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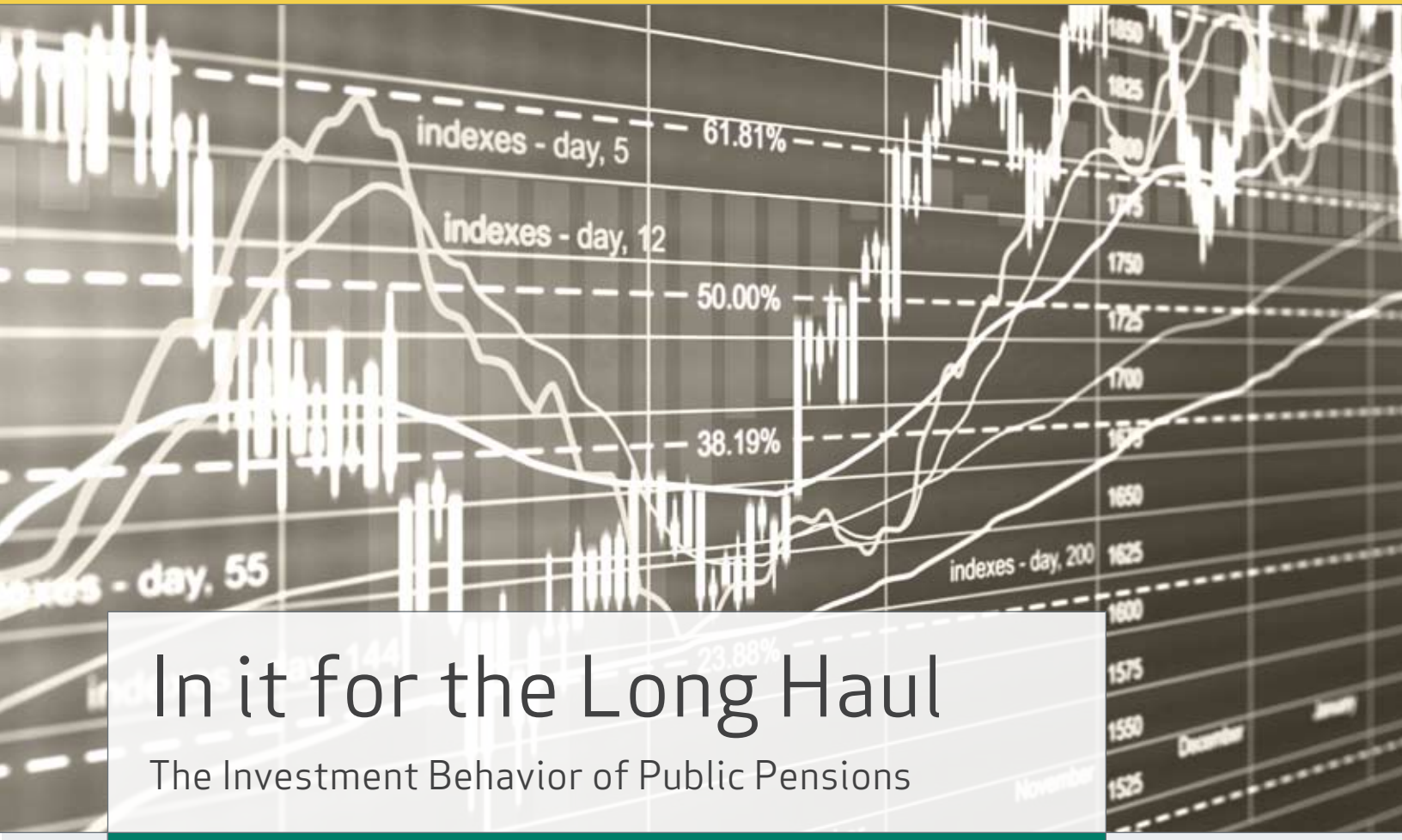

In it for the Long Haul

The Investment Behavior of Public Pensions

by Christian E. Weller, Ph.D. and Jeffrey Wenger, Ph.D.

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EXECUTIVE SUMMARY

The current financial crisis brings renewed attention to the issue of retirement security. Employees and retirees today watch their 401(k) savings plans shrivel as financial markets plummet, while beneficiaries of public pensions learn that the performance of their retirement plans are not immune to financial market volatility.

Investment losses in public pension plans, if they persist, may have to be made up with additional contributions from employers and (in some cases) employees and taxpayers. That's why taxpayers and employees alike have legitimate concerns about future commitments required to ensure the continued long-term integrity of public pension plans.

So how do public pension plans react to the ups and downs of financial markets? Do they "double down" and seek out more risk to compensate for investment losses? Or do they instead "buckle down" and continue a careful approach that is focused on a long-term strategy?

Using data on public pension plan investment patterns from the Federal Reserve and the U.S. Census Bureau, this report analyzes how public pension plans invest, in both bull and bear markets. We also examine how defined benefit plans responded to the last extreme drop in financial markets that occurred after 2000—with an eye to providing reasonable insights on how these plans might respond to the current financial market turmoil.

The result? Using economic tools such as descriptive statistics and multivariate analysis, we examined public pension plan data from 1993 to 2005 and found the following:

- **Public pension plans exhibit prudent investment behavior.** Plans regularly rebalanced their portfolios and adopted best investment practices of industry leaders.

- **Public pension plans avoid the "moral hazard" of making risky investment decisions believing that someone else will cover for any mistakes.** These plans' stock allocations are larger in the period *after* we observe higher funding levels, indicating that investment officials wait to know what their financial situation is before they change the risk exposure of their portfolio. If anything, plans may have been somewhat overly cautious in their asset allocation decisions in the wake of past instances of under-funding.

- **Public pension plans avoid so-called employer conflicts of interest whereby increased demands for contributions leads to pressure from employers to chase returns by taking on more risk.** Public pension plans tend to hold *smaller* amounts of stocks when employers are faced with the need to contribute more to their pension plans. This relationship seems to have become stronger after 2000. This means public pension plans avoided employer conflicts of interest because larger demands on employers for additional contributions translated into flights *from* risk rather than a rush *toward* more risk.

This analysis of public pension plans' past behavior may not be a perfect guide to what the future holds. However, the data underscore that public pension plans are suitable for employees and taxpayers alike whether financial markets are tranquil or volatile, on the rise or falling.

INTRODUCTION

The stunning collapse of global stock markets and the incredibly low rates of return on U.S. Treasury bonds amid the first world financial crisis of the 21st century has sparked debate about the wisdom of workers placing their retirement savings in individual defined contribution plans such as 401(k) plans. These plans are predicated on individual workers maximizing their returns on retirement savings through savvy investments in stocks and bonds over the course of their careers.

Today, this "on your own" approach is widely questioned as millions of retirees and those nearing retirement have seen a decade's worth of investment gains evaporate in 2008. Even under optimistic assumptions it will take at least several years to recover these losses.

Many of those who have retirement savings held in defined contribution plans look longingly at traditional defined benefit pension plans—retirement plans that provide steady, lifetime benefits—as a safer and wiser source of financial security in retirement. Defined benefit pension plans offer employees a predictable retirement income for life.

And these plans have important advantages for employers as well. Defined benefit pension plans are generally a much more efficient way to deliver retirement benefits, meaning that each dollar contributed to such a plan will provide a larger benefit in retirement than a comparable defined contribution plan.[1]

In comparison to 401(k) plans, where individuals bear the risk of market ups and downs, employers with defined benefit plans generally absorb the consequences of the underlying risks of the investments of pension assets. By bearing these investment risks, employers who offer these plans to their employees may enjoy the opportunity to reduce their pension costs when markets outperform as they did in the 1990s and in the mid-part of this decade. Yet it is also true that they have to make larger contributions to their pension plans (or require their employees to contribute more) if investment returns are worse than anticipated over an extended period of time.[2]

In the case of public pension plans for state and local government employees, recent investment losses could mean that taxpayers will be called upon to make additional pension contributions. It is too early to assess the precise impact the recent global market turmoil has had on the financial health of public pension plans, but there is plenty of data available to examine how these plans weathered the last consequential market downturn earlier this decade. Such an examination may offer indications of what the future may hold for public pension plans, the 25.8 million employees and retirees who rely on these pensions, and the taxpayers who help to finance these benefits.

After the stock market downturn in 2000, the vast majority of defined benefit pension plans (in both the public and private sectors) experienced a drop in their funding ratios—the difference between the assets they held and the benefit obligations they owed to current and future retirees—largely due to a drop in stock prices. Anecdotal reports and claims made by some in media outlets inaccurately fueled concerns that some public pension plans might have acted imprudently by chasing returns in their investment portfolios after funding levels dropped earlier in the decade. Such concerns are being played up again today. [3]

This study examines whether these concerns are warranted, based on the record of how public pension plans have made investment decisions in good times and bad – during bull and bear markets. In particular, we draw on the data available before, during and after the last stock market downturn to see

if public pension plans typically "buckle down" in the face of a crisis, taking prudent steps to protect the interests of beneficiaries and taxpayers or if they instead "double down" after experiencing investment losses, pursuing more risky strategies in an effort to recoup those losses.

The past can often be a good guide to the future. Understanding how public pension plans have dealt with challenges in the past gives us useful information on how they will react to the current crisis to protect benefit security for public servants at the lowest cost to taxpayers. The answer may provide an indication of how public sector pension plans will respond to the severe financial turmoil we have witnessed over the past year.

We analyze data from a number of key sources to specifically look at whether public pension plans have generally followed prudent investment practices after experiencing losses or pursued riskier investment strategies that could expose beneficiaries to the risk of lower benefits and taxpayers to higher demands from their state's pension plans in the future. Specifically, we examine the extent to which public pension plans "buckle down" by:

- **Rebalancing their investment portfolios** when prices for stocks and other assets change. Like other investors, public pension plans can take advantage of opportunities to "buy low and sell high" if they regularly rebalance their portfolios in response to price changes in line with a strategy focused on the long-term. In the end, this standard approach to professional investment management will secure the assets of a pension plan and keep pension costs to employees, employers and taxpayers at a minimum.

- **Implementing best investment practices** to ensure that a plan takes advantage of the best know-how in the industry. Financial markets are fast evolving with innovative products always emerging. Investment professionals handling billions of dollars for public pension plans need to balance the need to protect the assets for the benefit of pension plan participants with maximizing the expected rate of return, so as to keep costs for taxpayers over the long run to a minimum. Following what the industry leaders are doing is thus a necessary step in this fast paced, innovative world to ensure that pension plans can achieve both goals.

We also examine whether public pension plans "double down" on risky investments after experiencing investment losses in an effort to chase return. They could do so by:

- **Avoiding "moral hazard."** Investment officials may be tempted to offset investment losses by chasing returns through higher-risk investment strategies in the hopes of covering real or anticipated losses in the short run. The "moral hazard" in this situation would occur when investment decision makers count on taxpayers backstopping risky decision-making. Strong governance of a pension plan can protect beneficiaries and taxpayers from this type of moral hazard.

- **Avoiding employer conflicts of interest.** Employers may desire to keep contributions to a minimum by encouraging investment officials to pursue risky investment strategies in the short run. Here again, proper plan governance is critical to avoiding such conflicts.

To determine whether public pension plans rebalance their portfolios, we use data from the Federal Reserve's Flow of Funds from 1952 to 2007. To examine the remaining three indicators listed above, we use data from the U.S. Census Bureau's State and Local Government Employee Retirement Systems database, where consistent data for state- and local-government plans are available from 1993 to 2005.

The results indicate that public pension plans tend to be prudent in their asset allocation, "buckling down" when faced with adverse circumstances. For instance, public sector plans mostly rebalance their assets actively in response to stock price changes. The analysis also indicates that public pension plans followed the best practices of peer leaders, especially when investing in stocks. Specifically, public pension plans gradually expanded their exposure to the stock market during the period under examination, thus catching up with private sector pension plans' investment practices. In this way, public plans exhibited prudence by considering the performance examples set by other plans.

In addition, the results indicate public pension plans typically avoid "doubling down" when the going gets tough, thus protecting the interests of their beneficiaries and taxpayers. In particular, these plans tend to hold fewer risky assets when

they have fewer assets to cover benefit obligations. This indicates that moral hazard is not distorting plan investment decisions. On the contrary, investment officials decide to invest more in stocks only after funding levels rise, which indicates that they wait to know what their financial situation is before they change the risk exposure of their portfolios.

Similarly, public pension plans tend to hold fewer stocks when demands on employers for higher contributions increase. This relationship seems to have become stronger after 2000. This suggests that public pension plans avoided employer conflicts of interest because larger demands on employers in the 1990s translated into flights *from* risk rather than a rush *toward* more risk. If anything, public pension plans may have been somewhat overly cautious in their asset allocation decisions following large under funding problems.

Importantly, public pension plans' investment strategies did not systematically differ after the stock market crash of 2000, providing some indication that these plans will behave similarly in the current crisis and continue to invest their funds in a prudent manner.

In the pages that follow we will detail our methodology and the results of our analysis. The bottom line is this: public pension plans for state and local government employees performed largely as they should to ensure steady, predictable retirement benefits to current and future retirees amid market swings that were as dramatic in 2000 as what we are all experiencing today. Our study confirms that a sound alternative to defined contribution retirement savings plans is available today for people who are now worried about their retirement security.

BACKGROUND: HOW PUBLIC PENSION PLANS INVEST

The most important decision a pension fund investment manager makes is the overall asset allocation of the plan, that is, the proportion of a plan's assets that should be devoted to each type of asset—stocks, bonds, real estate, or more liquid assets such as U.S. Treasury bills.

Asset allocation decisions are designed to meet multiple objectives—to generate healthy investment returns to keep employer costs manageable, to manage investment risk so that demands on employers are predictable, and to ensure that the pension plan will have funds available to pay all benefits when they are due.

The task we set ourselves in this study—to examine the determinants of public pension plans' asset allocation strategies—required us to use two different data sets. The first is the Federal Reserve's Flow of Funds Accounts of the United States. This source includes aggregate data for all state and local pension plans on a quarterly basis going back to 1952. The Flow of Funds data offer the longest time horizon and include flow variables, in particular net purchases of financial assets. (All other data sets that provide information on public sector pension plans do not provide such data on asset flows.)

The second data set is from the U.S. Census Bureau's State and Local Government Employee Retirement Systems reports. These reports provide aggregate data going back to 1993, which cover a range of relevant variables for state and local plans separately for each state.[4] The Census data covers all public pension plans and provides relevant variables beyond plans' finances such as demographics and benefit payments.[5] In addition, the Census provides data for some individual pension plans, although there are restrictions on the comparability over time and on the availability of relevant variables. Where

feasible, this analysis uses both aggregate data for state and local plans for each state and individual plan data. Because of the data restrictions for individual plans, though, our conclusions largely rest on the aggregate data.

Finally, although the goal of the Census data set is to provide information on defined benefit plans, some survey respondents—state and local government plans—also included data on defined contribution plans. This poses a minor issue because the vast majority of public pension plans are defined benefit plans, yet one of the largest public sector defined contribution plans – the Teachers' Insurance Annuity Association or TIAA – is excluded. Still, the two data sets provide a sense of the determinants of the asset allocation of public pension plans. Moreover, both data sets allow for a comparison of the determinants of asset allocations before and after 2000, the last market peak.

The analysis of the two data sets finds that the asset allocations of public pension plans and private sector defined benefit plans are quite similar today. As illustrated in Table 1, public pension plans have held slightly more stocks directly than private sector defined benefit plans since the 1990s. Since 2000, stocks accounted for 60.3 percent of all public plan assets and for 59.6 percent of private pension plan assets. Since the 1970s, asset allocations in public plans have gradually converged with those of private sector plans.

Data from the Census indicates that state and local government public pension plans differ only slightly in their asset allocation. Local plans had a greater allocation of domestic stocks than state plans did starting in 2000. In 2005, local plans held 37.2 percent of their assets in domestic stocks, compared to 35.8 percent for state plans.[6]

Public pension plans' allocation of stocks in their portfolios also correlate with the rate of return that plans earn on their total portfolio of assets. In this case, we defined the rate of return as investment earnings divided by the average price of all assets at the start and end of a period. Plans with stock allocations greater than the median showed a rate of return that was approximately half a percentage point higher than for plans that had allocations toward stocks that were less than the median, based on the aggregate data, as shown in Table 2. When, we consider data for individual plans, instead of aggregates at the state level, we also find that larger equity allocations tend to go along with higher rates of return, again with a difference of about half a percentage point for longer-term investment horizons.

This finding is consistent with prior research, which found that the allocation of assets towards risky assets, mainly corporate stocks, is typically a systematic indicator of the overall rate of return earned on a defined benefit pension plan's portfolio. At least in the past, an allocation toward corporate stocks has

Table 1: **Public and Private Defined Benefit Plans Invest in a Diversified Mix of Assets**

Business Cycle Dates	Stocks		Corporate & Foreign Bonds		Treasuries & Agency Debt		Mutual Funds		Other Investments	
	Private Sector	Public Sector	Private Sector	Public Sector	Private Sector	Public Sector	Private Sector	Public Sector	Private Sector	Public Sector
Sep. 1953 - Sep. 1957	n/a	1.5	n/a	23.6	n/a	44.7	n/a	0.0	n/a	30.3
Dec. 1957 - Jun. 1960	n/a	2.6	n/a	32.7	n/a	33.3	n/a	0.0	n/a	31.4
Sep. 1960 - Dec. 1969	n/a	7.0	n/a	48.4	n/a	22.5	n/a	0.0	n/a	22.1
Mar. 1970 - Dec. 1973	n/a	21.5	n/a	56.6	n/a	8.8	n./a	0.0	n/a	13.1
Mar. 1974 - Mar. 1980	n/a	22.8	n/a	55.3	n/a	11.3	n/a	0.0	n/a	10.6
Jun. 1980 - Sep. 1990	39.8	29.8	10.6	30.9	19.1	28.9	0.8	0.7	29.7	9.6
Dec. 1990 - Mar. 2001	47.4	52.1	12.1	15.2	16.2	21.1	5.5	4.1	18.8	7.4
Jun. 2001 - Jun. 2007	59.6	60.3	9.3	9.3	11.5	16.4	10.5	8.7	9.0	5.2

Notes: All figures are percent of total financial assets. Data on private defined benefit plans are available only annually from 1985 onward. Authors' calculations based on BOG (2007).

been associated with higher rates of return for public pension plans.[7]

But how can we know if these investment outcomes are the result of professional, prudent practices? How can taxpayers, who help finance these public pension benefits, be confident that the plans are being managed in a fiscally-responsible way? And should employees trust that their benefits will be secure? In light of the recent turmoil in financial markets, a factual assessment of what drives the public pension investment patterns is both timely and useful.

FACTORS INFLUENCING PENSION PLAN INVESTMENT PATTERNS

Prior research in economics and finance indicates that investors' portfolio allocations typically are based on the available investment opportunities and the standard trade off between risk and return, whereby higher expected rates of return are associated with greater financial risks.[8]

Additional factors that can influence the investment decisions of pension plans include the demographics of the beneficiaries in the pension plan, the size of the pension plan (which may also proxy for the financial strength of the employer sponsoring the plan), and regulatory/legislative restrictions.[9] All else being equal, we would expect allocations of stocks to be greater in plans that have a younger demographic, that are larger, and that face fewer constraints on investments.[10]

In our analysis, we focus on a number of additional factors that would indicate either prudent or imprudent investment behavior. In particular, this analysis examines four factors: portfolio rebalancing, tendencies by plans to follow best investment practices by observing the behavior of peer leaders, possible moral hazard, and employer conflicts of interest. Taken together – regular rebalancing, learning from peer leaders, and the absence of moral hazard and conflicts of interest influencing investments – provide evidence of prudent investment behavior.

Indicators of Prudent Investment Behavior in Different Market Conditions

Rebalancing

Extraordinarily large movements in the price of financial assets should lead investment professionals to reallocate funds away from assets that have performed better and towards those that have not fared as well—a process called rebalancing. For instance, a large upward movement in stock prices in one period, such as the late 1990s, increases the probability of below average rates of return in the future as asset prices revert to the mean relative to expected earnings.[11] Consequently, one would expect to see plans sell some of their stock holdings after a large increase in prices and invest the proceeds in other assets, such as bonds. Thus, higher returns on stocks in one period would, in the following period, lead to lower expected rates of return on stocks, which should result in fewer stocks purchase by plans.

Peer Learning

Second, investment professionals of pension plans—trustees, chief investment officers, and investment boards, among others—may learn from studying the investment allocation decisions of other plans. This type of learning has most often been observed in the mutual fund industry. Specifically, mutual fund managers may mimic the performance of their peers who have shown an outstanding performance in the past. [12]

Indeed, most investors will imitate each other's behavior, given that information is naturally limited.[13] This may especially apply to public sector plans, where legislative and regulatory obstacles have been eliminated over time and plans have

moved toward more balanced asset allocations, with a mixture of higher- and lower-risk assets. In fact, one economist finds that learning from leaders can translate into higher rates of returns.[14]

Indicators of Imprudent Investment Behavior in Different Market Conditions

Moral Hazard

Absent good governance, under-funded plans may seek to take on more risk due to the problem of moral hazard, meaning that investment officials may find it opportune to increase their risk taking when there is a funding shortfall, assuming a bailout by taxpayers if larger, unexpected risks materialize. Empirically, though, there seems to be a positive relationship between funding ratios and allocations towards riskier assets. Well-funded defined benefit plans in the private sector tend to be more heavily invested in stocks than less well-funded plans.[15] The same is true for real estate investments.[16] So, our assumption is that this will also be the case with public pension plans, reflecting their prudent asset management practices.

Employer Conflicts of Interest

Imprudent investments may also occur if employers who sponsor defined benefit pension plans have conflicts of interest. In such a case, an employer may try to minimize its contributions to the plan to meet current and future benefit obligations. An unexpected increase in employer contributions to their pension plans may thus result in a change toward riskier asset allocations in an effort to reduce contributions in the short run by incurring more risk.[17]

Table 2: **Pension Plans Do Slightly Better Investing Slightly More in Stocks, One, Three, and Five-Year Rates of Return by share of Assets Allocated**

Size of allocation towards equities	1-year rate of return	3-year rate of return	5-year rate of return
Aggregate Data			
Small	8.0	7.0	7.0
Large	8.1	7.5	7.6
Plan Level Data			
Small	6.6	6.9	7.2
Large	7.9	7.3	7.6

Notes: All figures are in percent. Rates of return are averages for 1, 3, and 5 years. Size classes refer to quartiles of assets allocated to corporate stocks averaged over 1, 3, and 5 years. Aggregate data exclude system wide observations. Authors' calculations based on Census (2007).

ASSESSING THE AVAILABLE DATA

Portfolio Rebalancing After Price Shocks

Large changes in the price of financial assets should result in a movement of money, or rebalancing of assets. Specifically, higher stock prices should mean a shift away from stocks, while lower stock prices should result in a shift toward stocks to maintain a stable share of stocks in a portfolio.

To explore if public pension plans rebalance their portfolios in response to price changes we conducted a so-called multivariate analysis (which controls for a variety of other factors) of net stock purchases by these plans. We examine net stock purchases relative to stock holdings, with rebalancing by plan investment officials anticipated to be based on their aversion to risk as stock prices change. That is, we expect that net purchases of stocks are negatively correlated with stock prices. When stock prices go up, net stock purchases should decline and vice versa; lower prices should be associated with higher net purchases.

For the purposes of the analysis we use price changes in stocks that make up the S&P 500, controlling as well for the relative rate of change in those prices over time. Because investment restrictions have been lifted gradually for state and local government public pension plans we account for this change by including this change as independent variable in our analysis. [18]

The results in Table 3 show that public pension plans systematically and actively rebalance their portfolios in response to price changes. In particular, higher stock prices result in smaller net purchases of stocks—either in absolute terms or relative to existing equity holdings. Importantly, alternate specifications that include a time trend and different periods of analysis do not alter the main findings. A so-called Durbin-Watson test for serial correlation of any errors also provides a statistical result that shows that our results are not unduly influenced by statistical factors. [19]

Adopting Best Investment Practices from Peer Leaders

We also try to get a sense if public pension plans learn from and adopt the successful investment strategies of their peers. We first identify the best performer in each period based on a plan's rate of return. Plans that have the highest rate of return in a given year are considered "leaders." Next, we compare the changes in asset allocation for leaders during the year when they are leaders with changes of asset allocations of all plans in the following year.

It is important to note that this behavior does not suggest that public pension plans follow fads. In this analysis, the leader can always change and thus the stock allocation changes and rates of return are not self-reinforcing as would be the case in an investment fad. Instead, the technique that is used here shows that public pension plans follow the investment practices of the plan that has shown the best performance in the previous year and that plans can and typically do change from year to year. Consequently, the systematic link between the investment practices of the followers and the leaders shows the adoption of best investment practices.

The results of our analyses show that public sector plans "follow the leader." In about 50 percent of the cases, regardless of the kind of assets and regardless of the level of aggregation, plans follow the lead of leaders, either up or down, as Table 4 illustrates. When we use different statistical techniques and account for several factors at once, we find that public sector pension plans, especially state plans, in fact systematically mimic the behavior of performance leaders. Plans tend to implement best investment practices to improve the rate of return for their beneficiaries.[20]

There is also a difference between state and local public pension plans with respect to stock allocations. For instance, among state plans the followers in our analysis increased or decreased their equity allocation in 51.2 percent of the cases after leaders did the same in the preceding period, based on aggregate data. Based on fund level data, this was true for 44.6 percent of cases. Among local plans, followers followed leaders in 46.2 percent of cases, based on aggregate data, and 33.5 percent of instances, based on fund level data. This suggests that state public pension plans are somewhat more likely to follow the leader than local plans and thus more likely to implement best investment practices. Again, additional statistical analyses confirm systematic "follow-the-leader" behavior among state plans, especially large state plans.

Table 3: **Public Pension Plan Rebalancing Works: Multivariate Estimates for Rebalancing of Public Sector Pension Plans Show that Public Plans Actively Move Their Money in Response to Price Changes**

	Net Purchases$_t$	(Net Purchases/ Holdings)$_t$	Net Purchases$_t$	(Net Purchases/ Holdings)$_t$
Net Purchases$_{t-1}$	-0.033 (0.069)		-0.039 (0.068)	
(Net Purchases/ Holdings)$_{t-1}$		0.1085 (0.0690)		0.0601 (0.0683)
ΔS&P 500$_t$	-154.5*** (22.57)	-0.0096***† (0.0014)		
ΔS&P 500$_{t-1}$	-17.94 (25.18)	0.0008† (0.0016)		
Δln(S&P 500)$_t$			-32,564.2*** (12,437.1)	-0.0193** (0.0079)
Δln(S&P 500)$_{t-1}$			-3,767.7 (12,605.2)	0.0023 (0.0080)
Constant	1,240.8 (777.8)	0.0009 (0.0005)	788.9 (882.1)	0.0007 (0.0006)
N	220	220	220	220
R-squared	0.183	0.150	0.021	0.016
F-statistic	17.35	13.87	2.53	2.15
p-value	0.000	0.000	0.058	0.095

Notes: *** denotes significance at 1 percent level, ** denotes significance at 5 percent level, and * denotes significance at 10 percent level. † indicates coefficients multiplied by 100. Source: Yahoo! Finance, 2009, and Board of Governors, Federal Reserve System, 2008, Release Z.1 Flow of Funds Accounts of the United States, Washington, DC: BOG.

Avoiding Moral Hazard

If plans' investment decisions are being distorted by moral hazard, then we would expect to see less well-funded plans adopting more risky asset allocations. In order to test this premise, we need to examine whether a plan's funded status has an effect on its investment behavior.

Because the U.S. Census Bureau data we employ for our analysis does not report the value of a plan's total benefit obligations we must estimate a funding ratio using the data that is reported on annual benefit payments.[21] To do this, we assume that the median ratio of benefit payments to benefit obligations held by plans (based on the so called PENDAT data set for state and local governments) between 1998 and 2000 holds for all plans in our analysis.[22] The median ratio of benefit payments to liabilities was 5.7 percent for those years, which means that typically benefit payments in a given year represented a little less than 6 percent of the total money that a pension plan owed to all of its current and future beneficiaries.

We also assume that benefit obligations move in line with the age profile of a plan's participants and beneficiaries. The ratio of beneficiaries to active participants—the "dependency ratio"—

is used as an approximation of the age profile of a plan. We index each pension plan's dependency ratio with 1999 as the base year. Benefit obligations grow along with the dependency ratio, and are also a function of the plan's benefit payments. This calculation translates current benefit payments and the changing age structure of a pension plans into an amount that approximates the total expected benefit payments of a pension plan to its current and future beneficiaries.

Table 5 defines three categories of funding ratios to facilitate evaluating the data—plans with funding ratios of less than 80 percent ("under-funded plans"), with ratios of between 80 percent and 100 percent; and with ratios above 100 percent. What this analysis reveals is that less well-funded plans are correlated with lower stock allocations. Under-funded plans hold fewer stocks relative to their total assets than better-funded plans, and also held more in government securities. These correlations are even more pronounced when we consider plan-level data instead of aggregate data. The figures indicate that less funding goes along with smaller stock allocations. Additional statistical tests confirm that lower funding levels precede lower stock allocations, and not the other way around.[23]

Table 4: **Public Sector Plans Prudently Follow Peer Leaders: Share of Allocation Changes when Leaders and Followers Move in the Same Direction**

	% Changes in stocks to assets	% Changes in bonds to assets	% Changes in gov't debt to assets	% Changes in other investment assets
Aggregate data				
State and local plans				
Leaders and followers increase	26.2	21.1	12.6	28.1
Leaders and followers decrease	19.8	32.2	43.0	20.8
State plans				
Leaders and followers increase	36.6	28.7	13.5	21.5
Leaders and followers decrease	14.8	26.8	41.0	28.5
Local plans				
Leaders and followers increase	7.0	12.2	10.2	21.3
Leaders and followers decrease	39.2	40.6	33.5	20.3
Plan level data				
State plans				
Leaders and followers increase	25.5	29.0	9.6	17.6
Leaders and followers decrease	19.1	20.1	47.0	30.4
Local plans				
Leaders and followers increase	33.5	39.2	0.0	n/a
Leaders and followers decrease	0.0	0.0	53.0	n/a

Notes: All figures are in percent. Figures are shares of all allocation changes in specified asset category. Only instances are considered, where leaders and followers move in the same direction in subsequent periods.

Table 5: **Under-funded Public Pension Plans Hold Fewer Stocks: Asset Allocation of State and Local Government Retirement Plans by Funding Levels**

Shares of financial assets	Funding level: <80% (under-funded plans)	Funding level: 80% - 100%	Funding level: >100%
Aggregate data			
Domestic Stocks	28.7 -	35.7 (-3.67***)	34.6 (-3.55***)
Corporate and foreign bonds	15.6 -	18.2 (-1.93*)	17.1 (-1.31)
Treasuries and agency debt	15.9 -	11.3 (2.16**)	16.2 (-0.18)
Other investments	39.4 -	34.7 (1.76*)	32.4 (3.05***)
Plan level data			
Domestic stocks	16.6 -	37.2 (-3.42***)	39.1 (-2.87***)
Corporate and foreign bonds	24.5 -	22.9 (1.36)	19.6 (1.13)
Treasuries and agency debt	11.3 -	13.1 (-1.483)	18.0 (-7.265***)
Other investments	29.8 -	29.2 (0.349)	25.5 (4.025***)

Notes: Authors' calculations based on Census (2007). Figures in parentheses are t-test statistics for testing the null hypothesis the respective shares are the same as for pension systems with funding ratios less than 80 percent. * indicates significance at the 10 percent-level, ** indicates significance at the 5 percent-level and *** indicates significance at the 1 percent-level. When the test statistic in parenthesis has a positive sign, this indicates that the share allocated to that asset class for better funded plans is smaller than the share allocated in under-funded plans. The opposite is true when the sign is negative. A negative sign indicates that the share allocated to that asset class for better-funded plans is greater than the share allocated in under-funded plans.

Avoiding Employer Conflicts of Interest

If public pension plans' investment decisions are being distorted by employer conflicts of interest, then we would expect to find plans adopting more risky asset allocations in periods after demands on employers for more contributions grew. Conflicts of interest would be present where employers who offer pensions to their employees may try to minimize their contributions in any given year, particularly when those contributions escalate because of under-funding. Following an increase in employer contributions, plan sponsors may try to get the plan to pursue a riskier asset allocation strategy in the short-term to make up for pension shortfalls.

To test this hypothesis, we first identify periods when employer contributions grew by an extraordinary amount. For instance, when we use aggregate data, 3.3 percent of quarterly observations are classified as periods with extraordinary increases in employer contributions, compared to 8.1 percent for state plans and 0.7 percent for local plans.

The basic analysis compares changes in the stock allocation of public pension plans in the periods immediately following an

extraordinary increase in employer contributions with changes in stock allocations during all other periods. If there is employer conflict of int erest then we should see larger allocations of stocks during the period immediately following extraordinary employer contributions. If there is no employer conflict of interest, then changes in the stock allocation of public pension plans immediately following extraordinary increases in employer contributions should not differ from those during other periods.

The differences between the two types of periods—those following extraordinary increases and all other periods—are tested using standard statistical tests. Specifically, we use a so called t-test and a Mann-Whitney test (see the explanation of these two tests in the notes below Table 6) to confirm that our test results are not skewed by small samples.

The results of our analysis show no evidence that public sector plans seek more risk in the year following an unexpected increase in employer contributions as shown in Table 6. Specifically, both tests show that the changes in the stock allocations of public pension plans do not systematically differ between periods immediately following extraordinary increases and all other periods.

Lessons from the 2001 Market Downturn

After the Internet boom of the late 1990s burst, stock markets plunged through 2001. Many investors, including public pension plans, saw asset values decline sharply. But, over time, these investments were eventually recovered in many cases. This most recent past crisis can serve as an example of how public sector plans may react to the financial market turmoil we are experiencing today.

To determine if there was a systematic difference in the behavior of public pension plans before and after 2000, we used a statistical technique called a multivariate regression analysis with interactive terms. This analysis controls for a number of determinants of the asset allocation of public pension plans at the same time. It also permits us to see if the impact of the determinants that we are interested in—follow-the-leader behavior, moral hazard, and employer conflicts of interest—differed systematically after 2000 from their influences on public pension plans' asset allocation in earlier years. The methodology and results are detailed in a forthcoming article in the Journal of Pension Economics and Finance.[25]

Table 6: **Public Pension Plans Follow a Steady Course: Tests for Faster Stock Allocation after Unexpected Employer Contribution Increases**

	t-test	Mann-Whitney Test
System-wide data	-1.304	-0.047
State plans (aggregate)	-1.410	-1.356
Local plans (aggregate)	0.000	-0.225
State plans (plan data)	0.034	0.292
Local plans (plan data)	0.721	0.802

Notes: The t-test is used to test for the equality of means of the two samples. One sample consists of the periods immediately following an increase in employer contribution and the other sample consisting of all other periods. Mann-Whitney test is a ranksum test used here due to the small sample sizes to demonstrate robustness of the results. The Mann-Whitney test is a non-parametric test that allows for the comparison of the average of two groups. In each case, the null hypothesis is that the average change in equity allocation in the period after an extraordinary increase is the same as the average change during all other periods. None of the test statistics are significant, thus we cannot reject these null hypotheses. In other words, both tests show that the changes in the equity allocation of public pension plans do not systematically differ between periods immediately following extraordinary increases and all other periods.

Several important results emerge from this analysis. First, the results confirm our findings so far. That is, the asset allocation of public pension plans displays best industry practices, avoids moral hazard, and shows no employer conflicts of interest.

Second, the determinants of public pension plans' asset allocations are largely the same before and after 2000. Put differently, public pension plans continued on their path of prudent, professional management in the wake of the 2001 financial market downturn.

Third, when we find differences in plans' asset allocation decisions after the 2001 financial crisis, they point toward more prudent, not less prudent, investment behavior. In particular, we find that greater employer contributions are followed by smaller stock allocations after 2000, but not before. While this

suggests that public sector plans generally are not negatively influenced by employer conflicts of interests, it may indicate that some plans became overly cautious in the face of quickly rising employer contributions after 2000.[26]

The results clearly show that public pension plans generally operate in a prudent and professional manner. The results further show that these pension plans continue to act prudently in the face of a crisis and do not seek to "double down" on their risk taking to make up for experienced or expected financial market losses in the short run.

CONCLUSION

Our analysis of the asset allocation decisions by public pension plans should give taxpayers and employees alike confidence in how these plans are being run. We find that public pension plans followed prudent investment behavior by regularly rebalancing their investment mix, learning from industry leaders, and avoiding moral hazard and employer conflicts of interests. These results cast doubt on anecdotal reports and claims about investment officials investing imprudently when their funding ratios are on the decline.

Specifically, our descriptive statistics and multivariate analyses of public sector plan data from 1993 to 2006 demonstrate that public plans are prudent in their asset allocation. Public sector plans rebalance their assets actively in response to stock price changes.

Such prudent investment decision-making is also evident in the fact that public pension plans do not get caught up in a herd mentality, but rather follow the best investment practices in the industry. We find that public pension plans, especially state plans, systematically follow the practices of performance leaders.

Public pension plans tend to hold more risky assets when they have higher funding levels, thereby indicating that moral hazard is not distorting investment decision-making. And these plans' stock allocations are larger in the period after we observe higher funding levels, which shows that investment officials wait to know what their financial situation is before they change the risk exposure of their portfolio. In fact, our findings indicate, if anything, public pension plans may have been somewhat overly cautious in their asset allocation decisions following past periods of lower funding.

Further, we find no evidence that public pension plan investment patterns are being distorted by employer conflicts of interest. Plans tend to hold smaller amounts of stocks when employers feel the pressure to contribute more to their pension plans. This relationship seems to have become stronger after 2000, which means public sector plans avoided employer conflicts of interest because larger demands on employers in the 1990s translated into flights *from* risk rather than a rush *toward* more risk.

The results of our study underscore that public pension plans are suitable for their plan participants and beneficiaries when debt and equity markets are tranquil or volatile, or on the rise or falling. Given the severe market swings in U.S. and overseas stock markets and debt markets, workers and government policymakers alike should value the safety of defined benefit pension plans that follows from prudent and professional asset management.

ENDNOTES

1 Almeida, B. and W. Fornia. 2008. *A Better Bang for the Buck: The Economic Efficiencies of Defined Benefit Pension Plans*. Washington DC: National Institute on Retirement Security.

2 An important difference between defined benefit plans in the public and private sectors is who makes the contributions. In the private sector, employers typically finance the benefits, whereas in state and local plans contributions are typically made by both the employer *and* the employee.

3 Whoriskey, P. "Downturn Clobbers Public Pension Funds," *Washington Post*, October 28, 2008.

4 Consistent data are available only through 2005 due to a change in the sample.

5 Aggregate data provide for consistent time series observations for each state at the state and local level. Individual plan level data does not offer the same time series consistency due to a change in survey methodology and plan survivals and deaths. We thus primarily rely on the aggregate data, although we report results based on plan level data to show the robustness of our results.

6 Weller C., and J. Wenger. 2009. "Prudent Investors: The Asset Allocation of Public Pension Plans." forthcoming, *Journal of Pension Economics and Finance*.

7 Coronado, J.L., E.M. Engen, and B. Knight. 2003. "Public Funds and Private Capital Markets: The Investment Practices and Performance of State and Local Pension Funds." *National Tax Journal*, 61, No.3: 579-594. The authors find that one standard deviation increase in asset allocation toward stocks was associated with a rate of return that was 1.3 percent higher in 1998, It is important to note, however, that such past results tend to reflect an equity premium, which may not exist in the future. Thus, these results cannot be a guide for future asset allocation decisions.

8 Grossman, S., and J.E. Stiglitz. 1980. "On the Impossibility of Informational Efficient Capital Markets." *American Economic Review*, 70, No. 3: 393-408. Weller C. and J. Wenger op. cit. for a detailed review of the relevant literature.

9 McCarthy, D., and D. Miles. 2007. "Optimal Portfolio Allocation for Pension Funds in the Presence of Background Risk." Unpublished manuscript, London, UK: London School of Economics.

10 For a complete discussion, see Weller C., and Wenger, J. op. cit.

11 Campbell, J. Y., and R.J. Shiller. 1988. "Stock Prices, Earnings, and Expected Dividends." *Journal of Finance*, 43(3): 661–676, and Campbell, J.Y., and R. Shiller. 2001. "Valuation Ratios and the Long-Run Stock Market Outlook: An Update." NBER Working Paper No. 8221, Cambridge, MA: National Bureau of Economic Research.

12 Chevalier, J.A. and G.D. Ellison. 1999. "Career Concerns of Mutual Fund Managers." *Quarterly Journal of Economics*, 389-432, and Sirri, E.R. and P. Tufano. 1998. "Costly Search and Mutual Fund Flows." *Journal of Finance*, 53, 1589-1622.

13 Jegadeesh, N., and S. Titman. 1993. "Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency." *Journal of Finance*, 48, 65-91.

14 Pomorski, L. 2006 "Follow the Leader: Peer Effects in Mutual Fund Portfolio Decisions." Unpublished manuscript, Joseph L. Rotman School of Management, University of Toronto.

15 Rauh, J. 2007. "Risk Shifting versus Risk Management: Investment Policy in Corporate Pension Plans." *NBER Working Paper* No. 13240, Cambridge, MA: National Bureau of Economic Research.

16 Craft, T. 2005. "How Funding Ratios Affect Pension Plan Portfolio Allocations." *Journal of Real Estate Portfolio Management* 11, No.1: 29-35.

17 McCarthy, D. and D. Miles, op. cit.

18 The full regression model that we estimate using OLS is thus defined as:

$$(Net\ Purchase)_t = \beta_0 + \beta_1(Net\ Purchases)_{t-1} + \beta_2 \Delta(S\&P\ 500) + \beta_2 \Delta(S\&P\ 500)_{t-1} + \varepsilon$$

We use the same data as for the univariate discussion of rebalancing. The model is estimated for public sector plans only.

19 A Durbin-Watson test for serial correlation in errors was conducted. This is a test for a statistical regularity that relates a variable to its previous values and which shows no such relationship, when it takes values of 2 or close to that. The test produced a result very close to 2 (across specifications the minimum was 1.95 and the maximum for 2.08), which means we can reject the null of serial correlation. This means that our results were not unduly influenced by a statistical regularity over time.

20 Multivariate results are not shown here. See Weller, C., and J. Wenger, op. cit.

21 Specifically, benefit obligations or liabilities for each system are calculated as:

$$L = \frac{B}{0.057}\ (AgeIndex)$$

Where L are the proxied liabilities, B are benefit payments, and *AgeIndex* is the dependency ratio indexed to 1999 for each system. The resulting funding ratios, weighted by asset size, for each year show the familiar pattern of improving funding ratios in the late 1990s, a sharp drop off after 2001 and stabilization in 2006. Authors' calculations based on Census (2007). Assets are reported here as total assets at market value. Since most public pension plans will likely use some form of smoothing to reduce swings in asset values in the calculation of plan funding ratios, our calculation will show larger swings in funding ratios than is likely the case for actuarial funding ratios.

22 PENDAT is a pension data set that collects information on the largest public sector pension plans for the years from 1994 to 2000. It was constructed by the Government Finance Officers Association. Thus, the years chosen here are in the middle of the Census (2007) data series and ensure sufficient observations.

23 Weller C., and J. Wenger, op. cit.

24 To define "extraordinary" changes in contributions, we begin by scaling employer contributions to plan outflows (benefit payments and withdrawals). Then we calculate the average percentage point change in this ratio between each period in our sample as well as the standard deviation of the change. (The standard deviation is a measure of the typical fluctuation around the average.) Next, we set a threshold measure for periods of extraordinary changes in contributions. This threshold is equal to 1.5 times the standard deviation above the average. We calculate this for all plans in the aggregate, for state plans, and local plans.

25 Because of the limitations of the Federal Reserve's Flow of Funds data, we were not able to perform this statistical analysis on the question of portfolio rebalancing. However, using the Census data, we were able to test the other three out of four indicators—adopting best practices, avoiding moral hazard, and avoiding employer conflicts of interest. See Weller C., and J. Wenger, op. cit.

26 Weller, C. and J. Wenger, op. cit. also show that there was no clear trend towards other investments. Also, while the allocation toward international securities increased, the allocation toward real estate remained relatively stable according to our calculations based on Census data from 2007.

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