Massa and Simonov, 2006).

We examine the possible motives for the observed corporate focus bias in pension plans' asset allocation. Our results show that the effect is not consistent with risk shifting. We find that plans reduce the weight of risky assets in their portfolios as the pension liability funded status deteriorates. Our results do not support theories based on hedging or diversification motives. Our finding that the share of active participants is not positively related to the investment in risky asset does not support the hypothesis that sponsors try to hedge wage growth risk. Similarly, measures of the volatility of the sponsoring firm cash flow do not have a significant effect on the proportion of risky assets which would be the case if firms were hedging business risk. Overall, our results suggest that familiarity bias is the most compelling explanation of why plans tilt their portfolios towards sponsors' corporate focus.

Next, we examine the effect of this familiarity bias on pension plan performance. We find that when we sort the pension plans investing in international equity, private equity and real estate by corporate focus, the plans with the strongest bias have the lowest abnormal returns and Sharpe ratios. The worse performance of these pension plans is consistent with pension managers being over-confident about familiar assets (Doskeland and Hvide, 2010) and thus taking excess risks for which they are not compensated.

The remainder of this paper is organized as follows. In the next section, we briefly review the related literature. Section 3 discusses the empirical specification. Section 4 presents

---

[4] If pension assets have low expected returns in periods of economic difficulty, the plan's solvency may require additional contributions to be made when the sponsoring firm's cash flows are already low. On risk management, see Black (1989) and Bodie (1991).

the data and provides some descriptive statistics. Section 5 contains the estimation results and robustness checks. The final section concludes.

2. Related Literature

2.1. Investment Policy of Corporate DB Pension Plans

Asset allocation in DB pension plans has received considerable attention in both the academic literature and industry practitioners' press due to the large economic impact these institutions have. While in an environment with frictionless capital markets, funding policy has no effect on the investment strategy of the pension plan (Sharpe, 1976), corporate taxes create an incentive for contributing as much to the pension plan as regulations allow and to invest the funds in fixed income securities entirely (Black, 1980, and Tepper, 1991). Since the contributions and returns of the pension plan assets are tax exempt, the company can generate interest tax shields, and hence value for shareholders, by placing fixed income assets in the pension plan and holding equity on the balance sheet.

These corporate tax-based predictions are at odds with the reality of investment and funding of corporate DB pension plans. Most plans are under-funded and have a significant proportion of their assets invested in equity. To reconcile theoretical predictions with the observed pension portfolios, a number of authors have appealed to different incentives to increase pension investment risk. First, risky assets may lower future contributions. The incentives for risk shifting are exacerbated when a government agency provides pension liability insurance in case of default[5]. In the US, for example, the Pension Benefit Guarantee Corporation (PBGC) provides sponsoring companies with a put option on their extremely under-funded pension obligation (Harrison and Sharpe, 1983). Together with the limited tax deductibility of over-funded plans this implies that the asset allocation and funding decisions are joint and extreme. Alternatively, equity investing may hedge against increases in real wages if future earnings growth and stock returns are positively correlated (Black, 1989, Lucas & Zeldes, 2006). In addition, DB plans tend to be large relative to almost any individual investor

---

[5] In practice, pension insurance premiums are the same for all corporations, regardless of their risk and are relatively lower than the fair economic value. See also Bader (1991).

and they have fairly predictable inflows and outflows. These characteristics make them well suited to hold asset classes where large investments are required and liquidity is limited (Campbell and Viceira, 2005).

The complexity of pension accounting and the reliance of pension expense calculations on an expected long term return of pension assets may also create opportunistic behaviour on the part of sponsoring firm's managers. First, managers tend to be more aggressive when changes to pension assumptions have a greater impact on reported earnings, when they exercise stock options, and before acquiring firms (Bergstresser, Desai, and Rauh, 2006). Second, pension plans of more indebted firms with a higher proportion of insider-trustees invest a higher proportion of the pension plan assets in risky equities (Coco and Volpin, 2007). This evidence suggests that such firms maximize the value of their put option and shift risk to the pension plan beneficiaries. In addition, the presence of insider-trustees allows sponsoring firms to make lower contributions to the pension plan.

On the other hand, prior research has tried to explain why plans seek to reduce their risk taking when the pension liability funded status deteriorates. Bader (1991) argues that firms attempt to minimize the volatility of their pension contributions. These contributions are often predictable for moderately underfunded or overfunded plans, but less predictable when funding levels become more extreme. Bader's argument suggests an inverted U-shape relationship between funding levels and equity investment where extremely over-funded and under-funded plans invest in fixed income securities and only moderately funded plans should increase their allocation to equity investment. Rauh (2009) documents that risk management incentives to avoid costly financial distress dominate risk shifting, whereby shareholders maximize the value of their put option. His empirical findings show that the better funded U.S. pension plans in his sample--which should have less incentives to engage in excessive risk-taking-- in fact invest more in risky equity.

Our findings contribute to the literature that examines the extent to which pension plans and their sponsoring firms are integrated. A number of studies have focused on the sponsor's choice of plan design and contribution policy (Petersen, 1994) and the effect of

pension funding on corporate investment policy (Rauh, 2006) or corporate capital structure (Shivdasani and Stefanesco, 2010). These studies show that firms incorporate the pension plan design and pension liability risk into their corporate policies.

2.2. Familiarity Bias

Previous research on familiarity bias has documented the tendency of many investors to tilt their portfolio holdings toward familiar investments. Further, studies have provided evidence that financial analysts and advisers make better stock picks or recommendations concerning firms that are either geographically, culturally or professionally close. In the US, Huberman (2001) shows that the shareholders of a Regional Bell Operating Company (RBOC) tend to live in the area which it serves, and an RBOC's customers tend to hold its shares rather than other RBOCs' equity. Investors' preference to invest in familiar stocks has been established in Norway (Døskeland and Hvide, 2010) and in Finland (Grinblatt and Keloharju, 2001). Individual investors also exhibit a strong familiarity bias both in their 401(k) pension plan through investments in employer stock (Benartzi, 2001) and through their direct stock holdings outside of their retirement plan (Ivkovich and Weisbenner, 2005). There is no evidence that such bias in portfolio holdings generate positive abnormal returns. Bernartzi's (2001) finds that companies with high ownership of employer stock in their 401(k) plan do not outperform companies with lower concentrations of ownership in employer stock and Døskeland and Hvide (2010) find that individuals who trade excessively in professionally close stocks generate negative abnormal returns.

Studies have also documented evidence that familiarity bias affect the holding of institutional investors. For example, the portfolios of U.S. mutual fund managers are characterized by a local bias (Coval and Moskowitz, 2001). There is evidence of a positive return to local information for institutional investors as they are able to generate excess returns on their local holdings. Equity analysts and corporate acquirers also seem to exploit a local informational advantage. For example, geographically-proximate analysts issue more accurate forecasts and update their forecasts more frequently (Malloy, 2005). Bae, Stulz, and Tan (2008) document local analysts' information advantage in a non-U.S. setting. Kang and Kim (2008) find

that local acquirers of a "block" of corporate shares engage in more monitoring than do more distant acquirers, with the more local target earning a higher return on the announcement of the acquisition and having better post-acquisition operating performance.

We contribute to this literature by providing new evidence of familiarity bias in institutional investment. We show that the asset allocation decisions made by the largest US corporate pension funds exhibit a familiarity bias related to the corporate focus of their sponsoring firm. We do not find evidence in support of risk shifting, hedging or diversification motives in the investment policy of the pension plans. Instead, our results are consistent with Cao et al (2009) and Boyle et al (2010) who model a familiarity bias through the avoidance of unfamiliar asset classes and with Barber and Odean (2001) who argue that overconfident investors overweight certain asset because they disagree with market valuation.

3. Empirical Specification

In our first set of results, we estimate the probability of investing in a given asset class conditional on the sponsoring firm corporate focus. When choosing an asset allocation, firms evaluate the benefits of investing in an asset class. The net benefit of is unobservable, but it can be approximated by a linear function of the plan's and sponsor's characteristics.

$$Net\ Benefit_{it} = \alpha_i + \beta_1 Focus_{i,t-1} + \beta_2 FundedStatus_{i,t-1} + \beta_3 ActiveParticipants_{i,t-1} + Controls + \varepsilon_{it} \quad (1)$$

Instead of observing the net benefit of investing in an asset class, we observe the firm's actual pension choice. The firm chooses to invest when its net benefit is positive and chooses not to invest otherwise. Thus, the coefficients in Eq. (1) must be estimated using a binary choice model where the dependent variable is[6]:

$$Y = \begin{cases} Net\ Benefit \geq 0 \\ Net\ Benefit < 0 \end{cases} \quad (2)$$

---

[6] We can calculate the marginal probabilities for the binary model by setting all non-dummy variables at their mean level and the dummy variables to zero.

The main explanatory variable of interest is $Focus_{ij}$, which is the ratio of foreign sales to total sales, R&D expenditures to total assets or PPE to total assets in the corresponding regression for the probability of investing in foreign assets, private equity and real estate and mortgages. Our null hypothesis is that stronger corporate focus increases the probability of investing in the given asset class, i.e. $\beta_1 > 0$. Alternatively, if the corporate focus is irrelevant for pension plan investment, we expect $\beta_1 = 0$.

Theories based on risk shifting incentives suggest that firms will invest in pension assets that are correlated with their own stock. The incentives for risk shifting are stronger the more underfunded the pension plan liabilities. To test for risk shifting in pension investment we include $FundedStatus_{ij}$. It is calculated as the ratio of plan assets to liabilities based on the beginning-of-year assets and the RPA'94 current liabilities reported in the 5500 forms. Thus, under-funded plans have $FundedStatus < 1$. We examine whether the funded status of a pension plan has significant effect on the probability of investing in risky assets by testing the hypothesis that $\beta_2 \neq 0$. In particular, we can test for risk-shifting, $\beta_2 < 0$, versus risk-management, $\beta_2 > 0$.

According to the theories based on hedging incentives, firms will invest in assets whose returns are correlated with the sponsor's industry returns in order to hedge future wage growth. This incentive for hedging is stronger for plans with larger share of active participants. To test for wage growth hedging motives in pension investment we include $ActiveParticipants_{ij}$. It is calculated as the ratio of plan's active participants to total participants. We examine whether the share of active participants of a pension plan has significant effect on the probability of investing in risky assets by testing the hypothesis that $\beta_3 = 0$. Alternatively, we can test for hedging motives, i.e. $\beta_3 > 0$.

We include several plan specific control variable. The share of sponsor contributions, which is measured as the contribution payments made the sponsor firm divided by the beginning of year pension plan assets. Another theoretically important variable is the plan termination status. We include a dummy variable that equals one if the plan is terminated and zero otherwise. The other controls include the plan size, which is measured as the log of plan

assets at the beginning of the year and the plan age, which is measured as the log of one plus the plan age in years.

Our control variables also include sponsors characteristics. Petersen (1994) points out that cash flow variability can be reduced by formal hedging or by adopting costs (pension contributions) that vary with revenues. To measure cash flow variability, we use the standard deviation of the firm's cash flow over a ten year period preceding the year of the observation. Cash flow is defined as income before extraordinary items plus depreciation and amortization. In a similar spirit, Frank (2002) and Rauh (2009) provide evidence that sponsors offset their (non-pension) business risk by reducing the investment risk of the pension plan assets. We include the sponsor's credit rating as measure of sponsor's credit risk to capture this incentive. To perform statistical analysis with credit ratings, we have a numerical scale for the S&P credit rating as in Rauh (2009). We scale the credit rating variable so that values are between zero and one, with higher values implying better credit ratings. If the sponsor has an AAA credit rating with S&P, then the credit rating variable equals 0.929; if the sponsor has a D rating, then the credit rating variable has a value of 0.036, and each of the rating steps in between raises the credit rating variable by 0.036. Observations with no credit rating receive a value of zero but there is also a dummy variable for observations with no credit rating, which equals one for 6.7% of sample observations. Finally, we include the sponsor's size and leverage as additional controls.

In the second set of results in this paper, we estimate panel regressions of the portfolio weights on the measure of corporate focus, the plan funded status, the share of active participants and other explanatory variables and controls. Conditional on deciding to invest in an asset class, the pension plan then decides on the desired percentage allocated to this asset class given the previous period portfolio weight and plan and sponsor characteristics[7]. For plans

---

[7] The following equation summarizes the relationship among the coefficients of the two models.

$$\frac{\partial E[\omega_{it}]}{\partial x_{it}} = \frac{\Pr[y_{it}=1]\partial E[\omega_{it} \mid x_{it}, y_{it}=1]}{\partial x_{it}} + \frac{E[\omega_{it} \mid x_{it}, y_{it}=1]\partial \Pr[y_{it}=1]}{\partial x_{it}}$$

When the explanatory variable is binary, the partial derivative represents a difference, i.e. the change in the dependent variable when the explanatory variable changes from zero to one.

that do not invest in the given asset class, the observed weight is zero and their asset allocation behaviour cannot be specified. The observed portfolio weight can be examined using the following specification:

$$Weight_{it} = \alpha_i + \beta_1 Focus_{i,t-1} + \beta_2 FundedStatus_{i,t-1} + \beta_3 ActiveParticipants_{i,t-1} + Controls + e_{it} \quad (2)$$

The dependent variable $Weight_{it}$ is the actual portfolio weight for the given asset class. The main explanatory variables of interest are again the measure of corporate focus, funded status and active participants.

4. Data and Descriptive Statistics

Our sample period consists of fiscal years 1993-2002. We use three different sources of data. Corporate pension plans with more than 100 participants are required to file annually a Form 5500 with the IRS[8]. We select the publicly traded sponsors and link the sponsors of each pension plan indicated on the Form 5500 filing with firms from COMPUSTAT using the sponsor's employee identification number (EIN) and sponsor's name[9]. We obtain data on asset allocation from the annual Pensions and Investments Magazine survey[10]. The newspaper Pensions and Investments collects survey data on asset allocation (for both public and corporate plans) for pension plans with the largest amount of assets. We match the results of this survey to COMPUSTAT by company name. This results in 346 corporate plans that have at least one year of matching data[11].

---

[8] The form provides information about the type of plan, type of funding, about participants (those currently in the plan, those who have left but are entitled to receive benefits and participants with account balances at the end of the year) as well as information about the plan itself.

[9] We obtain foreign sales data from the WorldScope database. This database contains information for the percentage of foreign (non-US) assets and sales. These data are provided under the disclosure requirements of SFAS No. 14 and are available only for a subset of our sample firms.

[10] Detailed asset allocation information is typically unavailable from the IRS 5500 forms. This occurs because the plan assets are commonly invested through a trust or through an insurance company, without detailed information being provided regarding how the assets held by these entities are invested. The asset allocation information for those disclosing detailed information may also suffer from a sample selection bias, as pension plans—especially those undertaking risky investments—face incentives to conceal their asset allocation information.

[11] This number is smaller than the sample size in Rauh (2009). There are no survey data for 1995 and for 1993, 1994 and 1996 only 200 DB plan sponsors were surveyed.

When we analyze pension plan performance we use abnormal returns calculated as the actual plan returns over the returns for portfolios of benchmarks where the portfolio weights are the pension plans asset allocations. The benchmarks used are as follows:

- S&P 500 for U.S. equities;

- MSCI EAFE for international equities;

- Barclay's US Aggregate Bond Index for U.S. bonds;

- Barclay's Global Bond Index for global bonds;

- Ryan ALM Cash Index for cash;

- NCREIF Property Index for real estate investment returns;

- Cambridge Associates LLC U.S. Private Equity Index for private equity;

- Barclay's Mortgage Index for returns from mortgage investments;

Panel A of Table 1 contains descriptive statistics for the pension plans in our sample. Our sample consists of pension funds of very different size. The average pension plan in our sample has asset value of $908 million and the coefficient of variation (CV) shows that the standard deviation is 361% of the mean. On average the share of active participants is 48.76%. The average DB plan has a ratio of contributions to assets of 4.76% and a ratio of benefits to assets of 6.20%. During the sample period, the average plan return was 6.51% and the median pension plan was funded (beginning of year pension asset over current liabilities) at 108.66% level[12].

Panel B of Table 1 provides summary statistics for the sponsors in our sample. The average sponsoring firm has USD 27.14 billion in total assets with 65.15% PPE to total assets ratio. The average sponsoring firm has a leverage ratio (long-term debt to total assets ratio) of

---

[12] Investment returns of less than −80% or greater than 500% are replaced as missing. All ratio variables are winsorized at the 1% level to avoid outliers.

22.88%, a research and development expenditures to total assets ratio of 3.20% and 12.09% of their total turnover is generated by international sales.

Panel C of Table 1 provides summary statistics for the asset mix of the pension plans in our sample. Traditionally, the investment portfolio of DB pension funds has been heavily weighted towards publicly traded domestic equity, with bonds, cash and alternative assets having a smaller share of the asset portfolio. The table shows that the CV for domestic equity and bonds is 27% and 46% respectively. In contrast, the variation in asset allocation to foreign assets, private equity and real estate is much large and varies from 91% to 934%. In our sample, only two plans never invest in domestic equity over the sample period. However, fewer than 65% of the plan-year observations have positive investment in foreign equity, 17% in foreign bonds, 31% in private equity, 50% in real estate and 4% in mortgages.

Table 2 illustrates the importance of sponsor's corporate focus for the plan asset allocation in a simple way. The portfolio weight of international assets of pension plans sponsored by firms in the top foreign sales to total sales quartile on average is 7.5% higher than the portfolio weight of plans sponsored by firms in the bottom quartile. The means reported in the table are different at the 10% level. The results for R&D expenditures and PPE are even stronger. Table 2 shows that the difference in private equity investment for sponsors in the top and bottom quartile for R&D expenditures to assets is 50% and the difference in real estate and mortgages investment for sponsors in the top and bottom quartile for PPE to total assets is 28%. The means reported in the table are different at the 1% level. The next section provides formal tests of this result in a rigorous regression framework.

5. Estimation Results and Interpretation

Our first set of results analyzes the role of corporate focus using the regression specification (1). The results can be interpreted as tests of several of the above hypotheses about the relationship between the investment behaviour of the pension plan and the corporate focus of its sponsor. Table 3 reports the maximum likelihood estimates of a logistic discrete choice model with fixed effects. The coefficient of corporate focus is positive and statistically significant in all regressions for the three asset classes. We find that for one

standard deviation increase in the ratio of foreign sales to total sales, the probability of investing in foreign equity increases by 3.55%. Similarly, for one standard deviation increase in the ratio of R&D expenditures to total assets there is an increase in the probability of investing in private equity by 9.46%. Finally, for one standard deviation increase in the ratio of PPE to total assets, there is 2.72% increase in the probability of investing in real estate. These coefficients are large and economically significant.

Table 3 shows that our results are not consistent with theories based on risk shifting according to which firms have an incentive to invest in risky assets and assets that are correlated with their own stock. This risk shifting incentives are stronger the more underfunded the pension plan. In contrast, we find that the effect of pension funded status on the probability of investing in foreign equity, private equity and real estate is positive and significant at any conventional significance level. Our findings are consistent with Rauh (2009) who provides evidence that the better funded U.S. pension plans in his sample invest more in risky equity.

We do not find evidence that pension plans invest in assets that are correlated with the sponsor's industry returns in order to hedge against increases in real wages. Such an incentive for hedging will be stronger for pension plans with a large share of active participants. However, Table 3 shows that the share of active participants has a significant negative effect on the probability of investing in foreign equity, private equity and real estate. Similarly the variability of sponsor's cash flow does not appear to be a significant driver of pension investment in alternative assets. Firms that have less volatile cash flow are not significantly more likely to have pension plan invest in these risky assets. This is inconsistent with Petersen (1994) who argue that sponsors incorporate pension risk in their overall operating risk management policies.

On the other hand, we find that sponsors that do not have an S&P credit rating have pension plans that are less likely to invest in foreign equity, private equity and real estate. For those that do have a credit rating, the effect of sponsor's rating on the probability of investing in these assets is positive and very significant. Rauh (2009) argues that the credit rating is the

best available measure of the firm's financial strength and the likelihood of defaulting on debt agreements. Table 3 shows that the credit rating result is the opposite of the expected prediction if risk shifting incentive was an important determinant of pension plan investment in alternative assets. In our sample, the highly rated sponsors have plans that are more likely to invest in alternative assets.

We find that plan size and sponsor size are important determinants of the probability of investing in alternative assets with larger pension funds being significantly more likely to invest in foreign equity, private equity and real estate. Age, our proxy for maturity of the pension plan, on the other hand, is either positive or does not not seem to affect the probability of investing. Similarly, the termination dummy is not significant, contrary to a risk reduction motive where a terminated plan's portfolio is gradually shifted from risky assets into fixed income securities that immunize liabilities. Sponsor's leverage and contributions also do not affect pension plan investment choice for foreign equity, private equity and real estate.

Finally, we include the one year lagged investment return as a robustness check. We find that higher returns preceding higher probability of investing in risky assets. This finding is consistent with the risk management story in Rauh (2009) as well as a number of other frictions including the transactions costs of rebalancing, behavioral biases such as investor inertia or an excessive focus by managers on the short-term lagged return. The fact that the relationship between pension asset allocation and sponsor's corporate focus is robust to controlling for lagged investment returns suggests that the allocation bias is not explained by the tendency of short-term asset allocation to be affected by lagged performance.

The overall conclusion is that existing theoretical models cannot explain the observed bias in pension asset allocation. We find that deteriorating funded status is associated with de-risking of the plan contrary to the risk-shifting motive. Similarly, there is no evidence for wage growth or corporate cash flow hedging. We think that familiarity bias is the most compelling explanation of the fact that pension plans tilt their portfolio towards the corporate focus of the sponsoring firm.

Our second set of results characterizes the observed portfolio weights for foreign equity, private equity and real estate using the regression specification (2). Table 4 reports the estimation results from OLS panel regressions with fixed effects, Tobit regressions and GMM dynamic panel regressions. Standard errors adjusted for heteroskedasticity and within cluster correlation are reported in parenthesis.

Table 4 shows that conditional on investing in the asset class, the sponsoring firm corporate focus still has a significant positive effect on the actual portfolio weight. These effects are large and economically significant. For one standard deviation increase in the ratio of foreign sales to total sales, the asset allocation to foreign equity increases by 0.56%. Similarly, for one standard deviation increase in the ratio of R&D expenditures to total assets there is an increase in the portfolio weight of private equity by 0.49%. Finally, for one standard deviation increase in the ratio of PPE to total assets, there is 0.44% increase in the asset allocation to real estate. These effects are economically significant relative to the means of foreign equity, private equity and real estate. In addition, the effect of corporate focus on asset allocation is robust to accounting for the fact that asset allocation weights are censored below zero in Tobit regressions and accounting for persistence in asset allocation in GMM dynamic panel regressions.

Our second set of results also does not support the risk shifting hypothesis since the coefficient of funded status has either significant positive effect on the portfolio weights of alternative assets or in just a few cases it has no significant effect at conventional statistical levels. Table 4 also shows that sponsor's credit risk has a significant positive coefficient. This result can be interpreted as indicative of the importance of the financial strength of the sponsor and the availability and cost of external funds for the riskiness of the pension portfolio. In addition as Rauh (2009) argues, the positive correlation between credit rating and the investment in risky assets is the opposite of what would be expected if credit ratings were being set endogenously to reflect the risk that pension plans had. If anything, rating agencies should tend to give lower ratings to sponsors whose plans have riskier positions for a given level of funding.

We find that sponsor size is an important determinant of portfolio allocation with larger pension funds investing significantly more in foreign equity, private equity and real estate. Age, our proxy for maturity of the pension plan, on the other hand, is either positive or does not seem to affect the probability of investing. Similarly, the termination dummy and sponsor's leverage and contributions do not affect pension plan investment choice for foreign equity, private equity and real estate. The relationship between the observed pension asset allocation and sponsor's corporate focus is robust to controlling for lagged investment returns. This suggests that the allocation bias is not explained by the tendency of short-term asset allocation to be affected by lagged performance. Finally, the results in Table 4 show that there is weak evidence for persistence in asset allocation as the coefficients of the lagged dependent variable for international equity and real estate is positive and significant but not significant for private equity.

The general conclusion from these results is that the sponsor's corporate focus is important for the actual asset allocation. However, the effect of plan size and is funded status on the observed portfolio allocation is larger and more significant.

Our final set of results discusses the effect of familiarity bias on performance. Table 5 reports the plans' abnormal returns calculated as the excess of the actual pension return over the benchmark return. The plans with positive portfolio weight in the given asset class are sorted in quartiles by the measure for corporate focus. The table shows that the effect of investing in foreign assets, private equity and real estate is positive as on average the abnormal returns for plans with investment in theses asset class as exceed the average return of -1.57%. This is consistent with theories that suggest there is an added value from investing in alternative assets. Our results concerning the effect of the corporate focus, however, suggest that in general there is a negative effect of the asset allocation bias on the plan performance. For foreign assets this effect is not significant but for private equity and real estate and mortgages the abnormal returns of the plans in the top quartile and lower that those of the plans in the bottom quartile. The means reported in Table 6 are significantly different at conventional levels.

Overall, our results show that the impact associated with familiarity biases on the pension plans investment policy is negative. It is likely that this cost arises from the over confidence of pension plan managers about the performance of familiar assets.

7. Conclusions

This paper considers the asset allocation decisions of the large US defined benefit pension plans. We estimate reduced form models of the determinants of pension fund asset allocation decisions and examine the effect of sponsoring firm's corporate focus on the investment strategy of the pension funds' investment in foreign assets, private equity, and real estate and mortgages. We show that pension plans whose sponsors have a higher proportion of foreign to total sales are more likely to invest in international assets, plans sponsored by firms that spend more on research and development are more likely to invest in private equity, and plans whose sponsors have more fixed assets are more likely to invest in real estate and mortgages. Our results are not consistent with risk shifting motives as we find that plans de-risk their asset allocation as their funded status deteriorates. Similarly, our findings do not support theories based on hedging or diversification motives. We show that pension plans that align their investment policy with the sponsor's corporate focus do not have higher share of active participants and their returns exhibits higher correlation with the sponsor's equity returns. Overall, our results suggest that familiarity bias is an important determinant of pension investment. The worse performance of pension plans with such allocation bias is consistent with pension managers being over-confident about familiar assets thus taking excess risks for which they do not get compensated.

Many questions await future research. For example, examining pension plans' trading and rebalancing activities can help distinguish between different sources of familiarity bias. If the allocation bias is associated with more frequent trading, this will lend further support for the over confidence explanation. Also a comparison of pension plans that manage their asset internally versus plans that outsource investment externally to professional money managers is required to shed light on the mechanism of pension fund governance.

References:

Bader, L. N. 1991. *The Financial Executive's Guide to Pension Plans*. New York: Salomon Brothers, Inc.

Bae, K., Stulz, R. M. and Tan, H., 2008. "Do local analysts know more? A cross-country study of the performance of local analysts and foreign analysts," *Journal of Financial Economics*, 88(3), 581-606,

Barber, B.M. and T. Odean, 2001. "Boys will be boys: gender, overconfidence, and common stock investment", *Quarterly Journal of Economics*, 116, 261–292.

Benartzi, S., and R. H. Thaler, 2001, "Naïve Diversification Strategies in Defined Contribution Savings Plans", *American Economic Review*, 91(1), 79-98.

Black, F. 1980. "The Tax Consequences of Long-run Pension Policy." Financial Analysts Journal, 36, 25-31.

Black, F., 1989. "Should you use stocks to hedge your pension liability", Financial Analysts Journal, 45, 10-12.

Bodie, Z. 1991. "Inflation, index-linked bonds and asset allocation", *Journal of Portfolio Management*, 18, 48–53.

Bodie, Z., J. O. Light, R. Morck, and R.A. Taggart. 1984. "Funding and Asset Allocation in Corporate Pension Plans: An Empirical Investigation". NBER Working Paper No. 1315 (March): Cambridge, MA: National Bureau of Economic Research.

Boyle, P., L. Garlappi, R. Uppal and T. Wang, 2010, "Keynes Meets Markowitz: The Tradeoff Between Familiarity and Diversification", mimeo LBS and UBC

Brown, J., J. Pollet and S. Weisbenner 2010. "The Investment Behavior of State Pension Plans", working paper

Calvet, L., J. Campbell, and P. Sodini, 2007, "Down or Our: Assessing the Welfare Costs of Household Investment Mistakes", *Journal of Political Economy*, 115, 707-747.

John Y. Campbell & Luis M. Viceira, 2001. "Who Should Buy Long-Term Bonds?," *American Economic Review*, 91(1), 99-127.

John Y. Campbell and Luis M. Viceira,. 2002, *Strategic Asset Allocation: Portfolio Choice for Long Term Investors*. Oxford University Press.

John Y. Campbell and Luis M. Viceira, 2006, "Strategic Asset Allocation for Pension Plans." In *Oxford Handbook of Pensions and Retirement Income*, edited by Gordon Clark, Alicia Munnell and Michael Orszag. Oxford University Press.

Cao, H., B. Han, D. Hirshleifer, and H. Zhang, 2009, "Fear of the Unknown: Familiarity and Economic Decisions", *Review of Finance*.

Carroll, T. J, and G. Niehaus, 1998, "Pension Plan Funding and Corporate Debt Ratings," *The Journal of Risk and Insurance*, 65(3), 427-443.

Cocco, J., and P. Volpin, 2007, "The Corporate Governance of Defined Benefit Pension Plans: Evidence from the United Kingdom", *Financial Analysts Journal*, 63, 70-83.

Comprix, J. and K. Muller III, 2006 "Pension Funding Rules and Sponsor Firms' Risk Taking with Defined Benefit Pension Plan Assets", working paper

Cohen, L., 2009, "Loyalty-Based Portfolio Choice", *Review of Financial Studies*, 22, 3, 1213-1245.

Coval, J., and T. Moskowitz, 1999, "Home bias at home: Local equity preference in domestic portfolios", *Journal of Finance*

Doskeland, T. and H. Hvide, 2010. "Do Individual Investors Have Asymmetric Information Based on Work Experience?", *Journal of Finance*, forthcoming

Frank, M., 2002, "The Impact of Taxes on Corporate Defined Benefit Plan Asset Allocation", *Journal of Accounting Research*, 4. 1163-84.

Friedman, B.M. 1984. "Pension Funding, Pension Asset Allocation, and Corporate Finance: Evidence from Individual Company Data", in *Financial Aspects of the United States Pension System,* edited by Z. Bodie and J.B. Shoven. Chicago: University of Chicago Press: 107-152.

Goetzman, W. N., and A. Kumar, 2008, "Equity Portfolio Diversification", *Review of Finance*, 12, 433-463.

Graham, J., C. Harvey, and H. Huang, 2009, "Investor Competence, Trading Frequency, and Home Bias", *Management Science*, 1094-1106.

Grinblatt, M., and M. Keloharju, 2001, "How Distance, Language, and Culture Influence Stockholdings and Trades", *Journal of Finance*, 56, 1053-73.

Harrison, J.M., and W.F. Sharpe. 1983. "Optimal Funding and Asset Allocation Rules for Defined Benefit Pension Plans", in Financial Aspects of the United States Pension System, edited by Z. Bodie and J.B. Shoven. Chicago: University of Chicago Press: 91-106.

Huberman G., 2001, "Familiarity Breeds Investment", *Review of Financial Studies*.

Jin, Li & Merton, Robert C. & Bodie, Zvi, 2006. "Do a firm's equity returns reflect the risk of its pension plan?" *Journal of Financial Economics*, Elsevier, vol. 81(1), pages 1-26, July.

Lucas, D. and S. P. Zeldes 2006. "Valuing and Hedging Defined Benefit Pension Obligations: The Role of Stocks Revisited," Mimeo, Columbia University GraduateSchool of Business

Massa, M., and A. Simonov, 2006. "Hedging, Familiarity and Portfolio Choice" *Review of Financial Studies*, 19, 633-85.

Malloy, C. J. 2005. "The Geography of Equity Analysis," *Journal of Finance*, 60(2), 719-755

Merton, R. C. 1987. "A Simple Model of Capital Market Equilibrium with Incomplete Information", *Journal of Finance*, 42(3), 483-510

Petersen, M. A. 1994. "Cash flow Variability and Firm's Pension Choice: A Role for Operating Leverage" *Journal of Financial Economics* 36(3): 361-383.

Rauh, Joshua, 2006, "Investment and Financing Constraints: Evidence from the Funding of Corporate Pension Plans," *Journal of Finance*, 61, 33-71.

Rauh, J., 2009. "Risk Shifting versus Risk Management: Investment Policy in Corporate Pension Plans", *Review of Financial Studies,* 22: 2687-2733

Shivdasani, A. and I. Stefanescu, 2010. "How Do Pensions Affect Corporate Capital Structure Decisions?", *Review of Financial Studies*, 23(3), 1287-1323

Tepper, I. 1981. "Taxation and Corporate Pension Policy". *Journal of Finance*, 36, 1-14.

Table 1: Summary Satistics for Corporate DB Plans and Their Sponsors (1992-2002)

We report the mean, standard deviation (STD), the median and the coefficient of variation (CV). Size is the beginning of year (BOY) total assets. Funded status is BOY Assets/Current Liabilities. Contributions is contributions made by sponsoring firm. PPE is property, plant and equiptment and Leverage is Long term Debt/Total Assets.

Panel A: Plan Characteristics	MEAN	STD	MEDIAN	CV
Plan Size (Million USD)	908.00	3,280.00	110.00	361%
Share of active participants	48.76%	22.67%	50.06%	47%
Benefits/Assets	6.20%	5.83%	5.30%	94%
Contributions/Assets	4.76%	19.10%	0.00%	401%
Plan return	6.51%	11.87%	8.25%	182%
Funded status	113.73%	31.05%	108.66%	27%
Panel B: Sponsor Characteristics				
Sponsor Size (Million USD)	27,143.50	69,878.21	7,933.00	257%
Cash Flow/Assets	9.37%	6.49%	9.15%	69%
Leverage	22.88%	13.25%	22.84%	58%
Foreign Sales/Sales	12.09%	7.84%	10.58%	65%
R&D Expenditures/Assets	3.20%	3.08%	2.22%	96%
PPE/Assets	65.15%	29.61%	67.33%	45%
Asset Allocation				
US Equity	53.08%	14.37%	53.00%	27%
US Fixed Income	27.05%	12.51%	26.00%	46%
Non US Equity	9.42%	8.59%	10.00%	91%
Non US Fixed Income	1.02%	3.43%	0.00%	337%
Cash	2.50%	6.87%	1.00%	275%
Private Equity	1.51%	3.28%	0.00%	218%
Real Estate	2.02%	2.94%	0.00%	146%
Mortgages	0.13%	1.18%	0.00%	934%

Table 2: Investment in Foreign Equity, Private Equity and Real Estate by Corporate Focus (1992-2002)

We report foreign equity, private equity and real estate portfolio weights for plans sorted in quartiles by corporate focus. Asset allocation weights are in percentage of total assets. T test is a test for differences in means between groups.

Foreign Sales/Sales	Foreign Equity					
	MEAN	STD	MEDIAN	25%	75%	CV
Top 25%	10.26%	9.71%	10.00%	0.00%	17.00%	94.64%
Bottom 25%	9.49%	10.08%	9.00%	0.00%	15.00%	106.22%
T statistics	1.357*					
R&D /Assets	Private Equity					
Top 25%	2.04%	3.76%	0.00%	0.00%	2.50%	184.03%
Bottom 25%	1.36%	3.31%	0.00%	0.00%	1.00%	213.04%
T statistics	3.4427***					
PPE/Assets	Real Estate					
Top 25%	2.43%	3.00%	1.00%	0.00%	4.00%	123.66%
Bottom 25%	1.90%	2.91%	0.00%	0.00%	3.00%	153.67%
T statistics	3.3433***					

Table 3: Probability of Investing in Foreign Equity, Private Equity and Real Estate (1992-2002)

We report the results from logistic discrete-choice models of the pension investment choice by full information maximum likelihood with sponsor fixed effects and clustered standard errors. The dependent variable is the plan's decision to invest or not to invest in the asset class. We tabulate the coefficients (COEFF), their standard errors (STD), and marginal effects (MARG) for the decision to invest (Y=1) which we obtain by setting all non-dummy variables at their mean level and the dummy variables to zero. The pseudo R^2 is McFadden's likelihood ratio index.

	Panel A: Foreign Equity								
	(i)			(ii)			(iii)		
	COEFF	STD	MARG	COEFF	STD	MARG	COEFF	STD	MARG
Foreign Sales/Total Sales	2.8870	(0.3794)***	0.4532	1.1596	(0.4730)***	0.1663	1.1353	(0.4752)***	0.1626
Plan characteristics									
Funded status				0.5722	(0.1597)***	0.0820	0.6155	(0.1611)***	0.0882
Share of active participants				-1.3999	(0.2536)***	-0.2008	-1.4439	(0.2549)***	-0.2069
Contributions/Assets				0.5544	(0.4219)	0.0795	0.4607	(0.4038)	0.0660
Terminated dummy				-0.6441	(1.0824)	-0.1016	-0.6607	(1.1016)	-0.1042
Plan size				0.0451	(0.0237)**	0.0065	0.0445	(0.0241)*	0.0064
Plan age				-0.0209	(0.0909)	-0.0030	-0.0349	(0.0915)	-0.0050
Sponsor characteristics									
Credit rating				1.6347	(0.6473)***	0.2344	1.5774	(0.6480)***	0.2260
No credit rating dummy				-2.6765	(0.5067)***	-0.4904	-2.6313	(0.5077)***	-0.4816
SDT of Cash flow/Assets				0.1302	(0.0505)***	0.0187	0.1282	(0.0504)***	0.0184
Sponsor size				0.3661	(0.0527)***	0.0525	0.3689	(0.0529)***	0.0529
Leverage				0.0041	(0.0039)	0.0006	0.0041	(0.0039)	0.0006
Investment return *t*- 1							1.1571	(0.4429)***	0.1658
Time dummies		Yes			Yes			Yes	
Psuedo R^2		16.25%			23.34%			23.49%	

	(i)			(ii)			(iii)		
Panel B: Private Equity									
	COEFF	STD	MARG	COEFF	STD	MARG	COEFF	STD	MARG
R&D Expenditures/Asset	8.3752	(0.9332)***	2.8834	11.4273	(1.1509)***	3.1377	11.5633	(1.1546)***	3.1544
Plan characteristics									
Funded status				0.3205	(0.1086)***	0.0880	0.3265	(0.1099)***	0.0891
Share of active participants				-0.6687	(0.1513)***	-0.1836	-0.6817	(0.1526)***	-0.1860
Contributions/Assets				-0.0060	(0.0239)	-0.0016	-0.0061	(0.0253)	-0.0017
Terminated dummy				-0.4999	(0.7598)	-0.1297	-0.6073	(0.7538)	-0.1540
Plan size				0.0351	(0.0138)***	0.0096	0.0399	(0.0139)***	0.0109
Plan age				0.0840	(0.0595)	0.0231	0.0886	(0.0601)	0.0242
Sponsor characteristics									
Credit rating				3.6314	(0.4251)***	0.9971	3.6901	(0.4276)***	1.0067
Credit rating dummy				-2.6000	(0.3413)***	-0.4421	-2.6667	(0.3443)***	-0.4452
SDT of Cash flow/Assets				-0.0073	(0.0060)	-0.0020	-0.0074	(0.0061)	-0.0020
Sponsor size				0.6543	(0.0392)***	0.1797	0.6603	(0.0395)	0.1801
Leverage				-0.1718	(0.3353)	-0.0472	-0.2204	(0.3384)	-0.0601
Investment return $t-1$							1.8996	(0.6109)***	0.5182
Time dummies		Yes			Yes			Yes	
Psuedo R^2		11.88%			29.32%			29.77%	

	Panel C: Real Estate								
	(i)			(ii)			(iii)		
	COEFF	STD	MARG	COEFF	STD	MARG	COEFF	STD	MARG
PPE/Assets	0.1192	(0.0657)*	0.0408	0.2794	(0.0894)***	0.0885	0.2900	(0.0900)***	0.0918
Plan characteristics									
Funded status				0.3007	(0.0828)***	0.0953	0.3155	(0.0836)***	0.0999
Share of active participants				-0.4505	(0.1204)***	-0.1427	-0.4553	(0.1211)***	-0.1442
Contributions/Assets				-0.0110	(0.0161)	-0.0035	-0.0113	(0.0177)	-0.0036
Terminated dummy				0.1198	(0.7677)	0.0379	0.1085	(0.7658)	0.0343
Plan size				0.0309	(0.0116)***	0.0098	0.0311	(0.0117)***	0.0098
Plan age				0.2058	(0.0452)***	0.0652	0.1995	(0.0455)***	0.0632
Sponsor characteristics									
Credit rating				1.9664	(0.3164)***	0.6231	1.9433	(0.3171)***	0.6153
Credit rating dummy				-0.7239	(0.2602)***	-0.2128	-0.6998	0.2609533	-0.2065
SDT of Cash flow/Assets				0.0086	(0.0046)*	0.0027	0.0085	(0.0046)*	0.0027
Sponsor size				0.1283	(0.0282)***	0.0407	0.1222	(0.0285)***	0.0387
Leverage				0.3769	(0.2498)	0.0363	0.3634	(0.2511)	0.0317
Investment return *t*-1							1.5272	(0.5900)***	0.5344
Time dummies	Yes			Yes			Yes		
Psuedo R^2	13.36%			19.46%			19.49%		

Table 4: Observed Asset Allocation (1992-2002): Foreign Equity, Private Equity and Real Estate

We report the results from regressing the asset allocation on the corporate focus, plan and sponsor characteristics. The dependent variable is the plan's observed portfolio weight for the asset class. For (i) *and* (ii) *the coefficients are the estimates from OLS regression with fixed effecs; for* (iii) *the coefficients are the estimates from a Tobit regression with random effects; for* (iv) *the coefficients are the GMM estimates of an Arellano-Bond panel regression. Robust strandard error are reported in parentheses.*

	Panel A: Asset Allocation to Foreign Equity			
	(i)	(ii)	(iii)	(iv)
Lag Foreign Assets				0.0828 (0.0502)*
Foreign Sales/Total Sales	0.0795 (0.0137)***	0.0588 (0.0166)***	0.0417 (0.0178)***	0.0331 (0.0167)**
Plan characteristics				
Funded status		0.0017 (0.0069)	0.0254 (0.0071)***	-0.0034 (0.0125)
Share of active participants		-0.0224 (0.0119)*	-0.0395 (0.0108)	-0.0322 (0.0193)*
Contributions/Assets		0.0002 (0.0002)	-0.0019 (0.0068)	0.0020 (0.0141)
Terminated dummy		0.0310 (0.0282)	-0.0259 (0.0406)	0.0199 0.0348327
Plan size		0.0012 (0.0032)	0.0023 (0.0012)*	0.0056 0.0061937
Plan age		0.0020 (0.0104)	-0.0002 (0.0045)	0.0130 0.0221497
Sponsor characteristics				
Credit rating		0.0244 (0.0242)	0.0352 (0.0245)	-0.0606 (0.0405)
No credit rating dummy		-0.0353 (0.0182)**	-0.0870 (0.0192)***	-0.0610 (0.0298)**
SDT of Cash flow/Assets		0.0003 (0.0002)	0.0003 (0.0002)	0.0140 (0.0064)**
Sponsor size		0.0031 (0.0035)	0.0105 (0.0025)***	0.0035 (0.0107)
Leverage		0.0001 (0.0001)	0.0001 (0.0001)	0.0001 (0.0001)
Investment return *t*- 1		0.0589 (0.0177)***	0.0831 (0.0229)***	0.0193 (0.0238)
Time dummies	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	No	Yes

	(i)	(ii)	(iii)	(iv)
		Panel B: Asset Allocation to Private Equity		
Lag Private Equity				0.0845 (0.0756)
R&D Expenditures/Asset	0.1575 (0.0345)***	0.1592 (0.0422)***	0.1447 (0.0233)***	0.1050 (0.0544)**
Plan characteristics				
Funded status		0.0070 (0.0035)**	0.0053 (0.0049)	0.0088 (0.0045)**
Share of active participants		0.0059 (0.0061)	-0.0086 (0.0074)	0.0001 (0.0089)
Contributions/Assets		0.0001 (0.0001)	-0.0046 (0.0074)	0.0025 (0.0046)
Terminated dummy		0.0264 (0.0222)	0.0124 (0.0277)	-0.0091 (0.0194)
Plan size		0.0014 (0.0019)	0.0071 (0.0034)**	0.0027 (0.0036)
Plan age		0.0083 (0.0061)	0.0077 (0.0083)	0.0065 (0.0080)
Sponsor characteristics				
Credit rating		-0.0036 (0.0144)	0.0508 (0.0154)***	0.1142 (0.0236)***
No credit rating dummy		-0.0109 (0.0054)**	-0.0922 (0.0198)***	-0.0820 (0.0167)***
SDT of Cash flow/Assets		-0.0001 (0.0020)	-0.0002 (0.0001)	-0.0039 (0.0033)
Sponsor size		0.0023 (0.0007)***	0.0223 (0.0019)***	0.0114 (0.0048)***
Leverage		-0.0061 (0.0093)	-0.0001 (0.0156)	-0.0039 (0.0119)
Investment return t-1		0.0132 (0.0064)**	0.0376 (0.0177)**	0.0398 (0.0103)***
Time dummies	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	No	Yes

	(i)	(ii)	(iii)	(iv)
		Panel C: Asset Allocation to Real Estate		
Lag Real Estate				0.1850 (0.0508)***
PPE/Assets	0.0157 (0.0032)***	0.0150 (0.0042)***	0.0123 (0.0039)***	0.0443 (0.0087)***
Plan characteristics				
Funded status		0.0037 (0.0022)*	0.0097 (0.0035)***	-0.0038 (0.0045)
Share of active participants		-0.0008 (0.0041)	-0.0105 (0.0056)	-0.0055 (0.0071)
Contributions/Assets		-0.0002 (0.0006)	-0.0045 (0.0043)	0.0010 (0.0039)
Terminated dummy		-0.0018 (0.0096)	0.0019 (0.0156)	0.0042 (0.0130)
Plan size		0.0220 (0.0057)***	0.0284 (0.0082)***	-0.0001 (0.0023)
Plan age		-0.0015 (0.0043)	0.0112 (0.0029)	0.0030 (0.0076)
Sponsor characteristics				
Credit rating		0.0158 (0.0083)**	0.0485 (0.0129)***	0.0216 (0.0124)*
No credit rating dummy		-0.0116 (0.0062)*	-0.0206 (0.0102)**	0.0071 (0.0110)
SDT of Cash flow/Assets		0.0001 (0.0001)	0.0002 (0.0001)**	-0.0006 (0.0024)
Sponsor size		0.0076 (0.0015)	0.0113 (0.0015)***	0.0265 (0.0043)***
Leverage		-0.0012 (0.0011)	0.0010 (0.0007)	0.0004 (0.0099)
Investment return t-1		0.0122 (0.0060)***	0.0221 (0.0106)**	0.0219 (0.0086)***
Time dummies	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	No	Yes

Table 5: Asset Allocation and Pension Plan Performance (1992-2002)

The returns reported are the excess of the actual pension return over the benchmark return. Benchmark return is the return on a portfolio invested in benchmark indexes with portfolio weights the same as the asset allocation of the pension plan for year t. T statistics is from a test for differences in mean between the top and bottom quartiles.

	Abnormal Returns
Foreign Sales/Sales	
Bottom 25%	0.39% (0.0696)
Inter-quartile 25%-75%	-0.97% (0.0784)
Top 25%	-0.86% (0.0667)
T statistics	0.9494
R&D /Assets	
Bottom 25%	1.73% (0.0319)
Inter-quartile 25%-75%	0.94% (0.0395)
Top 25%	0.24% (0.0360)
T statistics	2.5118 ***
PPE/Assets	
Bottom 25%	-0.98% (0.0614)
Inter-quartile 25%-75%	-1.79% (0.0709)
Top 25%	-2.43% (0.0753)
T statistics	1.9472 **