Public Pension Plans: Myths and Realities for State Budgets

Abstract - We explore the interaction of state pension systems with state finances. We find that changes in pension assets are an important source of funding for state governments, but that states face incentive problems that impede funding efforts with the result that many plans are underfunded. We analyze the substantive differences between defined benefit and defined contribution plans for public employees and state governments. Regression analysis using a panel of 85 state public pension plans indicates some evidence of actuarial assumption manipulation to reduce funding pressure. Plan demographics and state tax revenues are significant influences on funding ratios, while plan features are not.

INTRODUCTION

Public employee pension issues are high on the policy agenda in many states. There are, of course, traditional funding problems. But there are newer issues as well, such as attempts to move from defined benefit to defined contribution plans and possible responses to new Government Accounting Standards Board rules that require the disclosure of the costs of promised post-retirement health care benefits. There is also an important reciprocal relationship between the funding of public pensions and state finances. State pension systems are placing increasing demands on state revenues, while pension funds, because of their pre-funded nature, sometimes serve as a source of ready cash when legislatures need to balance their budgets.

In this paper we explore the interaction of state pension systems with state finances. We begin by describing the nature of defined benefit plans, the funded status of public plans in the U.S., and the significance of underfunding. The pro-cyclicality of both state revenues and investment returns means that states will need to make large contributions to their plans when they are least able to do so. We illustrate this link using data from the last 17 years and find that changes in pension assets are among the most important sources of funding for state governments. We also find that, in spite of widespread underfunding, states have the capacity to manage their pension obligations effectively over time, but

1 This work builds on an earlier paper by Giertz (2003).
they face incentive problems that impede these efforts.

In several states, there are discussions of moving subsets of public employees from a defined benefit (DB) pension plan to a defined contribution (DC) plan, as in the private sector, as a way to cut expenses. However, the debates frequently cloud, rather than enlighten, the issues. In the third section, we address issues to consider in moving from defined benefit to defined contribution plans in the public sector. We find that many of the differences featured in the debate between these two plan types are imaginary—or at least not intrinsic features of the two approaches. The two substantive differences between DB and DC plans for public employees and for state budgets are (1) in the assignment of investment risk; and (2) in moral hazard problems in funding. We conclude that there are real benefits to maintaining pensions in the DB form if participants are more risk averse than state governments and if moral hazard problems can be overcome.

In the fourth section, we explore the connection between plan demographics, plan features, state finances, and pension funding with a panel of 85 state public pension plans. We find some evidence of actuarial assumption manipulation to reduce funding pressure, and that plan demographics and state tax revenues have a significant influence on funding ratios. The concluding section reviews the findings in the paper and suggests ways to provide stronger incentives for states to use their existing capacity to deal with pension problems more effectively.

STATE REVENUES AND PENSION PLAN FUNDING

State (and local) public pensions are predominately of the defined benefit form. Under defined benefit arrangements, employee and employer contributions plus the investment returns on these contributions are intended to cover the cost of benefit payments. Benefits are typically related to years of service and some measure of final salary level. In a fully funded system, the accumulated assets at any point should be sufficient to meet the benefits earned by participants up to that time if the actuarial assumptions of the plans are realized. A system is said to be fully funded if the existing assets are sufficient to cover the discounted present value of the benefits earned to date by participants, i.e., the system’s liabilities. The estimation of liabilities in a DB system depends on a number of key assumptions, including the future growth of wages and the returns on investments. Small changes in these assumptions can have important impacts on the estimates of a system’s fiscal health. We discuss these assumptions in more detail in the third and fourth sections. Plan sponsors, not the employees, bear the risk of fluctuating investment returns and are responsible for any shortfalls. In practice, many state pension systems are not fully funded because of insufficient contributions by governments in the past, the ad hoc expansion of benefits and, less often, the failure to meet actuarial assumptions. In fact, underfunded pension systems constitute a hybrid of prefunded and pay-as-you-go arrangements. In most states, underfunded liabilities are either explicitly (through constitutional or statutory guarantees) or implicitly the obligation of state governments.2

State finances are directly affected by the annual required pension payments made by governments for their employees. It is less well understood that state finances are potentially impacted to a much larger degree indirectly by changes in the asset values of the investment portfolios of their pension systems. Figure 1, which shows the magnitude of annual pension

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2 This is discussed in more detail in Giertz (2003).
funds from various sources, demonstrates both the size and volatility of investment returns since 1993. Over the period 1993 to 2004, investment returns were in total 3.3 times larger than employer contributions and 5.8 times larger than employee contributions. However, investment returns have been subject to large year–to–year variations.

Stock market movements over this period included an unprecedented run–up of asset values in the 1990s, a precipitous decline at the end of the stock market bubble in early 2000, and a strong recovery starting in 2003. This volatility in the equity markets coincided with a similar cycle in state government income tax receipts caused by capital gains realizations as well as bonuses and stock options. The late 1990s was a period of substantial revenue growth for state governments (as well as for the federal government). From 1995 to 2000, state tax revenues grew at an annual rate of 6.2 percent and income tax receipts grew at a 7.5 percent rate. This was followed in fiscal years 2002 to 2004 by the most significant decline in state revenues since at least the Great Depression. Both the revenue increases and declines were more pronounced than predicted because of the difficulty in forecasting capital gains. More recently, revenues have begun to expand again at a strong pace (but more modestly than in the 1990s), bolstered again with capital gains.

Giertz (2003) notes that changes in pension assets have a huge, but often little–noticed, impact on state finances. He demonstrates that the relatively high levels of pension funding in the late 1990s were an artifact of the strong assets markets. These high investment returns allowed some states to reduce or eliminate their annual contributions to pension funds—just as some companies reduced

their contributions to their fully funded pension funds. A few states whose plans were fully funded on an actuarial basis considered closing or did close their DB plans to new entrants, replacing them with a defined contribution plan (Papke, 2004, 2007).

Changes in asset values are of significant size compared to state revenues. Figures 2 and 3 show the magnitude of pension asset changes as a percent of total state tax revenues and individual income tax revenues. The figures show not only the size, but also the volatility of pension asset changes. Note that in four of the 12 years, the increase in pension assets exceeded state income tax collections. But there were also two years (2001 and 2002) when the change was negative and one year (2003) when it was close to zero.

Quantitatively, the changes in pension assets are among the most important sources of funding for state governments, but this impact is largely ignored by most policymakers and observers. Over the entire period, investments returns were 23 percent of total state tax revenues and 69 percent of individual income tax revenues. It should be noted, however, that while there is considerable annual volatility, there is more stability over the longer term. The existence of longer-term stability is a key issue that relates to both the health and structure of state pension systems. This will be discussed below.

Figure 4 shows that state pension funds were actually overfunded for a brief period at the end of the market expansion of the 1990s. However, underfunding is the more typical state of affairs. Funding

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Figure 2. Change in Pension Assets Compared to State Tax Revenues


3 The chart deals with the combined funding and liability of all reporting state pension systems. There is considerable variation among the states in funding levels. According to the Wilshire report (Wilshire Consulting, 2007), 80 percent of reporting systems were funded at less than 100 percent. The overall funding ratio for all systems was 88 percent, while the ratio for underfunded systems was 79 percent.
Figure 3. Change in Assets Compared to Total Taxes and Income Taxes


Figure 4. Funding Levels

levels fell to the low 80 percent levels during the market decline and have since moved up to about 88 percent in 2006. Figure 5 shows that the overall level of underfunding in 2005 was slightly less than $300 billion. This is clearly a large number, but does it constitute a serious fiscal problem for the states? There is some disagreement about whether a 100 percent funding ratio is necessary for state governments. Unlike private pension funds, state governments have an infinite life expectancy along with the power to tax. If they choose (possibly unwisely), states can operate their systems on a partial pay–as–you–go arrangement with little danger of default. This may be an expensive method of funding compared to prefunding arrangements, but it is clearly possible. Accounting rules allow states to average several years of returns in estimating required contributions—the effect of unusually high or low returns is smoothed over several years. States, unlike private sector pension sponsors, are not required by federal rules to achieve 100 percent funding or to rectify underfunding problems within a designated time period with higher contribution levels. However, underfunding may affect the real cost of government through lower credit ratings and the resultant slightly higher borrowing costs.

The total 2006 underfunded state pension liabilities are estimated at $284 billion by Standard and Poor’s (Young, Prunty, and Cutler, 2006). This amounts to 2.1 percent of GDP, 44 percent of annual state tax revenues, and $960 on a per–capita basis. The state of Illinois is among the most poorly funded state pension systems. Its $40.7 billion unfunded liability is 7.3 percent of state GDP and 154 percent of annual state tax collections. For comparison purposes, the estimate

Figure 5. Underfunding


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4 This conclusion may not apply to local pension systems where the economic base may be considerably less secure than that of a state. That is, current taxpayers can move out of the local area and never be responsible for pension liabilities.
of unfunded benefits for retirees for two federal programs (Medicare and Social Security) is a staggering $65.9 trillion (Gokhale and Smetters, 2005). This is five times the annual GDP and nearly $300,000 on a per-capita basis. While this state–federal comparison of liability may not be directly comparable, the comparison does put the state liability in perspective. It appears that even in states with substantial underfunding, meeting pension obligations is more a question of will than capacity. Pension funding clearly constitutes a serious problem for many states, but it is a manageable problem, especially over the long term. As we suggest in the third section, the funding problems are due to a lack of fiscal discipline resulting from moral hazard problems.

While volatility of investment returns may appear to be an acute problem for states, the long–term nature of the pension obligation has meant that states have been able to realize their actuarial investment assumptions. Figure 6 compares actual returns of public pensions systems between 1990 and 2006 (both state and local) to the eight percent return that is often used in actuarial assumptions. There is, indeed, a substantial amount of annual variation. During this 17 year period, there were two years of negative returns, and two others that, while positive, fell five percentage points below the expected eight percent return level. On the upside, there were four years when returns exceeded 15 percent. But year–to–year volatility need not create a major problem for an ongoing long–term liability. Figure 7 shows the hypothetical growth of $100 over the 17 year period with actual rates of return and with the assumed rates of 8.0 and 8.5%

Figure 6. Public Pension Systems Returns

Source: Public Retirement Funds Index, State Universities System Comprehensive Annual Financial Report, various years, Champaign, Illinois.
percent. The figure shows that actual rates of return of public pension systems have been sufficient to meet the assumed 8.0 and 8.5 percent returns used to calculate pension system liabilities and required contributions. Of course, this result would not necessarily hold for certain sub-periods.

This suggests that underfunding resulting from the cyclicality of both pension asset returns and other state revenues could be addressed over a multi-year time frame. Since returns and state revenue growth have been highly correlated for at least the last 15 years, cyclical underfunding has occurred at the times when states are under the greatest fiscal pressure from slow-growing or declining tax revenues. Rather than attempting to address the underfunding immediately, it would be more reasonable to take action over a longer period. Funding ratios will typically improve during expansions, and state revenues will be more plentiful to make up for any remaining underfunding. An added benefit is that states will not increase their permanent spending base during strong revenue years since extra contributions to pension funds are not recurring expenditures. This, however, assumes that states have the discipline to follow a multi-year funding strategy. This will be discussed in the third section.

While there is no guarantee this pattern of returns will continue in the future, it appears that, historically at least, states do not necessarily have to immunize their pension liabilities by choosing a low-risk and low-return portfolio if they are willing to accept volatility in their annual returns. This is the strategy chosen by the

Source: Public Retirement Funds Index, State Universities System Comprehensive Annual Financial Report, various years, Champaign, Illinois.

Figure 7. Actual vs. Assumed Returns (100 in 1989)
overwhelming majority of both private and public pension funds.\textsuperscript{5}

The theme of this section is the potential impact of changes in pension assets on state finances. Clearly, the changes are large compared to other revenue sources and very volatile on an annual basis. They also tend to be highly correlated with tax revenue changes. We conclude, however, that, over the long term, this is less a problem than it appears. Based on data from a period with significant positive and negative fluctuations in both asset values and state tax receipts, pension funding goals could have been met, for the most part, if states had adhered to reasonable, but not heroic, funding discipline. The problem of maintaining such discipline is addressed in the next section.

**DEFINED BENEFIT VS. DEFINED CONTRIBUTION PLANS IN THE PUBLIC SECTOR**

In the private sector, defined contribution plans have come to dominate defined benefit plans in recent years. Defined contribution plans require a designated contribution from the employer and employee to an employee’s account. The employee then invests the assets in a limited range of investment options. An employee’s retirement benefits are based on the accumulated assets in the account at the time of retirement. The investment risk is borne by the employee. Only a few states have moved some public sector employees to DC plans by closing their (fully funded) DB plans to new hires and offering existing employees the choice (Papke, 2004, 2007). In this section, we discuss real and imagined differences between the two plan types—which differences are a necessary consequence of pension form, and which ones are discretionary policy choices. While plan generosity is usually the focus of the debate, we conclude that the two substantive issues in the DB vs. DC choice are the assignment of risk between the state and its employees, and the moral hazard in funding DB plans.

Both proponents and opponents of a proposed switch to a DC plan often assume it will be less generous than the existing DB plan. For this reason, DC plans are often opposed by employees and unions, while they are pushed by proponents of fiscal discipline. But just as a switch to private accounts for Social Security would not solve the funding of legacy debt, a shift from DB to DC public plans will not address past underfunded liabilities. Even with a new and less–generous DC plan, state governments are still responsible for dealing with past underfunding problems. And while a new DC plan could be less generous in order to reduce future benefits, similar cost saving could be realized from a less generous new DB plan that applies to future benefits.

The debate is also often confused by discretionary features of plan arrangements. Opponents of DC plans often argue that they are inferior because they would not provide medical benefits, disability coverage, and survivor benefits. But in principle there is no reason why these benefits could not be provided as part of a DC plan through supplementary insurance arrangements. Some argue that DC plans are flawed because they cannot provide guaranteed lifetime income to retirees. However, voluntary or mandatory annuity options can be included as

\textsuperscript{5} For a review of the literature dealing with the portfolio choice of pension funds, see Siegmann (2007). Most of the work is based on the optimal portfolio approach dealing with risk–return options from finance. Siegmann, however, finds that pension funds that are either underfunded or overfunded use more aggressive strategies, while those near the 100 percent funding level chose more conservative asset allocations.
part of DC plans. Opponents also assert that DC plans would result in excessive administrative fees and transaction costs, while they ignore similar costs that are imbedded in DB programs. TIAA–CREF is an example of a low–cost, efficient DC arrangement. There are also assertions about poor investment decisions that are made by DC participants. This problem could be partially addressed by limiting the range of investment choices and by establishing basic efficient portfolios as default options. Some have even suggested that DC funds could be managed like a conventional DB pension fund where participants would have pro rata share of a fund managed by investment professionals on a lockstep basis for all members. This would maintain the benefits of the purported low costs and investment expertise of DB arrangements, although participants would lose the ability to manage their own investments even while they bear the investment risk.

Similarly, proponents of DC plans criticize some DB formulas for penalizing short–term employees who do not reach certain service thresholds while creating undue pressures for retirement once certain thresholds have been achieved. However, these features need not be part of DB plans. Plans can be designed to avoid such penalties and rewards. There is no intrinsic reason why DB plans cannot be made more portable by allowing cash–outs of benefits earned, for example. This is often not done because of the power of employers and long–term employees who gain when benefits are sacrificed by mobile short–term workers.

From the perspective of state funding, however, there are two important differences between DB and DC plans. DB plans present states with a persistent incentive problem that may discourage the full funding of benefits. A moral hazard problem arises when recipients believe that, either because of explicit or implicit guarantees, pension payments to retirees will ultimately be paid regardless of funding levels. Similarly, politicians are not concerned about long–term funding issues because they operate under a relatively short time horizon. Politicians faced with the unpopular choices of raising taxes or cutting programs may decide to use available revenue for other purposes by reducing pension contributions, or by changing assumptions that lower required contributions, knowing that they will likely be gone from office when the pension underfunding problem becomes critical. Employees accept such fiscally unsound arrangements knowing their future pension benefits are protected. But future taxpayers lose. Future taxpayers must make up not only the forgone contributions, but also the investment returns these contributions would have earned.

The same process can also lead to the extension of unfunded pension improvements, such as early retirement plans that exacerbate the underfunding of pensions even in relatively good times. This moral hazard problem in funding is largely avoided by DC plans—the state is required to pay its share of the pension contribution in a timely manner so it can be invested in the employees' DC accounts. Employees are less likely to accept a default on a promised payment to their retirement account as opposed to a failure to contribute to a DB plan. A switch to a DC plan would address this moral hazard problem in future funding; but, as noted above, it would do nothing to address past underfunding.

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6 The moral hazard problem with private sector pensions is similar, but not identical. Private employees may accept pension promises that involve a substantial default risk if their pensions are backed by government programs such as the Pension Guarantee Trust Corporation. The private pension reforms of 2006 that mandated higher private funding levels were adopted largely to address this problem.
A second intrinsic difference between DC and DB plans is the assignment of risk. Under a DB plan, the plan sponsor has an obligation to make the required pension payments when workers retire. If employee and employer contributions plus the investment returns are insufficient (either because of intentional underfunding or poor investment performance), the employer must make up the difference. If contributions and investment returns exceed the amount necessary for pension payments, the employer can capture the benefits through reduced future contributions. Assuming no default risk, employees bear no risk.

With a DC plan, the only employer obligation is to make the required contributions in a timely manner. The workers’ retirement benefits will be strictly a function of the combined employer–employee contributions and the investment returns. The risk is fully borne by the employee. This suggests that a movement from a DB to a DC plan with the same expected cost would result in a decrease in welfare for a risk–averse employee. This may, in part, explain why employee–managed DC plans typically generate lower rates of return compared to DB plans. Employees in DC plans may correctly choose a lower risk portfolio with the accompanying lower rate of return.

If there are differences in risk aversion between employers and employees, DB plans may be superior for both state employers and employees. Figure 8 illustrates this situation. The graph shows the tradeoff between risk and return for investors. Unlike most analyses, the return here represents the total return for a given amount of invested resources rather than the rate of return. The Risk–Return frontiers give the optimal combinations of risk and total return for a given cost, with Risk–Return 1 representing a lower level of cost as compared to Risk–Return 2. Each Risk–Return frontier can be thought of as the combination of final portfolio values and risk that are available for a given initial investment. (In this case, the investment is the contribution to a pension plan.) On Risk–Return 1, the amount C could be achieved with certainty, while the expected value B could be achieved with the same initial cost, but with considerable risk. Movements along a given Risk–Return line are achieved by combining various assets with differing risk–return characteristics and with different correlations with other assets. The indifference curve for a representative participant demonstrates greater risk aversion as compared to the indifference curve for the pension–sponsoring government.

In this particular situation, the participant would optimize with a zero–risk at point A that is equivalent to a defined benefit arrangement. This could be achieved by investing at point A, but at a considerable loss of expected return on Risk–Return 2. The government could finance this pension at a much lower cost by choosing point B (on Risk–Return 1) with the same total expected return, but with substantially more risk. For some reason, the government is able and willing to bear more risk than the participant. This transference of risk from the more risk–averse employee to the less risk–averse state employer generates real benefits. This difference in risk aversion provides a basis for mutual gains from the provision of defined benefit plans. Participants receive a more attractive defined benefit pension at a lower cost than they could provide under a similar risk–free arrangement through a defined contribution plan.

This presents an important choice in regard to plan structures. DC plans reduce the moral hazard problems, but DC plans cannot capture the possible gains from risk assignment discussed above. If workers value the assumption of risk by the employer, it is preferable to maintain DB plans in the public section (adjusting the generosity or plan provisions as neces-
sary) and address the moral hazard problems associated with DB funding directly. Unfortunately, there are no easy answers to underfunding pressures resulting from moral hazard behavior. This problem may require statutory and even constitutional funding rules similar to those imposed on private funds.

Legislatures have another option to control pension costs. Legislatures authorize annual pension contributions, but they may also affect the “required” contribution by influencing the actuarial assumptions that underlie that contribution. Required contributions are those necessary to cover the accrued additional pension costs of employees in the year in question plus whatever “catch-up” contributions have been agreed to. Convenient increases in the assumed rate of returns are a backdoor means of real underfunding. In the next section, we describe plan provisions and actuarial assumptions for a panel of 85 public plans. We estimate the influence of plan characteristics, actuarial assumptions, and annual state tax revenue on the funding status of these plans.
EMPIRICAL ESTIMATES OF THE DETERMINANTS OF PLAN FUNDING RATIOS

In this section we use plan level data to examine the relative importance of plan demographics, plan generosity, plan investment strategy, and state tax revenues in determining plan funding ratios. Policymakers can do little about the demographics of plan participants, but they can alter future plan generosity if more generous plans are chronically underfunded. Plan investment strategy may influence funding ratios as well. We examine plan funding and whether there is evidence that plans change actuarial assumptions over time. These results provide some indirect evidence about the prevalence of moral hazard problems that reduce funding.

While there may be no optimal funding ratio target, funding ratios are important since the implications of low funding are possibly higher borrowing costs for the state. In addition, underfunding pushes the payment for current services forward to future residents. In the past, it was not possible to compare funding ratios across time since different actuarial methods and assumptions were used but not reported. Over the last decade, the Government Accounting Standards Board has tightened reporting requirements for the actuarial reports for public plans. Plans are still allowed more leeway in accounting assumptions than private plans, but reports must include the actuarial methods and assumptions.

We use a sample of 85 public pension plans whose actuarial reports are surveyed every two years by the Wisconsin Retirement Research Committee. We use data from the 2000, 2002, and 2004 surveys. These plans cover general employees and teachers, rather than narrower categories of employees such as police, firefighters and elected officials. At least one plan is included from each state, but there are three plans from Illinois, Michigan, Minnesota, Missouri, Texas, and Wisconsin.

In 2004, the 85 plans covered 11.8 million active employees and 2.3 million retirees and beneficiaries. The number of active participants grew by two percent between the 2002 and 2004 surveys, and the number of retirees grew by eight percent. Eleven plans cover state employees only, 27 plans cover teachers only, and eight plans cover only local employees. Sixteen plans cover state and local employees, three cover state employees and teachers, and 20 cover state and local employees and teachers. In 68 of the 85 plans, the participants are also covered by Social Security. Of the 17 plans with no Social Security coverage, ten are teacher–only plans.

We provide summary statistics for 2004 in Table 1. The plans average about 133 thousand active members and 59 thousand beneficiaries in 2004. The ratio of active members to beneficiaries is 2.22 (down from 2.61 in 2002), and 30 of the systems had a ratio less than two. On average, the plans in this sample comprise over half the public employees in their respective states.

Actuarial reports also include plan characteristics and provisions that reflect plan generosity. About half of the plans offer an early–out provision that is based on years of service only—the average number of years of service for this provision is about 28. Eighteen plans require ten years of service to vest, while 61 plans allow full vesting in five years or less—the average across all plans is 5.87 in 2004. Eight of the plans reduced their vesting period to five years or less since 2002, perhaps reflecting changing requirements for private sector plans.

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7 Bi–annual survey data since 1982 can be found at http://sss.legis.state.wi.us/lc.
8 Nationally, state and local public employment is about 13 million.
As mentioned above, retirement benefits in defined benefit plans depend on a formula that includes years of service, a formula multiplier, and final average salary. The formula multiplier is the percentage of final average salary that an employee earns as a retirement annuity for each year of service.\(^9\) Formula multipliers are higher on average for the 17 plans whose employees are not covered by Social Security—the multiplier averaged 2.32 in 2004 for those employees, 1.87 for plans whose employees are also covered by Social Security, and 1.96 overall.\(^10\) The shorter is the number of years used to calculate final average salary, the more generous is the plan—57 of the 85 plans use a three–year period to calculate final average salary; 15 use a five–year period. Sixty plans (about 71 percent) have some form of automatic inflation adjustment (most of these are capped). The remaining plans are either money purchase plans or may provide adjustments on an ad hoc basis.

Public plans use a variety of actuarial assumptions to calculate their liabilities. They primarily use one of three types of actuarial methods to determine the present value of future benefits and allocate that value and its cost to specific time periods.\(^11\) Sixty–six of the plans in this sample use the entry–age method and 13 use the unit–credit method.\(^12\) The interest rate, or “earnings,” assumption is used to calculate the level of required employer contributions.\(^13\) The average rate in 2004 was about 8.00 percent (see Table 1)—only one plan used a rate between five and seven percent, and

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\(^9\) Two of the 85 plans are money purchase plans where the retirement benefit is determined by the amount of money in the employee’s account. We exclude these plans from our empirical analysis. Some of the defined benefit plans also include money purchase elements.

\(^10\) Formula multipliers for plans that are coordinated with Social Security sometimes vary by years of service, date of employment, or retirement age. Since 2002, six of the plans coordinated with Social Security increased their multiplier and two reduced it (see Ford (2005) for details).

\(^11\) All three methods are intended to fully fund obligations as they become due, but they may allocate costs in different ways over the period of employment. See Steffen (2001) for a detailed discussion.

\(^12\) Five plans use the aggregate cost method, but this method is designed to keep the funding ratio fairly constant. We exclude these plans from our regression analysis.

\(^13\) This can be thought of roughly as the discount rate in a present value calculation.
four plans went as high as 8.75 percent. The wage inflation assumption—general salary increases assumed apart from merit or seniority increases—averaged 3.9 percent. The difference between the wage inflation assumption and interest assumption is the assumed real rate of return on invested assets (often called the “economic spread”). This averaged 4.12 percent (with a standard deviation of 0.75) in 2004.

We are interested in relating a plan’s funding status to state government finances, but since actuarial methods and assumptions vary across plans, asset and liability measures are not strictly comparable (Mitchell, McCarthy, Wisniewski, and Zorn, 2001). However, government accounting rules established by the Government Accounting Standards Board (GASB) since the mid 1990s have improved comparability to the point where the funding ratio—the ratio of actuarial assets to the unfunded actuarial liability—can be a meaningful measure of a plan’s funding status (Steffen, 2001). Further, we attempt to address plan-specific components in the regression analysis to follow.

Reported funding ratios have declined since 2000, reflecting a general decline in earnings over this period. The plan funding ratios averaged 96 percent in 2002, but had fallen to 84 percent in 2004. We have no plan data on investments, so we supplement these data with state level public plan data from the Census. State pension funds are invested about 17 percent in bonds and 37 percent in stocks, on average. State tax revenue per capita averaged about $2,000 in 2004.

It is interesting to ask whether plans change their actuarial assumptions over time. This may be justified by changing economic conditions, for example, or it may be done to change the annual required employer contribution. In Table 2, we present OLS regressions of the two key actuarial assumptions and the plan funding ratio on year dummies—the coefficients measure the change in the dependent variable in 2002, say, from the 2000 value. While there is no statistically significant change in the interest rate assumption over time, the estimates suggest that the economic spread assumption—the assumed real rate of return on invested assets—was increased by 36 basis points in 2002 relative to 2000, and by about 60 basis points in 2004 relative to 2000. These changes tend to reduce the required employer contribution. Table 2 also illustrates the drop in average funding ratios over time—funding ratios were almost 12 percentage points lower in 2004 than 2000. And they would have been even lower without the change in the rate-of-return assumption.

In Table 3 we investigate the relative importance of plan demographics, plan generosity, plan investment strategy, and state tax revenue in determining plan funding ratios. Most of these variables do not change much over time, so while we allow for plan fixed effects in later regressions, the coefficients in the first four columns of Table 3 are estimated

<table>
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with pooled OLS and we report standard errors robust to heteroskedasticity and serial correlation. In the first column, we consider only plan membership and demographics—we include dummy variables for the type of employee covered (plans for state employees only are the omitted category), plan size (log of active membership), plan demographics (the ratio of active members to beneficiaries)
and year dummies. The ratio of actives to beneficiaries is statistically significant and suggests that plans with a one unit higher ratio have a funding ratio that is 4.5 percentage points higher (this would be a large change in the ratio). The coefficient on the local employees dummy suggests that local plans have a funding ratio that is 5.5 percentage points higher, but it is not statistically significant at conventional levels. This may be the result of state mandates on local funding rules or possibly of moral hazard problems being less severe at the local level. Local employees may be more concerned about the default risk as compared to their state counterparts and, thus, less willing to accept underfunding.

In column two, we add plan characteristics that tend to make a plan more generous—automatic inflation adjustments (COLA), an early out dummy, the DB formula multiplier, the percentage of salary that the employee contributes, and a dummy variable for one of the two actuarial methods used in determining liabilities. The estimates suggest that more generous plans, as measured by the formula multiplier, have higher funding ratios, and that higher employee contributions are associated with lower funding ratios, but these coefficients, while important economically, do not remain statistically significant in more complete specifications.

In column three, we add two state–level variables—the log of per–capita tax revenue and log of population to the plan demographics and characteristics variables. The coefficient estimate indicates that a ten percent increase in tax revenue per capita, holding population constant, is associated with about a one percentage point higher funding ratio, but the estimate is not precisely measured. Finally, in column four, we add state–level public plan investment in stocks and bonds. In this most complete model without plan fixed effects, only the ratio of active members to beneficiaries is statistically significant. The estimates indicate that a plan with a higher ratio of actives to beneficiaries has about a 6.5 percentage point higher funding ratio—still not an economically large effect.

To summarize, plan features such as automatic COLAs, formula multipliers, early–out features or actuarial methods do not appear to affect plan funding ratios. The local employee dummy variable is marginally statistically significant (p–value of 0.069), indicating that a plan that covers only local employees has a funding ratio that is 8.7 percentage points higher than a state–employee only plan. As we discussed earlier, there is less of a moral hazard problem in funding local plans than funding state plans, since there is some positive probability of default at the local level (or at least shirking the burden by moving).

Panel data allows us to control for characteristics of the plan that do not change over time—plan or state characteristics or past events that affect the historic level of public pension funding (plan fixed effects are strictly more general than state fixed effects). Once plan fixed effects are included (column five), state tax revenue is the only precisely measured determinant of plan funding ratios. The estimate indicates that a ten percent increase in per–capita state tax revenues is associated with a five percentage point higher funding ratio. This is an economically important factor but it is hardly surprising—states with more resources have better funded public pension plans. The other determinants of plan funding either do not matter or cannot be distinguished from the plan fixed effects.

**CONCLUSION**

We find that pension asset changes have large annual impacts on state finances, especially on state balance sheets. However, over the longer term, these impacts
are manageable if states adhere to a disciplined approach to pension funding. For the most part, pension funding problems can be dealt with effectively by states with the appropriate fiscal discipline, i.e., techniques for conquering moral hazard problems.

We also conclude that the debate of moving from defined benefit plans to defined contribution plans in the public sector often focuses on extraneous issues. For example, the replacement of DB plans with DC plans will not address past underfunding problems, as is often asserted, nor will it save money in the future unless the overall level of generosity is reduced. Reduced generosity could be achieved under either a DC or DB arrangement. There are, however, two key issues. The use of DC plans can reduce moral hazard problems that may encourage underfunding, but DC plans may limit potential gains that could be achieved by moving risk from more–risk–averse employees to less–risk–averse governments. This is the trade–off that must be considered in moving from a DB to a DC arrangement.

Various means of insuring more funding discipline are also important. States can impose such discipline on local governments, but they are less able to control their own behavior. It is unlikely that the federal government will impose funding rules similar to those in the private sector. State constitutional rules for funding are a way of pre–committing contribution behavior, but they may be difficult to get approved. One technique might be to approve constitutional rules that would go into effect several years in the future. This would allow sitting legislators to continue their current behavior while constraining future legislatures.

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REFERENCES


