OUTRAGED BY COMPENSATION: IMPLICATIONS FOR PUBLIC PENSION PERFORMANCE

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Abstract

We model public pension funds that contract with investment managers and the resulting portfolio allocation and performance. Frictions in optimal contracting emerge from board members' sensitivity to employee and public outrage over high compensation. In global data covering $5.4 trillion in assets, we estimate a system of compensation and returns equations. Relaxing outrage constraints by one standard deviation results in $90,000 more compensation. In pass-through estimation from outrage-to-compensation-to-returns, we find that relaxing outrage threats implies 5-8.5 bps higher returns, driven by performance in alternatives and public equities. Outrage relaxation results in $22-38 million of incremental value-add annually for an average public pension fund. We discuss implications for inequality, which can drive outrage. Outrage is orthogonal to distortions from underfunding and political payoffs to local investment.

Keywords: Public pension funds, pension governance, underfunding, pension board of directors, trustees, fund management, bureaucracy, politicization, asset allocation, compensation
JEL codes: G11, G23, G30

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1. Introduction

In 2018, global public pensions and sovereign funds held $21.5 trillion in assets according to the Official Monetary and Financial Institutions Forum. However large that sum may seem, it is insufficient. Scarfstein (2018) documents that the average OECD public pension is on the hook to replace 44% of the population's lifetime average pre-retirement income, but holds just 6.8% of the national income in assets.[1] In addition, we know that pensions with insufficient assets in their coffers must result to extracting from already-strained public sector workers and local taxpayers, to support pension payouts for retirees. In such an environment, the importance of the financial performance of public pension assets cannot be understated. Yet, growing evidence suggests that politicization causes distortions in public pensions' investment decisions, thereby lowering performance. The literature points to two primary sources of these distortions – politicians' private-benefit extraction and political pressure stemming from plan underfunding.[2] This paper explores a new and complementary source for political distortions.

We study the possibility that pension workers and beneficiaries can be prone to outrage over the compensation of investment managers. This outrage threat causes trustees to hire lower-skilled managers and offer less-than-optimal incentive contracts, leading to performance implications. Outrage can emerge in a public sector setting because the trustees either are selected by public sector employees or politicians or are themselves politicians. As a result, trustees have career concerns sensitive to information emerging in the public domain. What becomes more troubling is that outrage may increase with local income inequality, particularly the difference in the pay of investment managers relative to local workers. Thus, the friction at the heart of this paper sheds light on an additional loss that *main street* communities face from inequality.

To illustrate outrage constraints in public pension funds, consider the dilemma of the Oregon State Treasurer in his service as the chair of the state pension fund. *The Oregonian* newspaper reports: "Unspoken, but also politically inconvenient is the compensation to attract

[1] By contrast, private pension systems are on the hook for just 17% of lifetime average pre-retirement income, have coffers with capital amounting to 58.6% of GDP.

[2] Hochberg and Rauh (2013) and Bradley, Pantzalisa and Yuan (2016), present evidence of pension fund overinvestment in local assets, leading to lower returns. Adonov, Hochberg and Rauh (2017) document that politicians on pension fund boards leads to weaker performance in private equities. Theoretical and empirical understanding of the importance of underfunding, and resulting risking-up pressures, for public pensions is found in Rauh (2009), Novy-Marx and Rauh, (2011), Ang, Chen and Sundaresan (2012), Addoum, van Binsbergen and Brandt (2015) and Adonov, Bauer and Cremers (2017).

talent from the private sector. The state's existing investment officers are some of the best paid public employees, making an average of $200,000 a year. But Treasury officials quietly complain that staff is underpaid by industry standards, and bristle about having to explain and get approval from the Legislature to release performance-based pay each year." As Treasurer Read pleads: "If we have the talent, we will be able to make the decisions better." Attempts by Treasurer Reed to hire better-paid investment professionals were rebuffed, with concerns about compensation exceeding members' wages and public pay scales – i.e., outrage.[3] Appendix Table 1 provides a sampling of other anecdotes of how similar tensions arise across many different types and many different geographies of pension funds.

To identify the importance of this human capital channel for public pension fund performance, we first introduce an agency model of portfolio choice. Public pension trustees must hire and compensate an investment manager, who constructs the portfolio over three assets – a mean-variance efficient risky asset, a political risky asset that is non-frontier in returns, and fixed income. Boards choose the skill level (ability to capture the risk premium) of the investment manager. Boards then set the manager's compensation contract to induce the desired skill level and incentivize the optimal risk-taking in the portfolio.

The model incorporates the three agency frictions that arise from political influence on the composition of the board of trustees. First, we introduce an 'outrage pay constraint' on skill that binds for some public pension funds. If a pension fund is in a low reference wage area or has trustees from occupations that are sensitive to wage comparisons (teachers, municipal workers, etc.), the trustees hire managers below a skill threshold to avoid compensation breaching outrage. We also incorporate the previously-documented effects of private benefit extraction and risking-up pressures of unfunded liabilities. Private benefit incentives emerge from political motives (local economy-building and direct vote-chasing) to tilt investments locally, as documented by Bradley, Pantzalis and Yuan (2016), Bernstein, Lerner, and Schoar (2013), Hochberg and Rauh (2013), Brown, Pollet, and Weisbenner (2015), and Dyck and Morse (2011). In addition, private-benefit-taking can emerge from pay-to-play schemes generating campaign contributions or direct side payments (Adonov, Hochberg and Rauh (2017)). Underfunding affects the risk preferences of boards (Adonov, Bauer and Cremers (2017)), as modelled in swinging-for-the-fences or gambling-

[3] "Treasurer looks to reorganize investment division into quasi-public entity," Ed Sickinger, Jan 16, 2013

for- resurrection models of Ang, Chen, and Sundaresan (2012) and Addoum, Van Binsbergen and Brandt (2015).

The model produces comparative statics relating board agency to intermediate outcomes (investment manager skill and the riskiness of asset allocations) and then to ultimate outcomes of portfolio performance. Of particular interest are the predictions arising from introducing an outrage pay constraint. If outrage binds, the public pension fund hires lower skill managers. Because managers lack skill to capture the risk premium, they choose to tilt the portfolio towards fixed income and away from risky assets. The fund exhibits lower returns within risky asset classes and lower portfolio returns because of both the tilt away from risk and the lower performance within the risky portfolio.

To test the theoretical predictions we use a global sample of 111 public pension funds that account for $5.4 trillion in assets at the end of our sample period and that cover the U.S., Canada, Oceania, and Europe for 1995-2014. The average (median) fund has $45 ($14) billion in AUM. We hand collect data on compensation and biographical information as to the occupations of trustees.

Our empirical methodology mimics our theoretical setting by setting up a system of two equations, estimated by GMM. In the first equation, compensation is a function of outrage, politicization, underfunding, along with fund characteristics such as size and time. In the second equation, performance is a function of outrage-predicted compensation along with other board, fund and time characteristics. With a structurally-motivated, linear system of two equations, we can draw inference concerning the pass-through effect of outrage on compensation.

Our exogeneity condition is that the outrage determinants do not affect within-asset class performance except through the mechanism of managerial contracting. Outrage determinants are of two types – reference wages and occupations of trustees. Our reference wage variables are the the income of local citizens and the wages of those work in the relevant public sector covered by the pension., Trustee occupation variables are the percentages of municipal workers, teachers and finance occupation civil servants. The idea is that board members are sensitive to industry wages, as they are elected or appointed by industry members and work in the industry themselves. So, for example, if trustees are municipal workers or teachers, both of which receive relatively low wages compared to finance salaries, they may be prone to outrage. A substantial fraction of board members have experience in public financial administration (auditors, revenue commissioners,

etc.), which we predict makes them sensitive to concerns about salary levels of public officials. Finally, all board members may be sensitive to compensation in their local community. Consistent with these predictions, we find that compensation is about $90,000 lower in funds with a standard deviation higher level of municipal workers or finance civil servants. Likewise, compensation is $60,000 lower for pensions with 10% lower income of local citizens or workers.

We then test for a relationship between outrage-predicted compensation and performance. In our structurally-motivated system we can measure the pass-through from outrage to outrage-predicted compensation to returns. We find that a one standard deviation higher fraction of municipal workers or finance civil servants, passing through compensation, results in 5 to 8.5 lower portfolio net returns, benchmarked at the asset class level. This result is driving by a statistically significant relationship between outrage-predicted log compensation and within-asset class returns in alternatives and public equities.

For a plan with an average allocation to alternatives, our estimates suggest that if that fund were to find a way to relax the threat of outrage, it would benefit by producing additional annual benefits of $22 to $38 million in annual value-add (using the method of Berk and Binsbergen). The projected benefit from relaxing outrage is even greater for plans with an above average allocation to alternatives, which is more common with underfunded plans. Importantly, the cost-benefit analysis is even encouraging for the lowest quartile pensions, who might reap $3.8 to $6.4 in value-add for a cost figuring out a way to unwind outrage threat. We suggest pension policy remedies – profit sharing and education – in the conclusion. As robustness, we document that these results are not driven by realizing net risk.

Finally, consistent with the prior literature, we find that distortions arising from politicians' payoffs to local investment and distortions arising from underfunding also impact asset allocation and returns. Importantly, including them in the model and in our regressions does not eliminate the importance of the human capital channel. Consistent with Adonov, Bauer and Cremers (2017) we find that underfunding leads to increased asset allocation to alternatives. Consistent with Adonov, Hochberg and Rauh (2017) and Hochberg and Rauh (2013) we find that politicization has a direct effect on returns in alternatives asset classes. We interpret our results as complementing these papers, showing an important and neglected human capital channel whereby politics can also undermine returns.

The rest of the paper is organized as follows. In section 2, we fix ideas by introducing a theoretical model of portfolio choice with political agency costs and management contracting. Section 3 lays out our empirical methodology, and section 4 describes our data. In section 5 we present our empirical results, and we conclude in section 6.

2. Model of Portfolio Choice with Political Agency Costs

Imagine a setup in which beneficiaries of a pension fund would optimally invest in a mean-variance efficient portfolio over a risky asset and fixed income. The board of trustees for this pension fund achieves this objective by making manager-contracting choices to maximize beneficiaries' utility subject to manager participation and incentives. In our setting, because the pensions are *public pension fund*s, being in the political domain can affect trustees' incentives and decisions. Although trustees have a fiduciary duty to act in the best interests of their beneficiaries, political private costs and benefits from their funds' choices create incentives to deviate from a strict interpretation of this duty. We call the resulting distortions *political agency costs*.

Our model and empirical analysis consider three political agency costs. The first emerges from outrage, the inability of politicized boards to pay optimally for investment manager skill because of political costs emerging from workers, retirees, and other voters in the community. The second emerges from politicized boards' preference for investing in political assets. Political assets are defined as investments which generate private benefits to a political board member, either in the form of local-tilted assets (which generate positive media attention, reputation, and ultimately votes and legacies) or in the form of pay-to-play allocations (which involve kickbacks from asset managers to politicians or political campaigns in return for asset allocations). The third political agency cost emerges from the pressure of liabilities that can induce public pension fund boards to risk-up portfolios to meet funding needs (e.g., to pay pensioners) rather than to have to face disclosure of shortfalls.

The focus of our model is on how these political agency costs affect allocations and performance, working through the mechanism of hiring and compensating an investment manager.

2.1. Assets and Investment Manager Heterogeneity

A public pension fund board hires and sets a linear compensation contract for an investment manager to allocate the pension's capital among assets. Managers are risk averse and are assumed to have the same risk aversion as the beneficiaries of the pension fund, λ. Managers are heterogeneous in one dimension, their skill in the selection of assets within each asset class (or in the selection of asset manager for delegation within each asset class), represented by the parameter *s*. Skill levels are transparent, and their supply is perfectly competitive. A manager of type *s* has an outside option $O(s)$, where $O(\cdot)$ is an increasing function such that skilled managers have higher outside options.

The manager chooses portfolio weights among three assets: fixed income, a mean-variance efficient risky security (MV security) and a political asset. Fixed income pays a riskless return r_f:

$$Fixed\ Income: E[R_f] = r_f.$$

The MV security has variance σ_{MV}^2 and risk premium φ_{MV}:

$$MV\ security: E[R_{MV}] = r_f + s\varphi_{MV}.$$

The political asset is also risky, but has variance σ_P^2 and risk premium φ_P.

$$Political\ Asset: E[R_P] = r_f + s\varphi_P\ .$$

We assume that $\varphi_P/\sigma_P < \varphi_{MV}/\sigma_{MV}$, such that the MV security dominates the political asset in Sharpe ratio terms.

In both risky securities, managers earn a fraction s of the potential risk premium, in proportion to their skill. Only managers with maximal skill (i.e., $s = 1$) can capture the full risk premium with their asset selections. This assumption is empirically motivated; while some investment managers in public pension funds have significant financial experience from working previously in a finance position in a public pension fund or the private sector, others prior experience is limited to a managerial or civil servant role with no asset management responsibilities.

Differences in *s* can also be interpreted as delegation costs. If managers delegate portfolio management (or a fraction thereof) to external institutions, they incur intermediation fees, reducing the effective fraction of the risk premium earned by the fund. The skill variable *s* captures both the managers' skill and the ability to economize on intermediation costs, such as internally managing assets.

Managers form portfolios by selecting the weights on MV-efficient securities, political assets, and fixed income as w_{MV}, w_P, and $(1 - w_{MV} - w_P)$, respectively.[4] For tractability, we assume that the MV security and political assets have a joint normal distribution with correlation ρ, which is large enough to prevent hedging between asset classes.[5]

2.2. Utility & Political Agency Costs

Under the assumption of mean-variance preferences, the utility of beneficiaries, and that of the board if no political agency costs are at work, is given by:

$$U_{board}^{no\ agency} = U_{beneficiaries} = E[R - manager\ pay] - \frac{1}{2}\lambda Var[R - manager\ pay], \qquad (1)$$

where R is the total return of the portfolio; *manager pay* is the compensation paid to an investment manager; and $\boldsymbol{\lambda}$ is the risk aversion of beneficiaries. We introduce three political agency costs that cause the board's utility to deviate from that of the beneficiaries.

Outrage Pay Constraints

First, trustees in public pension funds are in a political domain, and this leads them to consider potential political costs arising from their choices. Such costs arise for trustees if beneficiaries or others in the community become outraged by the compensation of investment managers. In practice, these private costs usually take the form of negative media attention and the resulting negative reputation consequences. If the board were to set compensation sufficiently high such that outrage occurred, it would have to bear some utility cost:

$$U_{board} = E[R - manager\ pay] - \frac{1}{2}\lambda Var[R - manager\ pay] - outrage\ cost. \qquad (2)$$

If trustees' utility consequences of outrage are large they would want to preclude the possibility of outrage altogether. The easiest way for trustees to ensure that compensation, which is stochastic, does not go over the outrage threshold is to hire lower quality managers. To model this intuition, we assume that each fund has a threshold on skill, $s^{outrage}$. Thus the board's utility reverts to equation (1), but with a constraint:

$$U_{board} = E[R - manager\ pay] - \frac{1}{2}\lambda Var[R - manager\ pay]$$

[4] A pension fund not affected by agency problems would invest in a combination of the MV security and fixed income.

[5] Hochberg and Rauh (2012) find no evidence of such hedging. See the appendix for the explicit restriction on ϱ that prevents the portfolio manager from taking short positions in any asset class.

$$subject\ to:$$

$$(outrage\ constraint):\ s \leq s^{outrage}. \tag{3}$$

For some funds, the threshold is large and never binding. This is more likely if the reference wage level of beneficiaries or others in the community is sufficiently high.

Private Benefits from Politicized Investing

Second, allocation choices can create private benefits for political trustees. These private benefits include votes from investing locally and creating employment opportunities for local citizens, or side-payments (e.g. in the form of campaign contributions or direct payouts) from pay-to-play arrangements.[6] We incorporate the political agency cost from private benefits from politicized investing in our model by assuming that the board receives a riskless, private benefit worth κ dollars for each dollar invested in political assets:

$$U_{Board} = E[R - manager\ pay] - \frac{1}{2}\lambda Var[R - manager\ pay] + \kappa w_P. \tag{4}$$

Liability-Driven Preference for Risk

Finally, effective board risk aversion, λ_B, can be affected by liability obligations of the pension fund. Ang, Chen, and Sundaresan (2012) model the tensions pensions face due to the constant need to fund payments to retirees. Their main inference is that when funding is low, pension boards have a lower effective risk aversion; i.e., a desire to "swing for the fences." The friction often at work is that boards having to go back to legislatures to request funds to cover a down year of returns face a personal reputational cost. The resulting risk-taking behavior is similar to gambling for resurrection ideas of van Binsbergen and Brandt (2015). Such increased risk taking in the presence of underfunded liabilities has been found in US public pension funds, for example, by Adonov, Bauer and Cremers (2017).

We assume that underfunded status results in a higher risk appetite:

$$\lambda_B = \frac{\lambda}{\theta}. \tag{5}$$

where θ is an exogenous politically-determined variable that captures the risking-up pressure. The final utility formulation for the board, incorporating all political agency issues, is thus given by:

[6] Andonov, Hochberg and Rauh (2017) find that U.S. pension funds with political boards tend to invest in local and less profitable private equity funds, Dyck and Morse (2011) and Bernstein, Lerner and Schoar (2013) show a similar pattern in the investments of sovereign wealth funds. Bradley, Pantzalisa and Yuan (2016)) show not only a local bias but a bias to invest in politically-connected firms.

$$U_{Board} = E[R - manager\ pay] - \frac{1}{2}\lambda_B Var[R - pay] + \kappa w_P.$$

$$subject\ to: \tag{6}$$

$(outrage\ constraint)$: $s \leq s^{outrage}$ if reference wages are low.

2.3. Solving for the Optimal Contract and Manger Skill

We solve the model by considering post-hiring portfolio choice, assuming that a manager with skill *s* already is hired. The board asserts its preferences for risk and for political investments by offering a compensation contract to the investment manager to induce preferred portfolio choice. For any skill *s*, we derive the optimal contract. Next, we calculate the optimal manager skill *s* chosen by the board, from which we can figure out the resulting asset allocation.

We restrict our model to linear contracts. The manager receives a cash salary *c*, independent of her performance. In addition, the board gives a share $1-a$ of the realized financial return to the manager to induce risk-taking. The board also asserts its political preferences by giving the manager an additional transfer of b dollars for each dollar invested in political assets. Linear compensation is given by:

$$manager\ pay\big(R, w_p | c, a, b\big) = c + (1-a)R + bw_p \tag{7}$$

Like the beneficiaries, we assume that the investment manager has CARA utility with risk aversion λ. Thus, the manager chooses risk and political asset weight $\big(w_{mv}, w_p\big)$ solving the following program:

$$\max_{w_{mv}, w_P} U_M = \max_{w_{mv}, w_P} \Big\{E[manager\ pay] - \frac{1}{2}\lambda Var[manager\ pay]\Big\} \tag{8}$$

The board maximizes the expected monetary payoff penalized by the variance, with penalizing factor $\lambda_B = \lambda/\theta$, which depends on the risking-up pressure θ. The optimization problem is restricted by: (i) the manager's incentive constraint and (ii) the manager's participation constraint, which obligates the board to offer a contract that generates an expected utility for the manager not smaller than her outside option $O(s)$.

The participation constraint is the channel connecting political asset investing to manager contracting. Because political assets are dominated in performance relative to the MV security, boards realize less utility from the skill of managers. Thus, the higher the political benefits κ are, the less willing is the board to pay compensation for skill.

The underlying program, which defines the optimal contract and the indirect utility $V_B(s)$ of the board when hiring the manager with skill *s*, is given by:

$$
\begin{aligned}
V_B(s) \equiv \max_{c,a,T} U_B &= E[R - manager\ pay] - \frac{1}{2}\lambda_B Var[R - manager\ pay] + \kappa w_P \\
&= (\kappa - b)w_P + aE[R] - c - \frac{1}{2}\lambda_B a^2 Var[R] \\
&\textit{subject to:} \\
\textit{(participation constraint)} \quad & c + (1-a)E[R] + bw_P - \frac{1}{2}\lambda_M (1-a)^2 Var[R] \geq O(s) \\
\textit{(incentive constraint)} \quad & \{w_{mv}, w_P\} = \underset{w_{mv}, w_P}{\operatorname{argmax}} \{U_M | c, a, b\}.
\end{aligned}
\tag{9}
$$

In the appendix, we show that the optimal contract is given by:

$$
\begin{aligned}
a^* &= \frac{\lambda}{\lambda + \lambda_B} \\
b^* &= (1 - a^*)\kappa.
\end{aligned}
\tag{10}
$$

The optimal payment factor a^* reflects the standard sharing rule in which the less risk averse agent receives a larger component of the risky outcome. In the optimal contract, the manager receives the same fraction $1 - a^*$ of the financial return R and of the political return κ. The resulting base salary c^* is the number that makes the participation constraint binding.

Finally, the board will choose the manager skill that satisfies the outrage constraint (if local reference wages are low) and maximizes their ex-ante utility:

$$
\max_s V_B(s), \ \text{s.t.}\ s \leq s^{outrage}. \tag{11}
$$

If the outrage constraint is not binding, then marginal disturbances around the optimal s^* are such that the marginal increase on the squared Share ratio is equal to the marginal cost of hiring a slightly better manager.[7] If outrage is binding, the public pension fund will hire a lower skilled manager, foregoing opportunities for increase in the portfolio Sharpe ratio.

2.4 Comparative Statics

The solution to (11) sets up comparative statics illustrating how funds differ in their performance-cost tradeoffs when choosing manager skill. For instance, boards facing high private benefits κ from political investing as well as boards facing an outrage constraint on compensation both prefer to hire managers with lower skill compared to the optimal manager for the beneficiaries. On the other hand, boards facing a personal cost from not having sufficient returns to cover pension

[7] In the appendix we show that this leads to the following first order condition on the marginal payment to managers: $O'(s^*) = \frac{(\sigma_P^2 \varphi_{MV}^2 - 2\rho\sigma_P\sigma_{MV}\varphi_{MV}\varphi_P + \sigma_{MV}^2\varphi_P^2)s^* + (\sigma_{MV}^2\varphi_P - \rho\sigma_P\sigma_{MV}\varphi_{MV})\kappa}{\lambda\sigma_P^2\sigma_{MV}^2(1-\rho^2)}$

liabilities might optimally choose a higher-skilled manager to benefit from risking-up the portfolio. Table 1 reports these comparative statics, focusing not just on how the agency issues affect manager contracting of skill, but to how ultimately these frictions translate into portfolio choice effects -- allocations and performance.

Panel A isolates the effect the outrage constraint being binding or not has on performance and allocations. The mechanical consequence of a binding outrage constraint is that the board of an outrage-prone pension fund hires a less skilled manager ($\Delta s < 0$). The lower skilled manager realizes lower risky asset returns per unit of risk ($\Delta R_{MV} < 0,\ \Delta R_P < 0$)); thus the board optimally sets a contract to induce more portfolio weight on fixed income ($1 - \Delta w_{mv} - \Delta w_P > 0$). There is no point in paying compensation for extra risk not rewarded with a capture of extra risk premium. The combination of more investment in fixed income and weaker managerial skill adds up (on both counts) to a portfolio with poorer overall expected performance ($\Delta R < 0$).

Panel B looks at the partial derivatives with respect to changes in the other political agency issues. Boards with greater benefits from investments in political assets ($\partial\kappa$) hire less skilled managers, since the expected return payoff from skill is lower in the portfolio tilted toward the political asset. Lower skill leads to smaller within-asset-class expected returns ($\Delta R_{mv} < 0,\ \Delta R_P < 0$) and less investment in the MV security ($\Delta w_{mv} < 0$). In addition, these boards design contracts to incentivize greater investment in the political asset ($\Delta w_P > 0$), which further reduces overall performance ($\Delta R < 0$).

By contrast, boards with higher liability-driven risk-up pressure (larger θ) hire more skilled managers to take more advantage of the risky asset classes ($\Delta s > 0,\ \Delta w_{mv} + \Delta w_P > 0$), hence increasing within-asset class and overall performance ($\Delta R_{mv} > 0,\ \Delta R > 0$). The extra risk that these boards induce may be rewarded with realization of expected capture of the risk premium, but the extra risk is above the utility preferences of the beneficiaries. As stakeholders and taxpayers, beneficiaries may find themselves bailing out pension liabilities from taxes when bad returns realizations occur.

Although we do not explicitly include the cross partials in Table 1, one final piece of intuition is worth highlighting. When public pension funds have high liability pressures, the effect of an outrage constraint is very damaging. Public boards that incentivize a poorly-skilled investment manager to take on more risk end up with a more risky portfolio that underperforms in the risky asset classes.

3. Empirical Methodology

Our goal is to estimate how agency affects public pension fund outcomes working through the compensation contract mechanism. Although we are interested in the other political agency issues, we set up our system to focus on the mechanism of outrage, because we can make plausible exogeneity arguments and because the novelty of our paper vis-à-vis the prior literature is in the introduction of outrage.

We employ GMM and a two-equation, linear sytem of equations. We choose a linear system approach, rather than a structural model approach, for three reasons. First, our dataset of compensation observations is limited in sample size, making inference from more complex non-linear moment optimization problematic. Second, the point of the model is to motivate comparative statics by combining agency with portfolio choice rather than to provide an exact parameter calibration of relationships. Third, because our model is one of outrage working through the mechanism of compensation contracts to distortions in performance, outrage only affects outcomes through the management contract. This restriction lends itself to a linear structural GMM specification, where we can make linear exogeneity assumptions as if we were in the familiar instrument setting.

Our linear system of equations, with subscripts *i* and *t* respectively refering to the public pension fund and year, is as follows:

System Equation I:

$$Log(Manager\ Compensation)_{it} = Outrage_{it}\Phi_1 + \phi_2 Underfunding_{i,t-1} + \phi_3 PoliticalChair_i + X_{it}^{covariates}\,\Gamma^{eq\ I} + \varepsilon_{it}^{eq\ I}$$

System Equation II:

$$Performance_{it} = Log(\widehat{Manager\ Compensation}_{it}) + \beta_2 Underfunding_{i,t-1} + \beta_3 PoliticalChair_i + X_{it}^{covariates}\,\Gamma^{eq\ II} + \varepsilon_{it}^{eq\ II}$$

The equations are naturally dynamic in events; the manager contracting happens first, followed by the realization of returns. In System Equation I, the *Outrage* variables include (i) trustee occupation variables and (ii) reference wage variables. System Equation I also includes the covariates from System Equation II (the log of lagged public pension fund size and year fixed effects) and the two other political agency variables, *Political Chair* and *Underfunding*. System Equation II takes the outrage-predicted compensation as predetermined, included alongside *Politicial Chair* and

Underfunding, as well as controls of lagged fund size and year fixed effects. We estimate this system using GMM and cluster standard errors at the fund level.

We are interested in interpreting outrage working through the mechanism of compensation on performance. The exogeneity condition for a causal interpretation is that outrage variables are exogeneous to performance conditional on compensation. We contend that this condition is plausible because the outrage variables, described in the data section, either reflect board composition percentages or local income levels that should be unrelated to investment performance.

We do not make the same exogeneity assumption when we consider *Political Chair* and *Underfunding*. A policitized chairperson might steer investment choices for political private benefits through pay-to-play arrangements or local favoritism. Likewise, underfunding may not only impact compensation, but also could directly impact portfolio choice by triggering active intervention of the board. Thus, we set up the system so that we can use *Outrage*, but not the other agency variables, as predetermined causes of some variation in compensation that can later potential explain performance.

4. Data

4.1. Public Pension Funds Sample

Our sample is from the union of two sets of public pension funds. We source U.S. public pension funds from the Center for Retirement Research (CRR) dataset at Boston College. Globally, we collect all public pension funds with over $10 billion in assets identified in *Pensions & Investments* in 2011. Because of the need to manually search for the personal characteristics and compensation of trustees and managers, we limited the sample to funds in North America, Oceania, and Europe. Table 2 defines all variables and their sources. We convert all monetary data to 2010 U.S. dollars.

Table 3 reports statistics about our sample of public pension funds. As Panel A reports, the full sample consists of 164 funds and 1,856 fund-year observations. The mean and median pension fund have $45 billion and $14 billion in assets, respectively. Panel B reports our estimation sample, that with compensation and trustee data. The cross-section remains large, covering 111 public pension funds, but we only have a short panel, with 463 fund-year observations. Our estimation sample reflects larger funds, with a mean and median of $102 and $30 billion respectively.

The returns comparisons, however, do not show any tilt. The returns in Panels A and B are similar in aggregate (a 0.042-0.043 gross return on average over the sample) and in the regional distributions. As both Panels show, although our sample favors U.S. pension funds, over a third of the sample is from Canada, Europe, and Oceana. Our results are not just reflective of a U.S. story.

4.2. Allocations and Performance Data

In terms of portfolio choice variables, we collect each fund's asset allocations, performance and the fraction of assets managed via delegation over 1995-2011 from a combination of sources: annual reports, funds' current and cached websites, direct requests to the funds, the Boston College CRR dataset and CEM Benchmarking. We analyze performance in three primary asset classes: (i) alternatives (hedge funds, private equity and real estate), (ii) public equities, and (iii) fixed income. We order these asset classes in decreasing risk. When we make inferences, we assume that alternatives not only have the highest expected risk, but they also provide the greatest opportunities for private benefit-taking by politicians because of their "2-and-20" compensation structure, which affords opportunities for kickbacks and local investing bulky tilting of portfolios.

Table 4 reports portfolio summary statistics, starting with allocations in Panel A. We present two sets of portfolio weights – those for the sample in which we observe returns and those restricted to observing all portfolio weight allocations across the portfolio (used in the weight estimations). The mean distribution of allocations is public equities (0.513), fixed income (0.296), and alternatives (0.191). Table 4 also presents statistics on our delegation variable, defined as the fraction of assets managed by external institutions in each asset class. On average, the fractions of assets managed via delegation are 0.500 for fixed income, 0.734 for equities, and 0.747 for alternatives (excluding hedge funds, which are all outsourced).

Panel B of Table 4 reports performance statistics. At the portfolio level, mean gross and net returns are 4.2% and -0.3% respectively. The benchmark we use is the CEM consulting benchmark. CEM requires that the trustees of a fund select the benchmarks, not the asset manager. Furthermore, the benchmarks reported by trustees are done in consultation with (often with the advice of) CEM and, more than not, are multiple within an asset class, with appropriate adding-up weights, to reflect the desired portfolio risk.

As another measure of performance we use the closeness of the investment manager performance relative to benchmark performance, i.e., the realized tracking error. We estimate in-

sample, fund-level tracking error, as the standard deviation of the error term in a no constant model where we regress each fund's annual realized return on its benchmark. We produce one measure of tracking error per fund, with a cross-sectional mean tracking error of 0.030 across 110 funds. Not surprisingly, tracking error is highest in alternatives then equities and finally in fixed income.

4.3. Investment Manager Compensation and Skill Data

We hand-collect compensation data for investment managers. For funds with mandated disclosure, we successfully search for compensation in annual reports and public filings. For the other funds, we issue freedom of information requests and search for each named manager and public pension fund in newspaper databases. As we search, we look for the highest paid investment executive, which could be either the CEO or CIO depending on the fund. The resulting sample covers 111 public pension funds with a total panel of 463 observations, including all geographies spanned by our sample.[8] We report summary statistics on compensation in our dataset in Table 5. The median total compensation of the investment executives is $537,197 USD, with a mean of $807,416. A quarter of the fund managers make salary of $292,328 or less. These are large numbers, but recall that observability limits our sample to large funds, and these managers control pension funds of $102 billion on average.

Our model refers to manager skill, which induces higher compensation. Although we do not a measure of skill, we hand gather the prior professions of all investment managers. Table 6, Panel B, reports the breakdown of the immediately prior job these managers held. For almost two thirds of the fund managers their immediate prior experience was in finance, with 4.9% of managers working as a senior investment manager at another pension fund, 31.1% in the private sector in a financial capacity, and 30% as a bureaucrat with financial responsibility. But notably for the other third of investment managers, their prior experience was either as a civil servant with no financial expertise or as a non-financial executive in a pension fund (16.4% + 18% = 34.4%).

Figure 1 depicts box plots of the distribution of compensation by prior profession categories. The [red] dashed vertical lines present the quartile cutoffs from sample at large. The no-financial-expertise professionals (non-finance civil servants, the 5th category and pension executives, the 2nd category) which together account for 34.4% of the sample clearly earn lower

[8] Because the panel is short, we interpolate (but do not extrapolate) the data for funds for which we have a time series but with gaps.

compensation. The mean compensation of non-finance civil servants is only $244,372. Even two standard deviations higher compensation for these individuals does not put them in the realm of the median (or mean) compensation for everyone else. The non-finance pension executives fare a little better, with a mean of $459,576. However, the box plot well portrays that the skew in this category is large; most investment managers with non-finance pension experience have quite modest salaries. The lack of compensation for these public servants reflects strongly the dialogues presented as outrage examples in Appendix Table 1. For example, a recruiter quoted in the New Mexico State Investment example (#7 in Appendix Table 1) states: "Pay scales in public plans tend to reflect the pay scales for the state bureaucracy." In the Missouri State Employees Retirement example (#5), the state senator in charge of appropriations calls the idea of bonuses (performance pay) to investment managers "unconscionable" in lieu of payments to services for the disabled, college scholarships, etc.

4.4. Outrage Variables

Our outrage variables are of two types -- (i) reference wage variables and (ii) trustee occupation variables. The first reference wage variable is the wages of the working beneficiaries. We collect information on the average wages of working beneficiaries either directly from the annual report or as a calculation from data on the employee contributions and the reported average rates of contributions (also predominantly from funds' annual reports). As reported in Table 5, the average wage of working beneficiaries is $47,811.

We also collect information on the average household income in the municipality (or MSA) where the fund is located. For each fund we look for the finer measure of regional income calculated by the agency responsible for collecting and compiling income statistics in each country. We presume board members are also likely to be drawn from the same region, and would be sensitive to this average wage. The average local household income (Table 5) is $55,434. Both measures have a tight and quite symmetric distribution.

Trustee occupation variables emerge from, first, sourcing the names of the trustees from the websites and, then, looking up biographical information from c.v.'s on the funds' websites or other web information sources (e.g., Linkedin). Data availability force us to use a single cross-section of data (2011) for trustee biographies. We were concerned about this limitation. However, empirically, the average fund is in the data for three years, making the board information for one

year likely to be relevant for the entire sample period.[9]

Table 6, panel B provides a tabulation and descriptions of professional titles. We split the table into broad categories of civil servant and non-civil servants, each representing about half of the mean distribution of trustees. We further break civil servants into politicians, finance civil servants and other civil servants. Politicians (those representing the government at large or elected as a politician) are somewhat rare as non-chair trustees, accounting for 6.4% of board seats. Finance civil servants (most commonly, treasurer, revenue commissioner, controller, auditor, and finance directors) hold 34.4% of seats. Other civil servants (clerks, commissioners, public university academics, and legal government officials) hold 13.7%. Among non-civil servants, teachers represent 14.7% of the mean distribution. Next are municipal workers (7.7%), who are fire workers, librarians, workers at city hospitals, and other such public municipal service occupations that are not internal to the running of the government administration per se. Finally, the largest non-civil servant category is professionals (23.1%), who are financial sector professionals as well professionals from medicine, media, NGOs, or other private firms.

We use three board occupation categories to capture outrage – *Municipal Workers*, *Teachers,* and *Finance Civil Servants*. A trustee is more likely to perceive costs from outrage, and thus more likely to want to implement outrage pay constraints on investment manager compensation, if she herself has a history as a local worker (variables: *Municipal Workers* and *Teachers*), or if she is involved in the finances of the local government directly (*Finance Civil Servants*). The exogeniety condition asserts that these trustees do not influence performance except through their role in manager contracting.

One concern would be if our use of trustee occupations as outrage variables were correlated with politicians on the board, which prior research has found has a causal effect on portfolio performance (Adonov, Hochberg and Rauh (2017)). We do not think this to be the case because

[9] In addition, we took steps to understand how these particular people arrived to be trustees. We gathered the charter for each public fund and coded the process for voting on each trustee seat. Trustee seats are specific to representing certain stakeholders, reflected in who appoints, elects or is ex offico the trustee. We use these data in the construction of the Political Chair variable, but this collection process also convinced us that the type of person in each position is likely to be very stable. The charters are usually decades-old and are often quite secific as to the stakeholder process in electing, appoining or designating trustees. If the public funds is, for example, a public railway or teachers union, and the trustee seat turning over is designated to be elected by such workers, it is unlikely a different occupation would emerge. Of course, other pensions are less specific, but even having the trustees seat representing the retirees versus the workers, or being a ex officio trustee, implies a stickiness in the biography of who represents a particular trustee seat.

Municipal Workers, *Teachers*, and *Finance Civil Servants* do not account for all of the non-politician variation in the other civil servants and not-a-civil-servant categories. Nevertheless, to make sure that the main estimations are not driven by an effect of "one-minus Adonov et al (2017)" r, we include an appendix of estimations defining the outrage variables based on professional designation as a fraction of the non-politician board members.

4.5. Political Chair and Underfunding Variables

Using the data we collected on the process by which each member of the board is appointed or elected, we construct a dummy variable called *Political Chair* if the chair is appointed by an executive of government (e.g., governor, mayor, finance minister, king, etc.) or ministry of government. Fourteen percent of boards have a *Political Chair*.

Finally, we measure the extent of underfunding pressures by creating an index of two variables. We have data on the funded ratio (the level of assets-to-liabilities), but not for all funds. The other measure of liability strain comes from Rauh (2008), who finds that funds with a higher age profile of pension beneficiaries have more liability concerns. Thus, we construct the average age of pension beneficiaries, using data on the average age of workers and retirees with the fraction of members being retired. Then we construct the *Underfunded Index* as the negative of the standardized funded ratio plus the standardized age variable. The underfunded index has correlations of 0.81 with age and of -0.79 with the funded ratio.

5. Results

5.1. Do Outrage and Political Agency Issues Affect Compensation?

In Figures 2a and 2b, we plot the mean and median compensation across tertiles of the outrage variables (*Municipal Workers*, T*eachers*, and *Finance Civil Servants* in 2a and the reference income variables in 2b) The plots show, with some variation, that compensation is lower with higher outrage occupations percentages and lower reference incomes. The exceptions are in the *Teachers*' and *Worker Wages'* plots, which show non-monotonic patterns across the tertiles of the x-variable. These patterns may be due to not controlling for pension fund size in the plots; thus, we turn to multivariate results.

Table 7 reports the relationship between compensation and political agency variables. As a baseline, in column (1), we regress log compensation lagged fund size and year fixed effects. Lagged fund size significantly associates with compensation, but with a limited explanatory power (an R-squared of 0.0365).

In columns (2) to (4), we explore iteratively add in the outrage and other political agency variables. Column (2) adds the trustee composition outrage variables in addition to the baseline controls. All three trustee composition outrage variables – *Municipal Workers*, *Teachers*, and *Finance Civil Servants* – negatively associate with compensation, but only *Teachers* and *Finance Civil Servants* are statistically significant. Notably, the R-squared increases sharply to 0.115. Column (3) instead includes only the reference wages outrage variable with the baseline. We find a positive and significant relationship of both *Regional Income* and *Worker Wages* with compensation. The elasticity of manager compensation to reference income is between 0.6 and 0.9. The R-squared in column (3) increases relative to column (1) to 0.106.

In column (4), we explore the relationship between other political agency issues (*Political Chair* and *Underfunded Index*) and compensation. We find a strong negative association between *Political Chair* and compensation (column (5)) and an insignificant impact of underfunding. The partial R-squared of political chair is weaker than outrage, but this in no way contradicts with the prior literature (Andonov, Hochberg and Rauh, 2017; Andonov, Bauer and Cremers; 2017), as political influence may work directly in the investment choices.

Finally, in column (6), we include all sets of variables and find that most of the results in the prior columns are independent of each other; the R-squared continues to increase (to 0.153) and most variables remain robustly significant. Controlling for the other effects also adds precision in the estimation, making *Municipal Workers* and *Underfunded* significant.

In Panel B, we evaluate the economic impact of increases in all statistically significant political agency variables, using the column (5) estimates. For the variables representing a fraction of trustees or a fraction of the chair, we induce a one standard deviation change simulation. A board of trustees has on average 11 trustees, so the one standard deviation change, although it is a cross-sectional average, is fairly realistic change in the influence a 1 to 2 trustee members for a pension fund. Table 7, Panel B reports the magnitudes of a one standard deviation change. For the reference income variables, in logs, we study a 10% change elasticity effect, about $5000 higher income.

We find that the economic magnitude of the changes are very similar (in absolute value) across most variables. A standard deviation change in the fraction of either *Municipal Workers*, *Finance Civil Servants*, or *Political Chair* implies approximately a $90,000 lower manager compensation. A 10% change decrease in either *Regional Income* or *Worker Wages* implies approximately $60,000 less manager compensation. These effects are 7-13% in percentage changes relative to mean compensation in sample. All of these effects are consistent with our model comparative statics and our intuition of how agency affects manager contracting. Underfunding has a positive but lower effect on compensation, consistent with our model that the trustees will want the manager to risk-up, thereby making it desirable to hire a manager who can better capture risk premia.

5.2. Do Outrage Pay Constraints Affect Returns?

5.2.1. Performance Results

Section 3 laid out our empirical methodology as a two-equation, linear sytem of equations to estimate how agency affects public pension fund outcomes working through the compensation contract mechanism. Table 8 report results from estimating the system using GMM. The first column (Equation I) presents the test of outrage on compensation akin to Table 7, but with additional Equation II control variables. The results are very similar to those in Table 7.

Our focus is on columns (1) to (4), where we estimate the effect of outrage on returns through *Log Compensation*. We refer to this variable as *Outrage-Predicted Log Compensation.* The outcome variable is net returns, for the entire portfolio (column 1), alternatives (column 2), public equities (column 3) and fixed income (column 4).

We find that log compensation explained by outrage has a positive and significant effect on portfolio net returns (column 1). The coefficient is a positive 0.00635. Because this return is already benchmarked to the asset class policy weights, it is likely that this portfolio return sensitivity to *Outrage-Predicted Log Compensation* is due within-asset class outrage-performance sensitivity. In columns (2) to (4), we replace portfolio net returns with net returns in alternatives (2), public equities (3) and fixed income (4).[10] Our results for the risky asset classes are very consistent with

[10] The number of observations varies by column because some public funds do not have exposures to all of the asset classes, and some funds only report performance at the aggregate portfolio level. We do not report the first equation estimation for each column; they are materially the same as the estimation presented in the first column.

the model. In particular, *Outrage-Predicted Log Compensation* positively and significantly predicts net returns in alternatives (coefficient of 0.0209) and equities (0.00689). We find no effect for fixed income. We also note that *Political Chair* has a negative and significant impact in alternatives, confirming the results in Andonov, Hochberg and Rauh (2017). We discuss the *Political Chair* result in greater length and related evidence in section 5.4 below.

To understand the economic impact of outrage on portfolio returns, we consider a one standard deviation change in either *Municipal Workers*, *Finance Civil Servants* or *Regional Outrage* (iteratively). Table 9 presents these pass-through, economic magnitude results. A one standard deviation higher fraction of *Municipal Workers,* working through $76,033 less compensation, results in 0.06% (6 basis points (bps)) lower net returns. Likewise, a standard deviation higher fraction of *Finance Civil Servants*, implying $107,627 lower compensation, results in 8.5 bps lower returns. A 10% change lower (flipping the sign to be consistent in rhetoric with outrage arguments) *Regional Income* predicts $63,221 lower compensation and 5 bps lower returns. We sum up these effects in an average statement. All else equal, if a pension fund could unwind the equivalent of a standard deviation effect of outrage (mimicking about a 10% change in local income or 1-2 trustee member change in the board composition) and hire accordingly a more experienced manager to the tune of about $80,000 more in pay, the pension would reap a benefit of a returns of 6.5 basis points.

Panel B of Table 9 speaks to the dollar-value materiality of these effects, and whether it might be worth the cost for pension funds to implement mechanisms (education programs, performance-sharing, etc.) to avoid outrage effects on manager contracting. In Panel B, we evaluate the return implications from outrage on pension funds of different AUM size. Evaluated at the mean estimation sample fund of $102 billion in AUM, outrage could cost a pension $50-86 million per year. It could be that the cost-benefit is not transparent for small funds. Thus, we evaluate the economic magnitude for the representative sample (the right hand-side of the table), which is smaller and at the different quartiles (25^{th}, 50^{th}, and 75^{th}) of the sample size distributions provided in Table 3. The smallest fund evaluated is the 25^{th} percentile fund for the representative sample. For this small fund, the benefit from unwinding outrage is $3.8 to $6.4 million in additional AUM per year. This is presumably a large enough benefit to enable a fund to enact programs to unwind constraints on management hiring. As we mention in our introduction, the importance of unwinding outrage might be especially important because funds that are most constrained by outrage are lower

income area funds where local economy spillovers from poor pension asset performance might be most severe.

5.2.2. Robustness

Higher net returns do not necessarily reflect a higher Sharpe ratio if the net return performance arises from taking on increased risk. We address this possibility in two ways. First, we add in the weights allocated to the sub-asset class categories. (Our performance data in these sub-asset classes is not comprehensive; but we usually have weights.) These additional levels of investment focus are: (in alternatives) real estate, hedge funds, private equity, and infrastructure; (in equities), domestic versus non-domestic public equities; and (in fixed income), cash versus bonds. We take bonds as the omitted category. Appendix Table AT2 shows that inclusion of the portfolio weights in our system does not change our outrage results.

Perhaps as a more direct test, in Table 10, we study realized tracking error. Tracking error can result from higher risk strategies, but also from lower skill. Yet, in the presence of our results from Table 8, our concern would be that any lower returns due to outrage could be attributed to lower risk strategies, which would be associated with lower within-asset class tracking error.

We set up cross-sectional estimations, with each observation being the within-fund tracking error estimated in performance data. We regress portfolio returns on benchmark returns with no constant for each pension fund and square the residual. Tracking error is the standard deviation of the mean squared error across time. Taking this tracking error as Equation II dependent variable, we estimate the system as before, including the compensation equation, System Equation I, as the first, unnumbered column. With the fewer number of observations, we drop the agency variables without power in the Table 8 estimations.

In columns (1) to (4), we find that *Outrage-Predicted Log Compensation* has no statistically significant relationship with realized tracking error for any of the asset classes. This counters the concern that our findings from Table 8 result from increased within asset-class risk.

A final robustness concern with our main Table 8 results is the exogeneity of the trustee occupations. One might be concerns that we are picking up the inverse of the politicization result of Hochberg and Rauh (2013) if the lack of politicized board members mechanically implies more teachers, workers, and finance civil servants. Thus, also in Appendix Table AT2, we take our outrage trustee occupation counts and divide by the denominator of the total number of non-

political trustees, calculating a fraction relative to non-political trustees. As Table AT2 shows, our results are, if anything, stronger.

5.3. Do Outrage Pay Constraints affect Asset Allocations?

In Table 11 we explore the possibility that outrage pay constraints affect funds' asset allocation according to predictions from our theory; in particular, higher outrage may lead to lower risk-taking, working through reduced compensation. Because asset class weights are constrained to be between 0 and 1, with many funds having low exposures to alternatives, we estimate Table 11 using a Tobit second stage model. In addition, because asset class weights are jointly determined, we report two sets of standard errors. The top standard error is a fund-clustered standard error, as before, and the bottom is a robust standard error under the seemingly-unrelated-regression assumption (SUR).

The results indicate that funds with compensation *not* constrained by outrage would exhibit higher exposures to the riskiest asset class (alternatives, column 1) in lieu of public equities (public equities). Inside our model, such an effect may arise with the hiring of a skilled manager that can extract a larger fraction of the premia in riskier asset classes. What is perhaps a bit inconsistent with our theory is that eschewing of public equities for alternatives also implies that the pension increases exposure to fixed income (column 3).

5.3.1 Do Outrage Pay Constraints Affect Delegation?

One possible mechanism driving the underperformance of outrage-constrained pension funds is the payment of intermediation fees, which could be a consequence of less skilled managers delegating larger fractions of their portfolios to external institutions. We investigate this possibility by estimating our two-equation system using the fraction of assets managed via delegation (in each asset class) as outcome variable of Equation II. We use the same asset classes defined in the previous sections, with the only difference being that for alternatives we do not include hedge funds, as they are delegation institutions. Given that our delegation fraction is a number between 0 and 1, we estimate our model using a Tobit specification on the second stage and show the results in Table 11.

The negative and significant coefficient on log compensation in all Equation II columns shows that funds that are able to avoid outrage constraints on compensation are more likely to

reduce their use of delegation and manage assets in-house. The economic impact is meaningful: a reduction of one standard deviation in *Municipal Workers* or *Finance Civil Servants* results in 6% or 8%, respectively, fewer delegation percentage points. An increase of 10% in *Regional Outrage* is followed by a reduction of around 4% in the fraction of assets managed via delegation. As the coefficients looking across the columns imply, the effect is largest for asset classes with more risk (i.e., more skill required) and for asset classes with higher mean delegation per Table5.

5.4. Other Agency Costs: Can We Speak to Mechanisms?

The results in 5.2 speak to the impact of the compensation channel on allocation and performance in public pension funds. As noted in the introduction and in the theory model, this is not the only channel of political influence. In this sub-section, we turn our attention to the other channels of distortions arising from politicians' payoffs to local investment and distortions arising from underfunding.

The key variables in our empirical setup to explore the potential distortions from politicians' payoffs to local investing is *Political Chair*. Pay-to-play arrangements of political funds may cause public pension funds to invest in political assets (e.g. local assets) to provide private political benefits for the board chair. The key variable to predict risking-up of portfolios due to pressures from liability obligations is *UnderfundedIndex*.

These variables are introduced in Tables 8-11 in the compensation regressions (System Equation I) as well as in the outcome regressions (System Equation 2). We include the variables in both equations because we believe these political variables will fail the exogeneity condition, with *Political Chair* and underfunding also being directly correlated with outcomes.

Returning to the net returns system in Table 7, we find that *Political Chair* significantly explains variation in compensation. Over-and-above this effect, in Table 8 we find that *Political Chair* significantly explains lower returns in alternatives (model 2). The point estimate is large; 367 basis points lower performance in alternatives for *Political Chair* =1 funds. This is consistent with the research of Andonov, Hochberg and Rauh (2017) that found that political funds were more likely to invest in local private equity that underperformed.

Our theory suggests that politically compromised boards will not have the incentive to pay for highly-skilled managers, since the *Political Chair* will be making selections into political assets and thus the portfolio need for skill is lower. Using the language of our model, a large reward for

political investments L leads to a manager with low skill (s), large weights in political assets (w_P), and small weights on vanilla assets (w_{MV}). Our empirical results suggest that above any role in compensation, *Political Chair* affects performance directly. One way to see this is that pay-to-play relationships need not be dependent on the manager skill level.

The asset allocation estimations in Table 10 are also consistent with a pay-to-play interpretation for *Political Chair*. Pay-to-play anecdotes in the media suggest that such activity is primarily about a Political Chair or, often, board and manager collusion, directing funds to particular asset manager who represent alternatives funds (e.g., hedge funds, private equity, etc.). What is different about these alternatives funds structures is that they are by definition bulky investments that are not atomistic in properties like stocks. In Table 10 we find a negative, significant coefficients on *Political Chair* for public equities allocation, offset by positive (but not significant) shifts to alternatives and fixed income. The fact that these shifts do not result in additional positive returns (Table 8) or risk (Table 9) supports the punchline of these anecdotes and the prior literature.

Finally, we turn our attention to the impact of *UnderfundedIndex*. The only significant impact is on asset class weights. Consistent with prior papers, notably, Andonov, Bauer and Cremers (2017) we find that *UnderfundedIndex* strongly predicts higher allocations to alternatives and negative allocations to fixed income, with significant results using the SUR standard errors.

6. Conclusion

The paper introduces a model in which trustees of public pension funds worry about their private costs arising from outrage over high compensation, and this leads them to alter management contracts and lowers management skill. The end result of this political constraint on human capital choice is distortions in portfolio allocation and most importantly weaker performance in the risky asset classes. This political agency cost is nested in a broader model that also allows for distortions coming from politicians' private benefits of local investment and from underfunding that have been the focus of prior literature.

We then test these predictions using a hand-collected global panel data set that includes information on investment manager compensation and structural features of boards and trustees that predict outrage. We use a two-equation, linear version of the model relationships to estimate

how agency affects public pension fund outcomes working through the compensation contract mechanism. In our model, outrage only affects allocations and performance through the management contract. This restriction lends itself to a structural two-stage least squares (GMM) specification, where we can make linear assertions as if we were in an instrumental variables (IV) setting.

We find there are outrage pay constraints on compensation driven by public pension funds' governance structures. Second, and most importantly, those outrage pay constraints impact fund performance and hence beneficiary welfare. We find that relaxing outrage constraints on compensation improves portfolio net returns, with the gains coming as expected from the risky asset classes where skill is particularly important. The net portfolio returns associated with weaker outrage pay constraints does not come at the expense of greater overall risk, with realized tracking error lower for funds that are less affected by outrage pay constraints. These results are consistent with politically-related contracting constraints reducing managerial skill.

The empirical results provide quantitative estimates of the costs and benefits of relaxing outrage constraints. For a plan with an average allocation to alternatives, our estimates suggest that if that fund were to relax outrage, with a cost of $81,000 to $179,000, it would benefit by producing additional benefits of $13 to $32 million in annual value-add. The projected benefit from relaxing outrage is even greater for plans with an above average allocation to alternatives, which is more common with underfunded plans.

Our paper suggests that measures to change the governance of public pension funds to insulate them from outrage and other political agency costs have the potential to benefit beneficiaries. Freeing boards from frictions on hiring and paying qualified managers is associated with better returns. And this may be of increasing importance. Growing income inequality between finance and average salaries increases outrage pressures to which public pension fund boards are particularly exposed.

Of course it is natural to ask if it possible for funds to change outrage constraints. Funds cannot change the fact that disclosure and media attention of high finance salaries will lead to public outrage. But funds can take steps to make board members less sensitive to these concerns. One way to do this is to ask the beneficiaries and political entities that are plan sponsors to appoint experts to fill these positions, rather than having the trustees be either beneficiaries or politicians.

It is instructive to see that in spite of political interests in board choices, outside of the United States there are no public pension fund board chairs that are politicians.

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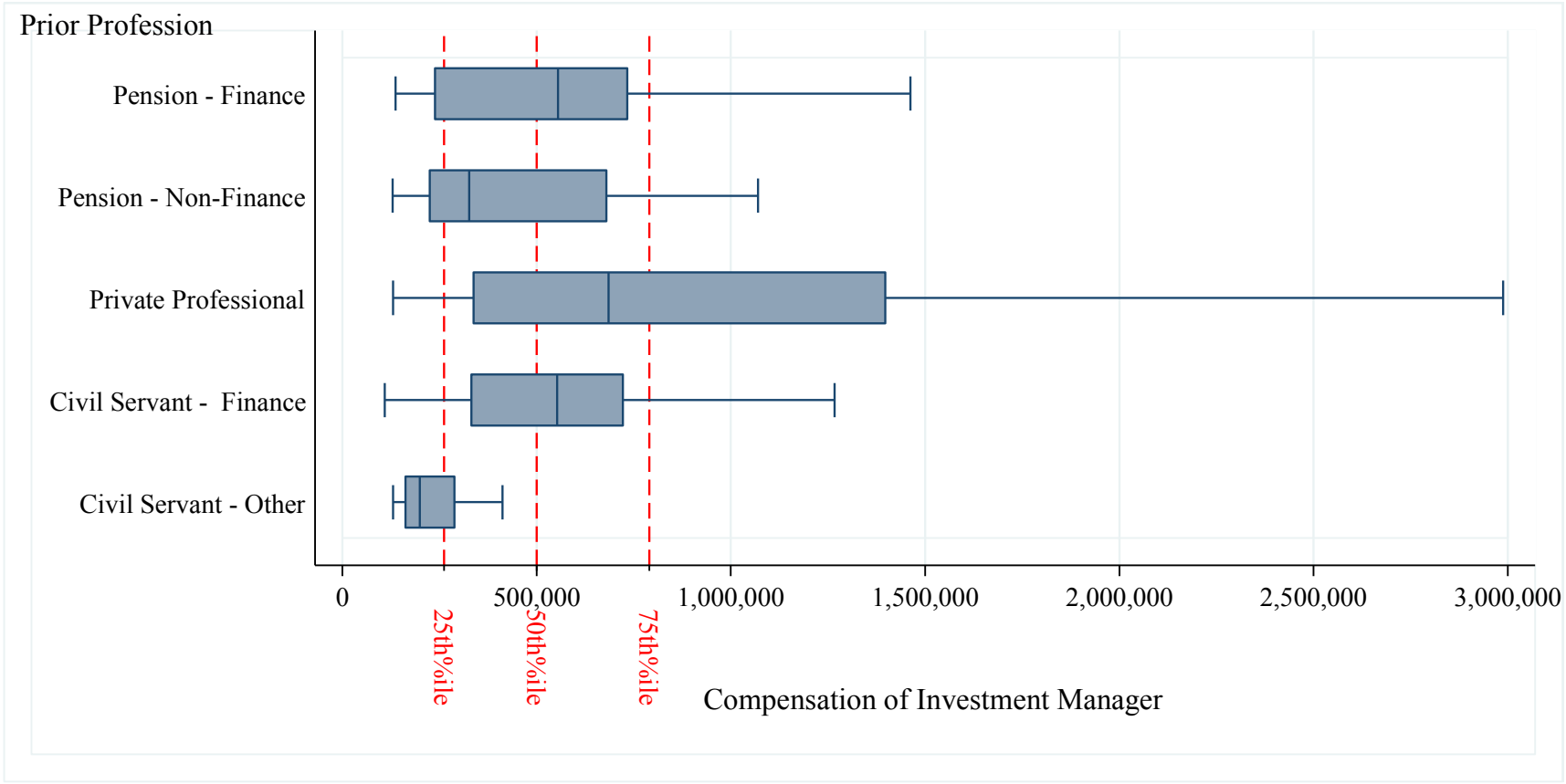


Figure 1: Compensation of Investment Manager by Prior Profession
Graphed are the distribution of investment manager compensation for each category of prior professions of the managers. The box plot displays the mean (box center line) as well as the first (box edges) and second (stem edges) standard deviations. The dashed (red) line indicates the overall sample 25th , 50th, and 75th percentiles. The distribution of the sample is as follows (also reported in Table 6, along with the more detailed titles of the professions under the categories): Pension – Finance (4.9%), Pension – Non-Finance (18.0%), Private Professional (31.1%), Civil Servant – Finance (29.5%), and Civil Servant – Non-Finance (16.4%).

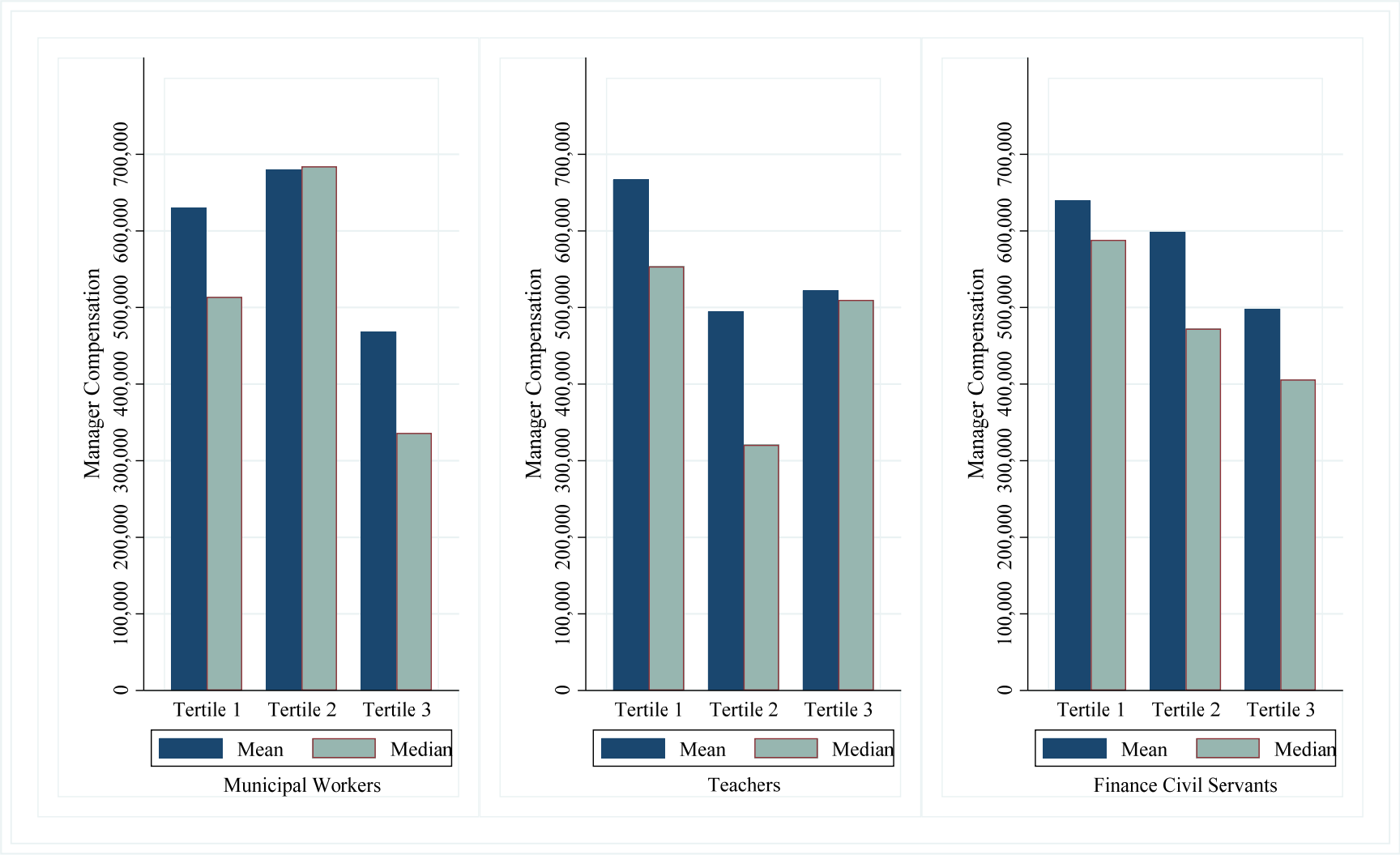


Figure 2a: Compensation by Tertitle of Trustee Occupation-Outrage Variables

Plotted are the mean (blue/darker bars) and median (green/lighter bars) manager compensation by tertitles of the trustee occupation variables which are our proxies for outrage. The variables (from left to right plotted) are the percentage *Municipal Workers*, the percentage *Teachers* and the percentage *Finance Civil Servants*.

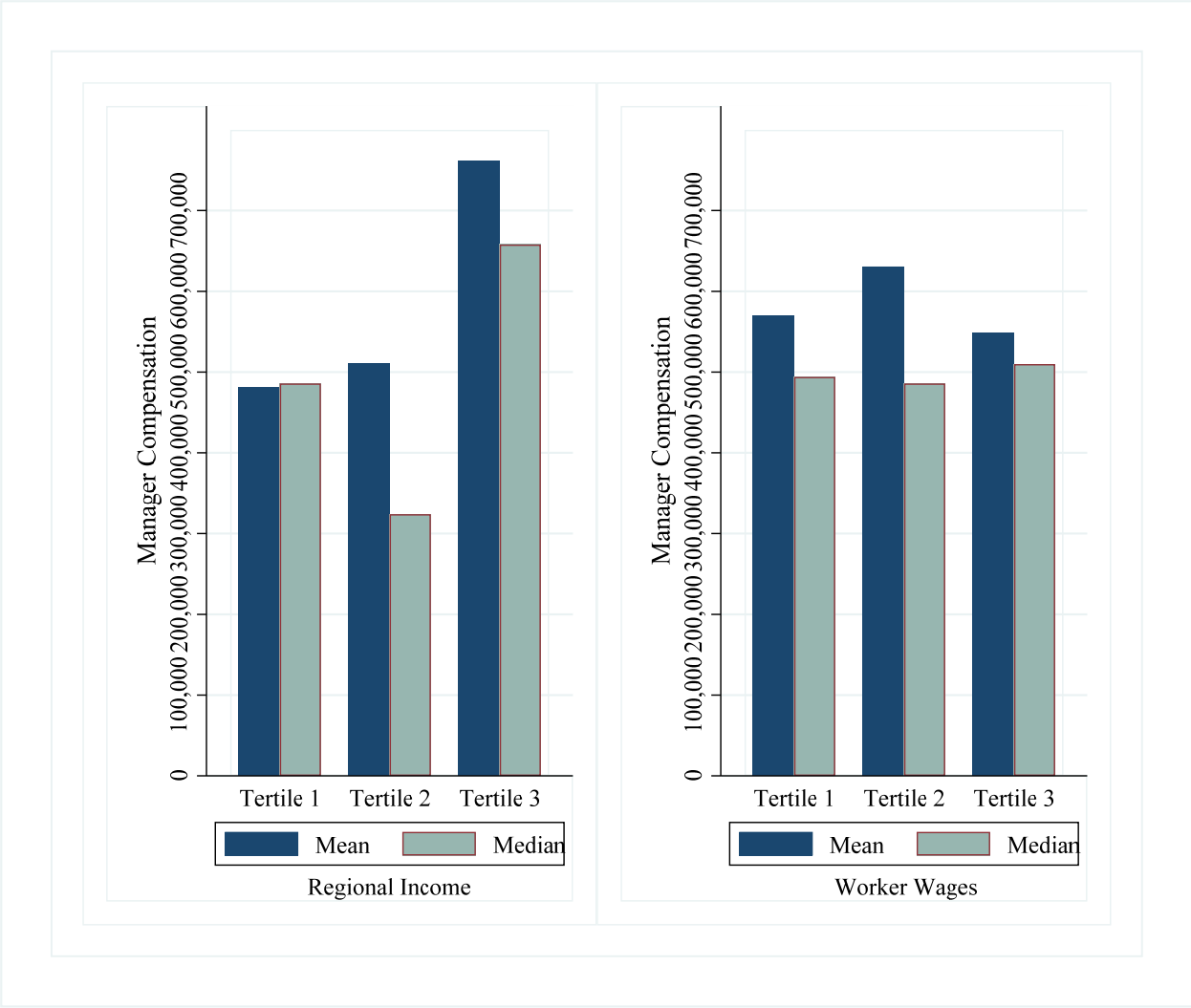


Figure 2a: Compensation by Tertitle of Reference Income-Outrage Variables

Plotted are the mean (blue/darker bars) and median (green/lighter bars) manager compensation by tertitles of reference income variables which are our proxies for outrage. The variables (from left to right plotted) are the *Regional Income* and the penson *Worker Wages*.

Table 1: Comparative Statics: Political Agency Variables Role

This table lays out model predictions. showing the comparative statics of how manager skill, portfolio choice, and returns change in the model with changes in political agency variables. The political agency issue of outrage is considered in Panel A. Because outrage is a binding-or-not constraint, the comparaitive statics reflect a discret change from not binding to binding. In panel B, the political agency issues of private benefits of political assets and the underfunding are considered. In Panel B, the comparative staics show the partical derivatives of a change in either manager skill, allocations and performance with respect to a change in agency -- private benefits of political asset investing (κ) and the board preference for risk, driven by pension liabilities (Θ). The right column relates the prediction to the table of reference for empirical results

Panel A: Effect of a Binding Outrage Constraint

Variable	Model Notation	Predicted Change With: Δ Outrage	Test of Prediction
Manager skill	Δs	<0	Table 7
Allocations			
Weight on MV security	$\Delta(w_{MV})$	<0	Table 10
Weight on political asset	$\Delta(w_P)$	<0	Table 10
Weight on fixed income	$\Delta(1-w_P-w_{MV})$	>0	Table 10
Weight on all risky	$\Delta(w_P+w_{MV})$	<0	Table 10
Performance			
E[return on MV security]	$\Delta(R_{MV})$	<0	Tables 8,9
E[return on political asset]	$\Delta(R_P)$	<0	Tables 8,9
E[portfolio return]	$\Delta(R)$	<0	Tables 8,9

Panel B: Effect of Other Political Agency Costs

Variable	Model Notation	Partial Derivative of Row Variable With Respect to: $\partial\kappa$ (κ: private benefits of political asset)	$\partial\Theta$ (Θ: liability-induced preference for risk)	Test of Prediction
Manager skill	∂s	<0	>0	Table 7
Allocations				
Weight on MV security	$\partial(w_{MV})$	<0	>0	Table 10
Weight on political asset	$\partial(w_P)$	>0	?	Table 10
Weight on fixed income	$\partial(1-w_P-w_{MV})$	?	<0	Table 10
Weight on all risky	$\partial(w_P+w_{MV})$	?	>0	Table 10
Performance				
E[return on MV security]	$\partial(R_{MV})$	<0	>0	Tables 8,9
E[return on political asset]	$\partial(R_P)$	<0	>0	Tables 8,9
E[portfolio return]	$\partial(R)$	<0	>0	Tables 8,9

Table 2: Variable Definitions

This Table reports the definitions and the data sources for the main variables used in this paper.

Variable	Definition	Source
	Compensation, Portfolio Choice, and Performance Variables	
Investment Manager Compensation	The maximum compensation of the fund's investment managers, including CEO and CIO.	Hand-collected from annual reports, public filings, newspapers, and Freedom of Information requests.
Portfolio Allocation	Portfolio weights in each of three asset class -- alternatives (real estate, private equity, hedge funds, infrastrcuture), public equity, and fixed income. Expressed as a percentage of the total.	Center for Retirement Research (CRR), CEM Benchmarking and annual reports.
Return	Realized returns in each asset class and for the overall portfolio.	Center for Retirement Research (CRR), CEM Benchmarking and annual reports.
Benchmark Return	CEM requires benchmarks to be chosen by pension trustees rather than being self-selected by asset managers. Most funds report multiple indices and weights. A visual inspection of this information indicates the benchmarks capture dimensions of risk differences across and within asset classes.	CEM Benchmarking
Tracking Error	A single observation by fund for each asset class and the portfolio, calculated as the time-series average of the squared residuals from a regression of the pension fund returns on the benchmark returns, with no constant.	Center for Retirement Research (CRR), CEM Benchmarking and annual reports.
Portfolio Delegation	Fraction of assets managed via delegation in each asset class.	CEM Benchmarking.
	Political Agency Variables	
Municipal Workers	The fraction of trustees that are workers providing basic services to city residents, usually through city government.	From annual reports. Professional designation based on biographies and web sources such as LinkedIn.
Teacher	The fraction of trustees that are workers providing basic services to teachers or education administrators.	From annual reports. Professional designation based on biographies and web sources such as LinkedIn.
Finance Civil Servant	The fraction of trustees that are civil servant in finance service to the government.	From annual reports. Professional designation based on biographies and web sources such as LinkedIn.
Regional Income	Logarithm of the local household income within the smallest region available (MSAs for the US).	Regional income reported by National statistical offices (Census Bureau in the US).
Worker Wage	Logarithm of the average wage of the constituents of the pension fund.	Hand-collected from annual reports. If not reported, we estimate based on working employee contributions and reported contribution rates as a percentage of salary.
Political Board	A dummy equal to one if the chair is appointed by government executives or ministries or serves in the role ex officion because of his or her executive government position.	Collected from pension fund charters and annual reports.
Underfunded Index	The negative of the standardized funded ratio plus the standardized age variable.	Center for Retirement Research (CRR), CEM Benchmarking, annual reports, funds' current and cached websites, direct requests to the funds.

Table 3: Pension Fund Profile Statistics

This Table reports the assets under managementand portfolio returns statistics by region of the penion fund. Panel A presents these statistics for the full sample of funds in our sample, and Panel B, for the pension funds for which we have manager compensation of trustee profile data.

Panel A: Full Sample

		Assets under Management ($billion)					Gross Portfolio Returns				
	Number of funds	Fund-Year Observations	Mean	25th Percentile	Median	75th Percentile	Fund-Year Observations	Mean	25th Percentile	Median	75th Percentile
Canada	16	210	37.02	11.45	17.04	59.90	210	0.0548	0.0012	0.0672	0.1160
Europe	39	333	122.70	8.45	17.76	71.33	302	0.0173	0.0004	0.0018	0.0268
Oceania	17	163	15.11	6.61	12.84	19.13	160	0.0312	0.0001	0.0018	0.0960
United States	92	1150	27.65	6.88	12.81	32.03	1130	0.0498	0.0004	0.0323	0.1235
Total	164	1856	44.66	7.59	13.70	35.55	1802	0.0433	0.0004	0.0195	0.1098

Panel B: Sample with Compensation & Trustee Data

		Assets under Management ($billion)					Gross Portfolio Returns				
	Number of funds	Fund-Year Observations	Mean	25th Percentile	Median	75th Percentile	Fund-Year Observations	Mean	25th Percentile	Median	75th Percentile
Canada	10	97	49.68	13.14	33.78	81.30	97	0.0589	0.0009	0.0857	0.1267
Europe	17	115	283.42	19.41	70.39	322.17	115	0.0245	0.0009	0.0114	0.0360
Oceania	11	55	21.48	11.41	16.81	27.74	55	0.0385	-0.0010	0.0212	0.1053
United States	73	196	44.07	11.72	26.00	59.21	196	0.0451	-0.0290	0.0518	0.1331
Total	111	463	102.01	11.99	29.51	72.59	463	0.0421	-0.0005	0.0330	0.1126

Table 4: Performance and Allocation Statistics

This Table reports summary statistics of the portfolio weights and performance, at the portfolio level and by asset classes. Asset classes are: (i) alternatives, defined as hedge funds, real estate, private equity, and infrastructure, (ii) public equities, and (iii) fixed income. In Panel A, we present the weights in the main estimation sample (that with compensation and trustee data) plus the sample where we observe all weights such that the weights sum to unity. Also in Panel A are the fractions of each asset class delegated to outside management. Panel B reports performance in three metrics -- gross returns, net returns over the CEM benchmark, and realized tracking errror. The realized traking error is calculated in the data relative to the benchmark return; thus there is only one observation per pension fund.

	Count	Mean	Standard Deviation	25th Percentile	Median	75th Percentile
Panel A: Allocations						
Weights: Full Sample						
Alternatives	251	0.229	0.175	0.125	0.197	0.273
Public Equities	304	0.598	0.184	0.485	0.571	0.669
Fixed Income	253	0.323	0.121	0.25	0.305	0.368
Weights: Sample restricted to having data on all weights						
Alternatives	204	0.191	0.096	0.117	0.186	0.252
Public Equities	204	0.513	0.106	0.442	0.525	0.583
Fixed Income	204	0.296	0.075	0.243	0.297	0.350
Delegation Fraction						
Alternatives	214	0.747	0.327	0.484	0.990	1.000
Public Equities	190	0.734	0.360	0.386	1.000	1.000
Fixed Income	180	0.500	0.468	0.000	0.488	1.000
Panel B: Performance						
Gross Returns						
Alternatives	355	0.061	0.119	0.002	0.075	0.135
Public Equities	367	0.053	0.206	-0.107	0.117	0.206
Fixed Income	337	0.061	0.049	0.034	0.055	0.080
Portfolio	463	0.042	0.096	0.000	0.033	0.113
Net Returns						
Alternatives	251	-0.008	0.101	-0.053	-0.004	0.046
Equities	304	0.005	0.020	-0.004	0.003	0.013
Fixed Income	253	0.005	0.031	-0.003	0.003	0.016
Portfolio	351	-0.003	0.054	-0.011	0.001	0.014
Tracking Error Realized						
Alternatives	70	0.069	0.073	0.028	0.055	0.083
Equities	96	0.038	0.054	0.012	0.019	0.035
Fixed Income	92	0.021	0.016	0.009	0.018	0.028
Portfolio	110	0.030	0.023	0.014	0.024	0.045

Table 5: Compensation, Trustee Occupation, Reference Wage and Other Agency Statistics

Panel A reports the summary statistics, and Panel B reports the correlations of the main variables characterizing the governance of pension funds in our sample. *Manager Compensation* is defined as the highest paid executive (CEO or CIO) for the public fund. *Municipal Workers* is the percent of the board whose career is in the municipal labor force, defined as police, fire department, hosptials, libararies, and other non-civil servant positions. *Finance Civil Servan* t is the percent of the board whose background is in public sector financial positions (e.g., city controllers, auditors, etc.). *Teachers* is the percent of the pension board who are teachers. *Political Chair* is a dummy taking value 1 if the chair is appointed by the executives or ministers of the government. *Underfunded Index* is an index constructed by taking the mean across the standardized value of (1- the funded ratio) and age following Rauh (2008). The two outrage income measures -- *Worker Wages* and *Local Income* -- are, repectively the average wages of workers and the municipal income.

Panel A: Statistics

	Count	Mean	Standard Deviation	25th percentile	Median	75th percentile
Manager Compensation						
Manager Compensation ($)	463	807,416	1,018,136	292,328	537,197	819,979
Log Manager Compensation	463	13.20	0.828	12.59	13.19	13.62
Outrage: Reference Wages						
Worker Income	463	47,811	15,197	38,763	45,345	55,066
Log Worker Income	463	10.73	0.302	10.57	10.72	10.92
Regional Income	463	55,434	17,955	40,873	50,127	68,228
Log Regional Income	436	10.86	0.315	10.62	10.78	11.11
Outrage: Non-Political Trustee Occucations						
Municipal Workers (% Trustees)	463	0.053	0.087	0.000	0.000	0.100
Teachers (% Trustees)	463	0.109	0.167	0.000	0.077	0.133
Finance Civil Servants (% Trustees)	463	0.102	0.144	0.000	0.083	0.154
Other Agency Variables						
Political Chair	463	0.514	0.586	0.000	0.364	1.000
Underfunded Index	463	0.171	1.303	-0.144	0.000	0.203

Panel B: Correlations

	Compen-sation	Municipal Workers	Fin. Civil Servants	Teachers	Worker Wages	Local Income	Political Chair
Municipal Workers	-0.092						
Finance Civil Servants	-0.150	-0.198					
Teachers	-0.226	-0.111	-0.114				
Worker Wages	0.061	0.106	0.112	0.015			
Local Income	0.364	0.022	-0.176	-0.193	0.250		
Political Chair	-0.120	-0.133	-0.012	0.023	0.000	-0.080	
Underfunded Index	-0.101	0.075	0.082	-0.069	0.052	0.027	-0.030

Table 6: Professions of Investment Managers and Trustees

This table reports the immediate prior profession of investment managers (Panel A) and the current professions of trustees (Panel B). The data are collapsed to the cross section of public funds. All data are hand collected.

Panel A: Investment Managers' Professions

Occupation	Description	Professions Represented	%
		Prior Pension Executives	
Pension - Investment Executive	Investment manager from another pension fund	Director of Investment, CEO, CIO	4.9%
Pension - Other Executive	Other executive position in another pension fund	Assistant General Counsel, Assistant Executive Director, Deputy Executive Director, Chief of Staff, COO	18.0%
		Prior Private Firm Finance Professionals or Executives	
Private Firm Professional	Financial position from privately firm	CEO, CIO, Director, Managing Partner, Accountant, Actuary, Auditor, Consultant, CRO	31.1%
		Civil Servants	
Civil Servant (Finance)	Civil servant with financial experience	Treasurer, Auditor, Accountant, Controller, Budget Officer, Finance Director, Public Institution Professor	29.5%
Civil Servant (Non-Finance)	Civil servant without financial experience	City Council CEO, City Manager, Executive Director, Department of Correction Administrator, Deputy Chief of Staff, Director, Executive Commissioner, Natural Resource Advisor, Teacher, Senator	16.4%

Panel B: Trustees' Professions

Occupation	Description	Professions Represented	%
		Civil Servants	
Politician	Includes any representative or elected official of municipal, state or federal government	Senator, House Representative, Mayor, Governor, Lieutenant Governor, Secretary of State, Attorney General, Assembly Speaker, State Representative, Secretary, Minister, Borough President, City Manager, Assistant Deputy Minister, Deputy Governor, Premier Deputy Chief of Staff, Deputy Minister, , City Council, County Commissioner, Deputy City Manager, Deputy General Counsel,	6.4%
Finance Civil Servant	Civil servant with financial experience	Treasurer, Auditor, Accountant, Controller, Budget Officer, State Finance Director	34.4%
Other Civil Servant	Civil servant without financial experience	Judge, Prosecutor, Clerk, Commissioner, Assistant Commissioner, Professor, Dean	13.7%
		Non-Civil Servants	
Teacher	Teachers	Teachers	14.7%
Municipal Worker	Workers providing services to city residents, union labor	Police Officer, Fire Officer, Jail Worker, Railway , Steel , Construction, Electrician, Mail Employee, Librarian, Miner, Bus Driver, Chimney Sweep, Food Worker, Manufacturing Worker, Telecommunications	7.7%
Professionals	Local private sector professionals and NGO executives	Financial Sector Expert, Doctor, Nurse, Dentist, Private Firm CEO, CIO, Chairman, Pharmacist, Journalist, Media Professional, Architect, NGO Chairman, Owner of Private Firm	23.1%

Table 7: Effect of Outrage and Political Agency on Manager Compensation

The dependent variable is the log compensation of the investment manager. *Municipal Workers* is the percent of the board whose career is in the municipal labor force, defined as police, fire department, hosptials, libararies, and other non-civil servant positions. Teachers is the percent of the pension board who are teachers. *Finance Civil Servant* is the percent of the board whose background is in public sector financial positions (e.g., city controllers, auditors, etc.). *Political Chair* is a dummy taking value 1 if the chair is appointed by the executives or ministers of the governmentor is ex officio desginated as chair as an executives or ministers of the government. *Underfunded Index* is an index constructed by taking the mean across the standardized value of (1- the funded ratio) and age following Rauh (2008). *Worker Wages* and *Regional Income* are the outrage reference wages, equal to mean pension workers wages and meadian local area incomes. *Log Size* is the log of the fund AUM. All money variables are in 2010 USD. Panel A present Estimation is OLS with year fixed effects. Panel B presents the economic magnitude with the change induced as noted, choosing a half standard deviation in situations where the cross-sectional changes would be large for a time series application by a pension fund. Standard errors are clustered at the fund level. *** denotes p<0.01, ** denotes p<0.05, and * denotes p<0.1.

Panel A: Estimates

	Dependent Variable: Log Compensation				
	(1)	(2)	(3)	(4)	(5)
Municipal Workers		-0.604			-1.082*
		[0.546]			[0.611]
Teachers		-0.619**			-0.405
		[0.293]			[0.324]
Finance Civil Servants		-1.401***			-0.925**
		[0.284]			[0.374]
Log Regional Income			0.923***		0.783***
			[0.181]		[0.193]
Log Worker Wages			0.618**		0.690**
			[0.285]		[0.293]
Political Chair				-0.212**	-0.199**
				[0.0985]	[0.0971]
Underfunding Index (lag)				0.0204	0.0418*
				[0.0288]	[0.0238]
Log Size (lag)	0.284***	0.279***	0.154*	0.286***	0.164*
	[0.0842]	[0.0830]	[0.0828]	[0.0843]	[0.0836]
Year Fixed Effects	Y	Y	Y	Y	Y
Observations	453	453	426	453	426
Number of Funds	110	110	110	110	110
R-Squared	0.0365	0.115	0.106	0.0498	0.153

Panel B: Economic Magnitude

	Change Evaluated	$ Impact on Compensation	Percentage Change
1 standard deviation change =	0.087 higher fraction of Municipal Workers	-76,033	-9%
1 standard deviation change =	0.144 higher fraction of Finance Civil Servants	-107,627	-13%
10% percentage change =	4781 more Regional Income	63,221	8%
10% percentage change =	5543 more Worker Wages	55,712	7%
1 standard deviation change =	0.586 greater likelihood of Political Chair	-94,209	-12%
1 standard deviation change =	1.303 higher Underfunding Index	43,982	5%

Table 8: Effect of Outrage on Returns

Reported in columns (1)-(4) are estimates from a GMM system of two equations. The dependent variable in numbered columns (denoted above Equation II) is the net return over the asset-class benchmark. The far left column presents (Equation I) estimates of the effect of political agency on compensation for the sample in column (1). A similar estimate (unreported) is used for each of columns (2)-(4). In columns (1)-(4), the log compensation variable is the outrage-predicted compensation, from Equation I (the left column). *Municipal Worker, Teachers,* and *Finance Civil Servant* are the trustee composition outrage variables. *Worker Wages* and *Regional Income* are the outrage reference wages, equal to mean pension workers wages and meadian local area income. *Political Chair* is equal to one for funds whose chair is appointed by the government. *Underfunded Index* is an index constructed by taking the mean across the standardized value of (1- the funded ratio) and age following Rauh (2008). *Log Size* is the log of the lagged fund AUM. Standard errors are clustered at the fund level. The number of funds per estimation is indicated below the number of observations. The Cragg-Donald F-statistic, and the p-value of ints significance, is included as a test of weak identification. *** denotes p<0.01, ** denotes p<0.05, and * denotes p<0.1.

Panel A: Estimates		(1)	(2)	(3)	(4)
	Equation I:	Equation II: Net Returns			
	Log Compensation	Portfolio	Alternatives	Public Equities	Fixed Income
Outrage-Predicted Log Compensation		0.00635**	0.0209*	0.00689*	-0.00441
		[0.00291]	[0.0111]	[0.00400]	[0.00370]
Municipal Workers	-0.997**				
	[0.470]				
Teachers	-0.217				
	[0.252]				
Finance Civil Servants	-1.163***				
	[0.279]				
Log Regional Income	1.034***				
	[0.154]				
Log Worker Wages	-0.142				
	[0.156]				
Political Chair	-0.0978	-0.00362**	-0.0155**	-0.00353*	-0.000123
	[0.0705]	[0.00143]	[0.00777]	[0.00187]	[0.00219]
Underfunding (lag)	0.0230	0.000736	-0.00117	-0.000458	0.00297
	[0.0409]	[0.00133]	[0.00544]	[0.00179]	[0.00199]
Log Size (lag)	0.304***	-0.00314***	0.000651	-0.00409**	-0.000433
	[0.0393]	[0.00117]	[0.00552]	[0.00161]	[0.00178]
Observations	303	303	243	285	243
Number of Funds	89	89	71	86	80
Cragg-Donald F-stat	20.31				
F-Stat p-value	0.000				

Table 9: Economic Magnitude Calculations

Panel A: Return Implications

Below are the economic magnitudes as to the effect of the outrage threat resulting from the estimations in Table 8. In the system, the Equation I outrage variables affect compensation, which in turn affects manager compensation. We present this pass-through effect of a change in the outrage variables in Equation I to the return performance implication of column (1), Table 8. The interpretation is not necessarily that the outrage variable can be changed, but the extent to which, the political agency that allows outrage to happen could be unwound. Reutrns are expressed in annual performance. In the final row, we show the effect in Equation II of a change in political chair on returns, following Andonov et al (2017).

Equation I Change Evaluated	Working through Equation II Effect		Resulting Change in Returns
1 s.d. increase in Municipal Workers =>	-$76,033	change in Compensation =>	-0.060%
1 s.d. increase in Finance Civil Servants =>	-$107,627	change in Compensation =>	-0.085%
10% increase in Regional Income =>	$63,221	change in Compensation =>	0.050%
	1 s.d. increase in Political Chair =>		-0.212%

Panel B: Assets under Management Implications

Building off the calculations in Panel A, below are the implied changes in AUM per year for a pension fund evaluated at different points in the pension fund size distribution. The numbers presented can be interpreted as the inference to the following question: *how much in assets' dollar returns might a pension fund sacrifice because of hiring a manager whose compensation contract is affected by the threat of outrage* ? We repeat the exercise for the two pension fund samles (the estimation sample and the representative sample) represented in Table 3, Panels A and B. On the left are the pension funds in our estimation sample, which is biased toward larger funds because of our need to have observability in compensation.

	Annual AUM Change ($Million) for Different Size Pension Funds:							
	Estimation Sample (Table 3, Panel B)				Representative Sample (Table 3, Panel A)			
	Mean	25th Percentile	Median	75th Percentile	Mean	25th Percentile	Median	75th Percentile
1 s.d. increase in Municipal Workers =>	-$61.0	-$7.2	-$17.6	-$43.4	-$26.7	-$4.5	-$8.2	-$21.3
1 s.d. increase in Finance Civil Servants =>	-$86.3	-$10.1	-$25.0	-$61.4	-$37.8	-$6.4	-$11.6	-$30.1
10% increase in Regional Income =>	$50.7	$6.0	$14.7	$36.1	$22.2	$3.8	$6.8	$17.7

Table 10: Effect of Outrage on Realized Tracking Error

Observations in this Table are limited to one observation per fund, collapsed to funds who have at least 3 years of portfolio returns for which tracking errors can be calculated. The dependent variable in numbered columns is the realized tracking error for the fund, calculated by regressing portfolio returns on benchmark returns with no constant for each pension fund. The residuals are squared, and we take the standard deviation of the mean squared error across time. The far left column presents Equation I estimates of the effect of political agency on compensation for the sample in column (1). A similar estimate (unreported) is used for each of columns (2)-(4). *Municipal Worker, Teachers* , and *Finance Civil Servants* are the trustee composition outrage variables. *Worker Wages* and *Regional Income* are the outrage reference wages, equal to mean pension workers wages and meadian local area income. *Political Chair* is equal to one for funds whose chair is appointed by the government. *Underfunded Index* is an index constructed by taking the mean across the standardized value of (1- the funded ratio) and age following Rauh (2008). Log Size is the log of the lagged fund AUM.Weight variables are asset allocation weights, including null weights. *** denotes p<0.01, ** denotes p<0.05, and * denotes p<0.1.

		(1)	(2)	(3)	(4)
	Equation I:	Equation II: Tracking Error			
	Log Compensation	Portfolio	Alternatives	Public Equities	Fixed Income
Outrage-Predicted Log		0.00843	-0.0303	0.00179	-0.00626
Compensation		[0.00731]	[0.0275]	[0.0216]	[0.00509]
Municipal Workers	-1.029**				
	[0.507]				
Finance Civil Servants	-0.637*				
	[0.353]				
Log Regional Income	0.519**				
	[0.202]				
Political Chair	-0.0884	0.00474	-0.0135	-0.0174***	-0.00457*
	[0.0967]	[0.00380]	[0.0146]	[0.00674]	[0.00245]
Underfunded Index	-0.0227	0.00205	0.000394	0.00804	0.000375
	[0.0500]	[0.00238]	[0.00678]	[0.00544]	[0.00191]
Log Fund Size	0.0217	0.000484	-0.00298	0.0105**	-0.00208
	[0.0551]	[0.00186]	[0.00861]	[0.00455]	[0.00196]
Weights					
Private Equity	0.242	0.023	0.899**		
	[1.612]	[0.0506]	[0.373]		
Real Estate	-0.243	-0.00857	-0.141*		
	[0.864]	[0.0300]	[0.0745]		
Hedge Funds	-0.183	-0.115**	-0.241		
	[2.374]	[0.0516]	[0.184]		
Domestic Equity	-1.182***	-0.0143		-0.169***	
	[0.425]	[0.0183]		[0.0526]	
Foreign Equity	1.621***	-0.0151		0.0181	
	[0.576]	[0.0317]		[0.0918]	
Cash	-5.742**	0.0463			-0.0442
	[2.696]	[0.0901]			[0.105]
Bonds					0.00897
					[0.0146]
Observations, 1 per fund	112	112	70	97	94
R-Squared	0.337	0.009	0.072	0.38	--
Cragg-Donald F-stat	5.292				
F-Stat	0.00145				

Table 11: Asset Class Weights Results

Reported in columns (1)-(3) are marginal effects estimates from an MLE-Tobit system of two equations. The dependent variable in numbered columns (denoted above Equation II) is the asset class weight as designated in [0,1]. The sample is limited to fund-years for which we observe a full (sums to unity) set allocation weights. The far left column presents (Equation I) estimates of the effect of political agency on compensation for the sample in column (1). A similar estimate (unreported) is used for each of columns (2)-(3). In columns (1)-(3), the log compensation variable is the outrage-predicted compensation, from Equation I (the left column). *Municipal Worker*, *Teachers*, and *Finance Civil Servants* are the trustee composition outrage variables. *Worker Wages* and *Regional Income* are the outrage reference wages, equal to mean pension workers wages and meadian local area income. *Political Chair* is equal to one for funds whose chair is appointed by the government. *Underfunded Index* is an index constructed by taking the mean across the standardized value of (1- the funded ratio) and age following Rauh (2008). Log Size is the log of the lagged fund AUM. Standard errors are clustered at the fund level. *** denotes p<0.01, ** denotes p<0.05, and * denotes p<0.1. Two sets of standard errors are presented beneath the coefficient - standard errors clustered at the fund level (top) and robust standard errors under the seemingly unrelated assumption (bottom), inlcuded because of the joint determination of allocation weights.

		(1)	(2)	(3)
	Equation I:	Equation II: Tobit Estimation of Asset Class Weights		
	Log Compensation	Alternatives	Public Equities	Fixed Income
Outrage-Predicted Log Compensation		0.0355	-0.0666	0.0375
		[0.0144]**	[0.0179]***	[0.0156]**
		[0.0256]	[0.0314]***	[0.0344]
Municipal Workers	-0.801			
	[0.797]			
Teachers	-0.291			
	[0.371]			
Finance Civil Servants	-0.367			
	[0.514]			
Log Regional Income	1.221***			
	[0.320]			
Log Worker Wages	-0.206			
	[0.300]			
Political Chair	-0.0771	0.00009	-0.0169	0.0177
	[0.132]	[0.00962]	[0.0117]	[0.00960]*
		[0.0145]	[0.0184]	[0.0146]
Underfunded Index (lag)	-0.00322	0.00904	0.00126	-0.0101
	[0.0675]	[0.00587]	[0.00712]	[0.00584]*
		[0.00843]	[0.00749]	[0.00673]
Log Size (lag)	0.389***	0.0154	0.0037	-0.0220**
	[0.102]	[0.00884]*	[0.0109]	[0.00923]
		[0.0140]	[0.0216]	[0.0202]
Observations		197	197	197
Wald Chi-squared		64.4	50.41	17.9

Table 12: Portfolio Delegation Results

The far left column presents the first stage estimate, where log manager compensation is instrumented with `% Trustees who are Municipal Workers', `% Trustees with Public Sector Finance Experiences,`% Trustees who are Teachers', `Constituent Outrage' (=-log(average wages of constitutuents)), and `Regional Outrage' (=-log(median local income)). The dependent variable in numbered columns is the fraction of assets managed via delegation the asset class noted in the column. Columns (1)-(3) present the second equation results, and columns (4) - (6) present the corresponding OLS results for comparison. `Political Board' is equal to one for funds whose chair is appointed by the government. `Underfunded Index' is the funded ratio and age index of underfunding pressures. `Log Size' is the log of the lagged fund AUM. All money variables are in 2010 USD. Year fixed effects are included.The final row presents the F-stat for the relevance of the instruments. *** denotes p<0.01, ** denotes p<0.05, and * denotes p<0.1.

			(1)	(2)	(3)
Dependent Variable:	Log Compensation		Delegated Fraction in:		
		Portfolio	Alternatives	Public Equities	Fixed Income
Model:	Equation I	Equation II	Equation II	Equation II	Equation II
Outrage-Predicted Log Compensation		-0.600***	-0.635***	-0.242	-0.283
		[0.183]	[0.217]	[0.179]	[0.229]
Municipal	-1.447				
	[0.491]***				
Teachers	0.00855				
	[0.232]				
Finance Civil Servants	-1.596				
	[0.254]***				
Regional Outrage	-1.314				
	[0.145]***				
Constituent Outrage	-0.189				
	[0.158]				
Political Chair	-0.130		0.120	0.129	0.439
	[0.118]		[0.128]	[0.182]	[0.209]**
			[0.182]	[0.268]	[0.418]
Underfunding Index (lag)	0.00543		0.0697	0.0792	0.132
	[0.0517]		[0.0509]	[0.0762]	[0.0852]
			[0.0823]	[0.198]	[0.187]
Log Size (lag)	0.307		-0.0522	-0.275	-0.469
	[0.0458]***		[0.0419]	[0.0719]***	[0.0827]***
			[0.0928]	[0.113]**	[0.150]***
Observations	245		258	245	251
Pseudo R-squared	0.531				
F-Stat	29.17				

Appendix Table 1: Compensation Outrage Anecdotes in the Media

Presented are nine anecdotes of media outrage concerning compensation of public fund investment managers

1. Oregon	"Unspoken, but also politically inconvenient is the compensation to attract talent from the private sector. The state's existing investment officers are some of the best paid public employees, making an average of $200,000 a year. But Treasury officials quietly complain that staff is underpaid by industry standards, and bristle about having to explain and get approval from the Legislature to release performance-based pay each year." Source: *The Oregonian,* Ed Sickinger*,* "Treasurer looks to reorganize investment division into quasi-public entity," Jan 16, 2013
2. CalPERS	"Our compensation is just too low," board member Richard Costigan said in May. "We're not attracting quality candidates. The quality candidates who want to come here are negatively impacted by the salary levels." Source: *Sacramento Bee* , Adam Ashton, 'Pay for CalPERS' next Chief investment officer can reach $1.77 million,' June 20, 2018
3. Kentucky Retirement System	"We've got our issues here and it's hard enough attracting applicants," Thielen said, referencing KRS's status as one of the worst-funded pensions in the country.Thielen, who announced his intention to retire last year, has already had to stay on longer than planned due to a lack of qualified applicants for his position. ... As for the provisions regarding fund personnel and their compensation, Thielen said the bill would "create significant problems for us attracting and retaining staff." While KRS links employee compensation to performance, the bill would require adoption of the government's tenure-based pay structure. Source: *AiCIO* , Amy White, "Kentucky Pension Fights to Retain Control of Governance", February 25, 2016
4. New York Teachers' Retirement Sytstem	Depoliticizing, professionalizing, and streamlining the management of our pension funds will enhance investment returns and reduce pension costs....The proposal calls for the investment entity to be staffed by experienced industry professionals and for compensation packages to attract those investment professionals....* A Chief Investment Officer will lead the new investment management entity. Source: *Targeted News Service* , 'Comptroller Liu, Mayor Bloomberg and Labor Leaders Announce Agreement in Principle to Reform Pension Investment Governance and Management,' Oct 27, 2011
5. Missouri State Employees Retirement System	Dahl, chief investment officer for the Missouri State Employees Retirement System, will receive a $125,155 cash bonus this summer and up to that amount in deferred compensation, payable in two years. In effect, he could double his $250,309 salary.... The payments, originally scheduled for February, are slated to go out in June, a delay designed to avoid public scrutiny amid legislative budget-cutting. It's a politically sticky subject, because Gov. Jay Nixon and legislators are considering cutting thousands of government jobs, services for the disabled and college scholarships among many other things. Senate Appropriations Committee Vice Chairman Kurt Schaefer, R-Columbia, was surprised Thursday to learn of the bonuses. "Now is not the time for anyone to be getting a state-funded bonus," said Schaefer.... Nixon, who last year called MOSERS bonuses "unconscionable," said Thursday that the bonus system is on the way out, thanks to his appointees to the board of trustees. Source: *St. Louis Post-Dispatch* , Virginia Young, 'Bonuses for pension staff raise eyebrows in Missouri Top investment officer due to get $125,155 amid big cuts,' April 2, 2010,

Appendix Table 1 (continued)

6. Florida SBA	The Florida State Board of Administration (SBA) has bumped the annual paycheck of CIO Ash Williams up to $367,500 from $325,000. Williams, who oversees a team managing $176.4 billion in pension and endowment assets, has not had a pay raise since 2008, and in line with SBA rules, does not receive incentives, Dennis Mackee, a spokesman for the fund, told MMI. Public CIO compensation has been a hot-button topic in the industry. According to industry insiders, a freshly-minted MBA graduate starts out in the private sector earning at least $300,000 a year. The typical public fund cio earns about $200,000-350,000 annually. Source: *Money Management Letter* , Dawn Lim, Feb 28, 2014, 'Florida SBA CIO Gets First Pay Raise In Five Years'
7. New Mexico SIC	The New Mexico SIC has been in the market for a fixed-income director to oversee a $4 billion credit portfolio ... "The council is seeking to find a qualified credit portfolio manager, which is difficult under the current budgetary constraints.... New Mexico's portfolio managers currently command approximately $100,000-120,000 in annual compensation. Market practitioners estimate that the state needs to offer at least $150,000 to fill the position... New Mexico's compensatory challenge highlights a tricky dance public funds must perform to persuade state legislatures to grant investment staff compensation levels that are higher than other public employees. "Pay scales in public plans tend to reflect the pay scales for the state bureaucracy. A public plan is looked at as just another state agency," said Charles Skorina of recruitment firm Skorina & Co., which specializes in recruiting for asset management firms and endowments and foundations. Asset management and E&F executives generally command two to four times more compensation than public pension peers in similar positions. Source: *Money Management Letter* , Dawn Lim, May 14, 2013, 'Hiriing woes Confound Large Public Funds
8. Qsuper, Australia	Brad Holzberger, chief investment officer of the $54 billion QSuper -retirement fund was the highest paid executive in the not-for-profit -superannuation sector last year, taking home $1.2 million. .... Mark Delaney, who oversees the investment portfolio of the $78 billion AustralianSuper fund.... was paid $971,000. Ian Silk, the boss of AustralianSuper, the largest not-for-profit fund in the country, was paid $700,000. The salaries are modest compared with the remuneration packages of fund managers, whose services are bought by super funds. The highest paid executive director at Platinum Asset Management, which has $24 billion under management, is Philip Howard, the finance director, who was paid $3.6 million last year. Fund managers can earn up to $10 million a year. Source: *Financial Review* , Sally Patten, 'Salaries for industry fund bosses not as super as fundie pay,' Nov 6, 2014
9. Qsuper, Australia	SUPERANNUATION chiefs managing the nest eggs of Queensland public servants are receiving fat-cat bonuses while members are facing delays in getting advice. Source: *Courier Mail* , Renee Viellaris, 'QSuper fat cats take the cream,' Spetember 21, 2014

Appendix Table 2: Robustness of Return Results

Reported in columns (1)-(4) are estimates from a GMM system of two equations. The dependent variable in numbered columns (denoted above Equation II) is the net return over the asset-class benchmark. The far left column presents (Equation I) estimates of the effect of political agency on compensation for the sample in column (1). A similar estimate (unreported) is used for each of columns (2)-(4). In columns (1)-(4), the log compensation variable is the outrage-predicted compensation, from Equation I (the left column). *Municipal Worker, Teachers,* and *Finance Civil Servant* are the trustee composition outrage variables. *Worker Wages* and *Regional Income* are the outrage reference wages, equal to mean pension workers wages and meadian local area income. *Political Chair* is equal to one for funds whose chair is appointed by the government. *Underfunded Index* is an index constructed by taking the mean across the standardized value of (1- the funded ratio) and age following Rauh (2008). *Log Size* is the log of the lagged fund AUM. Weight variables are asset allocation weights, including null weights. The omitted category is bonds. Standard errors are clustered at the fund level. The number of funds per estimation is indicated below the number of observations. The Cragg-Donald F-statistic, and the p-value of ints significance, is included as a test of weak identification. *** denotes p<0.01, ** denotes p<0.05, and * denotes p<0.1.

		(1)	(2)	(3)	(4)
	Equation I:	Equation II: Net Returns			
	Log Compensation	Portfolio	Alternatives	Public Equities	Fixed Income
Outrage-Predicted Log		0.00842**	0.0351***	0.00864**	-0.00292
Compensation		[0.00361]	[0.0133]	[0.00419]	[0.00433]
Occupations as a % of Non-Political Trustees					
Municipal Workers	-0.173				
	[0.186]				
Teachers	0.094				
	[0.102]				
Finance Civil Servants	-0.310**				
	[0.129]				
Log Regional Income	1.104***				
	[0.146]				
Log Worker Wages	-0.033				
	[0.155]				
Political Chair	0.0408	-0.00257	-0.0187**	-0.00419**	-0.00537**
	[0.0669]	[0.00168]	[0.00754]	[0.00207]	[0.00268]
Underfunding (lag)	0.0073	0.000696	-0.0000633	-0.0000498	0.00382
	[0.0399]	[0.00143]	[0.00445]	[0.00164]	[0.00234]
Log Size (lag)	0.243***	-0.00255*	-0.00186	-0.00214	0.00221
	[0.0413]	[0.00152]	[0.00609]	[0.00193]	[0.00190]
Weights					
Private Equity	-1.279**	-0.00227	-0.0647	0.0127	0.018
	[0.564]	[0.0145]	[0.0732]	[0.0206]	[0.0426]
Real Estate	-0.177	0.00495	-0.0378	-0.0628**	-0.139***
	[0.398]	[0.0118]	[0.0346]	[0.0257]	[0.0433]
Hedge Funds	1.294	0.0357	0.156**	0.0669***	0.0212
	[0.924]	[0.0237]	[0.0791]	[0.0237]	[0.0326]
Domestic Equity	-0.709***	0.0197**	0.0896	0.0105	-0.0175
	[0.263]	[0.00972]	[0.0595]	[0.00832]	[0.0162]
Foreign Equity	0.326	0.00191	-0.132*	0.0289***	0.0183
	[0.326]	[0.0153]	[0.0694]	[0.0110]	[0.0184]
Cash	-1.261	0.0165	0.00585	0.0712***	-0.039
	[0.976]	[0.0252]	[0.0986]	[0.0208]	[0.0243]
Observations	299	299	243	281	243
Number of Funds	299	88	71	85	80
Cragg-Donald F-stat	14.61				
F-Stat p-value	0.000				

Appendix A: Model Solution

In this appendix we prove that the optimal manager quality chosen by the board and the optimal contract offered to the portfolio manager are given by equations (8) and (11).

A.1. Optimal Contract

First, we assume that the manager with quality $\boldsymbol{s}$ is hired, and then we calculate the optimal contact offered by the board of trustees. We can clearly assume that $b = (1-a)\kappa$, given that financial and political returns are perfectly exchangeable in our model, which implies that the board would always offer the same fraction of political and of financial returns to the portfolio manager. To find new optimal value of the risk sharing parameter $\boldsymbol{a}$, note that the objective function of the portfolio manager simplifies to:

$$r_f + (1-a)w^{\intercal}B(s) - \frac{1}{2}\lambda(1-a)^2 w^{\intercal}\Sigma w \tag{A.1}$$

Where w is the vector of portfolio weights, Σ is the covariance matrix of returns, and $B(s)$ is the vector $B(s) = (s\varphi_{MV}, s\varphi_P + \kappa)^{\intercal}$. The optimal response that maximizes (A.1) is given by:

$$w = (1-a)^{-1}\lambda^{-1}\Sigma^{-1}B(s) \tag{A.2}$$

Now we can write the board's objective function as follows:

$$r_f + w^{\intercal}aB(s) - c - \frac{1}{2}\lambda_B a^2 w^{\intercal}\Sigma w \tag{A.3}$$

Let $\nu = \frac{a}{1-a}$. Basic algebra shows that (A.3) is proportional to

$$\nu - \frac{1}{2}\frac{\lambda_B}{\lambda}\nu^2 \tag{A.4}$$

Which is maximized by $\nu = \frac{\lambda_B}{\lambda}$. This implies that the optimal a is given by

$$a^* = \frac{\lambda}{\lambda+\lambda_B} \tag{A.5}$$

A.2. Optimal Manager Quality

By plugging the optimal contract into the board objective function, we find the following indirect utility function:

$$V_B(s) = r_f + \frac{1}{2\bar{\lambda}} B(s)^{\intercal}\Sigma^{-1}B(s) - O(s) \tag{A.6}$$

Where $\bar{\lambda} = (\lambda^{-1} + \lambda_B^{-1})^{-1}$. The underlying first order condition for the choice of the optimal quality is:

$$B(s)^{\intercal}\Sigma^{-1}\varphi = O'(s) \tag{A.7}$$

Where $\varphi = (\varphi_{MV}, \varphi_P)^{\intercal}$. It's easy to see that this implies in the following condition:

$$\frac{(\sigma_P^2\varphi_{MV}^2 - 2\rho\sigma_P\sigma_{MV}\varphi_{MV}\varphi_P + \sigma_{MV}^2\varphi_P^2)s + (\sigma_{MV}^2\varphi_P - \rho\sigma_P\sigma_{MV}\varphi_{MV})\kappa}{\bar{\lambda}\sigma_P^2\sigma_{MV}^2(1-\rho^2)} = O'(s) \tag{A.8}$$

Appendix B: Comparative Statics Computations

In this appendix we compute the signals of the partial derivatives stated on the panels A and B on the comparative statics section of the paper. First we consider the case when the outrage constraint is not binding, and after that we compare the derivatives of the biding and not-biding cases.

B.1. Partial Derivatives of Manager Quality

If the outrage constraint is not binding, then the optimal manager quality s^* maximizes the ex-ante utility function of the board $V_B(s)$, which can be written as:

$$V_B(s) = \frac{1}{2\bar{\lambda}} B(s)^{\intercal}\Sigma^{-1}B(s) - O(s) \tag{B.1}$$

where Σ is the covariance matrix of returns, $O(s)$ is the outside option for a manager with quality s, and $B(s)$ is a vector defined by $B(s) = (s\varphi_{MV}, s\varphi_P + \kappa)^{\intercal}$. It's easy to see that we can write the underlying first order condition as

$$\bar{\lambda}^{-1}\boldsymbol{\varphi}^{\intercal}\Sigma^{-1}[s\boldsymbol{\varphi} + \kappa\boldsymbol{e}_2] = O'(s) \tag{B.2}$$

where $\boldsymbol{\varphi} = (\varphi_{MV}, \varphi_P)^{\intercal}$ and $\boldsymbol{e}_2 = (0,1)^{\intercal}$. Differentiating (B.2) with respect to the political return κ we get:

$$\left[O''(s^*) - \bar{\lambda}^{-1}\boldsymbol{\varphi}^{\intercal}\Sigma^{-1}\boldsymbol{\varphi}\right]\frac{\partial s}{\partial \kappa} = \bar{\lambda}^{-1}\boldsymbol{\varphi}^{\intercal}\Sigma^{-1}\boldsymbol{e}_2 \tag{B.3}$$

The term $\left[O''(s^*) - \bar{\lambda}^{-1}\boldsymbol{\varphi}^{\intercal}\Sigma^{-1}\boldsymbol{\varphi}\right]$ is positive by the concavity of the objective function on the maximum, while the term $[\lambda^{-1}\boldsymbol{\varphi}^{\intercal}\Sigma^{-1}\boldsymbol{e}_2]$ is negative if the Sharpe ratio of the mean-variance efficient securities is sufficiently larger than the Sharpe ratio of the political assets. This implies that:

$$\frac{\partial s}{\partial \kappa} < 0 \tag{B.4}$$

Now differentiating (B.2) with respect to the political return λ we get:

$$\left[O''(s^*) - \bar{\lambda}^{-1}\boldsymbol{\varphi}^{\intercal}\Sigma^{-1}\boldsymbol{\varphi}\right]\frac{\partial s}{\partial \lambda} = -\bar{\lambda}^{-1}O'(s) \tag{B.5}$$

The term $\left[O''(s^*) - \bar{\lambda}^{-1}\boldsymbol{\varphi}^{\intercal}\Sigma^{-1}\boldsymbol{\varphi}\right]$ is positive, while the term $\left[-\bar{\lambda}^{-1}O'(s)\right]$ is negative, which implies that:

$$\frac{\partial s}{\partial \bar{\lambda}} < 0 \tag{B.6}$$

B.2. Partial Derivatives of Portfolio Weights

The vector of portfolio weights will be given by:

$$\boldsymbol{w} = \bar{\lambda}^{-1}\Sigma^{-1}[s\boldsymbol{\varphi} + \kappa\boldsymbol{e}_2] \tag{B.7}$$

Differentiating (B.7) with respect to L we get:

$$\frac{\partial \boldsymbol{w}}{\partial \kappa} = \bar{\lambda}^{-1}\{\det(\Sigma)\}^{-1}\begin{bmatrix}\sigma_{MV}\sigma_P^2\left(\frac{\varphi_{MV}}{\sigma_{MV}} - \frac{\varphi_P}{\sigma_P}\right)\frac{\partial s}{\partial \kappa} - \rho\sigma_{MV}\sigma_P \\ \sigma_{MV}^2 - \sigma_{MV}^2\sigma_P\left(\frac{\varphi_{MV}}{\sigma_{MV}} - \frac{\varphi_P}{\sigma_P}\right)\frac{\partial s}{\partial \kappa}\end{bmatrix}$$

from which follows that:

$$\frac{\partial w_{MV}}{\partial \kappa} < 0,\ \frac{\partial w_P}{\partial \kappa} > 0 \tag{B.8}$$

Similar algebra shows that (i) the investment in fixed income is increasing on the risk aversion, and (ii) the investment on the mean-variance efficient security is decreasing on the risk aversion.

B.3. Comparison between Constrained and Unconstrained Cases

Now we compare the values of the partial derivatives with respect to the exogenous variables when boards are constrained and unconstrained. It's easy to see that:

$$\left[\frac{\partial \boldsymbol{w}}{\partial \kappa}\right]_{unconstrained} = \bar{\lambda}^{-1}\Sigma^{-1}\left[\frac{\partial s}{\partial \kappa}\boldsymbol{\varphi} + \boldsymbol{e}_2\right] \tag{B.9}$$

$$\left[\frac{\partial \boldsymbol{w}}{\partial \kappa}\right]_{constrained} = \bar{\lambda}^{-1}\Sigma^{-1}\boldsymbol{e}_2 \tag{B.10}$$

And therefore:

$$\Delta\frac{\partial \boldsymbol{w}}{\partial \kappa} \equiv \left[\frac{\partial \boldsymbol{w}}{\partial \kappa}\right]_{constrained} - \left[\frac{\partial \boldsymbol{w}}{\partial \kappa}\right]_{unconstrained} = \bar{\lambda}^{-1}\frac{\partial s}{\partial \kappa}\Sigma^{-1}\boldsymbol{\varphi} \tag{B.10}$$

And therefore:

$$\Delta\frac{\partial w_{MV}}{\partial \kappa} < 0, \qquad \Delta\frac{\partial w_P}{\partial \kappa} > 0$$

A similar argument shows that:

$$\Delta\frac{\partial (w_P + w_{MV})}{\partial \bar{\lambda}} > 0, \qquad \Delta\frac{\partial w_{MV}}{\partial \bar{\lambda}} > 0$$

Table 1: Comparative Statics: Political Agency Variables Role

This table lays out model predictions. showing the comparative statics of how manager skill, portfolio choice, and returns change in the model with changes in political agency variables. The political agency issue of outrage is considered in Panel A. Because outrage is a binding-or-not constraint, the comparaitive statics reflect a discret change from not binding to binding. In panel B, the political agency issues of private benefits of political assets and the underfunding are considered. In Panel B, the comparative staics show the partical derivatives of a change in either manager skill, allocations and performance with respect to a change in agency -- private benefits of political asset investing (κ) and the board preference for risk, driven by pension liabilities (Θ). The right column relates the prediction to the table of reference for empirical results

Panel A: Effect of a Binding Outrage Constraint

Variable	Model Notation	Predicted Change With: Δ Outrage	Test of Prediction
Manager skill	Δs	<0	Table 7
Allocations			
Weight on MV security	$\Delta(w_{MV})$	<0	Table 10
Weight on political asset	$\Delta(w_P)$	<0	Table 10
Weight on fixed income	$\Delta(1-w_P-w_{MV})$	>0	Table 10
Weight on all risky	$\Delta(w_P+w_{MV})$	<0	Table 10
Performance			
E[return on MV security]	$\Delta(R_{MV})$	<0	Tables 8,9
E[return on political asset]	$\Delta(R_P)$	<0	Tables 8,9
E[portfolio return]	$\Delta(R)$	<0	Tables 8,9

Panel B: Effect of Other Political Agency Costs

Variable	Model Notation	Partial Derivative of Row Variable With Respect to: $\partial\kappa$ (κ: private benefits of political asset)	$\partial\Theta$ (Θ: liability-induced preference for risk)	Test of Prediction
Manager skill	∂s	<0	>0	Table 7
Allocations				
Weight on MV security	$\partial(w_{MV})$	<0	>0	Table 10
Weight on political asset	$\partial(w_P)$	>0	?	Table 10
Weight on fixed income	$\partial(1-w_P-w_{MV})$	?	<0	Table 10
Weight on all risky	$\partial(w_P+w_{MV})$	?	>0	Table 10
Performance				
E[return on MV security]	$\partial(R_{MV})$	<0	>0	Tables 8,9
E[return on political asset]	$\partial(R_P)$	<0	>0	Tables 8,9
E[portfolio return]	$\partial(R)$	<0	>0	Tables 8,9

Table 2: Variable Definitions

This Table reports the definitions and the data sources for the main variables used in this paper.

Variable	Definition	Source
	Compensation, Portfolio Choice, and Performance Variables	
Investment Manager Compensation	The maximum compensation of the fund's investment managers, including CEO and CIO.	Hand-collected from annual reports, public filings, newspapers, and Freedom of Information requests.
Portfolio Allocation	Portfolio weights in each of three asset class -- alternatives (real estate, private equity, hedge funds, infrastrcuture), public equity, and fixed income. Expressed as a percentage of the total.	Center for Retirement Research (CRR), CEM Benchmarking and annual reports.
Return	Realized returns in each asset class and for the overall portfolio.	Center for Retirement Research (CRR), CEM Benchmarking and annual reports.
Benchmark Return	CEM requires benchmarks to be chosen by pension trustees rather than being self-selected by asset managers. Most funds report multiple indices and weights. A visual inspection of this information indicates the benchmarks capture dimensions of risk differences across and within asset classes.	CEM Benchmarking
Tracking Error	A single observation by fund for each asset class and the portfolio, calculated as the time-series average of the squared residuals from a regression of the pension fund returns on the benchmark returns, with no constant.	Center for Retirement Research (CRR), CEM Benchmarking and annual reports.
Portfolio Delegation	Fraction of assets managed via delegation in each asset class.	CEM Benchmarking.
	Political Agency Variables	
Municipal Workers	The fraction of trustees that are workers providing basic services to city residents, usually through city government.	From annual reports. Professional designation based on biographies and web sources such as LinkedIn.
Teacher	The fraction of trustees that are workers providing basic services to teachers or education administrators.	From annual reports. Professional designation based on biographies and web sources such as LinkedIn.
Finance Civil Servant	The fraction of trustees that are civil servant in finance service to the government.	From annual reports. Professional designation based on biographies and web sources such as LinkedIn.
Regional Income	Logarithm of the local household income within the smallest region available (MSAs for the US).	Regional income reported by National statistical offices (Census Bureau in the US).
Worker Wage	Logarithm of the average wage of the constituents of the pension fund.	Hand-collected from annual reports. If not reported, we estimate based on working employee contributions and reported contribution rates as a percentage of salary.
Political Board	A dummy equal to one if the chair is appointed by government executives or ministries or serves in the role ex officion because of his or her executive government position.	Collected from pension fund charters and annual reports.
Underfunded Index	The negative of the standardized funded ratio plus the standardized age variable.	Center for Retirement Research (CRR), CEM Benchmarking, annual reports, funds' current and cached websites, direct requests to the funds.

Table 3: Pension Fund Profile Statistics

This Table reports the assets under managementand portfolio returns statistics by region of the penion fund. Panel A presents these statistics for the full sample of funds in our sample, and Panel B, for the pension funds for which we have manager compensation of trustee profile data.

Panel A: Full Sample

		Assets under Management ($billion)					Gross Portfolio Returns				
	Number of funds	Fund-Year Observations	Mean	25th Percentile	Median	75th Percentile	Fund-Year Observations	Mean	25th Percentile	Median	75th Percentile
Canada	16	210	37.02	11.45	17.04	59.90	210	0.0548	0.0012	0.0672	0.1160
Europe	39	333	122.70	8.45	17.76	71.33	302	0.0173	0.0004	0.0018	0.0268
Oceania	17	163	15.11	6.61	12.84	19.13	160	0.0312	0.0001	0.0018	0.0960
United States	92	1150	27.65	6.88	12.81	32.03	1130	0.0498	0.0004	0.0323	0.1235
Total	164	1856	44.66	7.59	13.70	35.55	1802	0.0433	0.0004	0.0195	0.1098

Panel B: Sample with Compensation & Trustee Data

		Assets under Management ($billion)					Gross Portfolio Returns				
	Number of funds	Fund-Year Observations	Mean	25th Percentile	Median	75th Percentile	Fund-Year Observations	Mean	25th Percentile	Median	75th Percentile
Canada	10	97	49.68	13.14	33.78	81.30	97	0.0589	0.0009	0.0857	0.1267
Europe	17	115	283.42	19.41	70.39	322.17	115	0.0245	0.0009	0.0114	0.0360
Oceania	11	55	21.48	11.41	16.81	27.74	55	0.0385	-0.0010	0.0212	0.1053
United States	73	196	44.07	11.72	26.00	59.21	196	0.0451	-0.0290	0.0518	0.1331
Total	111	463	102.01	11.99	29.51	72.59	463	0.0421	-0.0005	0.0330	0.1126

Table 4: Performance and Allocation Statistics

This Table reports summary statistics of the portfolio weights and performance, at the portfolio level and by asset classes. Asset classes are: (i) alternatives, defined as hedge funds, real estate, private equity, and infrastructure, (ii) public equities, and (iii) fixed income. In Panel A, we present the weights in the main estimation sample (that with compensation and trustee data) plus the sample where we observe all weights such that the weights sum to unity. Also in Panel A are the fractions of each asset class delegated to outside management. Panel B reports performance in three metrics -- gross returns, net returns over the CEM benchmark, and realized tracking errror. The realized traking error is calculated in the data relative to the benchmark return; thus there is only one observation per pension fund.

	Count	Mean	Standard Deviation	25th Percentile	Median	75th Percentile
Panel A: Allocations						
Weights: Full Sample						
Alternatives	251	0.229	0.175	0.125	0.197	0.273
Public Equities	304	0.598	0.184	0.485	0.571	0.669
Fixed Income	253	0.323	0.121	0.25	0.305	0.368
Weights: Sample restricted to having data on all weights						
Alternatives	204	0.191	0.096	0.117	0.186	0.252
Public Equities	204	0.513	0.106	0.442	0.525	0.583
Fixed Income	204	0.296	0.075	0.243	0.297	0.350
Delegation Fraction						
Alternatives	214	0.747	0.327	0.484	0.990	1.000
Public Equities	190	0.734	0.360	0.386	1.000	1.000
Fixed Income	180	0.500	0.468	0.000	0.488	1.000
Panel B: Performance						
Gross Returns						
Alternatives	355	0.061	0.119	0.002	0.075	0.135
Public Equities	367	0.053	0.206	-0.107	0.117	0.206
Fixed Income	337	0.061	0.049	0.034	0.055	0.080
Portfolio	463	0.042	0.096	0.000	0.033	0.113
Net Returns						
Alternatives	251	-0.008	0.101	-0.053	-0.004	0.046
Equities	304	0.005	0.020	-0.004	0.003	0.013
Fixed Income	253	0.005	0.031	-0.003	0.003	0.016
Portfolio	351	-0.003	0.054	-0.011	0.001	0.014
Tracking Error Realized						
Alternatives	70	0.069	0.073	0.028	0.055	0.083
Equities	96	0.038	0.054	0.012	0.019	0.035
Fixed Income	92	0.021	0.016	0.009	0.018	0.028
Portfolio	110	0.030	0.023	0.014	0.024	0.045

Table 5: Compensation, Trustee Occupation, Reference Wage and Other Agency Statistics

Panel A reports the summary statistics, and Panel B reports the correlations of the main variables characterizing the governance of pension funds in our sample. *Manager Compensation* is defined as the highest paid executive (CEO or CIO) for the public fund. *Municipal Workers* is the percent of the board whose career is in the municipal labor force, defined as police, fire department, hosptials, libararies, and other non-civil servant positions. *Finance Civil Servan* t is the percent of the board whose background is in public sector financial positions (e.g., city controllers, auditors, etc.). *Teachers* is the percent of the pension board who are teachers. *Political Chair* is a dummy taking value 1 if the chair is appointed by the executives or ministers of the government. *Underfunded Index* is an index constructed by taking the mean across the standardized value of (1- the funded ratio) and age following Rauh (2008). The two outrage income measures -- *Worker Wages* and *Local Income* -- are, repectively the average wages of workers and the municipal income.

Panel A: Statistics

	Count	Mean	Standard Deviation	25th percentile	Median	75th percentile
Manager Compensation						
Manager Compensation ($)	463	807,416	1,018,136	292,328	537,197	819,979
Log Manager Compensation	463	13.20	0.828	12.59	13.19	13.62
Outrage: Reference Wages						
Worker Income	463	47,811	15,197	38,763	45,345	55,066
Log Worker Income	463	10.73	0.302	10.57	10.72	10.92
Regional Income	463	55,434	17,955	40,873	50,127	68,228
Log Regional Income	436	10.86	0.315	10.62	10.78	11.11
Outrage: Non-Political Trustee Occucations						
Municipal Workers (% Trustees)	463	0.053	0.087	0.000	0.000	0.100
Teachers (% Trustees)	463	0.109	0.167	0.000	0.077	0.133
Finance Civil Servants (% Trustees)	463	0.102	0.144	0.000	0.083	0.154
Other Agency Variables						
Political Chair	463	0.514	0.586	0.000	0.364	1.000
Underfunded Index	463	0.171	1.303	-0.144	0.000	0.203

Panel B: Correlations

	Compen-sation	Municipal Workers	Fin. Civil Servants	Teachers	Worker Wages	Local Income	Political Chair
Municipal Workers	-0.092						
Finance Civil Servants	-0.150	-0.198					
Teachers	-0.226	-0.111	-0.114				
Worker Wages	0.061	0.106	0.112	0.015			
Local Income	0.364	0.022	-0.176	-0.193	0.250		
Political Chair	-0.120	-0.133	-0.012	0.023	0.000	-0.080	
Underfunded Index	-0.101	0.075	0.082	-0.069	0.052	0.027	-0.030

Table 6: Professions of Investment Managers and Trustees

This table reports the immediate prior profession of investment managers (Panel A) and the current professions of trustees (Panel B). The data are collapsed to the cross section of public funds. All data are hand collected.

Panel A: Investment Managers' Professions

Occupation	Description	Professions Represented	%
		Prior Pension Executives	
Pension - Investment Executive	Investment manager from another pension fund	Director of Investment, CEO, CIO	4.9%
Pension - Other Executive	Other executive position in another pension fund	Assistant General Counsel, Assistant Executive Director, Deputy Executive Director, Chief of Staff, COO	18.0%
		Prior Private Firm Finance Professionals or Executives	
Private Firm Professional	Financial position from privately firm	CEO, CIO, Director, Managing Partner, Accountant, Actuary, Auditor, Consultant, CRO	31.1%
		Civil Servants	
Civil Servant (Finance)	Civil servant with financial experience	Treasurer, Auditor, Accountant, Controller, Budget Officer, Finance Director, Public Institution Professor	29.5%
Civil Servant (Non-Finance)	Civil servant without financial experience	City Council CEO, City Manager, Executive Director, Department of Correction Administrator, Deputy Chief of Staff, Director, Executive Commissioner, Natural Resource Advisor, Teacher, Senator	16.4%

Panel B: Trustees' Professions

Occupation	Description	Professions Represented	%
		Civil Servants	
Politician	Includes any representative or elected official of municipal, state or federal government	Senator, House Representative, Mayor, Governor, Lieutenant Governor, Secretary of State, Attorney General, Assembly Speaker, State Representative, Secretary, Minister, Borough President, City Manager, Assistant Deputy Minister, Deputy Governor, Premier Deputy Chief of Staff, Deputy Minister, , City Council, County Commissioner, Deputy City Manager, Deputy General Counsel,	6.4%
Finance Civil Servant	Civil servant with financial experience	Treasurer, Auditor, Accountant, Controller, Budget Officer, State Finance Director	34.4%
Other Civil Servant	Civil servant without financial experience	Judge, Prosecutor, Clerk, Commissioner, Assistant Commissioner, Professor, Dean	13.7%
		Non-Civil Servants	
Teacher	Teachers	Teachers	14.7%
Municipal Worker	Workers providing services to city residents, union labor	Police Officer, Fire Officer, Jail Worker, Railway , Steel , Construction, Electrician, Mail Employee, Librarian, Miner, Bus Driver, Chimney Sweep, Food Worker, Manufacturing Worker, Telecommunications	7.7%
Professionals	Local private sector professionals and NGO executives	Financial Sector Expert, Doctor, Nurse, Dentist, Private Firm CEO, CIO, Chairman, Pharmacist, Journalist, Media Professional, Architect, NGO Chairman, Owner of Private Firm	23.1%

Table 7: Effect of Outrage and Political Agency on Manager Compensation

The dependent variable is the log compensation of the investment manager. *Municipal Workers* is the percent of the board whose career is in the municipal labor force, defined as police, fire department, hosptials, libararies, and other non-civil servant positions. Teachers is the percent of the pension board who are teachers. *Finance Civil Servant* is the percent of the board whose background is in public sector financial positions (e.g., city controllers, auditors, etc.). *Political Chair* is a dummy taking value 1 if the chair is appointed by the executives or ministers of the governmentor is ex officio desginated as chair as an executives or ministers of the government. *Underfunded Index* is an index constructed by taking the mean across the standardized value of (1- the funded ratio) and age following Rauh (2008). *Worker Wages* and *Regional Income* are the outrage reference wages, equal to mean pension workers wages and meadian local area incomes. *Log Size* is the log of the fund AUM. All money variables are in 2010 USD. Panel A present Estimation is OLS with year fixed effects. Panel B presents the economic magnitude with the change induced as noted, choosing a half standard deviation in situations where the cross-sectional changes would be large for a time series application by a pension fund. Standard errors are clustered at the fund level. *** denotes p<0.01, ** denotes p<0.05, and * denotes p<0.1.

Panel A: Estimates

	Dependent Variable: Log Compensation				
	(1)	(2)	(3)	(4)	(5)
Municipal Workers		-0.604			-1.082*
		[0.546]			[0.611]
Teachers		-0.619**			-0.405
		[0.293]			[0.324]
Finance Civil Servants		-1.401***			-0.925**
		[0.284]			[0.374]
Log Regional Income			0.923***		0.783***
			[0.181]		[0.193]
Log Worker Wages			0.618**		0.690**
			[0.285]		[0.293]
Political Chair				-0.212**	-0.199**
				[0.0985]	[0.0971]
Underfunding Index (lag)				0.0204	0.0418*
				[0.0288]	[0.0238]
Log Size (lag)	0.284***	0.279***	0.154*	0.286***	0.164*
	[0.0842]	[0.0830]	[0.0828]	[0.0843]	[0.0836]
Year Fixed Effects	Y	Y	Y	Y	Y
Observations	453	453	426	453	426
Number of Funds	110	110	110	110	110
R-Squared	0.0365	0.115	0.106	0.0498	0.153

Panel B: Economic Magnitude

	Change Evaluated	$ Impact on Compensation	Percentage Change
1 standard deviation change =	0.087 higher fraction of Municipal Workers	-76,033	-9%
1 standard deviation change =	0.144 higher fraction of Finance Civil Servants	-107,627	-13%
10% percentage change =	4781 more Regional Income	63,221	8%
10% percentage change =	5543 more Worker Wages	55,712	7%
1 standard deviation change =	0.586 greater likelihood of Political Chair	-94,209	-12%
1 standard deviation change =	1.303 higher Underfunding Index	43,982	5%

Table 8: Effect of Outrage on Returns

Reported in columns (1)-(4) are estimates from a GMM system of two equations. The dependent variable in numbered columns (denoted above Equation II) is the net return over the asset-class benchmark. The far left column presents (Equation I) estimates of the effect of political agency on compensation for the sample in column (1). A similar estimate (unreported) is used for each of columns (2)-(4). In columns (1)-(4), the log compensation variable is the outrage-predicted compensation, from Equation I (the left column). *Municipal Worker, Teachers,* and *Finance Civil Servant* are the trustee composition outrage variables. *Worker Wages* and *Regional Income* are the outrage reference wages, equal to mean pension workers wages and meadian local area income. *Political Chair* is equal to one for funds whose chair is appointed by the government. *Underfunded Index* is an index constructed by taking the mean across the standardized value of (1- the funded ratio) and age following Rauh (2008). *Log Size* is the log of the lagged fund AUM. Standard errors are clustered at the fund level. The number of funds per estimation is indicated below the number of observations. The Cragg-Donald F-statistic, and the p-value of ints significance, is included as a test of weak identification. *** denotes p<0.01, ** denotes p<0.05, and * denotes p<0.1.

Panel A: Estimates		(1)	(2)	(3)	(4)
	Equation I:	Equation II: Net Returns			
	Log Compensation	Portfolio	Alternatives	Public Equities	Fixed Income
Outrage-Predicted Log Compensation		0.00635**	0.0209*	0.00689*	-0.00441
		[0.00291]	[0.0111]	[0.00400]	[0.00370]
Municipal Workers	-0.997**				
	[0.470]				
Teachers	-0.217				
	[0.252]				
Finance Civil Servants	-1.163***				
	[0.279]				
Log Regional Income	1.034***				
	[0.154]				
Log Worker Wages	-0.142				
	[0.156]				
Political Chair	-0.0978	-0.00362**	-0.0155**	-0.00353*	-0.000123
	[0.0705]	[0.00143]	[0.00777]	[0.00187]	[0.00219]
Underfunding (lag)	0.0230	0.000736	-0.00117	-0.000458	0.00297
	[0.0409]	[0.00133]	[0.00544]	[0.00179]	[0.00199]
Log Size (lag)	0.304***	-0.00314***	0.000651	-0.00409**	-0.000433
	[0.0393]	[0.00117]	[0.00552]	[0.00161]	[0.00178]
Observations	303	303	243	285	243
Number of Funds	89	89	71	86	80
Cragg-Donald F-stat	20.31				
F-Stat p-value	0.000				

Table 9: Economic Magnitude Calculations

Panel A: Return Implications

Below are the economic magnitudes as to the effect of the outrage threat resulting from the estimations in Table 8. In the system, the Equation I outrage variables affect compensation, which in turn affects manager compensation. We present this pass-through effect of a change in the outrage variables in Equation I to the return performance implication of column (1), Table 8. The interpretation is not necessarily that the outrage variable can be changed, but the extent to which, the political agency that allows outrage to happen could be unwound. Reutrns are expressed in annual performance. In the final row, we show the effect in Equation II of a change in political chair on returns, following Andonov et al (2017).

Equation I Change Evaluated	Working through Equation II Effect		Resulting Change in Returns
1 s.d. increase in Municipal Workers =>	-$76,033	change in Compensation =>	-0.060%
1 s.d. increase in Finance Civil Servants =>	-$107,627	change in Compensation =>	-0.085%
10% increase in Regional Income =>	$63,221	change in Compensation =>	0.050%
	1 s.d. increase in Political Chair =>		-0.212%

Panel B: Assets under Management Implications

Building off the calculations in Panel A, below are the implied changes in AUM per year for a pension fund evaluated at different points in the pension fund size distribution. The numbers presented can be interpreted as the inference to the following question: *how much in assets' dollar returns might a pension fund sacrifice because of hiring a manager whose compensation contract is affected by the threat of outrage* ? We repeat the exercise for the two pension fund samles (the estimation sample and the representative sample) represented in Table 3, Panels A and B. On the left are the pension funds in our estimation sample, which is biased toward larger funds because of our need to have observability in compensation.

	Annual AUM Change ($Million) for Different Size Pension Funds:							
	Estimation Sample (Table 3, Panel B)				Representative Sample (Table 3, Panel A)			
	Mean	25th Percentile	Median	75th Percentile	Mean	25th Percentile	Median	75th Percentile
1 s.d. increase in Municipal Workers =>	-$61.0	-$7.2	-$17.6	-$43.4	-$26.7	-$4.5	-$8.2	-$21.3
1 s.d. increase in Finance Civil Servants =>	-$86.3	-$10.1	-$25.0	-$61.4	-$37.8	-$6.4	-$11.6	-$30.1
10% increase in Regional Income =>	$50.7	$6.0	$14.7	$36.1	$22.2	$3.8	$6.8	$17.7

Table 10: Effect of Outrage on Realized Tracking Error

Observations in this Table are limited to one observation per fund, collapsed to funds who have at least 3 years of portfolio returns for which tracking errors can be calculated. The dependent variable in numbered columns is the realized tracking error for the fund, calculated by regressing portfolio returns on benchmark returns with no constant for each pension fund. The residuals are squared, and we take the standard deviation of the mean squared error across time. The far left column presents Equation I estimates of the effect of political agency on compensation for the sample in column (1). A similar estimate (unreported) is used for each of columns (2)-(4). *Municipal Worker, Teachers* , and *Finance Civil Servants* are the trustee composition outrage variables. *Worker Wages* and *Regional Income* are the outrage reference wages, equal to mean pension workers wages and meadian local area income. *Political Chair* is equal to one for funds whose chair is appointed by the government. *Underfunded Index* is an index constructed by taking the mean across the standardized value of (1- the funded ratio) and age following Rauh (2008). Log Size is the log of the lagged fund AUM.Weight variables are asset allocation weights, including null weights. *** denotes p<0.01, ** denotes p<0.05, and * denotes p<0.1.

		(1)	(2)	(3)	(4)
	Equation I:	Equation II: Tracking Error			
	Log Compensation	Portfolio	Alternatives	Public Equities	Fixed Income
Outrage-Predicted Log		0.00843	-0.0303	0.00179	-0.00626
Compensation		[0.00731]	[0.0275]	[0.0216]	[0.00509]
Municipal Workers	-1.029**				
	[0.507]				
Finance Civil Servants	-0.637*				
	[0.353]				
Log Regional Income	0.519**				
	[0.202]				
Political Chair	-0.0884	0.00474	-0.0135	-0.0174***	-0.00457*
	[0.0967]	[0.00380]	[0.0146]	[0.00674]	[0.00245]
Underfunded Index	-0.0227	0.00205	0.000394	0.00804	0.000375
	[0.0500]	[0.00238]	[0.00678]	[0.00544]	[0.00191]
Log Fund Size	0.0217	0.000484	-0.00298	0.0105**	-0.00208
	[0.0551]	[0.00186]	[0.00861]	[0.00455]	[0.00196]
Weights					
Private Equity	0.242	0.023	0.899**		
	[1.612]	[0.0506]	[0.373]		
Real Estate	-0.243	-0.00857	-0.141*		
	[0.864]	[0.0300]	[0.0745]		
Hedge Funds	-0.183	-0.115**	-0.241		
	[2.374]	[0.0516]	[0.184]		
Domestic Equity	-1.182***	-0.0143		-0.169***	
	[0.425]	[0.0183]		[0.0526]	
Foreign Equity	1.621***	-0.0151		0.0181	
	[0.576]	[0.0317]		[0.0918]	
Cash	-5.742**	0.0463			-0.0442
	[2.696]	[0.0901]			[0.105]
Bonds					0.00897
					[0.0146]
Observations, 1 per fund	112	112	70	97	94
R-Squared	0.337	0.009	0.072	0.38	--
Cragg-Donald F-stat	5.292				
F-Stat	0.00145				

Table 11: Asset Class Weights Results

Reported in columns (1)-(3) are marginal effects estimates from an MLE-Tobit system of two equations. The dependent variable in numbered columns (denoted above Equation II) is the asset class weight as designated in [0,1]. The sample is limited to fund-years for which we observe a full (sums to unity) set allocation weights. The far left column presents (Equation I) estimates of the effect of political agency on compensation for the sample in column (1). A similar estimate (unreported) is used for each of columns (2)-(3). In columns (1)-(3), the log compensation variable is the outrage-predicted compensation, from Equation I (the left column). *Municipal Worker*, *Teachers*, and *Finance Civil Servants* are the trustee composition outrage variables. *Worker Wages* and *Regional Income* are the outrage reference wages, equal to mean pension workers wages and meadian local area income. *Political Chair* is equal to one for funds whose chair is appointed by the government. *Underfunded Index* is an index constructed by taking the mean across the standardized value of (1- the funded ratio) and age following Rauh (2008). Log Size is the log of the lagged fund AUM. Standard errors are clustered at the fund level. *** denotes p<0.01, ** denotes p<0.05, and * denotes p<0.1. Two sets of standard errors are presented beneath the coefficient - standard errors clustered at the fund level (top) and robust standard errors under the seemingly unrelated assumption (bottom), inlcuded because of the joint determination of allocation weights.

		(1)	(2)	(3)
	Equation I:	Equation II: Tobit Estimation of Asset Class Weights		
	Log Compensation	Alternatives	Public Equities	Fixed Income
Outrage-Predicted Log Compensation		0.0355	-0.0666	0.0375
		[0.0144]**	[0.0179]***	[0.0156]**
		[0.0256]	[0.0314]***	[0.0344]
Municipal Workers	-0.801			
	[0.797]			
Teachers	-0.291			
	[0.371]			
Finance Civil Servants	-0.367			
	[0.514]			
Log Regional Income	1.221***			
	[0.320]			
Log Worker Wages	-0.206			
	[0.300]			
Political Chair	-0.0771	0.00009	-0.0169	0.0177
	[0.132]	[0.00962]	[0.0117]	[0.00960]*
		[0.0145]	[0.0184]	[0.0146]
Underfunded Index (lag)	-0.00322	0.00904	0.00126	-0.0101
	[0.0675]	[0.00587]	[0.00712]	[0.00584]*
		[0.00843]	[0.00749]	[0.00673]
Log Size (lag)	0.389***	0.0154	0.0037	-0.0220**
	[0.102]	[0.00884]*	[0.0109]	[0.00923]
		[0.0140]	[0.0216]	[0.0202]
Observations		197	197	197
Wald Chi-squared		64.4	50.41	17.9

Table 12: Portfolio Delegation Results

The far left column presents the first stage estimate, where log manager compensation is instrumented with `% Trustees who are Municipal Workers', `% Trustees with Public Sector Finance Experiences,`% Trustees who are Teachers', `Constituent Outrage' (=-log(average wages of constitutuents)), and `Regional Outrage' (=-log(median local income)). The dependent variable in numbered columns is the fraction of assets managed via delegation the asset class noted in the column. Columns (1)-(3) present the second equation results, and columns (4) - (6) present the corresponding OLS results for comparison. `Political Board' is equal to one for funds whose chair is appointed by the government. `Underfunded Index' is the funded ratio and age index of underfunding pressures. `Log Size' is the log of the lagged fund AUM. All money variables are in 2010 USD. Year fixed effects are included.The final row presents the F-stat for the relevance of the instruments. *** denotes p<0.01, ** denotes p<0.05, and * denotes p<0.1.

			(1)	(2)	(3)
Dependent Variable:	Log Compensation		Delegated Fraction in:		
		Portfolio	Alternatives	Public Equities	Fixed Income
Model:	Equation I	Equation II	Equation II	Equation II	Equation II
Outrage-Predicted Log Compensation		-0.600***	-0.635***	-0.242	-0.283
		[0.183]	[0.217]	[0.179]	[0.229]
Municipal	-1.447				
	[0.491]***				
Teachers	0.00855				
	[0.232]				
Finance Civil Servants	-1.596				
	[0.254]***				
Regional Outrage	-1.314				
	[0.145]***				
Constituent Outrage	-0.189				
	[0.158]				
Political Chair	-0.130		0.120	0.129	0.439
	[0.118]		[0.128]	[0.182]	[0.209]**
			[0.182]	[0.268]	[0.418]
Underfunding Index (lag)	0.00543		0.0697	0.0792	0.132
	[0.0517]		[0.0509]	[0.0762]	[0.0852]
			[0.0823]	[0.198]	[0.187]
Log Size (lag)	0.307		-0.0522	-0.275	-0.469
	[0.0458]***		[0.0419]	[0.0719]***	[0.0827]***
			[0.0928]	[0.113]**	[0.150]***
Observations	245		258	245	251
Pseudo R-squared	0.531				
F-Stat	29.17				

Appendix Table 1: Compensation Outrage Anecdotes in the Media

Presented are nine anecdotes of media outrage concerning compensation of public fund investment managers

1. Oregon	"Unspoken, but also politically inconvenient is the compensation to attract talent from the private sector. The state's existing investment officers are some of the best paid public employees, making an average of $200,000 a year. But Treasury officials quietly complain that staff is underpaid by industry standards, and bristle about having to explain and get approval from the Legislature to release performance-based pay each year." Source: *The Oregonian,* Ed Sickinger*,* "Treasurer looks to reorganize investment division into quasi-public entity," Jan 16, 2013
2. CalPERS	"Our compensation is just too low," board member Richard Costigan said in May. "We're not attracting quality candidates. The quality candidates who want to come here are negatively impacted by the salary levels." Source: *Sacramento Bee* , Adam Ashton, 'Pay for CalPERS' next Chief investment officer can reach $1.77 million,' June 20, 2018
3. Kentucky Retirement System	"We've got our issues here and it's hard enough attracting applicants," Thielen said, referencing KRS's status as one of the worst-funded pensions in the country.Thielen, who announced his intention to retire last year, has already had to stay on longer than planned due to a lack of qualified applicants for his position. ... As for the provisions regarding fund personnel and their compensation, Thielen said the bill would "create significant problems for us attracting and retaining staff." While KRS links employee compensation to performance, the bill would require adoption of the government's tenure-based pay structure. Source: *AiCIO* , Amy White, "Kentucky Pension Fights to Retain Control of Governance", February 25, 2016
4. New York Teachers' Retirement Sytstem	Depoliticizing, professionalizing, and streamlining the management of our pension funds will enhance investment returns and reduce pension costs....The proposal calls for the investment entity to be staffed by experienced industry professionals and for compensation packages to attract those investment professionals....* A Chief Investment Officer will lead the new investment management entity. Source: *Targeted News Service* , 'Comptroller Liu, Mayor Bloomberg and Labor Leaders Announce Agreement in Principle to Reform Pension Investment Governance and Management,' Oct 27, 2011
5. Missouri State Employees Retirement System	Dahl, chief investment officer for the Missouri State Employees Retirement System, will receive a $125,155 cash bonus this summer and up to that amount in deferred compensation, payable in two years. In effect, he could double his $250,309 salary.... The payments, originally scheduled for February, are slated to go out in June, a delay designed to avoid public scrutiny amid legislative budget-cutting. It's a politically sticky subject, because Gov. Jay Nixon and legislators are considering cutting thousands of government jobs, services for the disabled and college scholarships among many other things. Senate Appropriations Committee Vice Chairman Kurt Schaefer, R-Columbia, was surprised Thursday to learn of the bonuses. "Now is not the time for anyone to be getting a state-funded bonus," said Schaefer.... Nixon, who last year called MOSERS bonuses "unconscionable," said Thursday that the bonus system is on the way out, thanks to his appointees to the board of trustees. Source: *St. Louis Post-Dispatch* , Virginia Young, 'Bonuses for pension staff raise eyebrows in Missouri Top investment officer due to get $125,155 amid big cuts,' April 2, 2010,

Appendix Table 1 (continued)

6. Florida SBA	The Florida State Board of Administration (SBA) has bumped the annual paycheck of CIO Ash Williams up to $367,500 from $325,000. Williams, who oversees a team managing $176.4 billion in pension and endowment assets, has not had a pay raise since 2008, and in line with SBA rules, does not receive incentives, Dennis Mackee, a spokesman for the fund, told MMI. Public CIO compensation has been a hot-button topic in the industry. According to industry insiders, a freshly-minted MBA graduate starts out in the private sector earning at least $300,000 a year. The typical public fund cio earns about $200,000-350,000 annually. Source: *Money Management Letter* , Dawn Lim, Feb 28, 2014, 'Florida SBA CIO Gets First Pay Raise In Five Years'
7. New Mexico SIC	The New Mexico SIC has been in the market for a fixed-income director to oversee a $4 billion credit portfolio ... "The council is seeking to find a qualified credit portfolio manager, which is difficult under the current budgetary constraints.... New Mexico's portfolio managers currently command approximately $100,000-120,000 in annual compensation. Market practitioners estimate that the state needs to offer at least $150,000 to fill the position... New Mexico's compensatory challenge highlights a tricky dance public funds must perform to persuade state legislatures to grant investment staff compensation levels that are higher than other public employees. "Pay scales in public plans tend to reflect the pay scales for the state bureaucracy. A public plan is looked at as just another state agency," said Charles Skorina of recruitment firm Skorina & Co., which specializes in recruiting for asset management firms and endowments and foundations. Asset management and E&F executives generally command two to four times more compensation than public pension peers in similar positions. Source: *Money Management Letter* , Dawn Lim, May 14, 2013, 'Hiriing woes Confound Large Public Funds
8. Qsuper, Australia	Brad Holzberger, chief investment officer of the $54 billion QSuper -retirement fund was the highest paid executive in the not-for-profit -superannuation sector last year, taking home $1.2 million. .... Mark Delaney, who oversees the investment portfolio of the $78 billion AustralianSuper fund.... was paid $971,000. Ian Silk, the boss of AustralianSuper, the largest not-for-profit fund in the country, was paid $700,000. The salaries are modest compared with the remuneration packages of fund managers, whose services are bought by super funds. The highest paid executive director at Platinum Asset Management, which has $24 billion under management, is Philip Howard, the finance director, who was paid $3.6 million last year. Fund managers can earn up to $10 million a year. Source: *Financial Review* , Sally Patten, 'Salaries for industry fund bosses not as super as fundie pay,' Nov 6, 2014
9. Qsuper, Australia	SUPERANNUATION chiefs managing the nest eggs of Queensland public servants are receiving fat-cat bonuses while members are facing delays in getting advice. Source: *Courier Mail* , Renee Viellaris, 'QSuper fat cats take the cream,' Spetember 21, 2014

Appendix Table 2: Robustness of Return Results

Reported in columns (1)-(4) are estimates from a GMM system of two equations. The dependent variable in numbered columns (denoted above Equation II) is the net return over the asset-class benchmark. The far left column presents (Equation I) estimates of the effect of political agency on compensation for the sample in column (1). A similar estimate (unreported) is used for each of columns (2)-(4). In columns (1)-(4), the log compensation variable is the outrage-predicted compensation, from Equation I (the left column). *Municipal Worker, Teachers,* and *Finance Civil Servant* are the trustee composition outrage variables. *Worker Wages* and *Regional Income* are the outrage reference wages, equal to mean pension workers wages and meadian local area income. *Political Chair* is equal to one for funds whose chair is appointed by the government. *Underfunded Index* is an index constructed by taking the mean across the standardized value of (1- the funded ratio) and age following Rauh (2008). *Log Size* is the log of the lagged fund AUM. Weight variables are asset allocation weights, including null weights. The omitted category is bonds. Standard errors are clustered at the fund level. The number of funds per estimation is indicated below the number of observations. The Cragg-Donald F-statistic, and the p-value of ints significance, is included as a test of weak identification. *** denotes p<0.01, ** denotes p<0.05, and * denotes p<0.1.

		(1)	(2)	(3)	(4)
	Equation I:	Equation II: Net Returns			
	Log Compensation	Portfolio	Alternatives	Public Equities	Fixed Income
Outrage-Predicted Log		0.00842**	0.0351***	0.00864**	-0.00292
Compensation		[0.00361]	[0.0133]	[0.00419]	[0.00433]
Occupations as a % of Non-Political Trustees					
Municipal Workers	-0.173				
	[0.186]				
Teachers	0.094				
	[0.102]				
Finance Civil Servants	-0.310**				
	[0.129]				
Log Regional Income	1.104***				
	[0.146]				
Log Worker Wages	-0.033				
	[0.155]				
Political Chair	0.0408	-0.00257	-0.0187**	-0.00419**	-0.00537**
	[0.0669]	[0.00168]	[0.00754]	[0.00207]	[0.00268]
Underfunding (lag)	0.0073	0.000696	-0.0000633	-0.0000498	0.00382
	[0.0399]	[0.00143]	[0.00445]	[0.00164]	[0.00234]
Log Size (lag)	0.243***	-0.00255*	-0.00186	-0.00214	0.00221
	[0.0413]	[0.00152]	[0.00609]	[0.00193]	[0.00190]
Weights					
Private Equity	-1.279**	-0.00227	-0.0647	0.0127	0.018
	[0.564]	[0.0145]	[0.0732]	[0.0206]	[0.0426]
Real Estate	-0.177	0.00495	-0.0378	-0.0628**	-0.139***
	[0.398]	[0.0118]	[0.0346]	[0.0257]	[0.0433]
Hedge Funds	1.294	0.0357	0.156**	0.0669***	0.0212
	[0.924]	[0.0237]	[0.0791]	[0.0237]	[0.0326]
Domestic Equity	-0.709***	0.0197**	0.0896	0.0105	-0.0175
	[0.263]	[0.00972]	[0.0595]	[0.00832]	[0.0162]
Foreign Equity	0.326	0.00191	-0.132*	0.0289***	0.0183
	[0.326]	[0.0153]	[0.0694]	[0.0110]	[0.0184]
Cash	-1.261	0.0165	0.00585	0.0712***	-0.039
	[0.976]	[0.0252]	[0.0986]	[0.0208]	[0.0243]
Observations	299	299	243	281	243
Number of Funds	299	88	71	85	80
Cragg-Donald F-stat	14.61				
F-Stat p-value	0.000				

Appendix A: Model Solution

In this appendix we prove that the optimal manager quality chosen by the board and the optimal contract offered to the portfolio manager are given by equations (8) and (11).

A.1. Optimal Contract

First, we assume that the manager with quality $\boldsymbol{s}$ is hired, and then we calculate the optimal contact offered by the board of trustees. We can clearly assume that $b = (\mathbf{1} - \boldsymbol{a})\kappa$, given that financial and political returns are perfectly exchangeable in our model, which implies that the board would always offer the same fraction of political and of financial returns to the portfolio manager. To find new optimal value of the risk sharing parameter $\boldsymbol{a}$, note that the objective function of the portfolio manager simplifies to:

$$r_f + (1-a)w^{\intercal}B(s) - \frac{1}{2}\lambda(1-a)^2 w^{\intercal}\Sigma w \tag{A.1}$$

Where w is the vector of portfolio weights, Σ is the covariance matrix of returns, and $B(s)$ is the vector $B(s) = (s\varphi_{MV}, s\varphi_P + \boldsymbol{\kappa})^{\intercal}$. The optimal response that maximizes (A.1) is given by:

$$w = (1-a)^{-1}\lambda^{-1}\Sigma^{-1}B(s) \tag{A.2}$$

Now we can write the board's objective function as follows:

$$r_f + w^{\intercal}aB(s) - c - \frac{1}{2}\lambda_B a^2 w^{\intercal}\Sigma w \tag{A.3}$$

Let $\nu = \frac{a}{1-a}$. Basic algebra shows that (A.3) is proportional to

$$\nu - \frac{1}{2}\frac{\lambda_B}{\lambda}\nu^2 \tag{A.4}$$

Which is maximized by $\nu = \frac{\lambda_B}{\lambda}$. This implies that the optimal a is given by

$$a^* = \frac{\lambda}{\lambda + \lambda_B} \tag{A.5}$$

A.2. Optimal Manager Quality

By plugging the optimal contract into the board objective function, we find the following indirect utility function:

$$V_B(s) = r_f + \frac{1}{2\bar{\lambda}} B(s)^{\intercal}\Sigma^{-1}B(s) - O(s) \tag{A.6}$$

Where $\bar{\lambda} = (\lambda^{-1} + \lambda_B^{-1})^{-1}$. The underlying first order condition for the choice of the optimal quality is:

$$B(s)^{\intercal}\Sigma^{-1}\varphi = O'(s) \tag{A.7}$$

Where $\varphi = (\varphi_{MV}, \varphi_P)^{\intercal}$. It's easy to see that this implies in the following condition:

$$\frac{(\sigma_P^2\varphi_{MV}^2 - 2\rho\sigma_P\sigma_{MV}\varphi_{MV}\varphi_P + \sigma_{MV}^2\varphi_P^2)s + (\sigma_{MV}^2\varphi_P - \rho\sigma_P\sigma_{MV}\varphi_{MV})\boldsymbol{\kappa}}{\bar{\lambda}\sigma_P^2\sigma_{MV}^2(1-\rho^2)} = O'(s) \tag{A.8}$$

Appendix B: Comparative Statics Computations

In this appendix we compute the signals of the partial derivatives stated on the panels A and B on the comparative statics section of the paper. First we consider the case when the outrage constraint is not binding, and after that we compare the derivatives of the biding and not-biding cases.

B.1. Partial Derivatives of Manager Quality

If the outrage constraint is not binding, then the optimal manager quality s^* maximizes the ex-ante utility function of the board $V_B(s)$, which can be written as:

$$V_B(s) = \frac{1}{2\bar{\lambda}} B(s)^{\intercal}\Sigma^{-1}B(s) - O(s) \tag{B.1}$$

where Σ is the covariance matrix of returns, $O(s)$ is the outside option for a manager with quality s, and $B(s)$ is a vector defined by $B(s) = (s\varphi_{MV}, s\varphi_P + \boldsymbol{\kappa})^{\intercal}$. It's easy to see that we can write the underlying first order condition as

$$\bar{\lambda}^{-1}\boldsymbol{\varphi}^{\intercal}\Sigma^{-1}[s\boldsymbol{\varphi} + \boldsymbol{\kappa}\boldsymbol{e}_2] = O'(s) \tag{B.2}$$

where $\boldsymbol{\varphi} = (\varphi_{MV}, \varphi_P)^{\intercal}$ and $\boldsymbol{e}_2 = (0,1)^{\intercal}$. Differentiating (B.2) with respect to the political return $\boldsymbol{\kappa}$ we get:

$$\left[O''(s^*) - \bar{\lambda}^{-1}\boldsymbol{\varphi}^{\intercal}\Sigma^{-1}\boldsymbol{\varphi}\right]\frac{\partial s}{\partial \boldsymbol{\kappa}} = \bar{\lambda}^{-1}\boldsymbol{\varphi}^{\intercal}\Sigma^{-1}\boldsymbol{e}_2 \tag{B.3}$$

The term $\left[O''(s^*) - \bar{\lambda}^{-1}\boldsymbol{\varphi}^{\intercal}\Sigma^{-1}\boldsymbol{\varphi}\right]$ is positive by the concavity of the objective function on the maximum, while the term $[\lambda^{-1}\boldsymbol{\varphi}^{\intercal}\Sigma^{-1}\boldsymbol{e}_2]$ is negative if the Sharpe ratio of the mean-variance efficient securities is sufficiently larger than the Sharpe ratio of the political assets. This implies that:

$$\frac{\partial s}{\partial \boldsymbol{\kappa}} < 0 \tag{B.4}$$

Now differentiating (B.2) with respect to the political return λ we get:

$$\left[O''(s^*) - \bar{\lambda}^{-1}\boldsymbol{\varphi}^{\intercal}\Sigma^{-1}\boldsymbol{\varphi}\right]\frac{\partial s}{\partial \lambda} = -\bar{\lambda}^{-1}O'(s) \tag{B.5}$$

The term $\left[O''(s^*) - \bar{\lambda}^{-1}\boldsymbol{\varphi}^{\intercal}\Sigma^{-1}\boldsymbol{\varphi}\right]$ is positive, while the term $\left[-\bar{\lambda}^{-1}O'(s)\right]$ is negative, which implies that:

$$\frac{\partial s}{\partial \bar{\lambda}} < 0 \tag{B.6}$$

B.2. Partial Derivatives of Portfolio Weights

The vector of portfolio weights will be given by:

$$\boldsymbol{w} = \bar{\lambda}^{-1}\Sigma^{-1}[s\boldsymbol{\varphi} + \boldsymbol{\kappa}\boldsymbol{e}_2] \tag{B.7}$$

Differentiating (B.7) with respect to L we get:

$$\frac{\partial \boldsymbol{w}}{\partial \boldsymbol{\kappa}} = \bar{\lambda}^{-1}\{\det(\Sigma)\}^{-1}\begin{bmatrix}\sigma_{MV}\sigma_P^2\left(\frac{\varphi_{MV}}{\sigma_{MV}} - \frac{\varphi_P}{\sigma_P}\right)\frac{\partial s}{\partial \boldsymbol{\kappa}} - \rho\sigma_{MV}\sigma_P \\ \sigma_{MV}^2 - \sigma_{MV}^2\sigma_P\left(\frac{\varphi_{MV}}{\sigma_{MV}} - \frac{\varphi_P}{\sigma_P}\right)\frac{\partial s}{\partial \boldsymbol{\kappa}}\end{bmatrix}$$

from which follows that:

$$\frac{\partial w_{MV}}{\partial \boldsymbol{\kappa}} < 0,\ \frac{\partial w_P}{\partial \boldsymbol{\kappa}} > 0 \tag{B.8}$$

Similar algebra shows that (i) the investment in fixed income is increasing on the risk aversion, and (ii) the investment on the mean-variance efficient security is decreasing on the risk aversion.

B.3. Comparison between Constrained and Unconstrained Cases

Now we compare the values of the partial derivatives with respect to the exogenous variables when boards are constrained and unconstrained. It's easy to see that:

$$\left[\frac{\partial \boldsymbol{w}}{\partial \boldsymbol{\kappa}}\right]_{unconstrained} = \bar{\lambda}^{-1}\Sigma^{-1}\left[\frac{\partial s}{\partial \boldsymbol{\kappa}}\boldsymbol{\varphi} + \boldsymbol{e}_2\right] \tag{B.9}$$

$$\left[\frac{\partial \boldsymbol{w}}{\partial \boldsymbol{\kappa}}\right]_{constrained} = \bar{\lambda}^{-1}\Sigma^{-1}\boldsymbol{e}_2 \tag{B.10}$$

And therefore:

$$\Delta\frac{\partial \boldsymbol{w}}{\partial \boldsymbol{\kappa}} \equiv \left[\frac{\partial \boldsymbol{w}}{\partial \boldsymbol{\kappa}}\right]_{constrained} - \left[\frac{\partial \boldsymbol{w}}{\partial \boldsymbol{\kappa}}\right]_{unconstrained} = \bar{\lambda}^{-1}\frac{\partial s}{\partial \boldsymbol{\kappa}}\Sigma^{-1}\boldsymbol{\varphi} \tag{B.10}$$

And therefore:

$$\Delta\frac{\partial w_{MV}}{\partial \boldsymbol{\kappa}} < 0, \qquad \Delta\frac{\partial w_P}{\partial \boldsymbol{\kappa}} > 0$$

A similar argument shows that:

$$\Delta\frac{\partial (w_P + w_{MV})}{\partial \bar{\lambda}} > 0, \qquad \Delta\frac{\partial w_{MV}}{\partial \bar{\lambda}} > 0$$