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PUBLIC PENSION GOVERNANCE AND ASSET ALLOCATION

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Abstract:

This paper analyses the relationship between governance, asset allocation, and risk among state and local government-operated pension systems in the United States. It is argued that governance influences investment decisions and risk profiles of public sector pension systems, creating the potential for agency problems to exist between decision makers, plan members, and taxpayers.

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Public Pension Governance and Asset Allocation

As the American 'Baby Boomer' generation has drawn closer to retirement, the issue of retirement benefits and pensions has increased dramatically in importance in American political discourse. As early as the late 1990s, over a decade before the first of the Baby Boomers would reach the age of sixty-five, potential Social Security disasters started to become apparent. However, while Social Security is the largest source of retirement income among Americans, the majority of the retirement income of a typical American comes from one or more of three sources: Social Security, pension benefits, and private savings. To date, the issue of the solvency of the Social Security system is at the forefront of the public debate, public pensions at the state and local level are often overlooked in the public discussion of retirement incomes. This is an unfortunate oversight, as public pension funds hold considerable liabilities owing to a large number of Americans and many of these public systems find themselves in unenviable financial situations. Moreover, many of the individuals who are members of public pension systems are not eligible for Social Security benefits, implying that the general health of these public pension systems are of great import to their post-retirement plans.

State and local pension funds held assets that exceeded 2.7 trillion dollars at the end of the second quarter of 2006 (of Governors of the Federal Reserve System Board, 2006). There are approximately 20.5 million individuals covered in these programs: 5.3 million retirees/beneficiaries, 12.8 million current employees, and 2.4 million inactive members (Olivia S. Mitchell et al., 2001). The absolute size of these funds in terms of assets and members implies that even small improvements in the administration and investment performance of these programs could result in significant gains in retirement income for millions of individuals in the United States.

Because the majority of public pension plans are defined benefit (DB) plans, it is possible for pension liabilities to exceed pension assets. Before the bear market in 2001, the aggregated funding ratio (the ratio of assets to liabilities) across the major public pension systems was nearly 106%. However, as of year-end 2002, the combined funding ratio of state and local pension plans had dropped to approximately 91%, implying approximately $200 billion in unfunded liabilities. These aggregate numbers mask the wide variation among systems. Wilshire Associates compiled a dataset including 123 public pension systems (accounting for about 80% of the market value of public retirement funds), and found that the combined pension systems of only nine states had funding ratios above 100%. In contrast, the median state funding ratio was 83%, with fifteen states below 80% (Stephen L. Nesbitt, 2003), and there may be reason to believe these figures are optimistic.[1] Should investment returns not be sufficient to pay for future pension liabilities, the shortfalls will likely become a liability to future taxpayers.

Most of the previous papers analyzing the investment behaviour of public pension funds in the United States (William G. Albrecht and Vineeta Lokhande Hingorani, 2004, Michael Useem and David Hess, 2001, Michael Useem and Olivia S. Mitchell, 2000) have looked at the relationship between governance structure and measures of overall pension fund performance, typically real rates of return. Useem and Mitchell and Useem and Hess looked primarily for a direct link between asset

[1] The eight states with funding ratios above 100% were Wisconsin (126%), North Carolina (116%), Georgia (111%), Arizona (109%), Florida (104%), New York (102%), California (102%), Pennsylvania (102%), and South Dakota (101%). The fifteen states with funding ratios below 80% were Maryland (78%), Oregon (76%), Massachusetts (76%), Kansas (76%), Montana (75%), New Hampshire (74%), Connecticut (73%), Nevada (72%), Maine (72%), Rhode Island (70%), Mississippi (70%), Indiana (67%), Louisiana (65%), Oklahoma (56%), Illinios (54%), and West Virginia (45%). Some caution should be taken, however, in interpreting these results, as the date of the actuarial valuation used varies among states. The most recent actuarial valuations of those states with higher funding ratios tend to be before the bear market.

allocation and returns and found that measures of system governance have limited explanatory power and are generally insignificant in models that control for asset allocation. Perhaps not surprisingly, they find that asset allocation is the primary determinant of fund performance. Albrecht and Hingorani expanded upon these models, looking not only at the direct effect of governance on rates of return, but also at the indirect effect, through asset allocation. This paper builds on the work by Albrecht and Hingorani in a number of important ways. First, we narrow our focus to look exclusively at the link between governance, particularly board composition, and asset allocation. This allows us to examine the effect of this element of governance on a much larger set of asset allocation variables than have been examined in previous papers. Additionally, the paper improves on prior empirical work in this area, which has typically used cross-sectional data, by using an expanded panel dataset that includes data for 1994, 1996, 1998, and 2000.

Pension Governance and Data

All of the pension plan and pension system data come from the biennial survey administered by the Public Pension Coordinating Council (PPCC) (Paul Zorn, 1996, 1998, 2000, 2002). The PPCC is sponsored by the National Association of State Retirement Administrators, the National Conference on Public Employee Retirement Systems, and the National Council on Teacher Retirement. Each of these groups is interested in improving government sponsored pension programs in the United States, and the data from the survey are collected and synthesized into a report that outlines broad trends in public pensions and gives general summary statistics. Between 1995 and 2001, the survey was administered in the odd-years, asking for data about the prior year. For example, the 1995 survey reports data from 1994, and was published in 1996. Unfortunately, the survey underwent some revisions between

each of the four collection years. Between 1995 and 1997, the survey was only slightly modified, and all of the variables used in this study appear in both years. Between 1997 and 1999, the survey was shortened slightly, however for the 2001 survey the survey was changed substantially and many questions were omitted. Two of the governance variables we will examine were included in the 1995, 1997, and 1999 surveys but were dropped in 2001. The availability of each variable will be discussed below.

Despite undergoing constant revision, the survey remained consistent in its overall structure. The survey was broken into three sections: system, defined benefit (DB) plan, and defined contribution (DC) plan. A pension system is an organization charged with the responsibility of administering one or more pension plans. A pension plan is the actual program by which employees are provided either annuities or a lump sum payment upon retirement on the basis of any contributions made during their working years. Many systems administered more than one plan during this time period, and a few systems administered both DB and DC plans at the same time. For example, while PERS of Mississippi administered only one DB plan, the Minnesota State Retirement System administered six DB plans, and the State Universities Retirement System of Illinois administered two plans, one DB and one DC. We follow the custom within this literature to only consider systems that exclusively administer DB plans in our estimations, despite the fact that DC trustees are still able to exert considerable control over the assets held by the pension system.[2]

[2] Participants in DC systems are not typically given free reign over the investment of their individual balances, but rather are given a menu of investment styles over which to choose, and trustees are able to determine what assets constitute the items on the menu.

The system level survey includes most of the questions on governance and investment performance. The plan level surveys take a more detailed look at each individual plan, including membership, funding ratios, and benefit formulas.

Table 1 examines in detail the distribution of asset allocation among ten asset classes. Each variable measures the percentage of total assets held in that asset class. Five broad asset classes are considered: total equities, total bonds, cash and short term, alternate investments, and real estate equity. In addition, equities are further broken out into two sub-classes, domestic equity and international equity. Finally, fixed income investment is broken out into three sub-classes: domestic bonds, international bonds, and domestic government bonds. Except for domestic government bonds, data for each of these variables were collected in all four survey years. Data on domestic government bonds were collected only in the first three survey years.

[Table 1]

Thirteen independent variables are selected from the PPCC data. Of these thirteen variables, five are related to board composition, five are measures of formal external controls, and three are control variables. The governance variables pertaining to board composition are *active, retired, exofficio, appointed,* and *boardsize*. The first two examine the relationship between board membership and system membership. The percentage of the governing board that are active members of the retirement system is measured by *active,* and *retired* measures the percentage who are retired members of the retirement system. The percentage of the governing board that are non-members is omitted to prevent collinearity with the intercept term. The variables *exofficio* and *appointed* measure the percentage of the board that are *ex officio* members and appointed members, respectively. The percentage of the board

that is elected by system members is again omitted to prevent collinearity with the intercept term. The final board composition measure, *boardsize*, is the natural log of the total number of board members. All of these variables were collected in 1995, 1997, and 1999, while only *exofficio, appointed*, and *boardsize* were collected in 2001.

The other five governance variables measure the extent to which the board is subject to external controls. All of these variables are indicator variables and were included in each of the four surveys. The existence of state constitutional provisions that regulate the pension statement is given by *constitution*. For example, until 1996, the West Virginia constitution outlawed all equity investments, and many state constitutions place caps on the percentage of system assets that can be held in equity investments. Whether or not the system is forced to submit to an independent performance audit is measured by *evaluation*, and *prudent* indicates whether there is a prudent person investment restriction in place. Some states have passed laws delineating written ethics standards and policy guidelines, which are recorded as *policy*. Finally, some states have established lists of securities in which systems are either forced, or strongly incentivized, to invest; the existence of state legal lists is coded as *list*.

The final three variables are used to control for underlying plan characteristics that may have an influence on board investment behavior. Two variables are selected to control for underlying demographic factors that might influence the portfolio selected: the average income of currently active system members is coded as *income*, and the percentage of total system members who are retired is coded as *pctretired*. It is also possible that larger pension systems may have an advantage in being able to

diversify more extensively than smaller systems, we control for this with the variable *assets*, which measures total system assets in billions of dollars.

Conventional wisdom states that the first two variables in the set of governance variables, active system members as a percentage of the governing board and retired system members as a percentage of the governing board, should reveal systems moving their investments out of risky assets and into relatively safe assets. We hypothesize, however, that that the exact opposite will occur within public pension systems; boards that are dominated by active system members should tend to move out of equity and into relatively safe domestic bonds, while in contrast, boards that are dominated by retired members on the board of trustees should seek to increase investment in riskier asset classes (for example, venture capital and international equity).

Typically, members of defined benefit plans receive an annuity upon retirement, the annual value of which is usually determined by a complicated formula that varies among systems and incorporates the employee's final average salary and years of service. This annuity either terminates or, if the employee has a surviving spouse, is diminished upon death. One effect this may have is that any investment or risk preferences based on a bequest motive will either be reduced or eliminated, effectively shortening the time horizon of plan members. While this is true of all members, the time horizons of older and retired members will likely be shortened more than those of younger, active members.

On its own, a shorter time horizon (or a larger discount rate) would not necessarily prompt retired members to prefer riskier portfolios than active members. In fact, experimental results have shown that higher degrees of risk aversion are correlated with shorter time horizons (Vital Anderhub et al., 2001), implying that if

anything, retired members should prefer safer portfolios than active members. However, this will not be the case if the elected political actors (or their agents) who have influence over either benefits or contribution rates have short time horizons as well. A simple framework is offered to explore this hypothesis.

In the private sector, the Employee Retirement Income Security Act of 1974 (ERISA) mandates that all private pension systems be fully funded at all times. As noted above, this is not true of the public sector, where many pension systems have funding ratios well below 100%. However, in the long run, pension assets must equal pension liabilities for public retirement systems as well. Any shortfall in investment return must be met by an increase in contribution rates, a reduction in benefit, or an increase in general taxation. A windfall in investment return must be met by a wage hike, increase in benefits, or a decrease in general taxation. If political leaders are myopic, they will have a strong incentive to postpone their reaction to investment shortfalls, as wage cuts, tax increase, and benefits reductions are politically unpopular. As an example of this phenomenon, Eaton and Nofsinger (2004) have found that poorly performing public pension systems tend to manipulate their actuarial assumptions to make their retirement programs appear to be more fiscally sound than they actually are. Thus, rather than make the politically unpopular move of increasing taxes or reducing benefits, or look irresponsible for not fixing an ailing pension system, politicians would prefer to use "creative accounting" to make the pension system appear to be more solvent than it actually is. Their discovery of this tactic provides some evidence that politicians wish to delay the tax increases and/or benefits reductions necessitated by under-performing pension systems. On the other hand, myopic politicians will have a strong incentive to rush to react to investment windfalls, and tax reductions, wage hikes, and/or benefits increases to take advantage

of overfunding are policies that are likely to be pursued in the short run due to their political popularity.

These incentives imply that retired system members will receive most of the benefit from a high rate of return while bearing disproportionately little risk. One can draw an analogy between this argument and a standard public finance argument of loss offsets; if the government taxes profits without loss offsets, entrepreneurs will invest in fewer risky projects than they otherwise would. If the entrepreneur loses money, she bears the full cost, but if the entrepreneur earns a profit, she only receives part of the benefit. In the context of investment income for retired system members, losses are subsidized through intergenerational transfers, but benefits are fully realized by retired members, leading to retired members wanting to invest in more risky assets than they otherwise would.

Board size is expected to be a strong determinant of asset allocation choice as well. We predict that larger boards will tend to hold riskier portfolios, eschewing bonds in general, particularly domestic bonds, in favor of international investments. This result would be consistent with a wide variety of different literatures across the social sciences that associate group size with risks taken and/or performance in risky activities.

The theoretical framework for this phenomenon is provided by the literature in experimental psychology on group polarization and the "risky shift." In the 1960s and 1970s, psychologists began to take notice of a fairly persistent phenomenon: decisions made by groups tend to be significantly more risk preferring than the average risk position of the individuals within the group (see for example (Lawrence K. Hong, 1978). This phenomenon was termed the risky shift, and was a particular example of the general phenomenon known as group polarization. Group

polarization describes a situation in which an initial attitudinal predisposition, however small or large, by the individual members of the group is somehow exacerbated following group discussion. Within the context of the risky shift, for example, a group of individuals who have varying risk preferences will, upon being placed in a situation where the group can observe their risk-related decisions (or must make a group decision), endorse a position that is near the risk preference of the individual who prefers the most risk.[3] This mechanism implies that board risk preference will be increasing in board size, but at a decreasing rate: the likelihood of the marginal board member with a random risk preference to prefer a position riskier than any other board member is higher in a small board than in a large board. With this mechanism in mind, we use the natural log of the size of the board of investors to capture this effect.

While the present paper does not attempt to examine actual pension performance relative to the market, recent research in the experimental economics and finance literatures would imply that larger boards may in fact perform worse than smaller boards. In their working paper, Hayne and Cox (1997) examine performance in a winner's curse experiment among both individuals and groups, finding that groups perform less rationally than individuals; within the context of a common value auction, this implies that groups take on substantially more risk than individuals. Moreover, Yermack's (1996) analysis of the relationship between board size and market valuation in large U.S. corporations shows that board size is negatively

[3] It is of note that some experiments in this literature found the opposite conclusion—a "cautious shift" could result. Despite their seemingly contradictory nature, psychologists think of both the risky shift as examples of group polarization. Which one will occur is thought to be culturally dependent. For example, Hong (1978) argues that while American culture tends to exalt risk-taking behavior, Confucian cultural beliefs are such that cautiousness is applauded. Experimentally, he finds that individually, Taiwan Chinese and Americans are significantly different, with statistically significant risky-shifting by Americans and cautious-shifting by Taiwan Chinese. The data in this paper point to the risky shift as being the relevant type of group polarization present.

correlated with Tobin's Q. Hermalin and Weisbach (2003) survey the literature on boards of directors and state that the negative relationship between board size and the financial performance of firms is an "empirical regularity."

The final two variables looking at board composition are the percentage of the board that is either *ex officio* or appointed. These two variables are included to test whether or not board members who held their position by virtue of some political process have an impact on asset allocation. If trustees are pressed to make decisions with their political implications in mind, the greater the likelihood that investment and other decisions will not be wealth maximizing. Appointees are anticipated to be more likely to make decisions in this manner, as they simply hold their position by the grace of some elected official, whereas *ex officio* members are on the committee on their own virtue and face electoral constraints that restrains their ability to make non-wealth maximizing decisions. Typically, these decisions come in the form of economically targeted investments.

Economically targeted investments, or ETIs, are investments that are made based upon criteria other than the standard risk-return criterion. For example, in the early 1980s many public pension funds made large sacrifices to returns in the name of increased home-ownership by subsidizing high-risk home mortgages for low-income borrowers (Alicia H. Munnell, 1983). The primary argument for ETIs comes from Watson (1994), who argues that, if capital markets are inefficient, there must be some worthy projects that do not get funded. If these worthy projects can be identified, and furthermore determined to have some measurable corollary benefit to the plan participants (e.g., increased incomes or employment opportunities for plan members), then they are good candidates for targeted investing. Despite the adverse selection problem that obviously arises, making it very difficult for investors to select the

worthy project from the lemons (John R. Nofsinger, 1998),[4] ETIs are often used as justification for the *de facto* funneling of the assets of public pension funds into the state coffers to finance social investments, shore up budget deficits, encourage home-ownership by low-income households, or even engage in public works projects. Previous empirical research has shown that ETIs tend to reduce risk-weighted returns (Olivia S. Mitchell and Ping-Lung Hsin, 1997, Alicia H. Munnell, 1983, John R. Nofsinger, 1998).

It is unlikely that the approach taken in this paper would be able to identify any significant ETI activity. While we attempt to explain variation among broad asset classes, it is likely that ETIs are accomplished by targeting specific assets within an asset class rather than by favoring one asset class over another. For example, rather than simply purchasing more government bonds, a system could target its investments by underdiversifying within this asset class, purchasing disproportionately many local and state bonds from their jurisdictional sponsors.

It should be noted that the hypotheses laid out for each of the five board composition variables are fundamentally related to the riskiness of the overall portfolio held by the pension systems. While we anticipate that they will hold a greater proportion of their portfolio in riskier asset classes, doing so does not necessarily imply that their portfolio is in fact riskier, in fact it could imply less risk; if the correlation between the relatively riskier asset classes and the relatively safer asset classes is less than one, holding the riskier assets will reduce the overall risk

[4] Nofsinger (1998) argues that, even with inefficient capital markets, it is unlikely that fund managers can identify these opportunities because of the lemons problem. It is not evident whether a potential investment project is one that should have gone unfunded or not, and given that capital markets are considered to be very efficient, there will only be a few "good" projects that receive too little investment. This implies that fund managers attempting to make economically targeted investments must choose from a set that includes a large number of bad projects and a small number of good projects.

associated with the portfolio. We will empirically address the issue of risk directly in the next section.

The five political restriction variables can be broadly interpreted as examining the impact of the regulatory framework within which the systems operate. Each of the five variables look at various types of regulations that are ostensibly designed to provide protections to plan participants (and by extension, taxpayers), preventing trustees from acting imprudently in carrying out their fiduciary duties.

Legal lists originated in England in the eighteenth century as a list of assets for which, if they earned poor or negative returns, a trustee could not be held liable. These lists typically only included government bonds. Not surprisingly, cautious trustees generally concentrated their investments in these relatively safe assets. In the early eighteenth century the legal list evolved into the prudent person rule, a new standard that freed trustees to select any portfolio that, *ex ante*, would be selected by a prudent investor (Rachlinksi 2000). Often these investment restrictions are enacted at the constitutional level; historically state constitutions have limited equity investments through means ranging from the complete prohibition of all equity investments to equity caps to banning certain types of assets. Many systems subject the investment decisions made by the board to external performance evaluators. Finally, some systems have adopted written ethics standards or policy guidelines that create a degree of transparency in investment decisions—should the board not live up to these standards or guidelines, members and beneficiaries are given recourse. Although these regulations are justifiable in terms of helping resolve the principal-agent problem that exists between trustees and plan members, they could potentially provide a means through which policy makers external to the board of trustees can influence investment decisions.

While the preceding discussion of board composition and ETIs examines the incentives of board members, political decision makers outside the board of trustees are often capable of influencing investment decisions through external political restrictions and regulations that constrain board members. State legal lists could be used to resolve the principal-agent dilemma, but it is also plausible that they could be a means by which states coerce the plans they sponsor to invest only in state approved assets. Systems subject to such legal lists are expected to exhibit a strong tendency to invest much less in international equity and hold more domestic (particularly government) bonds. The closely related prudent person restriction, on the other hand, is expected to have a negligible effect on investment decisions.

Constitutional investment restrictions have become increasingly uncommon in recent years. Whereas many state constitutions have historically contained clauses restricting the amount of equity investment systems are able to pursue, these caps have increased or disappeared since the early 1990s. We suspect that these restrictions are generally no longer binding, however if we had data stretching back into the late 1980s, this variable may have some explanatory power. Using a similar specification but restricting their analysis to only data from 1992, Useem and Mitchell (2000) find just that: the relationship between equity investment and constitutional investment restrictions and found that the effect was negative and significant at the 1% level.

Finally, both independent performance evaluations and the existence of written ethics standards or policy guidelines are expected to have wide ranging effects on investments if there is agency problem stemming from asymmetric information between the trustees and plan participants, causing moral hazard. One hypothesis as to why this might occur is that the existence of independent evaluations and

guidelines help limit the liability of trustees. If trustees are risk averse, then they will be more likely to pursue risky investments when they feel protected from downside risk. Hence, an independent evaluation or standard is part of an optimal contract, as trustees will only pursue riskier strategies if they know the participants verify that bad years are a result of bad luck, not an imprudent investment decision. However, it could also be the case that evaluations and standards are binding constraints on any opportunistic actions of the trustees and serve as a monitoring device.

The variables described above are used to examine the relationship between governance factors and asset allocation. The models are estimated with a two-sided-Tobit specification as the dependent variables, the proportion of system assets allocated to specific asset classes, are naturally bounded by 0 and 100. Each model is estimated with system-level random effects and yearly fixed effects. Yearly fixed effects are included in each model because there is a clear trend of systems reallocating system assets from fixed income to equity investments over this time period. There are a number of reasons why this trend may emerge. For example, systems may have been attempting to take advantage of the bull market during the late 1990s, or they may not have been active in rebalancing their portfolios during this time. Including the yearly fixed effects allows the estimation of the effect of governance on asset allocation independent of these potential temporal trends. System-level random effects are chosen in favour of fixed effects because many of the governance variables are relatively time invariant within each system.[5]

[5] The robustness of these specifications are checked by estimating the models with pooled OLS and FGLS as well. The pooled OLS specification includes yearly fixed effects and system level clustering of standard errors; the FGLS estimation includes yearly fixed effects and system-level random effects. Hausman tests confirm the choice of random effects over fixed effects. The results are not reported but are generally consistent across specifications.

As stated above, the scope of the survey was reduced in the last two surveys, and data on active/retired board members was not collected in 2001, nor was data on government bond holdings. As a result, we report two sets of models. Our primary regressions use data from all four survey years, and a second set including data from just the 1995, 1997, and 1999 surveys to look at the effect of active and retired board members as well as the effect of all the governance variables on government bonds.

While the PPCC took great care to attempt to get high quality data, there are nevertheless some holes in the data. Some systems did not complete the survey in all four collection years, and others did not fully complete every question in the questionnaires. Unfortunately, we have little option but to drop the observations for which our variables of interest are missing and estimate the system with an unbalanced panel. This yields between 570 and 573 observations, including data from 246 systems, for the primary regressions and between 450 and 453 observations, including data from 237 systems, for the estimations that omit the 2001 survey data.

The general form of the regressions is:

Eq. 1 $$allocation\ class_{i,t} = \beta X_{i,t} + v_t + \mu_i + \varepsilon_{i,t}$$

In Equation 1, the dependent variables are each of the specific asset allocation class variables discussed in the previous section and $i = 1, 2, ..., 10$ for the ten different asset classes. The measures of pension governance and the control variables are contained in the matrix $X_{i,t}$. The term μ_i is a pension system specific error term. The year fixed effect is v_t and the error term is $\varepsilon_{i,t}$. The results from these regressions are reported in tables 2 through 5. The empirical results generally support most of the hypotheses laid out above.

[Table 2]

[Table 3]

[Table 4]

[Table 5]

While board composition with respect to appointees/*ex officio* membership has little effect (as predicted), we find that, relative to boards dominated by active system members, boards that are dominated by retired members on the board of trustees seek to increase investment in alternative investments and international equity. In addition, board size seems to be strongly correlated with both higher holdings of equities (domestic and international), alternate investments, and international bonds and lower holdings of domestic bonds. Both of these phenomena may in turn be indicative of the taking on of riskier portfolios, which will be examined in the next section.

The effects of both the constitutional and prudent person restrictions are found to be relatively insignificant. However, list restrictions have a strong effect in increasing bond holdings at the expense of equity holdings. The effect in the case of government bonds is very strong. Written investment policies have a weak effect on asset allocation, with their presence hinting at a likely increase in equity holdings, but independent performance evaluations have a very large effect on investment decisions. Systems subject to independent performance evaluations have a strong tendency to have much larger equity holdings, both in domestic and international equity, smaller bond holdings, and a greater portion of their bonds held in international bonds as opposed to domestic bonds.

Governance and Risk

Much of the foregoing analysis has argued that the effects of pension system governance on investment strategies may be indicative of governance having a

systematic effect on the riskiness of pension asset holdings. It is not necessarily the case, however, that systems with greater investments in relatively risky asset classes also bear more risk. While international securities on their own may be riskier than domestic ones, diversification of one's portfolio through the purchase of international securities would have the effect of reducing risk, not increasing it, so a more detailed analysis is necessary. In this section, we seek to address the question of risk directly.

The hypotheses as to how the board composition variables might affect risk were laid out above. Retired system members are anticipated to want riskier portfolios than active members, as the politicized nature of these pension systems could lead to intergenerational risk transfers. Larger boards are expected to hold riskier portfolios than smaller boards due to the psychological phenomenon of group polarization. Finally, if ETI activity is present, one predicts appointed membership to be associated with higher levels of risk relative to *ex officio* membership and elected membership.

While we have made a plausible case for why board composition might have an effect on portfolio risk, we do not feel that such a case can be made for the different types of investment restrictions. Prudent person laws, investment policy statements, and independent performance evaluations are designed for the purpose of reducing agency problems. However, the existence of agency problems would lead to these restrictions having an effect on risk-adjusted returns, not risk *per se*. And while constitutional and investment list restrictions may limit the classes of assets invested in, they do not put constraints on the riskiness of the portfolio chosen. Again, any effect these policies might have would be on risk-adjusted returns.

As acknowledged above, the potential to use risky asset classes to diversify one's portfolio makes their usage as indicators of portfolio risk problematic. To

address this, we will estimate the portfolio risk of each system using two methods, CAPM (Sharpe 1964) and asset class factor modeling, or style analysis (Sharpe 1988, 1992).

Financial models that estimate risk are typically estimated using at least four years of monthly data. Unfortunately, the PPCC survey did not collect monthly data, and is limited to yearly data between 1990 and 2000. We appreciate the difficulty of estimating financial models using only eleven observations, however, because these measures are being estimated for use as dependent variables, any errors-in-variables problems associated with their imprecision will simply inflate the standard errors of the second stage regressions. Thus, while the models explaining risk will be estimated with high error, so long as the measures of risk are estimated without bias, the estimated coefficients of the second stage regressions will be unbiased as well.

The CAPM model states that there is a linear relationship between risk and return and can be written as:

Eq. 2 $$\left(R_i - R_f\right) = \alpha + \left(R_m - R_f\right) + \varepsilon_i$$

In this model, the rate of return on portfolio *i* is given by R_i, R_f is the risk free rate of return, and R_m is the market rate of return. The estimated beta measures portfolio risk, alpha measures the extent to which the portfolio outperformed (or underperformed) the market, and the error term is often associated with luck. We estimate betas for each of the pension systems reporting 11 years of rate of return data using ordinary least squares, with the Wilshire 5000 as the market rate of return and the 30-day Treasury Bill rate as the risk free rate of return.

A style analysis model (Sharpe 1988, 1992) generally takes the form of:

Eq. 3 $$R_i = B_1F_1 + B_2F_2 + \cdots + B_nF_n + \varepsilon_i$$

where R_i denotes the return on asset *i* and F_j denotes the value of the *j*th factor. In this specification, each factor is the rate of return on a specific asset class. This method of analysis differs from a simple factor model in that it adds the following constraints:

Eq. 4 $$\sum_{j=1}^{n} \beta_{i,j} = 1$$

Eq. 5 $$0 \leq \beta_{i,j} \leq 1 \forall j$$

Because of data limitations, we restrict the number of factors to only two asset classes, the Wilshire 5000 and the Lehman Brothers Aggregate Bond index. This does, however, have the added benefit of simplifying the estimation process. To estimate a constrained regression of this type with inequality constraints, Sharpe (1987) and Markowitz (1987) have shown that one must estimate the model using quadratic programming. However, in the case that one estimates the model with only two factors, the estimation process can be simplified. If a regression model using only Equation 4 yields both estimated coefficients between 0 and 1, then Equation 5 is non-binding so the estimates from a regression using just the first constraint should be the same as a regression using both. If a model using only Equation 4 yields estimates that violate Equation 5, say $\beta_1 < 0$ and $\beta_2 > 1$, then the best fit for a regression satisfying both Equation 4 and Equation 5 should be $\beta_1 = 0$ and $\beta_2 = 1$. The estimated coefficients on the Wilshire 5000 rate of return are coded as the variable Estimated Style and are our second measure of portfolio risk.

We compute both risk estimates for each of the 67 systems in the PPCC dataset that reported rates of return for each year between 1990 and 2000. We use the same data governance data and controls as the previous section, however because the risk estimates do not vary within each system, we create a dataset of means by averaging the governance data over the available collection years. Finally, because

some of the systems did not respond to all of the governance questions, we drop those systems from the data and are left with 58 observations for our analysis.

We estimate the effect of board composition on risk by running regressions of the form $risk_i = \beta X_i + \varepsilon_i$ where X_i includes both the board composition variables and the same three control variables from before. Because the OLS estimates display heteroskedasticity, we account for this by estimating the equations using both weighted least squares and multiplicative heteroskedastic models. These results are reported in Table 6.

[Table 6]

Overall the results are reasonably strong, especially when one considers that the dependent variables are likely to have been measured with error. For the most part, the results are in line with the hypotheses above. While the *retired* coefficient is only significant at the 10% level in one of the estimations, this only signifies that retired members do not tend to behave differently from non-system members on the board. The relevant comparison is between retired and active board members, and the last row in the table shows the result of an F-test of the equality of the two coefficients. In all four specifications the *retired* coefficient is considerably higher than the *active* coefficient, and this difference is significant at the 10% level in three of the four specifications. The results also provide evidence that board size is positively correlated with portfolio risk. The results are statistically significant at the 10% level in one of the specifications and at the 5% level in two others.

The most puzzling result is the effect of *ex officio* membership on risk. We expected *ex officio* members to have less incentive to engage in ETIs than appointed members, which would lead to less risky portfolios, which is consistent with the estimates. An F-test (not reported) of the equality of the *exofficio* and *appointed*

variables is rejected at the 5% level in each regression. However, we would not have predicted that *ex officio* members would desire less risky portfolios than board members elected by system participants.

Conclusion

This paper makes four contributions to the literature on the governance of public pension systems. First, it qualifies prior assertions in the literature that asset allocation is the primary determinant of investment returns. We believe that governance has at least an indirect effect on investment performance by affecting these asset allocation decisions. Second, we have provided some evidence that pension board composition, in addition to influencing asset allocation, also may have an effect on portfolio risk as well. Third, this paper highlights many potentially fruitful avenues for further research by postulating multiple hypotheses to explain why governance has the effect it does. Finally, the results have a number of public policy implications that system participants and government sponsors alike can exploit to change the incentives of trustees.

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Table 1
Summary Statistics of Asset Allocation Variables

Variable	Mean	Variance	Min	25th Pctile	Median	75th Pctile	Max
Total Equity	48.31	481.296	0	42	56	63.2	99
Total Bonds	38.16	403.636	0	28.1	36.2	45.39	100
Alternate Investments	1.13	11.779	0	0	0	0	50.8
Cash & Short Term	4.23	79.720	0	0.1	2	5	100
Real Estate Equity	1.89	9.453	0	0	0	3.3	17.1
Domestic Equity	39.60	331.106	0	34.6	44.5	50.7	75.7
International Equity	6.82	49.455	0	0	5.5	12	49
Domestic Bonds	36.18	408.769	0	25.1	34	44	100
**Domestic Govt Bonds	14.06	403.618	0	0	0	25	100
International Bonds	2.07	20.882	0	0	0	3	61

This table contains summary statistics of the asset allocation variables used in this study. For all of the asset classes other than domestic government bonds, this includes data from 1994, 1996, 1998, and 2000. Unfortunately, the PPCC survey did not ask respondents for the percentage of their portfolios invested in domestic government bonds in 2000, so the data reported for this variable only includes data from 1994, 1996, and 1998.

Table 2

Broad Asset Classes—Large Sample

	Total Equity	Total Bonds	Alternate Investments	Cash	Real Estate Equity
appointed	**-3.684**	**-0.076**	**0.088**	**-0.653**	**-1.088**
	-1.115	*-0.025*	*0.044*	*-0.545*	*-0.728*
exofficio	**-0.757**	**1.824**	**-2.640**	**-2.605**	**0.796**
	-0.166	*0.459*	*-0.937*	*-1.512*	*0.368*
boardsize	**7.795*** **	**-7.599*** **	**2.790***	**0.938**	**1.612**
	3.242	*-3.368*	*1.882*	*1.081*	*1.484*
constitution	**-1.611**	**-0.199**	**-0.159**	**1.113**	**-1.342**
	-0.828	*-0.120*	*-0.113*	*1.553*	*-1.606*
evaluation	**9.494*** **	**-3.986** **	**0.972**	**-0.212**	**0.119**
	4.534	*-2.337*	*0.634*	*-0.274*	*0.120*
list	**-5.979*** **	**4.758*** **	**-1.565**	**0.552**	**-2.027** **
	-3.214	*3.041*	*-1.204*	*0.793*	*-2.466*
policy	**8.489***	**2.489**	**-5.246** **	**-0.789**	**2.606**
	1.927	*0.666*	*-2.305*	*-0.487*	*1.193*
prudent	**4.518***	**-0.220**	**-1.485**	**-0.235**	**-0.217**
	1.897	*-0.110*	*-0.880*	*-0.261*	*-0.204*
income	**0.018**	**-0.029** **	**0.005**	**0.009**	**0.006**
	1.027	*-2.061*	*0.443*	*1.300*	*0.953*
pctretired	**3.133**	**0.340**	**-3.878**	**-3.703** **	**1.191**
	0.774	*0.104*	*-1.270*	*-2.202*	*0.605*
assets	**0.104**	**-0.120** **	**0.082** **	**-0.002**	**0.040**
	1.587	*-2.111*	*2.394*	*-0.075*	*1.499*
Intercept	**14.194***	**61.468*** **	**-5.818**	**5.385** **	**-6.644***
	1.906	*9.314*	*-1.303*	*1.967*	*-1.827*
N	573	573	573	573	570

note: 0.01 - ***; 0.05 - **; 0.1 - *; z-statistics reported

This table uses data from 1994-2000 and shows the results from random effects Tobit estimation

Table 3

Narrow Equity/Bond Classes—Large Sample

	Domestic Equity	International Equity	Domestic Bonds	International Bonds
appointed	**-1.424**	**-3.445***	**1.041**	**-2.445**
	-0.479	*-1.787*	*0.337*	*-1.231*
exofficio	**0.516**	**-2.861**	**0.771**	**0.334**
	0.127	*-1.079*	*0.186*	*0.116*
boardsize	**4.302****	**5.168*****	**-10.461*****	**3.172****
	1.995	*3.647*	*-4.551*	*2.229*
constitution	**-1.002**	**-0.046**	**-0.171**	**-1.036**
	-0.577	*-0.039*	*-0.099*	*-0.764*
evaluation	**5.969*****	**5.679*****	**-6.033*****	**4.761*****
	3.250	*4.110*	*-3.357*	*2.846*
list	**-1.760**	**-4.775*****	**4.817*****	**-1.602**
	-1.062	*-4.223*	*2.941*	*-1.259*
policy	**7.826***	**-1.786**	**2.751**	**0.118**
	1.943	*-0.677*	*0.706*	*0.036*
prudent	**2.279**	**2.352**	**-1.813**	**3.365***
	1.074	*1.625*	*-0.866*	*1.930*
income	**0.003**	**0.003**	**-0.022**	**-0.011**
	0.176	*0.301*	*-1.481*	*-0.845*
pctretired	**4.529**	**-0.498**	**0.462**	**0.458**
	1.272	*-0.197*	*0.133*	*0.137*
assets	**0.012**	**0.072****	**-0.062**	**0.020**
	0.211	*1.973*	*-1.041*	*0.506*
Intercept	**17.725*****	**-11.258****	**66.525*****	**-13.664*****
	2.614	*-2.532*	*9.806*	*-2.690*
N	570	570	573	573

note: 0.01 - ***; 0.05 - **; 0.1 - *; z-statistics reported

This table uses data from 1994-2000 and shows the results from random effects Tobit estimation

Table 4

Broad Asset Classes—Small Sample

	Total Equity	Total Bonds	Alternate Investments	Cash	Real Estate Equity
active	**0.115**	**3.504**	**0.845**	**-0.947**	**1.760**
	0.029	*0.972*	*0.373*	*-0.658*	*1.012*
retired	**3.951**	**-1.671**	**9.168****	**-1.677**	**4.942**
	0.533	*-0.257*	*2.413*	*-0.623*	*1.610*
appointed	**-3.202**	**-1.897**	**2.070**	**-0.719**	**-0.866**
	-0.848	*-0.544*	*1.052*	*-0.532*	*-0.547*
exofficio	**-2.380**	**0.492**	**1.858**	**-3.446***	**0.254**
	-0.438	*0.097*	*0.618*	*-1.732*	*0.110*
boardsize	**8.998*****	**-9.991*****	**2.270***	**0.957**	**1.478**
	3.551	*-4.087*	*1.690*	*1.044*	*1.358*
constitution	**-2.309**	**0.702**	**-0.041**	**1.420***	**-0.863**
	-1.070	*0.384*	*-0.033*	*1.857*	*-0.971*
evaluation	**12.782*****	**-4.322****	**0.036**	**-0.399**	**0.885**
	5.242	*-2.154*	*0.025*	*-0.464*	*0.780*
list	**-6.542*****	**5.000*****	**-1.224**	**0.644**	**-1.536**
	-2.958	*2.597*	*-0.947*	*0.806*	*-1.616*
policy	**12.319****	**0.530**	**-6.561*****	**-1.019**	**2.637**
	2.484	*0.122*	*-2.984*	*-0.581*	*1.235*
prudent	**4.779***	**-0.156**	**-0.398**	**0.287**	**0.450**
	1.718	*-0.066*	*-0.241*	*0.286*	*0.376*
income	**4.898**	**-0.154**	**-5.604***	**-4.903*****	**1.867**
	0.996	*-0.040*	*-1.742*	*-2.580*	*0.870*
pctretired	**0.042**	**-0.036**	**-0.001**	**0.013**	**0.013**
	1.359	*-1.618*	*-0.035*	*1.066*	*1.211*
assets	**0.091**	**-0.076**	**0.067***	**-0.013**	**0.066****
	1.193	*-1.130*	*1.942*	*-0.480*	*2.295*
Intercept	**3.629**	**68.041*****	**-4.940**	**6.372****	**-9.413****
	0.417	*8.591*	*-1.046*	*2.027*	*-2.370*
N	453	453	453	453	450

note: 0.01 - ***; 0.05 - **; 0.1 - *; z-statistics reported

This table uses data from 1994-1998 and shows the results from random effects Tobit estimation

Table 5

Narrow Equity/Bond Classes—Small Sample

	Domestic Equity	International Equity	Domestic Bonds	International Bonds	Government Bonds
active	**-0.095**	**0.927**	**5.861**	**-2.875**	**-6.034**
	-0.026	*0.412*	*1.564*	*-1.096*	*-0.750*
retired	**-6.447**	**14.377*** **	**-4.251**	**3.916**	**3.964**
	-0.967	*3.532*	*-0.629*	*0.797*	*0.264*
appointed	**-1.257**	**-3.178**	**-0.803**	**-3.476**	**-12.984***
	-0.364	*-1.506*	*-0.223*	*-1.451*	*-1.764*
exofficio	**-1.646**	**-3.052**	**0.220**	**1.676**	**-12.098**
	-0.329	*-0.995*	*0.042*	*0.491*	*-1.109*
boardsize	**5.572****	**4.718*** **	**-12.377*** **	**3.450****	**-8.492**
	2.388	*3.337*	*-4.936*	*2.230*	*-1.587*
constitution	**-2.489**	**0.140**	**1.005**	**-1.274**	**3.392**
	-1.276	*0.114*	*0.525*	*-0.859*	*0.797*
evaluation	**7.137*** **	**7.703*** **	**-5.735*** **	**4.461****	**-1.681**
	3.272	*4.662*	*-2.711*	*2.381*	*-0.376*
list	**-1.543**	**-6.178*** **	**4.720****	**-1.543**	**14.181*** **
	-0.767	*-4.797*	*2.359*	*-1.051*	*3.359*
policy	**12.437*** **	**-0.736**	**0.498**	**0.133**	**-12.386**
	2.673	*-0.252*	*0.110*	*0.038*	*-1.277*
prudent	**2.381**	**1.736**	**-1.501**	**3.926****	**6.254**
	0.953	*1.074*	*-0.611*	*1.977*	*1.263*
income	**6.272**	**-1.959**	**-0.833**	**2.514**	**6.870**
	1.471	*-0.678*	*-0.206*	*0.646*	*0.782*
pctretired	**0.004**	**0.026**	**-0.021**	**-0.025**	**0.027**
	0.158	*1.124*	*-0.862*	*-0.938*	*0.546*
assets	**0.008**	**0.063**	**-0.026**	**0.013**	**-0.187**
	0.109	*1.582*	*-0.375*	*0.276*	*-1.072*
Intercept	**10.139**	**-14.392*** **	**70.489*** **	**-13.364****	**37.841****
	1.248	*-2.764*	*8.616*	*-2.273*	*2.186*
N	450	450	453	453	453

note: 0.01 - ***; 0.05 - **; 0.1 - *; z-statistics reported

This table uses data from 1994-1998 and shows the results from random effects Tobit estimation

Table 6

Risk and Board Composition

	Estimated Beta	Estimated Style	Estimated Beta	Estimated Style
active	**-0.029**	**-0.016**	**-0.050**	**-0.064**
	-0.39	*-0.20*	*-0.83*	*-1.13*
retired	**0.267***	**0.273**	**0.175**	**0.162**
	1.68	*1.58*	*1.25*	*1.20*
appointed	**0.048**	**0.034**	**0.023**	**-0.007**
	0.71	*0.47*	*0.44*	*-0.12*
exofficio	**-0.201****	**-0.213***	**-0.221*****	**-0.277*****
	-2.33	*-1.88*	*-3.19*	*-3.88*
boardsize	**0.083***	**0.076**	**0.083****	**0.080****
	1.79	*1.44*	*2.15*	*1.96*
assets	**0.001**	**0.001**	**0.001**	**0.001**
	1.00	*1.38*	*0.91*	*1.51*
pctretired	**-0.310**	**-0.323**	**-0.356***	**-0.505****
	-1.37	*-1.41*	*-1.82*	*-2.48*
income	**-0.001**	**-0.001**	**-0.001**	**-0.001****
	-0.84	*-1.19*	*-1.08*	*-2.04*
Intercept	**0.328****	**0.262***	**0.378*****	**0.372*****
	2.46	*1.79*	*3.32*	*3.27*
active=retired	**3.25***	**2.45**	**2.73***	**3.32***
Prob > F	*0.08*	*0.12*	*.10*	*.07*
N	**58**	**58**	**58**	**58**

note: 0.01 - ***; 0.05 - **; 0.1 - *;

This table uses data averaged over the four collection years. The first and second columns are estimated using WLS and report t-statistics. Columns three and four are maximum likelihood estimates of multiplicative heteroscedastic regression and report z-statistics. The active=retired row shows the results of F-Tests for the equality of the coefficients on active and retired.