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THE FUNDING OF STATE AND LOCAL PENSIONS: 2009-2013

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Introduction

The financial crisis reduced the value of equities in state and local defined benefit pensions and hurt the funding status of these plans. The impact will become evident only over time, however, because actuaries in the public sector tend to smooth both gains and losses, typically over a five–year period. The first year for which the crisis will have a meaningful impact on reported funding status is fiscal 2009, since in most cases the fiscal 2008 books were closed before the market collapsed. After 2009, the funding picture will continue to deteriorate to the extent that years of low equity values replace earlier years of high values. The current and future funding status of state and local pensions is crucially important, as state and local governments are facing a perfect storm: the decline in funding has occurred just as the recession has cut into state and local tax revenues and increased the demand for government services. Finding additional funds to make up for market losses will be extremely difficult.

This *brief* reports state and local pension funding levels for fiscal 2009, a year for which stock market performance is known and for which actuarial valuations are available for roughly half of the 126 plans in our sample. It also reports projections for 2010-2013 under alternative assumptions about the performance of the stock market. The discussion is organized as follows. The first section briefly describes the evolution of funding in the public sector, concluding that since the early 1980s, public plans made significant progress in terms of funding. The financial crisis, however, has thrown public plans seriously off course. As discussed in the second section, the aggregate funding ratio declined from 84 percent in 2008 to 78 percent in 2009. The third section describes three alternative scenarios for the stock market for the pe-

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riod 2010-2013 and reports that, under the most likely scenario, funding levels will decline to 72 percent by 2013. The final section notes the limited policy options available to states and localities.

The Evolution of Funding in the Public Sector

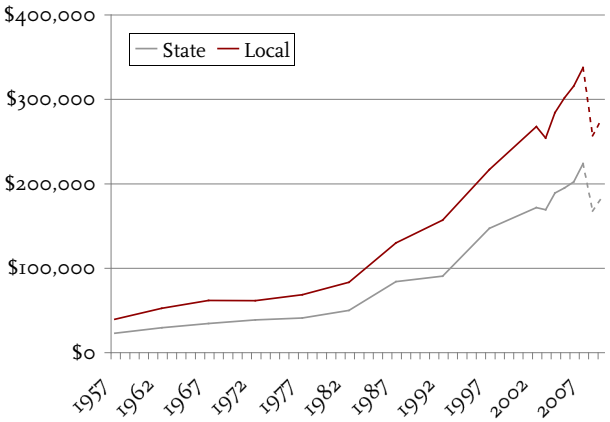
It is generally agreed that each generation of taxpayers should pay the full cost of the public services it receives. If a worker's compensation includes a defined benefit pension, the cost of the benefit earned in that year should be recognized, and funded, at the time the worker performs that service, not when the pension is paid in retirement. The discipline of making state and local governments pay the annual costs also discourages governments from awarding excessively generous pensions in lieu of current wages.[1] Most states and localities also have some unfunded pension obligations from the past, either because they did not put away money at the time the benefits were earned or because they provided benefits retroactively to some participants. The cost of these unfunded liabilities also needs to be distributed in some equitable fashion.

Despite the strong case for funding, public plans were not in very good shape in the late 1970s. State and local government employment had roughly doubled between the early 1960s and the mid-1970s, resulting in an enormous growth in benefit commitments to state and local workers. Nevertheless, primarily for constitutional reasons, public plans were not covered by the Employee Retirement Income Security Act of 1974, which established funding (and other) standards for the private sector. This legislation, however, did mandate a study of these plans, and the conclusions were not flattering.

> "In the vast majority of public employee pension systems, plan participants, plan sponsors, and the general public are kept in the dark with regard to a realistic assessment of true pension costs. The high degree of pension cost blindness is due to the lack of actuarial valuations, the use of unrealistic actuarial assumptions, and the general absence of actuarial standards."[2]

Perhaps at least partly in response to the report, states and localities became increasingly aware of the importance of sound funding and began to undertake a variety of approaches to achieve that goal. These funding efforts and a strong stock market produced a marked increase in assets per worker (see Figure 1).

Figure 1. Assets per Active Worker by Level of Administration, Fiscal Years 1957-2009 (2009 Dollars)



Notes: Assets are at market value beginning in 2002 and book value prior to 2002. Data for the period 1957-2002 is reported in five-year intervals, whereas 2003-2009 is reported on a yearly basis.
Sources: Authors' calculations from the U.S. Census Bureau (1959-2004); the U.S. Board of Governors of the Federal Reserve System (2007-2009); and the Center for Retirement Research at Boston College, *Public Pension Data* (PPD) (2008-2009).

Accounting organizations also played a role. The Governmental Accounting Standards Board (GASB), which came into being in the early 1980s, provided guidance for disclosure of pension information with Statement No. 5 in 1986.[3] One important requirement was that all plans report their benefit obligations and pension fund assets using uniform methods to allow observers to make comparisons across plans. In most cases, this required two sets of books, as the GASB method was very different from the approach most plan actuaries had adopted for establishing funding contributions. What's more, the uniform methods were not applied retroactively, which made historical comparisons impossible. As a result, when users needed information about a plan's funded status and funding progress, they generally looked to numbers generated by the plan's own methodology.

GASB Statements No. 25 and 27[4], issued in 1994, contained a key innovation: they allowed sponsors that satisfied certain "parameters" to use the numbers that emerge from the actuary's funding exercise for reporting purposes.[5] Among others, these parameters defined an acceptable amortization period, which was originally up to 40 years and reduced to 30 years in 2006, and an Annual Required Contribution (ARC), which would cover the cost of benefits accruing in the current year and a payment to amortize the plan's unfunded actuarial liability.[6]

GASB provides the parameters, but plans are not required to follow them. GASB, like its private sector counterpart, the Financial Accounting Standards Board, is an independent organization and has no authority to enforce its recommendations. Many state laws, however, require that public plans comply with GASB standards, and auditors generally require state and local governments to comply with the standards to receive a "clean" audit opinion. And bond raters generally consider whether GASB standards are followed when assessing credit standing.[7] Thus, financial reporting requirements probably have had considerable impact.

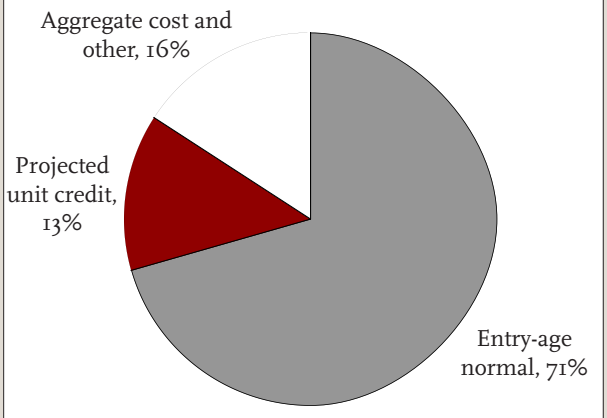
The Status of State and Local Plans in 2009

This section reports the ratio of assets to liabilities for our sample of 109 state-administered plans and 17 locally administered plans from 1994 through 2009.[8] The text refers to aggregate numbers, while Appendix A reports the data for individual plans. The reported ratios are not strictly comparable across plans due to variations in actuarial cost methods (see box). But in most cases, the only funding information available for public sector plans is that based on each plan's ac-

Actuarial Cost Methods

In contrast to the private sector, the public sector relies primarily on the entry-age normal approach for funding and reporting purposes (see Figure 2). But 13 percent use the projected unit credit and 16 percent the aggregate cost or other method. The aggregate cost method allocates unfunded liabilities as future normal costs, so a plan using this method shows no current unfunded liabilities and a 100-percent funding ratio. GASB now requires plans using aggregate cost also to report their funding ratios using entry-age normal, which turns out to have almost no effect on total funding.

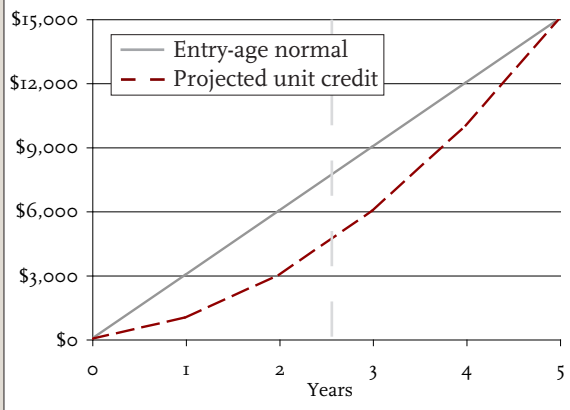
Figure 2. Percent of Public Sector Plans Using Alternative Actuarial Methods, 2009



Source: Authors' calculations based on CRR PPD (2009).

Both the entry-age normal and projected unit credit generate conventional funding ratios. An example may help clarify a key difference between the two methods. Suppose a plan sponsor needs to contribute $15,000 for a particular employee who will retire in five years, and that the sponsor fully funds the cost specified by either method. Under projected unit credit, the sponsor recognizes and funds, say, $1,000 in the first year, $2,000 in the second year, $3,000 in the third year, $4,000 in the fourth year, and $5,000 in the fifth year. Under entry-age normal, the actuary would level the contributions over the five-year period so that the sponsor would recognize and pay a normal cost of $3,000 per year. Had the sponsor used projected unit credit, the plan would have a cumulative liability of $6,000 and assets of $6,000 (see Figure 3).

Figure 3. Accrued Liability by Method, by Year



Source: Authors' illustration.

Had the sponsor used entry-age normal, after three years the plan would have an actuarial accumulated liability of $9,000 and assets of $9,000.

In other words, up to the point of retirement, the entry-age method recognizes a larger accumulated pension obligation for active employees and requires a larger contribution than the projected unit credit. Thus, given comparable funding ratios, plans using the entry-age normal method have recognized more liabilities and accumulated more assets than those using the projected unit credit.

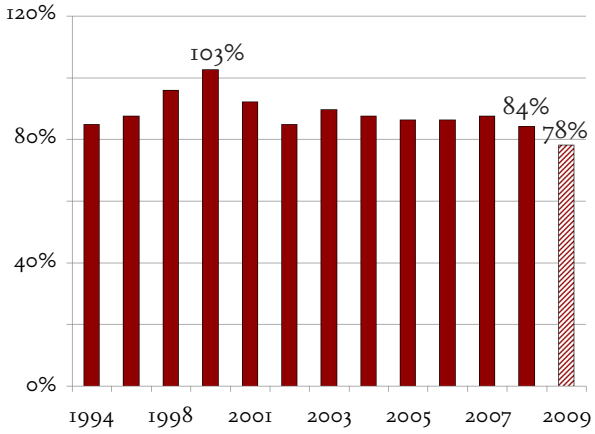
tuarial costing method and assumptions. Moreover, since plans do not generally change their actuarial cost method, the trend derived from these numbers provides a meaningful picture of the changes in plan funding.

Before looking at the funding status, it is useful to consider what might be an acceptable level of funding for state and local plans. On the one hand, states and localities are far less likely to go bankrupt, or otherwise repudiate their indebtedness, than sponsors of private sector plans, so probably funding of less than 100 percent is required to protect pension promises. In addition, while all entities should cover normal cost, GASB allows these plans up to 30 years to pay off unfunded liabilities. As states and localities are only about halfway through the amortization process begun in the mid-1990s, they would not be expected to be fully funded. The finance literature also suggests that full funding may not always be optimal.[9] On the other hand, GASB has established standards that will ultimately result in 100 percent funding, and rating agencies consider the funding status of pensions when rating public sector bonds. Consistent with all these arguments, the U.S. Government Accountability Office (2008) reports that many of the experts and government officials to whom they spoke considered 80 percent funding to be acceptable for public plans.[10]

Figure 4 shows the aggregate funding for our sample of state and local plans from 1994 through 2009. The funding ratios are based on actuarial assets and liabilities reported under GASB methods of accounting. From the mid-1990s to 2000, funding improved markedly in response to GASB guidelines and a rising stock market. In 2000, assets amounted to 103 percent of liabilities. With the bursting of the high-tech bubble at the turn of the century, funding levels dropped as years of low asset values replaced the higher values from the 1990s. Funding then stabilized with the run-up of stock prices, which peaked in 2007. But the collapse of asset values in 2008 has once again led to declining funding ratios.

Of the 126 plans in our sample, 68 had reported their 2009 funding levels by the end of March 2010. For those plans without valuations, we projected assets on a plan-by-plan basis using the detailed process described in the valuations.[11] Applying our methodology retrospectively produced numbers for previous years that perfectly match published asset values in half the cases and that came within 1 percent in the other half.[12] We projected liabilities based on the average rate of growth over the last four years. We then

Figure 4. State and Local Funding Ratios, 1994-2009

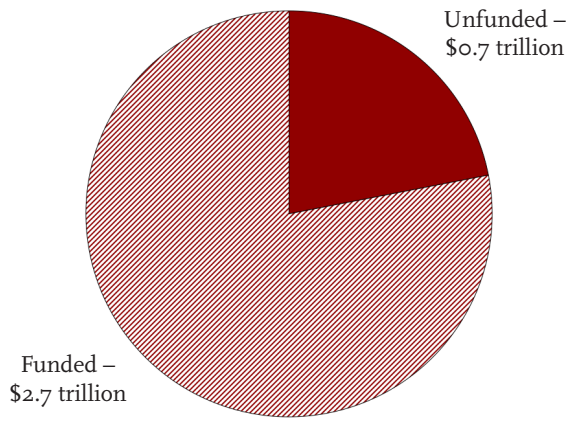


Sources: CRR PPD and author's estimates (2001-2009); and Zorn (1994-2000).

sent our proposed projections to the plan administrators and made any suggested alterations.[13] This process resulted in a complete set of plan funding ratios for fiscal year 2009. The aggregate funding ratio was 78 percent.

The 2009 unfunded liability for the sample of 126 plans is over $700 billion (see Figure 5). To pay off that amount over 30 years would require contributions to increase by about 2 percent of payrolls. To amortize the amount over 15 years (so that states and localities could reach full funding around their original target dates), states and localities would have

Figure 5. Funding of Aggregate Pension Liability, 2009

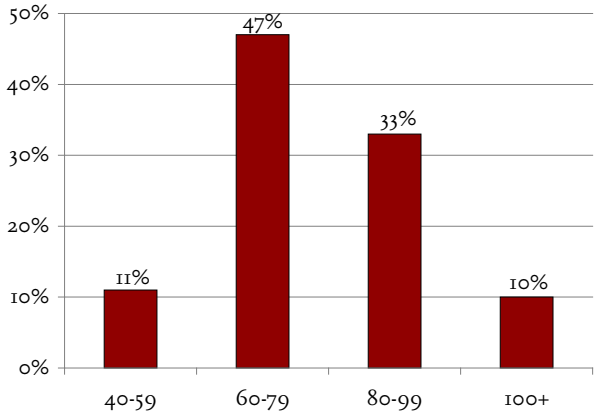


Source: Authors' estimates based on CRR PPD (2009).

to raise their contribution rate by substantially more. These increases should be compared to the recent average ARC paid of about 11 percent of payrolls.

In 2009, as in earlier years, funding levels vary substantially. Figure 6 shows the distribution of funding for our sample of plans. Fifty-eight percent of plans had funding below the acceptable 80-percent level. Although many of the poorly funded plans are relatively small, several large plans, such as those in Illinois (SERS, Teachers, and Universities) and Connecticut (SERS), had funding levels below 60 percent.

Figure 6. Distribution of Funding Ratios for Public Plans, 2009

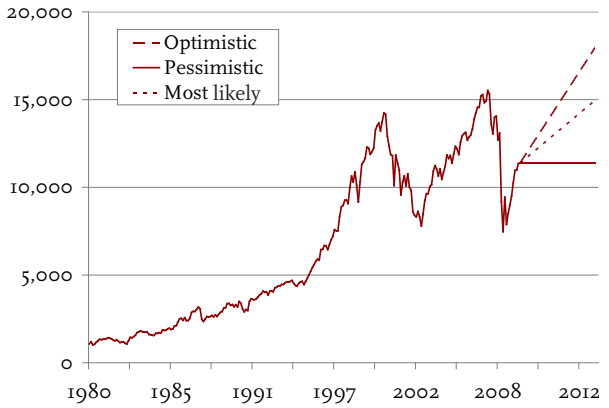


Note: Figure does not add to 100 percent due to rounding.
Source: Authors' calculations based on CRR PPD (2009).

Projections for 2010-2013

While funding ratios for 2009 were the lowest they have been in 15 years, reported numbers are likely to decline further over 2010-2013 as gains in the years leading up to 2007 are phased out and losses from the market collapse phased in. The precise pattern of future funding will depend, of course, on what happens to the stock market. To address such uncertainty, projections were made using three sets of assumptions for the Dow Jones Wilshire 5000 Index between now and 2013 (see Figure 7). The pessimistic projection assumes negligible economic growth, rising unemployment, profits growing at only 3 percent annually, falling price-earnings ratios, and the stock market remaining at its current level of roughly 12,000. The most likely projection assumes an economic expansion sufficient to reduce unemployment slightly, profits growing at 7 percent annually, and stock prices rising about 6 percent annually to produce a Wilshire 5000 of 15,000 by 2013. The optimistic projection

Figure 7. Dow Jones Wilshire 5000 Index, 1980-2010, and Projections for 2013 under Alternative Assumptions



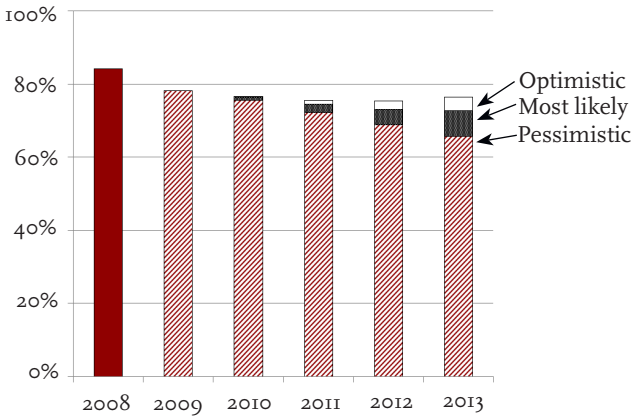
Sources: Wilshire Associates (2010) and authors' projections.

assumes a stronger economic expansion that reduces unemployment significantly and allows profits and stock prices to grow nearly 11 percent annually, so the Wilshire 5000 reaches 18,000 by 2013. The optimistic projection is designed to exceed the central projection to the same extent the central exceeds the pessimistic.

In order to estimate the actuarial level of assets for 2010-2013, we replicate the smoothing method of each plan in our data set as detailed in the plan's actuarial valuation, based on each of the assumptions regarding the Wilshire 5000.[14] Because, historically, contribution payments hold relatively steady for each plan, we estimate future contributions based on an average of the prior three years plus a 5-percent per-year increase (the average increase between 1990-2007). Benefit payments, which also show little variation over time, are estimated in the same manner as contributions.

The results are shown in Figure 8 on the next page. Certainly, the more distant the year, the more uncertain is the projection. In all likelihood, assuming any changes to benefits or contributions would have no material effect, 2010 actuarial reports will show assets equal to about 77 percent of promised benefits. What happens thereafter depends increasingly on the future performance of the stock market. Under the most likely scenario, the funding ratio will continue to decline as the strong stock market experienced in 2005, 2006, 2007, and much of 2008 is slowly phased out of the calculation. By 2013, the ratio of assets to liabilities is projected to equal 72

Figure 8. Projected State and Local Funding Ratios Under Three Scenarios, 2008-2013

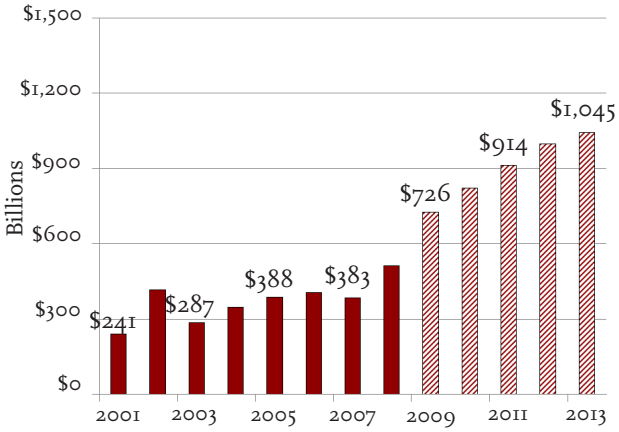


Source: CRR PPD (2008) and authors' estimates (2009-2013).

percent. The comparable 2013 ratio for the optimistic scenario is 76 percent and for the pessimistic scenario 66 percent.

The unfunded liabilities implied by these funding ratios are shown in Figure 9. In today's dollars, they will rise from $726 billion to about $1 trillion over the next four years.

Figure 9. Unfunded Actuarial Accrued Liability, 2001-2013, Billions of 2009 Dollars



Source: CRR PPD (2001-2008) and authors' estimates (2009-2013).

As discussed above, these projections assume that contributions will remain relatively steady. One might be tempted to question that assumption, given the substantial increase in the ARC for virtually all plans that will occur in response to the large increase in the unfunded liability caused by the collapse in equity values. Several factors, however, will prevent rapid increases in contributions. First, some plan sponsors have initiated funding relief that will reduce the amount of the ARC. For example, Louisiana extended the amortization period to 2040, Vermont extended its funding period to 2039, and California expanded the corridor on the actuarial value of assets to permit more smoothing to moderate the required increase in the ARC. (See Appendix C for a summary of actions taken both to provide funding relief and to improve funding in the wake of the financial crisis.) Second, many plans have statutory contribution requirements and, thus, must first obtain legislative approval for any increase in their contributions.[15] And third, the percent of ARC paid in 2009 is noticeably lower than it had been in prior years (see Table 1). On balance, the risk is that contributions may grow more slowly than assumed in our projections due to the fiscal crisis facing states and localities. If so, funding levels will be lower than projected.

Table 1. Percent of ARC Paid, 2003-2009

Fiscal year	Percent of ARC paid	
	Plans with 2009 reports	All plans
2003	84.3%	87.8%
2004	85.5	86.0
2005	82.5	84.1
2006	80.1	83.3
2007	83.2	86.7
2008	86.4	92.1
2009	82.5	87.9 (est.)

Source: CRR PPD (2003-2009).

Conclusion

The conclusion that emerges from this update is that while states and localities were on a path toward full funding of their pension liabilities, they were seriously knocked off track by the financial crisis. The first glimpse of the dimension of the damage is becoming evident with the actuarial valuations for 2009. (Since three-quarters of plans have a fiscal year ending June 30, the 2008 valuations were closed before the crisis hit.) Between 2008 and 2009, the ratio of assets to liabilities for our sample of 126 plans dropped from 84 percent to 78 percent. But this decline is only the beginning of the bad news that will emerge as the losses are spread over the next several years. The ultimate outcome will depend on the performance of the stock market, but under our most likely scenario, funding ratios will decline to 72 percent by 2013.

The key question is what should be done. A major increase in contributions is not realistic at this time. States and localities may have only limited ability to increase employee contributions, because some state courts have ruled that the public employer is prohibited from modifying the plan for existing employees. Higher contributions from new employees will take a long time to have any substantial effect. Thus, if funding levels are to be restored quickly, the money must come primarily from tax revenues. But the recession has decimated tax revenues and increased the demand for state and local services. Thus, finding additional taxes to make up for market losses will be extremely difficult. One small step that would be viewed as a commitment to responsible funding would be for states and localities to at least pay their full ARC. Otherwise, the only option is to wait for the market and the economy to recover.

Endnotes

1 Johnson (1997) found that the relative generosity of state and local government pensions is directly related to the ability to underfund the plans.

2 U.S. Congress, House Committee on Education and Labor (1978).

3 Statement No. 5 is titled "Disclosure of Pension Information by Public Employee Retirement Systems and State and Local Governmental Employers."

4 Statement No. 25 is titled "Financial Reporting for Defined Benefit Pension Plans and Note Disclosures for Defined Contribution Plans." Statement No. 27 is titled "Accounting for Pensions by State and Local Governmental Employers." The provisions of GASB 25 and 27 became effective June 15, 1996.

5 This arrangement is very different from what occurs in the private sector, where the actuary is required to make a number of valuations for different purposes. In the private sector, the actuary must produce 1) a traditional actuarial valuation to determine funding, which presents the actuary's best estimate of the plan's liabilities, assets, the annual contribution required to cover benefits accrued that year (the normal cost), and the amortization of any unfunded obligations, all assuming the plan will continue indefinitely; 2) a valuation as stipulated by the accounting profession for reporting purposes that again determines assets, liabilities, and the sponsor's annual pension expense, to be reported on the financial statements of the sponsor and the plan; and 3) a determination of the plan's "current" funding status for compliance purposes to determine minimum and maximum contributions and Pension Benefit Guaranty Corporation insurance premiums. While actuaries attempt to keep assumptions as consistent as possible across these valuations, the discount rates used to value future obligations, a critical variable, can differ considerably (Hustead, 2003).

6 This amortization period applied to both the plan's initial underfunding and any subsequent underfunding created by benefit increases attributed to past service or experience losses.

7 U. S. Government Accountability Office (2008).

8 The sample covers the same plans as the *Public Fund Survey* (PFS), as described in Brainard (2007), plus the University of California Retirement System. It represents about 90 percent of the assets in state-administered plans and 30 percent of those in plans administered at the local level. It differs from the PFS in three ways. First, it provides all information at the plan level rather than at the system level. Second, it includes a variety of actuarial data not available in the plan's Comprehensive Annual Financial Report (CAFR). Third, it presents the data on a consistent fiscal-year basis.

9 Full funding of public sector pensions may result in variations in state tax rates over time, and, if taxpayer utility is maximized at a constant tax rate, this approach may not be optimal. D'Arcy, Dulebohn, and Oh (1999) calculate optimal funding levels for selected states that, depending on the relative growth rates of pension obligations and the tax base, may be greater or less than 100 percent. Mumy (1978) also explored optimal funding in state and local pensions.

10 Some of these experts also suggested that it might be unwise politically for a plan to be overfunded – that is, have a ratio of assets to liabilities in excess of 120 percent – because the excess funding could become appropriated by politicians for other purposes or be used as an excuse to increase benefits.

11 For those plans without published 2009 actuarial valuations, we took the percent change in actuarial assets between 2008 and 2009, calculated according to the plan's own methodology, and applied that change to its published 2008 GASB level of actuarial assets.

12 We are less proud of our calculations for the following five plans: Louisiana SERS and TRS, Tennessee State and Teachers, Tennessee Political Subdivisions, and Minneapolis ERF. In these cases, our estimates fall within a 10-percent confidence interval. However, these are relatively small plans and have a negligible effect on aggregate funding levels.

13 A few plans declined to comment for various reasons. Connecticut SERS' valuation schedule does not include a 2009 report, and California PERF, Colorado PERA, Denver Employees Retirement Plan, and Wisconsin Retirement System do not yet have 2009 numbers. Connecticut Teachers, which also did not have 2009 numbers, emphasized that it did not want our numbers interpreted as official in any way.

14 Projections assume that plans retain their most recently reported investment return assumption and method for calculating actuarial assets.

15 See Munnell et al. (2008).

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APPENDICES

Appendix A

Table A1. Ratio of Assets to Liabilities for State and Local Plans 2001-2008, and Projections for 2009

Plan	Cost Method[a]	2001	2002	2003	2004	2005	2006	2007	2008	2009
Total		91.4	84.9	89.7	87.8	86.6	86.4	87.6	84.3	78.5
Alabama ERS	EAN	100.2	95.4	91.1	89.7	84.0	81.1	79.0	75.7	70.6*
Alabama Teachers	EAN	101.4	97.4	93.6	89.6	83.6	82.8	79.5	77.6	73.1*
Alaska PERS	EAN	100.9	75.2	72.8	70.2	65.7	78.2	77.8	78.8	64.6*
Alaska Teachers	EAN	95.0	68.2	64.3	62.8	60.9	67.8	68.2	70.2	57.9*
Arizona Public Safety	PUC	126.9	113.0	100.9	92.4	81.3	76.7	65.2	68.8	70.0
Arizona SRS	PUC	115.1	106.4	98.4	92.5	86.1	84.3	83.3	82.1	79.0
Arkansas PERS	EAN	105.6	100.1	94.5	88.7	86.1	83.4	89.1	89.7	78.0
Arkansas Teachers	EAN	95.4	91.9	85.9	83.8	80.4	80.3	85.3	84.9	75.7
California PERF	EAN	111.9	95.2	87.7	87.3	87.3	87.2	87.2	86.9	74.3*
California Teachers	EAN	98.0	N/A	84.8	84.7	85.7	87.0	88.8	87.3	77.7*
Chicago Teachers	PUC	100.0	96.3	92.0	85.8	79.0	78.0	80.1	79.4	73.6
City of Austin ERS	EAN	96.4	86.9	86.9	80.8	78.0	75.9	78.3	65.9	69.2*
Colorado Municipal	EAN	104.3	93.6	80.2	77.2	78.0	79.5	81.2	76.4	71.9*
Colorado School	EAN	98.2	87.9	75.2	70.1	73.9	74.1	75.5	70.1	65.1*
Colorado State	EAN	98.2	87.9	75.2	70.1	71.5	73.0	73.3	67.9	63.0*
Connecticut SERS	PUC	63.1	61.6	56.7	54.5	53.3	53.2	53.6	51.9	43.4*
Connecticut Teachers	EAN	N/A	75.9	N/A	65.3	N/A	59.5	N/A	70.0	61.0*
Contra Costa County	EAN	87.6	89.6	85.4	82.0	84.8	84.3	89.9	88.4	84.2*
DC Police & Fire	AGG	100.0	100.0	100.0	100.0	100.0	100.0	111.5	100.0	100.0*
DC Teachers	AGG	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0*
Delaware State Employees	EAN	112.4	109.6	106.9	103.0	101.6	101.7	103.7	103.1	98.8
Denver Employees	PUC	99.5	101.7	98.0	99.1	97.3	98.6	98.2	91.8	88.7*
Denver Schools	EAN	96.5	90.9	90.6	88.2	87.9	88.3	87.7	84.3	82.6*
Duluth Teachers	EAN	107.6	100.4	95.7	91.8	86.3	84.1	86.8	82.1	76.5
Fairfax County Schools	EAN	103.0	95.6	90.1	84.9	84.9	86.4	88.0	76.9	73.9*
Florida RS	EAN	117.9	115.0	114.2	112.1	107.3	105.6	105.6	105.3	87.1
Georgia ERS	EAN	101.7	101.1	100.5	97.6	97.2	94.5	93.0	89.4	85.7**
Georgia Teachers	EAN	103.9	102.0	101.1	100.9	98.0	96.5	94.7	91.9	86.7*
Hawaii ERS	EAN	90.6	84.0	75.9	71.7	68.6	65.0	67.5	68.8	62.9*
Houston Firefighters	EAN	112.9	97.6	N/A	88.2	86.1	87.0	91.1	95.6	95.4
Idaho PERS	EAN	96.2	84.1	83.1	91.0	93.5	94.6	104.9	92.8	73.7
Illinois Municipal	EAN	106.4	101.5	97.6	94.3	94.6	95.3	96.1	84.3	83.2**
Illinois SERS	PUC	65.8	53.7	42.6	54.2	54.4	52.2	54.2	46.1	43.5
Illinois Teachers	PUC	59.5	52.0	49.3	61.9	60.8	62.0	63.8	56.0	52.1
Illinois Universities	PUC	72.1	58.9	53.9	66.0	65.6	65.4	68.4	58.5	54.3

Plan	Cost Method[a]	2001	2002	2003	2004	2005	2006	2007	2008	2009
Indiana PERF	EAN	105.0	99.2	102.9	100.1	96.4	97.6	98.2	97.5	93.1 **
Indiana Teachers	EAN	43.0	42.1	44.4	44.8	43.4	44.3	45.1	48.2	42.8 *
Iowa PERS	EAN	97.2	92.6	89.6	88.6	88.7	88.4	90.2	89.1	81.2
Kansas PERS	EAN	84.8	77.6	75.2	69.8	68.8	69.4	70.8	58.8	64.0 **
Kentucky County	EAN	141.0	125.3	114.1	101.0	90.7	81.4	80.1	77.1	70.6
Kentucky ERS	EAN	125.8	110.7	98.0	85.8	74.6	61.3	58.4	54.2	46.7
Kentucky Teachers	PUC	90.8	86.6	83.5	80.9	76.3	73.1	71.9	68.2	63.6
LA County ERS	EAN	100.0	99.4	87.2	82.8	85.8	90.5	93.8	94.5	88.9
Louisiana SERS	PUC	74.2	70.2	66.2	59.6	61.5	64.3	67.2	67.6	60.8
Louisiana Teachers	PUC	78.4	73.9	68.8	63.1	64.6	67.5	71.3	70.2	59.1
Maine Local	EAN	108.2	122.8	116.3	112.1	114.2	112.2	113.6	108.1	98.7 *
Maine State and Teacher	EAN	73.1	69.6	67.6	68.5	69.8	71.3	74.1	74.1	67.7
Maryland PERS	EAN	102.2	98.0	93.1	91.2	86.7	80.4	79.5	77.2	63.9
Maryland Teachers	EAN	95.3	92.0	92.8	92.8	89.3	84.2	81.1	79.6	66.1
Massachusetts SERS	EAN	94.0	79.5	83.9	82.8	81.5	85.1	89.4	71.6	76.5
Massachusetts Teachers	EAN	76.2	64.5	69.6	67.6	67.2	71.0	73.9	58.2	62.5 **
Michigan Municipal	EAN	84.3	79.8	78.7	76.7	76.0	76.4	77.3	75.0	73.9 *
Michigan Public Schools	EAN	96.5	91.5	86.5	83.7	79.3	87.5	88.7	83.6	78.9 **
Michigan SERS	EAN	107.6	98.7	88.8	84.5	79.8	85.1	86.2	82.8	78.0 **
Minneapolis ERF	EAN	93.3	92.3	92.3	92.1	91.7	92.1	85.9	77.0	56.7
Minnesota PERF	EAN	87.0	85.0	81.3	76.7	74.5	74.7	73.3	73.6	70.0
Minnesota State Employees	EAN	112.1	104.5	99.1	100.1	95.6	96.2	92.5	90.2	85.9
Minnesota Teachers	EAN	105.8	105.3	103.1	100.0	98.5	92.1	87.5	82.0	77.4
Mississippi PERS	EAN	87.5	83.4	79.0	74.9	72.4	73.5	73.7	72.9	67.3
Missouri DOT and Highway Patrol	EAN	66.1	61.5	56.4	53.4	53.9	55.5	58.2	59.1	47.3
Missouri Local	EAN	104.0	100.4	96.4	95.9	95.1	95.3	96.1	97.5	80.0
Missouri PEERS	EAN	103.1	97.6	81.9	82.7	83.3	80.5	83.2	82.5	80.7
Missouri State Employees	EAN	97.0	95.9	90.9	84.6	84.9	85.3	86.8	85.9	83.0
Missouri Teachers	EAN	99.4	95.3	81.1	82.0	82.7	82.6	83.5	83.4	79.9
Montana PERS	EAN	N/A	100.0	N/A	86.7	85.5	88.3	91.0	90.2	83.5
Montana Teachers	EAN	N/A	77.3	N/A	77.4	74.4	76.9	80.4	80.7	67.4
Nebraska Schools	EAN	87.2	94.9	90.6	87.2	85.6	87.2	90.5	90.6	86.3 *
Nevada Police Officer and Firefighter	EAN	78.9	78.1	73.9	71.7	69.8	68.9	71.1	70.8	68.9
Nevada Regular Employees	EAN	85.5	83.5	83.2	80.5	77.3	76.5	78.8	77.7	73.4
New Hampshire Retirement System	EAN	85.0	82.1	75.0	71.1	60.3	61.4	67.0	67.8	58.3
New Jersey PERS	PUC	117.1	107.3	97.9	91.3	85.3	78.0	76.0	73.1	64.9
New Jersey Police & Fire	PUC	100.8	95.8	88.4	84.0	80.1	78.4	77.6	74.3	70.8

Plan	Cost Method[a]	2001	2002	2003	2004	2005	2006	2007	2008	2009
New Jersey Teachers	PUC	108.0	100.0	92.7	85.6	79.1	76.3	74.7	70.8	63.8
New Mexico PERF	EAN	105.4	103.1	97.3	93.0	91.6	92.1	92.8	93.3	84.2
New Mexico Teachers	EAN	91.9	86.8	81.1	75.4	70.4	68.3	70.5	71.5	67.5
New York City ERS	FIL	99.8	99.9	99.6	99.6	99.7	99.8	99.9	100.0	100.0*
New York City Teachers	FIL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0*
New York State Teachers	AGG	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0*
North Carolina Local Government	FIL	99.3	99.4	99.3	99.3	99.4	99.5	99.5	99.6	99.6**
North Carolina Teachers and State Employees	EAN	111.6	108.4	108.1	108.1	106.5	106.1	104.7	99.3	95.1**
North Dakota PERS	EAN	110.6	104.2	98.1	94.0	90.8	88.8	93.3	92.6	85.1
North Dakota Teachers	EAN	96.4	91.6	85.1	80.3	74.8	75.4	79.2	81.9	77.7
NY State & Local ERS	AGG	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
NY State & Local Police & Fire	AGG	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Ohio PERS	EAN	102.6	85.9	85.3	87.6	87.2	92.6	96.3	75.3	71.5*
Ohio Police & Fire	EAN	92.7	82.6	86.5	80.9	78.4	78.2	81.7	65.1	71.5*
Ohio School Employees	EAN	95.0	90.2	83.6	78.1	75.3	76.4	80.8	82.0	68.4
Ohio Teachers	EAN	91.2	77.4	74.2	74.8	72.8	75.0	82.2	79.1	60.0
Oklahoma PERS	EAN	82.6	79.8	76.8	76.1	72.0	71.4	72.6	73.0	66.8
Oklahoma Teachers	EAN	51.4	51.4	54.0	47.3	49.5	49.3	52.6	50.5	49.8
Oregon PERS	PUC	106.7	91.0	97.0	96.2	104.2	110.5	112.2	80.2	88.9*
Pennsylvania School Employees	EAN	114.4	104.8	97.2	91.2	83.6	81.2	85.8	86.0	79.2
Pennsylvania State ERS	EAN	116.3	107.2	104.9	96.1	92.9	92.7	97.1	89.0	83.5*
Phoenix ERS	EAN	102.5	91.6	88.5	84.2	84.2	81.3	83.9	79.1	75.3
Rhode Island ERS	EAN	77.6	72.6	64.3	59.4	55.8	53.4	56.2	60.9	58.0*
Rhode Island Municipal	EAN	118.1	111.3	100.7	93.2	87.2	87.1	90.3	92.8	87.2*
San Diego County	EAN	106.8	75.4	75.5	81.1	80.3	83.6	89.7	94.4	91.5
San Francisco City & County	EAN	129.0	117.9	109.0	103.8	107.6	108.6	110.2	103.8	97.0
South Carolina Police	EAN	94.6	93.0	91.5	87.7	87.4	84.7	84.7	77.9	75.3**
South Carolina RS	EAN	87.4	86.0	82.8	80.3	71.6	69.6	69.7	69.3	66.8**
South Dakota PERS	EAN	96.4	96.7	97.2	97.7	96.6	96.7	97.1	97.2	91.8
St. Louis School Employees	FIL	80.5	82.1	84.0	86.3	87.6	87.2	87.6	87.6	85.3*
St. Paul Teachers	EAN	81.9	78.8	75.6	71.8	69.6	69.1	73.0	75.1	72.2
Texas County & District	EAN	89.3	88.7	90.5	91.0	91.4	94.3	94.3	88.6	89.5*
Texas ERS	EAN	104.9	102.5	97.6	97.3	94.8	95.2	95.6	92.6	89.8
Texas LECOS	EAN	131.6	124.7	111.5	109.3	103.1	101.7	98.0	92.0	89.7
Texas Municipal	PUC	85.0	84.2	82.6	82.8	82.7	82.1	73.7	74.4	83.8*
Texas Teachers	PUC	102.5	96.3	94.5	91.8	87.1	87.3	89.2	90.5	83.1
TN Political Subdivisions	FIL	90.4	N/A	91.9	N/A	92.7	N/A	89.5	N/A	86.3
TN State and Teachers	FIL	99.6	N/A	99.8	N/A	99.8	N/A	96.2	N/A	90.6

Plan	Cost Method[a]	2001	2002	2003	2004	2005	2006	2007	2008	2009
University of California	EAN	147.7	138.4	125.7	117.9	110.3	104.1	104.8	103.0	94.8
Utah Noncontributory	EAN	102.8	92.2	94.4	92.3	93.2	95.8	95.1	84.2	85.6 **
Vermont State Employees	EAN	93.0	97.4	97.5	97.6	97.8	99.3	100.8	94.1	78.9
Vermont Teachers	EAN	89.0	89.5	89.6	90.2	90.7	84.6	84.9	80.9	65.4
Virginia Retirement System	EAN	107.3	101.8	96.4	90.3	81.3	80.8	82.3	84.0	77.6 *
Washington LEOFF Plan 1	FIL	129.3	119.6	112.4	100.0	113.1	116.4	122.1	128.0	128.4 *
Washington LEOFF Plan 2	AGG	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0 *
Washington PERS 1	FIL	90.9	85.6	80.6	77.2	70.8	73.0	70.7	70.9	69.5 *
Washington PERS 2/3	AGG	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0 *
Washington School Employees Plan 2/3	AGG	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0 *
Washington Teachers Plan 1	FIL	94.4	91.5	88.0	83.9	77.6	79.9	76.7	76.8	75.9 *
Washington Teachers Plan 2/3	AGG	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0 *
West Virginia PERS	EAN	84.4	75.4	73.1	80.0	83.6	86.8	97.0	84.2	65.9
West Virginia Teachers	EAN	21.0	19.2	19.1	22.2	24.6	31.6	51.3	50.0	41.3
Wisconsin Retirement System	FIL	96.5	97.1	99.2	99.4	99.5	99.6	99.6	99.7	97.1 *
Wyoming Public Employees	EAN	103.2	92.2	91.7	85.0	95.1	94.4	94.0	78.6	89.0 *

[a] EAN: Entry-Age Normal; PUC: Projected Unit Credit; FIL: Frozen Initial Liability; AGG: Aggregate Cost.
* Numbers are estimates.
** Numbers have been verified by plan administrator.
Source: CRR PPD and authors' estimates (2001-2009).

Appendix B

While every plan calculates actuarial assets slightly differently, the following equation shows the basic model used by most plans. The first step is to estimate the investment outcome according to plans' return assumptions.

Assumed investment outcome = (beginning-of-year market assets + 0.5 (contributions – benefits and expenses)) * assumed rate of return*

Next, plans calculate the difference between this expected outcome and their actual investment experience:

Actual investment outcome = end-of-year market assets – beginning-of-year market assets – (contributions – benefits and expenses)

Gain/loss = actual outcome – expected outcome

This difference is then spread over a smoothing period, generally five years, beginning with the current year. Each year, a declining proportion of the previous years' gains/losses is recognized.

$$\textit{Total deferred gain/loss} = (0.8 * \textit{gain/loss}_{t}) + (0.6 * \textit{gain/loss}_{(t-1)}) + (0.4 * \textit{gain/loss}_{(t-2)}) + (0.2 * \textit{gain/loss}_{(t-3)}) + (0 * \textit{gain/loss}_{(t-4)})$$

The actuarial value of assets is equal to the market level of assets minus the total deferred amount:

Actuarial assets = end-of-year market assets – total deferred gain/loss

To calculate funding levels, we apply the percent change in actuarial assets between 2008 and 2009 to each plan's reported GASB level of assets in 2008:

$$\textit{GASB actuarial assets}_{t} = (\textit{actuarial assets}_{t} / \textit{actuarial assets}_{(t-1)}) * \textit{GASB actuarial assets}_{(t-1)}$$

When projecting assets into the future under the optimistic scenario, we use the following equation to grow market assets from their 2010 level to their previous 2007 peak by 2013:

$$\textit{Market assets}_{t} = (\textit{market assets}_{2007} - \textit{market assets}_{2010}) / 3) + \textit{market assets}_{(t-1)}$$

Appendix C

Table C1. Actions Taken by States to Improve Funding in the Wake of the Financial Crisis

State	Action taken	Year
California	Changed amortization method to a fixed and declining 30-year period versus the current rolling 30-year amortization period.	2009
Hawaii	Prohibited benefit increases for any plan with an unfunded liability between 2008 and 2011.	2007
Iowa	Required Iowa PERS to adjust contribution rates based on the annual actuarial valuation, within limits. Instituted a gradual increase in the employer contribution to the Police Officers' Retirement Fund and the Judicial Retirement System.	2008
Kansas	Raised the required KPERS contribution rate for both state and school employers to the statutory rate in 2010 and subsequent fiscal years. State employers would have paid a lower rate based on the 2007 actuarial valuation if the law had not changed.	2009
Louisiana	Increased employer contributions to Teachers and ERS plans. Limited the transfer of investment gains to fund cost-of-living benefits, and increased the amount of excess investment gains applied to the unfunded accrued liability.	2009
Montana	Increased employer contribution rates for Montana PERS until 2011. Increased state contributions to Montana TRS with the goal of amortizing its unfunded liability by 2033.	2007
Nebraska	Increased employee, employer, and state contributions until 2014.	2009
New Hampshire	Prevented additional benefits if the funded ratio is less than 85 percent. Required that the employer contribution rate match the employees' rate.	2007
	Increased employee contributions for new hires.	2009
New Jersey	Increased employee contribution rates for several PERS plans.	2007
North Dakota	Increased the employer contribution rate for North Dakota TRS until the system is 90 percent funded.	2007
Oklahoma	Increased the employer contribution rate for Oklahoma TRS.	2007
	Allowed total ARC to exceed previous statutory cap of 10 percent.	2009
Texas	Increased employee contributions to Texas ERS.	2009
Washington	Phased in a new funding method to amortize the closed plans' unfunded liabilities over a rolling 10-year period.	2009
Wyoming	Increased the required employer contribution rate for the judicial retirement plan.	2008

Source: National Conference of State Legislators (2009).

Table C2. Actions Taken by States to Provide Funding Relief in the Wake of the Financial Crisis

State	Action taken	Year
Alaska	Approved $5 billion in pension obligation bonds to pay down unfunded actuarial liabilities.	2008
California	Expanded the corridor for the actuarial value of assets to allow for more smoothing of asset values and to moderate the required increase in ARC.	2009
Connecticut	Issued $2 billion of state General Obligation bonds to Connecticut TRS. Enacted a loan program to assist municipalities with their unfunded liabilities.	2007
Illinois	Issued $3.5 billion in bonds to cover part of the state's 2010 required contribution to statewide retirement systems.	2009
Louisiana	Extended the amortization period to 2040.	2009
Michigan	Temporarily reduced the required contribution for Michigan SERS to cover only the interest on the unfunded liability.	2007
New Hampshire	Extended the amortization period of the New Hampshire Retirement System from 20 to 30 years, or the maximum allowed by GASB, if less.	2007
New Jersey	Lowered employer contributions made by localities toward PERS and the Police and Fire plan.	2009
New Mexico	Temporarily lowered employer contributions and increased employee contributions for those earning more than $20,000.	2009
Vermont	Extended 30-year amortization period from 2018 to 2039 and repealed a statutory requirement that ARC increase by 5 percent annually.	2009
Washington	Lowered salary growth assumption, temporarily suspended the minimum contribution rates, and delayed the adoption of new mortality tables until the 2011-13 report.	2009
Wisconsin	Authorized large counties to issue appropriation bonds to pay down unfunded liability.	2008

Source: National Conference of State Legislators (2009).

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The Center for Retirement Research at Boston College was established in 1998 through a grant from the Social Security Administration. The Center's mission is to produce first-class research and forge a strong link between the academic community and decision-makers in the public and private sectors around an issue of critical importance to the nation's future. To achieve this mission, the Center sponsors a wide variety of research projects, transmits new findings to a broad audience, trains new scholars, and broadens access to valuable data sources. Since its inception, the Center has established a reputation as an authoritative source of information on all major aspects of the retirement income debate.

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