THE EFFECT OF STATE AND LOCAL PUBLIC PENSION PLAN GOVERNANCE ON SYSTEM FUNDING AND INVESTMENT PERFORMANCE

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ABSTRACT

This study explores the key determinants of state and local public pension funding capacity and investment performance. Using a sample of U.S. public retirement systems for 2001-2007 that combines data from the Public Fund Survey with new independently collected governance information, this research improves upon previous examinations of plan performance by including board turnover as a covariate of interest. A three equation empirical model is specified with actuarial funding ratio, percent of actuarially required contributions paid and investment rate of return used as the three outcome measures.

The regression results present mixed evidence to support the hypothesis that pension governance impacts plan performance. While board turnover and investment council both had the expected effect on actuarial funding ratio, neither of these covariates significantly impacted investment rate of return. Instead, behavioral persistence and investment asset allocation appear as the most critical explanatory factors for pension performance.
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Chapter 1. Introduction

The United States financial crisis of 2008-2009 threatens the solvency of many state and local public retirement systems that pay pension benefits to more than 27 million government employees. According to testimony by former Congressional Budget Office Director Peter Orszag in October 2008, the assets held by state and local plans declined by over $300 billion between the second quarter of 2007 and the second quarter of 2008 (Orszag, 2008). The net effect of this rapid asset depreciation was that public pension funds lost 14.8% of their total value in 2008.

There are important public policy consequences for this recent public fund financial turmoil. First, the poor fiscal health of these systems dampens the retirement prospects of teachers, police officers and other civil servants. Equally as critical, all states offer legal protection for the pension benefits of government employees, preventing the elimination or reduction of future payment obligations even if fund assets are insufficient. According to the Government Accountability Office, 31 states have constitutional provisions explicitly protecting pensions, while the other states all have legal protections for pensions provided in statutes or under common law. State constitutions offer the strongest form of protection for public retirement systems because constitutions preempt state statutes and require a broad range of support to change (Bovberg, 2008).
A principle concern of analyzing public pensions is the wide variability in funding status among retirement systems. According to recent estimates by the Center for Retirement Research at Boston College (CRR), nearly 40% of public retirement systems are underfunded (Munnell, Haverstick and Aubry, 2008). This trend is troubling because if pensions remain fiscally unsound, government employers will be forced to improve funding through socially unpopular measures such as increasing the level of participant contributions or raising taxes. Equally as important, the fiscal impact of growing unfunded pension obligations could span generations, with constituents enduring an increased tax burden for decades.

It should be noted that disagreement exists as to the specific level of underfunding that signals fiscal distress. While some researchers consider any shortfall to be problematic, the GAO considers any plan maintaining above 80% of required funding to be financially sound (Bovbjerg, 2008). Further, the validity of funding levels as an accurate measure of pension fiscal health remains a contentious topic—some argue that most state and local pensions remain highly solvent and resistant to downturns in the market despite the high presence of underfunding (Munnell, Haverstick, Sass and Aubry, 2008).

While academic consensus over the precise benchmarks and substantive meaning of plan funding remains evasive, there is growing agreement that a causal
relationship exists between pension governance and performance. Assets of public pensions are typically administered as trusts managed by boards of trustees. In accordance with relevant state and local statutes, these trustees work with pension administrative staff to make a broad range of policy decisions, including the selection of actuarial assumptions and developing financial reporting procedures. Additionally, many public pensions have separate investment councils comprised of experienced professionals responsible for the selection of a fund’s asset allocation strategy. Since boards and investment councils play a key role in public pension administration, it is important to examine the wide variety of governance structures in operation at state and local levels.

This research also analyzes the impact of board turnover rate on pension investment performance and funding capacity. Specifically, this research will offer a new contribution to the study of public retirement systems by evaluating the effect that the proportion of new members on a board for a given year has on the outcome measures of interest. By introducing this new dimension to the quantitative examination of public pensions, the study will broaden the analytical possibilities in this field.

Finally, this analysis evaluates the claim that behavioral persistence largely determines the funding patterns and investment performance of public retirement

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plans. Prominent pension experts such as Olivia Mitchell and Robert Smith have argued that previous pension performance might be a key determinant of future funding levels because it captures the political climate and culture of a plan’s administrative operations. Consequently, revisiting this hypothesis will allow a comparison between past explanations of pension performance and newly proposed determinants such as board turnover.

The data set used for this investigation is a longitudinal data source that combines pension finance and investment metrics from the National Association of Retirement Administrator’s (NASRA) *Public Fund Survey* with governance variables collected primarily from public pension comprehensive annual financial reports (CAFRs). The results from this study will serve as a roadmap for policymakers interested in identifying successful management approaches that produce high performing and fiscally sound public pension systems.

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1 For additional examples of behavioral persistence hypotheses tested in public pension empirical research see Klumpes, *Determinants of Government Under-funded Public Pension Liabilities in the OECD* (2003) and Mitchell and Smith, *Pension Funding in the Public Sector* (1994).
Background

Private vs. Public Sector Pensions:

There are two major types of retirement systems administered by employers: defined benefit and defined contribution. In a defined benefit plan the amount of benefit payment is determined by a retiree’s years of service and final average salary, while the pension fund investment return is not factored into future employer obligations. In contrast, with a defined contribution plan system, employees have individual investment accounts into which both they and their employers make payments. A critical difference between the two types of plans is that with defined contribution plans employees make the broad asset allocation decisions and thus assume much of the investment risk (Gomes and Michaelides, 2003). One major advantage of defined contribution plans is that they are generally more portable than defined benefit plans because employees own their individual accounts and can taken the funds with them when they leave their current position.

Over the past thirty years, private companies have increasingly moved away from offering defined benefit plans. In 1977, 40% of private sector workers were covered by defined benefit pensions and only 7% by defined contribution pensions. By 2003 the portion of corporate employees under defined benefit systems had declined to 20%, while the number under defined contribution had increased to 40%
National Conference of State Legislatures, 2005). One primary explanation for this corporate shift to defined contribution systems is the recent increase in worker mobility. Since employees no longer spend their careers at a single firm, defined contribution plans offer much needed fund portability. Also, unlike their public sector counterparts, private sector defined benefit systems rarely require matching employee contributions and thus companies must bear the financial burden for any defined benefit packages offered. Consequently, the shift from employer responsibility to employee responsibility with defined contribution plans has allowed private companies to rein in their financial obligation to retirees (Wolff, 2004).

In contrast to the private sector, the majority of state and local public employers continue to provide workers with defined benefit plans. As of 2007, only Alaska, the District of Columbia, Michigan and Nebraska had adopted defined contribution plans as their primary pensions (Bovbjerg, 2008). However, all state-level public retirement systems and some municipal programs now offer optional supplementary defined contribution plans.

State and local public retirement systems also differ significantly from corporate pensions because they are not covered under the Employment Retirement Income Security Act of 1974 (ERISA). This federal law establishes minimum standards company pension plans must satisfy in terms of financial disclosure, vesting
and participation among other requirements. A key component of ERISA is an insurance program operated by the Pension Benefit Guaranty Corporation (PBGC) that guarantees benefits to annuitants if employers are unable to pay. Since this program requires companies to maintain a high level of funding and deliver frequent payments to PBGC, pension insurance has made the administration of defined benefit plans complicated and expensive for private companies (National Conference of State Legislatures, 2005). Public pensions instead rely on state statutes and local ordinances for administrative guidance (Bovbjerg, 2008). This is particularly important in the context of PBGC because it has allowed state and local governments to administer defined plans at comparably low short-term cost but with significant long-term risk due to the lack of insurance.

The legislative difference between public and private retirement system governance is also critical in terms of fund performance evaluation. When corporate pension administrators calculate actuarial funding estimates, they are required to discount long-term liabilities at corporate bond rates. For public funds, the Governmental Accounting Standards Board (GASB), an independent entity providing voluntary public pension guidance, maintains accounting and financial reporting standards for state and local retirement systems. But unlike the universal actuarial standard deployed for private pensions, GASB currently supports six different
approved actuarial cost methods, and does not have the legal authority to compel public systems to adopt one of these approaches. Consequently, comparative performance analysis of public retirement systems remains a challenge.

**Retirement Plan Board Membership:**

Most public pensions are governed as trusts and managed by a board of trustees. Additionally, an executive director who coordinates a supporting staff to administer daily system functions assists most pension boards. Retirement plan boards are comprised of three kinds of members: ex-officio, elected trustees and appointed personnel. Ex-officios are public officials who have a guaranteed position on the board based on the particular public office that they hold. For example, some pension plan boards offer trustee positions to Governors, State Treasurers or Auditors. However, other boards do not include any ex-officio positions. Elected trustees are active or retired plan participants chosen by their unions or professional associations. Finally, appointed members are selected for service based on a particular area of needed expertise such as accounting or investment. Importantly, each type of board member brings different perspectives and motivations to their positions. For instance, elected trustees might work to ensure participant benefits are protected, but ex officio members are likely to be more interested in representing government concerns. While
the interaction between these different member types is a critical component of this study, it is important to note that some pension boards do not have all three kinds of members.

Board members serve as fund fiduciaries and are responsible for a broad range of policy decisions. One critical duty of most pension boards is the acquisition of assets sufficient to pay annuitant benefits. In some retirement systems, board members are tasked with selecting the actuarial valuation method and present discount rate for calculating fund liabilities, whereas with other plans actuarial assumptions are specified in state and local statutes (Peng, 2008). Finally, governance boards are in charge of selecting a fund’s investment strategy and adopting financial reporting procedures.

**Literature Review**

For the past two decades most empirical research of plan performance has made use of the Public Pension Coordinating Council’s Survey of State and Local Government Employee Retirement Systems (PENDAT). Conducted on a biannual basis, PENDAT collects a wide range of information about state and local public retirement system practices including data on financial reporting requirements,
investment restrictions, and plan administration. Survey discontinuation in 2001 led to a noticeable decline in the number of quantitative studies published in recent years.

Along with a common data source, there exists strong uniformity among the empirical models specified by public pension empirical researchers. Most previous studies have used OLS regression models, selecting actuarial funding ratio, percent of actuarial required contributions paid (ARCPAID), or investment rate of return (ROR) as the outcome measure. Overall, the literature is inconclusive about the impact of governance on pension performance. While some studies observe strong causal effects of the proportion of plan participants on pension boards and other covariates of interest, others find no compelling statistical evidence of the relationship between public administration and pension fiscal health.

Hsin and Mitchell (1994) and Mitchell and Smith (1994) were two of the first evaluations of plan governance on fund performance for the population of state and local pensions. Using 1991 PENDAT data, Hsin and Mitchell specified four separate regressions with actuarial funding ratio, flow funding ratio, and two estimates of investment ROR as the respective dependent measures. While these outcome measures are the same as those proposed for this study, Hsin and Mitchell did not include any interdependencies between actuarial funding ratio, flow funding ratio, and ROR in their models. The authors’ observed an increase in the proportion of plan
participants on the retirement plan board is associated with a decrease in both the actuarial funding ratio and investment ROR. Although Mitchell and Smith (1994) examine different covariates than Hsin and Mitchell (1994), the most important contribution from their research is the development of an empirical model that accounts for the relationship between the three dependent variables of interest.

Yang and Mitchell (2005) used a longitudinal PENDAT data set for 1990 to 2000 to improve upon the research design of Mitchell and Smith (1994) by developing three separate empirical equations each with time-lagged interrelated outcome variables. While the three respective outcome variables were also used as covariates in the other equations, the models are not mathematically interrelated such as the case with a Two-Stage Least Squares regression. For instance, investment ROR was selected as a covariate for an equation with actuarial funding ratio as the dependent variable, while actuarial funding ratio and investment ROR were both explanatory factors for the model with flow funding as the dependent variable. Yang and Mitchell (2005) reported a highly significant correlation between investment ROR and actuarial funding ratios for a given year, confirming the validity of this time-sensitive quantitative approach. The authors found statistically significant evidence that an increase in the number of retired or active plan participants on the pension board is
associated with a decrease in the actuarial and flow funding ratios as well as with investment ROR.

Research by Coronado, Engen, and Knight (2003) also examined the impact of board composition on pension performance, but in contrast to Yang and Mitchell they hypothesized a positive relationship between the two factors. Coronado, Engen and Knight defended their empirical expectation by arguing that since pension participant trustees were elected by plan membership, they were more likely to serve the best fiscal interests of the fund and be less subject to political pressure. While the observed correlation between percent of plan members and ROR was positive, the result was not statistically significant.

Munnell, Haverstick and Aubry (2008) performed one of the most recent evaluations of pension performance and have similarly reported inconclusive results about the effect of plan governance. They used financial and investment variables in the Public Fund Survey for 2006, along with governance variables they collected themselves from pension comprehensive annual financial reports. The authors concluded that an increase in the number of plan participants on the board has neither a statistically significant nor substantively important effect on the actuarial funding ratio. Importantly, these researchers were also the first to test the impact of whether a pension had an investment council, which is a separate governance structure comprised
of trustees responsible for setting fund investment policy, advising on asset allocation, and monitoring investment performance. These researchers concluded that there was a large positive differential in pension funding between systems with a separate council compared to those pensions without one.

In a companion study, Munnell, Haverstick, Aubry and Golub-Sass (2008) examined the effect of governance on the funding level for plan actuarial required contributions (ARC). In contrast to most other public pension studies, this research presented a probit regression model where the outcome measure was a dummy variable set to ‘1’ if a plan meets 100 percent or greater of the ARC and to set to ‘0’ otherwise. The empirical results indicated that increasing the number of plan participants on the pension board did not have a statistically significant effect on ARC payments. Despite the lack of empirical evidence to support a governance hypothesis, the model nevertheless provided an innovative approach for examining the determinants of ARC paid.

Importantly, Yang and Mitchell (2005) examined the behavioral persistence hypothesis for pension performance. These researchers expected a unitary relationship for plan funding from one year to the next, reasoning that since government funding practices do not change quickly over time, there would be a strong correlation between past and current performance. Yang and Mitchell observed a strong positive statistical
relationship for actuarial funding ratio from one year to the next, although the coefficient estimate was slightly less than 1. The empirical model used for this research will again evaluate the behavioral persistence expectation for plan performance.

This study contributes to the field of public pension performance analysis by introducing a new longitudinal dataset to further explore of the relationship between pension governance and plan performance. The discontinuation of PENDAT has left a gap in the availability of quality data. However, the data set constructed for use in this paper, which is comprised of governance, financial and investment variables for 2001 to 2007, can be viewed as a starting point for the next wave of public pension empirical investigation. Finally, an original hypothesis concerning the effect of board turnover will be developed and examined for the first time. To facilitate replication of the data presented in this research, the Appendix provides a complete listing of online resources for obtaining public fund comprehensive annual financial reports.
Chapter 2. Methodology

Conceptual Framework and Hypothesis

**Hypothesis:**

The primary goal of this study is to evaluate the relationship between public retirement system performance and the composition of pension plan boards. It is expected that pension boards that include a higher portion of participant trustees will experience decreases in both plan funding and investment rate of return \((ROR)\). This hypothesis is based on the assumption that participant trustees generally support more conservative and historically underperforming investment strategies than do politically affiliated members.

Just as importantly, this paper also examines the effect of board turnover on plan funding and investment performance. Since governance changes are disruptive, an inverse relationship is expected between turnover and plan performance.

Another relationship examined is the impact of whether a pension has a separate investment council on pension performance. Since these structures are comprised of business professionals with experience allocating assets, a positive differential is expected for systems utilizing investment councils.

Finally, this research will reexamine the behavioral persistence hypothesis previously examined by Yang and Mitchell (2005). Following that work, the
relationship between a pension’s actuarial funding ratio in year $t-1$ and year $t$ will be positively correlated.

**Dependent Variables:**

The empirical model for this analysis uses three different measures of public pension performance. The actuarial funding ratio ($AFR$) is obtained by dividing total plan assets by the present discounted value of fund liabilities. A plan is fully funded with a value of 100 such that assets equal accrued liabilities; a plan is underfunded when liabilities exceed assets and the actuarial ratio is below 100. The percent of annual required contributions paid ($ARCPAID$) is obtained by dividing the actual contributions a pension plan makes in a given year by the amount the system is required to pay to annuitants. To ensure that $ARCPAID$ and $AFR$ are in comparable units, the percent of required contributions paid is subsequently multiplied by 100. Much like the actuarial funding ratio, an $ARCPAID$ value of 100 indicates that a plan is fully meeting its obligations to plan participants while a value of less than 100 shows that some pension requirements are not being satisfied. A final performance measure used in this study is pension investment rate of return ($ROR$). Defined pension plans covered by the *Public Fund Survey* invest in a wide range of assets including bonds,
equities and real estate, and a high $ROR$ on fund assets is associated with strong system performance.

**Explanatory Variables:**

For this study, pension board composition, pension board turnover rate, plan and the impact of investment councils are the key explanatory measures of interest. In this model, *board composition* is measured as the proportion of trustees that are plan participants. An inverse relationship is expected between the proportion of plan participant trustees and pension performance. *Investment council* is an indicator variable set to ‘1’ if a board deploys a separate investment structure and set to ‘0’ otherwise.

One of the most important elements of this empirical model is the impact of *board turnover* on public pension financial and investment performance. While other explanatory variables measured in this study have been previously examined, analyzing the effect of *board turnover* represents a new contribution to the field. For each plan, this measure is quantified by comparing the board trustees from one year to the next, noting any new members on the board. Consequently, the board turnover metric presented in the empirical model below is the proportion of board members in the following year that are new trustees.
Finally, this analytical framework also controls for retirement system occupational type and plan size. A number of empirical public pension studies account for the funding differential between teacher, police officer, and other occupationally specific pension plans. For example, Eaton and Nofsinger (2008) observe teacher pensions to be significantly more underfunded than other plan types. They argue that this funding differential is related to the much higher proportion of female participants in teacher plans. Another explanation for these occupationally dependent performance differentials is that professions might have tenures or earnings levels generating systematically unique levels of pension liabilities. To control for occupational type, dummy variables for both teacher and police/fire pension plans are used in this study. Since many pensions represent multiple occupations, it is important to note that these indicator variables are coded as ‘1’ if teacher or police/fire are at least one of the occupations represented by the pension.² Plan size is represented in this empirical framework as the natural log of plan assets, and it is expected that this control will have a positive effect on pension performance.

² In alternative specifications, separate multiple occupational type dummy variables were specified for each possible combination of pension types. The model was specified in this way in order to create a set of occupational dummy variables that was both exhaustive and mutually exclusive. However, using eight separate dummy variables ultimately proved too cumbersome.
Empirical Model:

The three separate-equations approach introduced by Yang and Mitchell (2005) is used in this study to account for time-sensitive relationships between the three outcome variables: actuarial funding ratio (AFR), percent of actuarially required contribution paid (ARCPAID) and pension investment rate of return (ROR).

Equation 1:

$$AFR_t = \alpha_0 + \alpha_1 \text{BoardComposition}_t + \alpha_2 \text{BoardTurnover}_t + \alpha_3 \text{InvestmentCouncil}_t + \alpha_4 \text{AFR}_{t-1} + \alpha_5 \text{ROR}_t + \alpha_6 X_t + \varepsilon_t$$

In the first equation, the impact of AFR for $t-1$ on the actuarial funding ratio for the following year is expected to be positive. This assumption is based on what Yang and Mitchell (2005) propose as the ‘behavioral persistence hypothesis’, where pensions that are well funded in $t-1$ will continue to be financially sound in $t$ with the general trend being that all plans move toward full funding. As outlined above, board composition and board turnover are both assumed to have a negative impact on the actuarial funding ratio while separate investment councils are expected to generate a positive performance differential.
Equation 2: 
\[ ARCPAID_{t+1} = \beta_0 + \beta_1 BoardComposition_t + \beta_2 BoardTurnover_t + \beta_3 InvestmentCouncil_t + \beta_4 AFR_t + \beta_5 ROR_t + \beta_6 X_t + \epsilon_2 \]

Similar to the empirical model used by Munnell, Haverstick, Aubry and Golub-Sass (2008), the second equation presented is a probit model, where \( ARCPAID \) is an indicator variable equaling ‘1’ if a plan funds 100% of its obligations and ‘0’ if required contributions are not funded in full. It is hypothesized that the actuarial funding ratio for year \( t \) will have a positive marginal effect on the percent of actuarially required contribution paid (\( ARCPAID \)) by a pension fund for year \( t+1 \). The logic underpinning this expectation is based on the typical timeline for a public pension actuarial evaluation process. In the middle of the year, pension board trustees usually instruct actuaries to perform examinations of plan assets and liabilities. This process yields both the actuarial funding ratio for year \( t \) as well as the required contributions for \( t+1 \). At the end of year \( t+1 \), a plan pays out the actual contributions for that year, and it is at this point that the \( ARCPAID \) for \( t+1 \) is calculated. Consequently, due to the different timeframes for the calculation of \( AFR \) and \( ARCPAID \), the former can be used as covariate for the regression explaining the latter. The expectation of a positive effect of \( AFR \) for \( t+1 \) is based again on the assumption of behavioral persistence. The other covariates in this equation are expected to have the same directional impacts on the outcome variable as hypothesized in equation 1.
Equation 3:
\[
ROR_t = \gamma_0 + \gamma_1 \text{BoardComposition}_t + \gamma_2 \text{BoardTurnover}_{t-1} + \gamma_3 \text{InvestmentCouncil}_t + \\
\gamma_4 AFR_{t-1} + \gamma_5 \text{AssetAllocation}_t + \gamma_6 X_t + \epsilon_3
\]

For the third equation, an inverse relationship is expected between \(AFR_{t-1}\) and \(ROR_t\). The logic behind this hypothesis is that a low funding ratio might mean a pension plan is willing to take on higher investment risk, which would likely yield a stronger return on investment. This model also controls for asset allocation, which is represented here by two dummy variables: over 50\% of assets in equities and over 33\% of assets in fixed investments. The respective percentage thresholds for equities and fixed investments were selected because they correspond approximately to the mean portion of each asset held by plans in this sample. Although the directional impact of these two controls is uncertain, it is expected that asset allocation will explain a significant amount of the variation in investment returns across pension plans. Once again, the other explanatory variables in this equation assume the expected signs from equation 1 and equation 2.

Table 1 provides a consolidated presentation of the expected impact for all covariates examined in the three equations used in this paper.
Data and Methods

Data:

The primary dataset used in this study is the Public Fund Survey (PFS), an annual survey sponsored by the National Association of State Retirement Administrators (NASRA) and the National Council on Teacher Retirement (NCTR). The PFS collects financial, investment, plan provision and actuarial valuation data from 125 different state and local public pension plans. The membership and assets of the systems represent more than 85% of the nation’s state and local public pension community. NASRA and NCTR collect the survey data from a variety of sources including plan comprehensive annual financial reports (CAFRs), plan actuarial valuation reports (AVRs), and direct correspondence with pension staff. The PFS used here contains information on the 125 pension plans from 2001 to 2007.

The population of interest for this analysis is the nation’s community of state, city, and county public retirement systems. The one notable exclusion is the collection of defined contribution plans, which are new retirement systems that have been adopted in recent years by states such as Alaska and Michigan (Bovbjerg, 2008). Since these defined contribution plans feature individual accounts and benefits based in part on an employee’s own investment decisions, incorporating these pensions into the defined benefit empirical framework is not conceptually feasible. Additionally, the
PFS represents several hybrid plans that incorporate both defined benefit and defined contribution features. These hybrid plans are also excluded from the analysis.

While the PFS contains a strong collection of financial and investment pension data, it lacks information on system administration and governance. Consequently, information on board composition, board turnover and investment councils was collected directly from the various pension plans for 2001 to 2007. The goal is to have a rich source of data available from which to analyze changes in public pension governance over time and examine the impact of these factors on financial and investment performance. The list of online state and local pension CAFRs available in the Appendix should be of great assistance to other researchers interested in building upon the research presented in this paper.
Chapter 3. Findings

Descriptive Statistics

Table 2 provides summary statistics for the explanatory and dependent variables of interest for the pooled sample years of 2001 to 2007, with separate values reported for the subset of observations used in each of the 3 specified equations. While the total number of observations in equations 1 and 3 are comparable, equation 2 uses only 210 observations. This notable loss in data is largely explained by the high number of missing observations for amortization, which is a control variable only used in equation 2. In addition to the summary statistics reported for each of the 3 regressions, separate descriptive values are also given for the 2 different versions of equation 1. Both the total number of observations and the summary statistics for these two specifications of equation 1 are quite similar.

There are several key descriptive statistical trends for the covariates and outcome metrics used in this study. Across the three equations, over half of pension board trustees are plan participants. On average, the annual turnover rate for board members is approximately 18%. Among the total subset of observations for each equation, about one-third of pensions plans have a separate investment council. While the actuarial funding ratio ($AFR$) mean differs for the three equations, the typical plan funding ratio value is between 85% and 87%. Since a value of 100 indicates that a
pension is fully funded, it is concluded that plans in this sample are generally underfunded. For the percent of actuarially required contribution paid (ARC\textit{P}AID), just over half of the pensions used in equation 2 were able to fully fund their annual obligations to annuitants. Finally, the investment rate of return (\textit{ROR}) varies noticeably by equation, with plans on average earning anywhere from 9.41% to 11.70% on fund assets.

The summary statistics reported in Table 2 also provide some helpful insight about the control variables used in this empirical model. In terms of asset allocation, approximately 86% of the subset of plans used for equation 3 had over 50% of their assets in equities, while exactly 25% had more than a third of their funds invested in fixed assets. Across the three equations, the portion of plans with teacher plan participants ranged from about 44% to 48%. Similarly, for the respective subset of observations used in each regression, between 40% and 44% of pensions had some members who were police officers or firefighters. Finally, for the subset of observations used in equation 2, the amortization period for plan assets was about 26 years on average.
Regression Results

The regression results presented in Table 3 test the hypotheses about the effects of board composition, board turnover, investment councils and behavioral persistence on pension funding levels and investment performance outlined above. The coefficient estimates for each of three equations used in the empirical model are reported side-by-side to assist in the comparison of covariate effect on actuarial funding ratio (AFR), annual required contribution paid (ARCPAID) and investment rate of return (ROR).

Quite importantly, these regression results indicate that there is a large difference in both the magnitude and statistical significance of many coefficient estimates in the two estimations of equation 1. When the time lag of AFR is included in the model, this covariate is highly statistically significant and the $R^2$ for the regression is 0.89. Conforming to the hypothesis of ‘behavioral persistence’, a one percentage point increase in AFR for year $t-1$ is associated with a 0.90 percentage point increase for AFR in year $t$. In this first specification of equation 1, none of the other independent variables of interest, namely percent plan participants on board, percent new trustees on board or investment council, are statistically significant at conventional levels.
Under the second specification of equation 1, where $AFR$ for $t-1$ is dropped as a covariate, the other independent variables in the model are affected in noticeable ways. Supporting the inverse directional hypothesis for board composition, percent new trustees on the board is now statistically significant at the 5 percent level, with a 1 percentage point increase in new trustees associated with a 0.13 percent decrease in the funding ratio. Similarly, there is now a statistically significant estimate for investment councils, with a 3.17 percent increase in $AFR$ for pensions that have these councils. This positive performance differential for investment councils supports the corresponding hypothesis presented above. However, it should be noted that excluding $AFR$ as a covariate dramatically reduces the explanatory power of the regression, with $R^2$ dropping to 0.15. Also, in the second version of equation 1, there is a substantial increase in the size of many of the empirical estimates that cannot be strongly explained by analytical theory.

In the probit regression specified in equation 2, both board composition and investment council are reported as statistically significant. The coefficient estimate on board composition is substantively quite small, with a percentage point increase from the mean in plan participants on the board associated with a 0.004 percent decrease in the probability that a pension will pay 100 percent of $ARCPAID$. Interestingly, the coefficient on investment council indicates a negative marginal effect of -0.20 on the
probability a plan pays its full ARC. This inverse relationship between investment council and *ARCPAID* runs counter to expectations.

For equation 3, asset allocation and the time lagged actuarial funding ratio covariate drive much of the variation in investment rate of return. None of the governance variables of interest have a statistically significant impact on *ROR*. Conforming to expectations, a percentage point increase in the *AFR* for year $t-1$ is associated with 0.13 percent decrease in a pension fund’s *ROR* for year $t$. Pensions that invest over half of their assets in equities realize a 2.10 percent increase in *ROR* while plans investing more than a third of their resources in fixed assets typically experience a -3.88 percent decrease in *ROR*.

The occupational plan control variables used in the three regression equations produced a limited impact on performance. For the second estimation of equation 1, pensions that included at least some police officers and fire fighters in the plan were on average 3.20 percentage points better funded than pensions with no police or fire fighter plan participants. Similarly, plans that included at least some teachers had actuarial funding ratios that were on average 2.91 percentage points lower than plans that did not have any teacher participants. It should be noted that in alternative specifications of this model (not reported), a set of eight dummy variables was created to capture all the possible multi-occupational pension types. However, under this
previous model, only one of these dummy variables was statistically significant in any of the three regression equations.

Overall, the regression results in Table 3 present mixed evidence for the hypothesis that pension governance impacts plan performance. While board turnover and investment council both had the expected effect on actuarial funding ratio in the second estimation of equation 1, neither of these covariates significantly impacted investment rate of return in equation 3. Instead, behavioral persistence appears as a critical determinant of pension performance, with $AFR$ lag generating highly significant empirical estimates on both $AFR$ and $ROR$. 
Chapter 4. Conclusion

This study examined the key determinants of state and local public pension funding capacity and investment performance capacity. Using a sample of U.S. public retirement plans that combined data from the Public Fund Survey with new independently collected governance information, a three equation empirical model was specified with actuarial funding ratio (AFR), percent of actuarially required contributions paid (ARCPAID), and investment rate of return (ROR) selected as the corresponding outcome metrics. The specific covariates of interest that tested were board composition, board turnover, investment council and behavioral persistence.

The regression results reported here present mixed evidence for the impact of governance on pension performance. While the proportion of plan participants on the plan board was expected to have a negative impact on the three respective performance metrics, the effect was only statistically significant in the case of ARCPAID and even in this instance the coefficient estimate was noticeably small in magnitude. Similarly, InvestmentCouncil only generated a performance differential on AFR and ARCPAID, and in the case of ARCPAID the coefficient was not of the expected sign. For board turnover rate, the empirical estimate had a negative and significant relationship with AFR, but only when the AFR time lag was excluded as a covariate in the regression equation. When this time lag variable was included in the model, the coefficient
estimate had a highly significant effect on $AFR$, which lends strong empirical support to the behavioral persistence hypothesis that pensions tend to replicate funding practices from year to year. Finally, none of the governance factors of interest significantly impacted $ROR$. Instead, asset allocation proved to be a critical determinant driving pension investment returns.

The primary policy implication of these empirical results is that pension administrators and state and local governments should focus on behavioral persistence and asset allocation when deliberating ways to improve pension investment performance and funding practices. While it seems logical that public officials should pay attention to the level of turnover on a plan board, the limited empirical support provided in this study for the impact of board turnover suggests that management attention is better spent looking at other administrative issues. Additionally, for public fund administrators and state officials grappling with whether to add an investment council to the pension governance structure, the findings in this paper provide only limited support for council performance differentials.

Although behavioral persistence is likely a critical factor affecting pension funding levels, it remains unclear which specific governance practices provide the consistent leadership that yields strong performance results. Consequently, in the end, this study reveals that while governance factors might have a limited effect on pension
funding and investment returns, more empirical research is needed on the topic of pension behavioral persistence if a comprehensive understanding of public plan performance is to be reached.
References


Orszag, Peter R. The Effects of Recent Turmoil in Financial Markets on Retirement Security, Testimony Before the Committee on Education and Labor, United States House of Representatives. Congressional Budget Office.


Appendix

Online Resources for Public Pension Comprehensive Annual Financial Reports

The governance data collected for this study on board composition, board turnover and investment councils was acquired primarily through a comprehensive examination of public pension comprehensive annual financial reports (CAFRs). As described in the Data Methods section, this collected governance data was then merged to the Public Fund Survey. Since many of these CAFRs are available online, the following list should serve as a useful resource for researchers interested in pursuing new areas of public pension empirical research.

Alabama ERS / Alabama Teachers
http://www.rsa-al.gov/About%20RSA/about-rsa.html

Alaska PERS
http://www.state.ak.us/local/akpages/ADMIN/drb/pers/perscafr.shtml

Alaska Teachers
http://www.state.ak.us/local/akpages/ADMIN/drb/trs/trscafr.shtml

Arizona Public Safety Personnel
http://www.psprs.com/sys_psprs/AnnualReports/cato_annual_rpts_psprs.htm

Arizona SRS
http://www.azasrs.gov/web/AboutUs.do

Arkansas PERS
http://www.apers.org/annualreport_p1.html
Arkansas Teachers
http://artrs.gov/index.php?option=com_content&task=view&id=121&Itemid=1_05

California PERF
https://www.calpers.ca.gov/msspub/SearchController?viewcategory=action&PagId=SearchCatalog&category_code=8&subcategory_code=58

California Teachers

Chicago Teachers
http://www.ctpf.org/general_info/financial.htm

City of Austin ERS
http://www.coaers.org/publications.html

Colorado Municipal / Colorado School / Colorado State
https://www.copera.org/pera/tools/reports.stm

Connecticut SERS
No Link Available

Connecticut Teachers

Contra Costa County
http://www.cccera.org/publications.html

DC Police & Fire / DC Teachers
CAFRs Supplied directly by DC Retirement Board

Delaware State Employees
http://www.delawarepensions.com/information/annual_financial_reports.shtml

Denver Employees
http://www.derp.org/pub_list.asp

Denver Schools
http://www.dpsrs.org/FormsAndDocuments/FinancialAndPlanning.aspx
Duluth Teachers
http://www.dtrfa.org/

Fairfax County Schools
No Link Available

Florida RS
No Link Available

Georgia ERS
http://www.ersga.org/forms.htm

Georgia Teachers

Hawaii ERS
http://www4.hawaii.gov/ers/Financials.htm

Houston Firefighters
No Link Available

Idaho PERS
http://www.persi.idaho.gov/search.cfm?qt=report

Illinois Municipal
http://www.imrf.org/pubs/annual_reports/annual_rpts.htm

Illinois SERS
http://www.state.il.us/srs/sers/annreports_sers.htm

Illinois Teachers
http://trs.illinois.gov/subsections/pubs/cafr/cafr07.htm

Illinois Universities
http://www.surs.com/shepherd.surs?flk=Invst&shp=79

Indiana PERF
http://www.in.gov/perf/2376.htm

Indiana Teachers
http://www.in.gov/trf/2330.htm
Iowa PERS
http://www.ipers.org/publications/archives.html

Kansas PERS
http://www.kpers.org/publications.htm

Kentucky County
No Link Available

Kentucky ERS
http://www.kyret.com/annrpts/annidx.htm

Kentucky Teachers
http://ktrs.ky.gov/05_publications/index.htm

LA County ERS

Louisiana SERS
http://www.lasers.state.la.us/Publications_and_Reports/annual_reports_and_financial_statements.asp

Louisiana Teachers

Maine Local
No Link Available

Maine State and Teacher
http://www.mainepers.org/Publications/Publications.htm

Maryland PERS / Maryland Teachers
http://www.sra.state.md.us/cafreports.htm

Massachusetts SERS
No Link Available

Massachusetts Teachers
No Link Available

Michigan Municipal

Michigan Public Schools
http://www.michigan.gov/orsschools/0,1607,7-206-36585-117850--.00.html

Michigan SERS
http://www.michigan.gov/orssatedb/0,1607,7-208-33747-109600--.00.html

Minneapolis ERF
CAFRs Supplied directly by Minneapolis ERF

Minnesota PERF

Minnesota State Employees
http://www.msrs.state.mn.us/info/fincl.htmls

Minnesota Teachers
http://www.tra.state.mn.us/FORMSPUB/Newpublications.htm

Mississippi PERS
http://www.pers.state.ms.us/financials/annualfinancialreport.html

Missouri DOT and Highway Patrol
CAFRs supplied directly by Missouri DOT and Highway Patrol

Missouri Local
CAFRs supplied directly by Missouri Local

Missouri PEERS
http://www.prs-peers.org/PEERS/PastIssues-CAFR.htm

Missouri State Employees
http://www.mosers.org/about/annu_report_previous.asp

Missouri Teachers
No Link Available

Montana PERS
http://mpera.mt.gov/annualReports.asp
Montana Teachers
http://www.trs.doa.state.mt.us/Publications/AnnualReports/AnnualReports.asp

NY State & Local ERS / NY State & Local Police & Fire
http://www.osc.state.ny.us/pension/cafir.htm

Nebraska Schools
http://www.npers.ne.gov/public/howto/publications/

Nevada Police Officer and Firefighter / Nevada Regular Employees
http://www.nvpers.org/public/beneProgs/beneProgs.jsp

New Hampshire Retirement System
http://www.nhrs.org/Investments/Reports.aspx

New Jersey PERS / New Jersey Police & Fire
http://www.state.nj.us/treasury/pensions/pubslist.htm

New Jersey Teachers
http://www.state.nj.us/treasury/pensions/annrprts.htm

New Mexico PERF
http://www.pera.state.nm.us/financial.htm

New Mexico Teachers
http://www.nmerb.org/annualreports.htm

New York City ERS
http://www.nycers.org/(S(tjvbyr55o4xl0b45dsbcin55))/About/CAFR.aspx

New York City Teachers
No Link Available

New York State Teachers
http://www.nystrs.org/main/library/annual-report.htm

North Carolina Local Government
No Link Available

North Carolina Teachers and State Employees
North Dakota PERS

North Dakota Teachers
http://www.nd.gov/rio/SIB/Publications/CAFR/default.htm

Ohio PERS
https://www.opers.org/investments/cafr.shtml

Ohio Police & Fire

Ohio School Employees

Ohio Teachers
http://www.strsoh.org/about/8.html

Oklahoma PERS
http://www.opers.ok.gov/archived-publications

Oklahoma Teachers
http://www.ok.gov/TRS/Publications/

Oregon PERS
http://oregon.gov/PERS/section/financial_reports/financials.shtml

Pennsylvania School Employees
http://www.psers.state.pa.us/publications/cafr/index.htm

Pennsylvania State ERS
http://www.sers.state.pa.us/sers/taxonomy/sers_taxonomy.asp?DLN=2654

Phoenix ERS
http://www.ci.phoenix.az.us/AGENCY/PHXCOPER/gcmenu.html

Rhode Island ERS
http://www.ersri.org/public/howto/publications/
Rhode Island Municipal  
*No Link Available*

San Diego County  

San Francisco City & County  
[http://www.sfgov.org/site/sfers_index.asp?id=26861](http://www.sfgov.org/site/sfers_index.asp?id=26861)

South Carolina Police  

South Carolina RS  

South Dakota PERS  

St. Louis School Employees  

St. Paul Teachers  
[http://www.sptrfa.org/general/annual.htm](http://www.sptrfa.org/general/annual.htm)

TN Political Subdivisions  
*No Link Available*

TN State and Teachers  
*No Link Available*

Texas County & District  

Texas ERS / Texas LECOS  

Texas Municipal  
[http://www.tmrs.org/publications.php#investments](http://www.tmrs.org/publications.php#investments)

Texas Teachers  
Utah Noncontributory

Vermont State Employees

Vermont Teachers

Virginia Retirement System
http://www.varetire.org/Members/Publications/Index.asp?ftype=annualreport

Washington LEOFF Plan 1
No Link Available

Washington LEOFF Plan 2
No Link Available

Washington PERS 1
No Link Available

Washington PERS 2/3
No Link Available

Washington School Employees Plan 2/3
No Link Available

Washington Teachers Plan 1 & 2/3
No Link Available

West Virginia PERS / West Virginia Teachers
http://www.wvretirement.com/Publications.html

Wisconsin Retirement System
http://etf.wi.gov/publications.htm

Wyoming Public Employees
http://retirement.state.wy.us/ret1.htm#Admin
Table 1. Expected Signs For Covariates

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>( AFR_t )</th>
<th>( ARCPAID_{t+1} )</th>
<th>( ROR_t )</th>
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<tbody>
<tr>
<td></td>
<td>Equation 1</td>
<td>Equation 2</td>
<td>Equation 3</td>
</tr>
<tr>
<td><strong>Explanatory Variables</strong></td>
<td></td>
<td></td>
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<tr>
<td>BoardComposition(_t)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>BoardTurnover(_t)</td>
<td>–</td>
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<td>–</td>
</tr>
<tr>
<td>InvestmentCouncil(_t)</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>( AFR_{t-1} )</td>
<td>+</td>
<td>NA</td>
<td>–</td>
</tr>
<tr>
<td>( AFR_t )</td>
<td>NA</td>
<td>+</td>
<td>NA</td>
</tr>
<tr>
<td>( ROR_t )</td>
<td>+</td>
<td>+</td>
<td>NA</td>
</tr>
<tr>
<td>AssetAllocation(_t)</td>
<td>NA</td>
<td>NA</td>
<td>+/- –</td>
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Table 2. Summary Statistics of Explanatory and Dependent Variables, 2001-2007 Pooled Sample

<table>
<thead>
<tr>
<th></th>
<th>Equation 1</th>
<th>Equation 2</th>
<th>Equation 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AFR&lt;sub&gt;t&lt;/sub&gt;</td>
<td>W/out AFR&lt;sub&gt;t&lt;/sub&gt;</td>
<td>AFRPAID&lt;sub&gt;t+1&lt;/sub&gt;</td>
</tr>
<tr>
<td>Explanatory Variables</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>% Plan Participants on Board</td>
<td>56.89</td>
<td>24.39</td>
<td>56.91</td>
</tr>
<tr>
<td>% New Trustees on Board</td>
<td>17.78</td>
<td>18.11</td>
<td>17.88</td>
</tr>
<tr>
<td>Investment Council</td>
<td>36.76</td>
<td>48.28</td>
<td>36.50</td>
</tr>
<tr>
<td>Actuarial Funding Ratio&lt;sub&gt;t&lt;/sub&gt;</td>
<td>87.87</td>
<td>14.80</td>
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</tr>
<tr>
<td>Over 50% of Assets in Equities</td>
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<td>----</td>
<td>----</td>
</tr>
<tr>
<td>Over 33% of Assets in Fixed</td>
<td>----</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>Amortization Period</td>
<td>----</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>Natural Log of Plan Assets</td>
<td>16.18</td>
<td>1.19</td>
<td>16.18</td>
</tr>
<tr>
<td>Police/Fire in plan</td>
<td>40.10</td>
<td>49.07</td>
<td>39.50</td>
</tr>
<tr>
<td>Teachers in plan</td>
<td>44.22</td>
<td>49.73</td>
<td>45.00</td>
</tr>
<tr>
<td>Dependent Variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actuarial Funding Ratio&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>85.68</td>
<td>13.95</td>
<td>85.89</td>
</tr>
<tr>
<td>ARC Paid&lt;sub&gt;t+1&lt;/sub&gt;</td>
<td>----</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>% 1yr Investment ROR&lt;sub&gt;t&lt;/sub&gt;</td>
<td>9.72</td>
<td>7.51</td>
<td>9.41</td>
</tr>
<tr>
<td>Number of Observations&lt;sup&gt;b&lt;/sup&gt;</td>
<td>389</td>
<td>400</td>
<td>210</td>
</tr>
</tbody>
</table>

Source: Public Fund Survey and author's data collection

Notes: * ARC Paid<sub>t+1</sub> is a dummy variable that represents the portion of plans that are fully funded.

<sup>b</sup> Each equation uses a different subset of the total number of sample observations.
### Table 3. Regression Results, 2001-2007 Pooled Sample

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>Equation 1 (AFR)</th>
<th>Equation 2 ARCPAID</th>
<th>Equation 3 (ROR)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>With AFR, W/out AFR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Plan Participants on Board</td>
<td>-0.02 (0.01)</td>
<td>0.02 (0.03)</td>
<td>-0.004** (0.00)</td>
</tr>
<tr>
<td>% New Trustees on Board</td>
<td>-0.01 (0.01)</td>
<td>-0.13** (0.04)</td>
<td>-0.001 (0.00)</td>
</tr>
<tr>
<td>Investment Council</td>
<td>0.24 (0.49)</td>
<td>3.17** (1.36)</td>
<td>-0.20** (0.08)</td>
</tr>
<tr>
<td>Actuarial Funding Ratio&lt;sub&gt;-1&lt;/sub&gt;</td>
<td>0.90** (0.02)</td>
<td>----</td>
<td>0.003 (0.00)</td>
</tr>
<tr>
<td>% 1 yr Investment ROR</td>
<td>0.11** (0.03)</td>
<td>-0.37** (0.08)</td>
<td>-0.01 (0.01)</td>
</tr>
<tr>
<td>Over 50% of Assets in Equities</td>
<td>----</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>Over 33% of Assets in Fixed</td>
<td>----</td>
<td>----</td>
<td>2.10* (1.14)</td>
</tr>
<tr>
<td>Amortization Period</td>
<td>----</td>
<td>----</td>
<td>-3.88** (0.90)</td>
</tr>
<tr>
<td>Natural Log of Plan Assets</td>
<td>0.07 (0.22)</td>
<td>2.57** (0.59)</td>
<td>-0.03 (0.01)</td>
</tr>
<tr>
<td>Police/Fire in plan&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.54 (0.57)</td>
<td>3.20** (1.58)</td>
<td>0.18** (0.09)</td>
</tr>
<tr>
<td>Teachers in plan&lt;sup&gt;d&lt;/sup&gt;</td>
<td>0.04 (0.59)</td>
<td>-2.91* (1.63)</td>
<td>0.12 (0.09)</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>389</td>
<td>400</td>
<td>210</td>
</tr>
<tr>
<td>R&lt;sup&gt;2&lt;/sup&gt;</td>
<td>0.89</td>
<td>0.15</td>
<td>0.22&lt;sub&gt;b&lt;/sub&gt;</td>
</tr>
</tbody>
</table>

Source: Public Fund Survey and author’s data collection

Notes: *Significant at 10% level
**Significant at 5% level

<sup>a</sup> Equation 2 is specified as a probit regression. For continuous variables, the marginal effect is a one-unit change from the mean. For dummy variables, the marginal effect is a change from 0 to 1.

<sup>b</sup> This is a Pseudo R<sup>2</sup> value

<sup>c</sup> Many pension plans in the sample represent multiple occupations. This variable is coded as ‘1’ if teacher is at least one of the occupations covered.

<sup>d</sup> Coded as ‘1’ if police officers or firefighters are at least one of the occupations represented by the pension.