

State and Local Government Defined Benefit Pension Plans: Estimates of Liabilities and Employer Normal Costs by State, 2000-2011

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Abstract

In the 2013 comprehensive revision of the National Income and Product Accounts, BEA introduced a new accrual treatment of defined benefit pension plans based on actuarial estimates of liabilities and normal costs. Accrual accounting is the preferred method for compiling national accounts because it matches incomes earned from production with the corresponding output and records both in the same period. The recording of pension plan transactions on an accrual basis better aligns pension-related compensation with the timing of when employees earn the future retirement benefits. This paper describes the methodology for estimating defined benefit pension liabilities and normal costs for state and local governments and presents estimates by state for 2000-2011.

* The views expressed in this paper are solely those of the author and not necessarily those of the Bureau of Economic Analysis or the U.S. Department of Commerce. Please email David.Lenze@bea.gov with comments.

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The Estimates

The estimates of pension liabilities and employer normal costs presented in this paper are for the entire universe of state and local government defined benefit plans. Because of the importance of accrual accounting in the National Income and Product Accounts (NIPA), we adjusted the liability and normal cost data reported by the pension plans—typically calculated using an entry age actuarial method—to an accumulated benefit obligation (ABO) basis.¹ Instead of the usual 8.0% discount rate used by the pension plans in their present value calculations, the NIPA estimates are based on a 6.0% discount rate for 2000-03, 5.5% for 2004-09 and 5.0% for 2010-11. The estimates are available in an Excel workbook on the BEA web site.

In the aggregate, the growth rates of state and local government defined benefit pension liabilities and employer normal costs have tended to slow since 2001 (Chart 1). Liability growth slowed from 9.1% in 2001 to 4.1% in 2011. Employer normal cost growth slowed from 6.4% in 2001 to -3.2% in 2011.

The decline in employer normal costs in 2011 reflects a combination of adjustments plans have made to improve their finances, such as reducing cost of living adjustments to retirement benefits and requiring employees to contribute a larger share of normal costs.

Superimposed on the downward trend in the growth rates is a spike in 2004, when liabilities and normal costs jumped 15-16%, and in 2010, when they jumped 10-11%. The spikes resulted from ½ percentage point reductions in the discount rate.

¹ Pension liabilities and normal costs calculated using the entry age actuarial method are not accrual measures in an accounting sense; they take into account *future* pay raises that employees are likely to receive.

In 2010, pension liabilities ranged from 15.8% of state personal income in Indiana to 61.5% in Alaska (Table 1).² Assets held by pension funds to pay benefits, ranged from 42.4% of liabilities in Connecticut to 110.4% in Wisconsin, the only fully funded state when liabilities are measured using the ABO method and a 5.0% discount rate.³

Unfunded pension liabilities in 2010 ranged from 33.5% of state personal income in Alaska to -3.6 percent in Wisconsin.

Employer normal costs ranged from 9.5 percent of wages and salaries in Nebraska to 38.0 percent in Nevada. The denominator in this ratio is the payroll of all state and local government employees not just those who are covered by a defined benefit plan.

Actual employer contributions were below employer normal cost in all states except West Virginia.⁴ Actual employer contributions were 15.5% of wages and salaries in West Virginia compared to an employer normal cost of 11.3%.

In the aggregate, pensions were fully funded in 2000 with assets exceeding liabilities by 7.8% (Chart 2). In 2010 in contrast, pension funds had assets sufficient to cover only 64.7% of liabilities.

Some states such as California were more or less fully funded from 2000 to 2007. Since the financial crisis of 2008 assets plummeted and so did their funded ratios. For other states, such as Illinois, a widening funding gap from 2000 to 2007 was worsened by the financial crisis. Wisconsin remained fully funded over the entire 2000-11 period.

² Pension liabilities for the District of Columbia are only 13.2% of personal income. Liabilities accrued for service prior to July 1, 1997 are the responsibility of the U.S. Treasury and are excluded from the District liability estimate.

³ Assets (cash and investment holdings) are an average of fiscal year 2010 and 2011 data from the Census Bureau's Survey of Public Pensions.

⁴ Actual employer contributions are an average of fiscal year 2010 and 2011 data from the Census Bureau's Survey of Public Pensions.

Summary Methodology

BEA's estimates of the liabilities and normal costs of state and local government DB pension plans are based on data compiled from their financial and actuarial reports. Because of the variety of methods and assumptions used by the pension plans to calculate their liabilities, BEA standardized the data on a common actuarial cost method and discount rate. This was done in a manner similar to the method described by Novy-Marx and Rauh (2011).

In general, a DB pension liability is a promise of an employer to pay an annual benefit to a worker from his retirement until his death. The benefit is equal to some percentage of the worker's final salary times his years of service. Because the payment of the benefit is contingent on risks, such as disability and mortality, it is necessary to calculate its expected value; because it is paid in the future, it is necessary to calculate its present value.

Knowing a few basic facts about a worker (such as his age, years of service, and salary) and about his pension plan (such as the salary multiplier and cost of living adjustments to retirement benefits) and using standard risk factors (such as the mortality rates summarized in an annuity table) it is possible to roughly calculate the expected stream of pension benefits. With the additional assumption of a discount rate, this stream can be discounted to a present value.

In order to smooth the cost of accumulating the funds to pay the pension benefits, actuaries have developed several different methods to calculate an actuarial liability. They differ in the amount of the liability allocated to each year of a worker's career but they all yield an identical liability at the time of retirement.

In order to standardize the set of liability estimates prepared by different pension plans using different actuarial cost methods and discount rates, BEA performed two sets of calculations. Briefly, the procedure is as follows. First, we calculated the liability for a given

plan using its preferred actuarial cost method (e.g. entry age) and discount rate (e.g. 8%). Second we calculated the liability using the Accumulated Benefit Obligation (ABO) method and a common discount rate (e.g. 5.5%). The ratio of the two estimates was used to convert the liabilities of all plans that used the entry age method and an 8% discount rate to the common ABO method and 5.5% discount rate.

Our liability estimate, calculated using the plan's actuarial cost method and discount rate, will differ from that calculated by the plan itself for several reasons. For instance, the plans have a richer information set about the members and the provisions of the plan. The plans may also use different assumptions. However, these differences often have very similar effects on the liabilities calculated by the different actuarial cost methods and hence have a negligible effect on their ratio. For example, the liability calculated using the RP-2000 mortality table for males will be different from one using the table for females because of the longer expected lifespans of females. However the ratio of the ABO liability to entry age liability calculated using the male mortality table will be almost identical to the ratio calculated using the female mortality table.

A more detailed methodology follows.

Estimation Details

a. Data collected by BEA. From 2000 to the present, actuarial data have been collected by BEA staff from the financial and actuarial reports of a sample of the largest DB pension plans administered by state and local governments. The financial and actuarial reports are generally available from the websites of the pension plans. The sample consists of 120 plans, including 22 administered by local governments and 2 administered by the District of Columbia.⁵ These plans

⁵ The plans are listed in Appendix B. No plans from South Dakota are in the sample. The South Dakota Retirement System uses an "entry age with frozen unfunded actuarial accrued liability" actuarial cost method and does not report a true entry age actuarial liability and employer normal cost. Therefore we estimated South Dakota's actuarial liability and employer normal cost as a proportionate share of the national totals.

account for about 90% of the assets held by the universe of state and local government plans in 2007 as estimated by the Census Bureau and about 90% of active membership. The data for the sample are scaled up to represent the universe using the ratio of the number of members in the sample to the number of members estimated by the Census Bureau for the universe.

We collected the items listed in panels 1 and 2 of Table 2 for each pension plan in the sample. The most difficult data to compile were the normal cost data. Our approach is detailed in Appendix A.

In addition, we collected the data in panel 3: the distribution of active members by age and years of service, average annual wages by age and years of service, the distribution of beneficiaries by age, and the average annual benefit by age. These data are not published by every pension plan. We collected these data annually from 2000 to the present for a small subsample that, when aggregated, we felt was representative of the universe.

Lastly, it is necessary to separate the liability into (a) an active member liability and (b) a retired member liability (i.e. the liability to all beneficiaries including disabled and survivor beneficiaries).⁶ Although the Governmental Accounting Standards Board (GASB) does not require that this information be published, it is possible to obtain the active and retired member liabilities for most pension plans. These data can often be obtained from a table called the Solvency Test, which many pension plans publish in the actuarial section of their Comprehensive Annual Financial Reports.

b. Normal cost and actuarial liability estimates. The magnitudes of the normal cost and the actuarial liability can vary substantially depending on which actuarial cost method is used to calculate them and the value of the discount rate used. Before aggregating the data

⁶ There is also an inactive member liability (i.e. the liability to vested members who have separated from the employer but who are not yet receiving benefits) but this is generally small.

collected from individual public pension plans it is therefore necessary to standardize them on a particular actuarial cost method using a common discount rate. It was decided to use the ABO actuarial cost method and a discount rate based on a smoothed AAA corporate bond yield.^{7,8}

The procedure for standardizing the normal cost and liability for *active* members is as follows:

- (1) The provisions of a typical pension plan are specified (see Table 3). These provisions are held constant over time.
- (2) A set of economic and actuarial assumptions are selected (see Table 3).⁹
- (3) Estimates of normal costs and liabilities for workers of various ages and years of service are calculated using the equations in Winklevoss (1993) for the ABO, entry age, and projected unit credit actuarial cost methods.¹⁰
- (4) Weighted averages of the estimates are calculated using the actual distribution of active members by age and years of service as weights. The actual distribution of active members is based on data collected annually.

⁷ Gold and Latter (2008) advocate the use of the ABO method for state and local government plans. Since the private sector DB pension estimates in the NIPA will be based on the ABO method, using that method for the state and local government sector as well will allow direct comparisons of the pension estimates of the two sectors.

⁸ Using the same discount rate for the state and local government sector and the private sector makes the normal costs and the liabilities of the two sectors directly comparable. For its comparison of federal pensions to private pensions, the Congressional Budget Office also used the same discount rate for the private and public sectors (Falk 2012). The rate selected was about 1 percent higher than the rate of return on 20-year nominal treasury securities in 2009 (p.10). Moody's Investors Service (2013) also uses a high-grade long-term corporate bond index as the discount rate when it adjusts state and local government reported pension data.

⁹ Most of these assumptions are held constant over time. However, as indicated in Table B, the common discount rate used for NIPA estimates changes from 6.0% for 2000-03 to 5.5% for 2004-09 and to 5.0% for 2010 to the present. Since the real interest rate is held constant at 2.5%, expected inflation falls when the discount rate falls. Since wage growth depends on expected inflation, it also falls. Although we know the discount rates used by the individual pension plans in the actuarial calculations, we do not know their inflation rates. Therefore we assumed that they use a real rate of 4.4%. Whenever they change their discount rate, they lower the inflation component, leaving the real rate unchanged. For a retirement system using an 8% discount rate this implies an inflation rate of 3.5%. See the distribution of inflation rate assumptions in the *Public Fund Survey Summary of Findings for FY10* (p.11).

¹⁰ The equations that were used are discussed on pp.118-122 of Winklevoss (1993). Eq. 8.7 was used for the ABO method (which he calls the accrued benefit method), Eq. 8.8 for constant dollar projected unit credit method, and the constant percent versions of Eqs. 8.10a and 8.10b were used for the entry age method.

(5) Ratios are constructed of the weighted averages as calculated by each of the methods.

These ratios vary annually.

(6) The published normal cost and actuarial liability for an individual pension plan, calculated using a particular discount rate and actuarial cost method, are multiplied by the appropriate ratios to convert them to an equivalent normal cost and actuarial liability based on the common NIPA discount rate and ABO method.

(7) Actual member contributions, as published by the pension plan in its financial statements, are subtracted from the ABO estimate of normal cost to obtain the employer normal cost.

An example of the normal costs for workers of various ages and years of service, calculated using the provisions of the typical pension plan, an 8.0% discount rate (3.0% inflation and 4.9% real), and the entry age actuarial cost method is presented in Panel A of Table 4. Normal costs calculated for the same plan but using a 5.5% discount rate (2.9% inflation and 2.5% real) and the ABO method (all other assumptions the same as before) are presented in panel B. The actual distribution of active members by age and years of service is presented in Panel C. Using the data in panel C as weights, the average ABO normal cost is \$6,375 per worker, the average entry age normal cost is \$2,927, and their ratio is 2.2. To convert the published normal cost of a pension plan that used the entry age method and an 8.0% discount rate to our ABO, 5.5% standard, we would multiply it by 2.2.

Since the *retired* member liability is the same for all actuarial cost methods it needs only a discount rate adjustment. Using the plan provisions, data, and assumptions listed in tables 2 and 3, we can calculate the present value of expected benefits per retiree for a set of retirees of different ages. These estimates are multiplied by the number of retirees in each of the age

intervals and summed to obtain an aggregate retired member liability for the typical pension plan. The calculations are performed using each of the discount rates used by the individual pension plans in our sample and for the common discount rate used for the NIPA estimates. A set of adjustment factors are calculated as the ratio of the retired member liability of the typical pension plan based on the common NIPA discount rate to the liability based on another discount rate. The published retired member liabilities of the pension plans in our sample are then multiplied by the appropriate adjustment factor to standardize them on the common NIPA discount rate.

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Table 1. State and local governments, defined benefit pension liabilities and employer normal costs relative to end of year assets, personal income, and wages, by state, calendar year 2010

FIPS	State	Ratio: pension liabilities to personal income	Ratio: pension assets to liabilities	Ratio: unfunded pension liabilities to personal income	Ratio: employer normal cost to wages & salaries	Ratio: actual employer pension contributions to wages & salaries
1	Alabama	0.302	0.542	0.138	0.167	0.100
2	Alaska	0.615	0.456	0.335	0.147	0.105
4	Arizona	0.281	0.560	0.124	0.187	0.090
5	Arkansas	0.281	0.715	0.080	0.154	0.101
6	California	0.518	0.683	0.164	0.318	0.142
8	Colorado	0.358	0.563	0.156	0.139	0.072
9	Connecticut	0.351	0.424	0.202	0.157	0.141
10	Delaware	0.252	0.805	0.049	0.160	0.074
11	D.C.	0.132	1.196	-0.026	0.199	0.079
12	Florida	0.252	0.802	0.050	0.180	0.102
13	Georgia	0.348	0.597	0.140	0.160	0.076
15	Hawaii	0.361	0.530	0.169	0.202	0.134
16	Idaho	0.258	0.821	0.046	0.205	0.082
17	Illinois	0.513	0.434	0.290	0.240	0.175
18	Indiana	0.158	0.703	0.047	0.118	0.105
19	Iowa	0.242	0.826	0.042	0.139	0.059
20	Kansas	0.207	0.583	0.086	0.141	0.071
21	Kentucky	0.387	0.461	0.208	0.159	0.128
22	Louisiana	0.395	0.513	0.192	0.167	0.133
23	Maine	0.296	0.676	0.096	0.158	0.107
24	Maryland	0.272	0.585	0.113	0.179	0.109
25	Massachusetts	0.348	0.480	0.181	0.221	0.141
26	Michigan	0.330	0.626	0.123	0.107	0.088
27	Minnesota	0.303	0.667	0.101	0.131	0.060
28	Mississippi	0.391	0.632	0.144	0.145	0.098
29	Missouri	0.405	0.569	0.175	0.281	0.111
30	Montana	0.343	0.627	0.128	0.164	0.086
31	Nebraska	0.214	0.664	0.072	0.095	0.057
32	Nevada	0.391	0.596	0.158	0.380	0.215
33	New Hampshire	0.178	0.525	0.085	0.164	0.085
34	New Jersey	0.336	0.465	0.180	0.165	0.050
35	New Mexico	0.505	0.612	0.196	0.223	0.095
36	New York	0.458	0.706	0.135	0.347	0.181
37	North Carolina	0.255	0.829	0.044	0.169	0.036
38	North Dakota	0.187	0.627	0.070	0.110	0.043
39	Ohio	0.548	0.625	0.205	0.254	0.111
40	Oklahoma	0.268	0.591	0.110	0.148	0.103
41	Oregon	0.521	0.732	0.140	0.126	0.053
42	Pennsylvania	0.321	0.542	0.147	0.267	0.064
44	Rhode Island	0.357	0.485	0.184	0.165	0.161
45	South Carolina	0.311	0.527	0.147	0.133	0.077
46	South Dakota	0.357	0.646	0.127	0.241	0.053
47	Tennessee	0.207	0.826	0.036	0.177	0.084
48	Texas	0.228	0.839	0.037	0.150	0.070
49	Utah	0.287	0.780	0.063	0.235	0.106
50	Vermont	0.214	0.589	0.088	0.125	0.044
51	Virginia	0.252	0.671	0.083	0.189	0.092
53	Washington	0.259	0.759	0.062	0.141	0.047
54	West Virginia	0.265	0.607	0.104	0.113	0.155
55	Wisconsin	0.341	1.104	-0.036	0.168	0.078
56	Wyoming	0.315	0.754	0.078	0.149	0.045
...	United States	0.355	0.647	0.125	0.211	0.106

Assets and actual employer contributions are from the Census Bureau's Annual Survey of Public Pensions, <http://www.census.gov/govs/retire/>. Assets and actual employer contributions are an average of surveys for fiscal years 2010 and 2011.

Table 2. Data collected from the financial and actuarial reports of public-employee pension plans

1. For normal cost—collected for all plans in sample

Actuarial valuation date

Actuarial cost method

Discount rate (the assumed investment rate of return (%))

Total normal cost (\$)

Employer's normal cost (\$)

Actual member contributions (\$)

Covered payroll (\$)

2. For interest cost of actuarial liability—collected for all plans in sample

Actuarial accrued liability (AAL, \$)

Active member AAL (\$)

Retired member (beneficiaries) AAL (\$)

Number of active members

Number of retired members (including survivors and beneficiaries receiving periodic payments)

3. Other—collected for several of the largest plans

Distribution of active membership by age and years of service

Average annual wages by age and years of service

Distribution of retired membership (beneficiaries) by age

Average annual benefits by age

Table 3. Typical pension plan provisions and assumptions

Plan provisions

- Plan provides for retirement, disability, vested termination, and surviving spouse benefits
- Retirement benefit equals 2.0% of final average salary times the number of years of service
- Final average salary is the average of the last 3 years of service
- Normal retirement age is 65
- Vesting takes 5 years (10 years for disability benefits)
- Benefit cost of living adjustment (COLA) is an automatic 2.5% per year regardless of actual inflation

Actuarial assumptions

- RP-2000 male employee mortality decrement rate
- RP-2000 healthy male annuitant mortality decrement rate
- RP-2000 disabled male annuitant mortality decrement rate
- Disability decrement rate from Winklevoss (1993) Table 2.7
- Termination decrement rates for various entry ages from Winklevoss (1993) Table 2.3

Economic assumptions

- Discount rate is 6.0% (2000-03), 5.5% (2004-09), and 5.0% (2010-present)
- Expected real rate of interest is 2.5% for all years
- Salary scale from Winklevoss (1993) Table 2.10
- Average wage of all workers is \$35,735
- Expected productivity growth rate is 1%
- The wage of a worker depends on his age and years of service. It increases as he ages according to the salary scale and with the inflation rate and productivity growth rate. The inflation rate is (approximately) the difference between the discount rate and the real rate of interest.

Other assumptions

- No breaks in service
 - No waiting period before disability benefits begin
 - Upon death, 80% of members have a surviving spouse
 - Surviving spouse receives 50% of benefit of member
 - Surviving spouse is the same age as member
 - Estimates for active members are calculated for 45 age-service combinations: 5-year age intervals from 22 to 62 and 5-year intervals for years of service from 2 to 42
 - Estimates for retired members are calculated for 10 five-year age intervals from 47 to 92
-

Table 4. Sample Normal Cost Estimates

A. Entry Age normal cost for a worker by age and years of service (8% discount rate, 3% inflation, 4.9% real)

		Years of service								
		2	7	12	17	22	27	32	37	42
Age	22	581	...	...	...	...	...	...	...	...
	27	1,622	1,141	...	...	...	...	...	...	...
	32	2,221	2,108	1,373	...	...	...	...	...	...
	37	2,578	2,756	2,405	1,540	...	...	...	...	...
	42	2,817	3,126	3,048	2,641	1,620	...	...	...	...
	47	3,124	3,414	3,373	3,285	2,771	1,658	...	...	...
	52	3,382	3,887	3,817	3,792	3,509	2,910	1,842	...	...
	57	3,680	4,206	4,407	4,367	4,157	3,837	3,266	2,035	...
	62	3,370	4,086	4,366	4,737	4,591	4,353	4,005	3,468	2,262

B. ABO normal cost for a worker by age and year of service (5.5% discount rate, 2.9% inflation, 2.5% real)

		Years of service								
		2	7	12	17	22	27	32	37	42
Age	22	232	...	...	...	...	...	...	...	...
	27	641	1,596	...	...	...	...	...	...	...
	32	984	2,355	3,136	...	...	...	...	...	...
	37	1,332	2,979	4,311	5,369	...	...	...	...	...
	42	1,688	3,528	5,192	7,097	8,222	...	...	...	...
	47	2,167	4,185	5,917	8,257	10,687	11,828	...	...	...
	52	2,832	5,265	7,198	9,698	12,518	15,609	17,988	...	...
	57	3,644	6,755	9,132	11,930	15,016	18,956	23,885	26,738	...
	62	4,333	7,685	10,824	14,323	17,867	21,984	27,258	34,498	40,010

C. Distribution of employment (percent of total employment) for 2004

		Years of service								
		2	7	12	17	22	27	32	37	42
Age	22	0.023	...	...	...	...	...	...	...	...
	27	0.065	0.017	...	...	...	...	...	...	...
	32	0.051	0.044	0.012	...	...	...	...	...	...
	37	0.045	0.037	0.031	0.011	...	...	...	...	...
	42	0.040	0.033	0.029	0.030	0.012	...	...	...	...
	47	0.035	0.032	0.028	0.028	0.025	0.011	...	...	...
	52	0.028	0.027	0.027	0.028	0.022	0.024	0.013	...	...
	57	0.018	0.018	0.019	0.021	0.016	0.014	0.016	0.003	...
	62	0.013	0.012	0.012	0.011	0.008	0.007	0.005	0.002	0.001

Chart 1. Pension liabilities and employer normal costs, United States

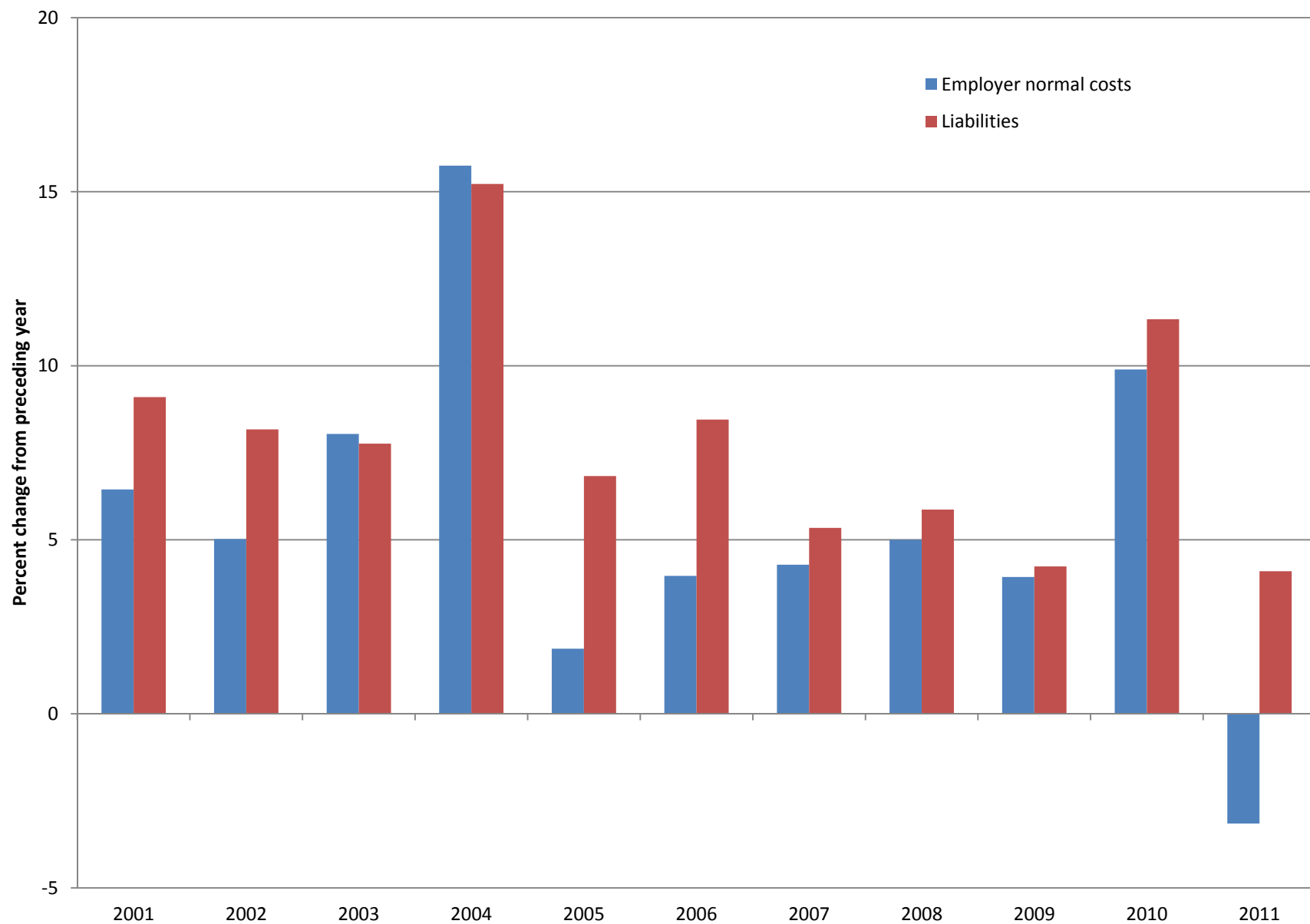
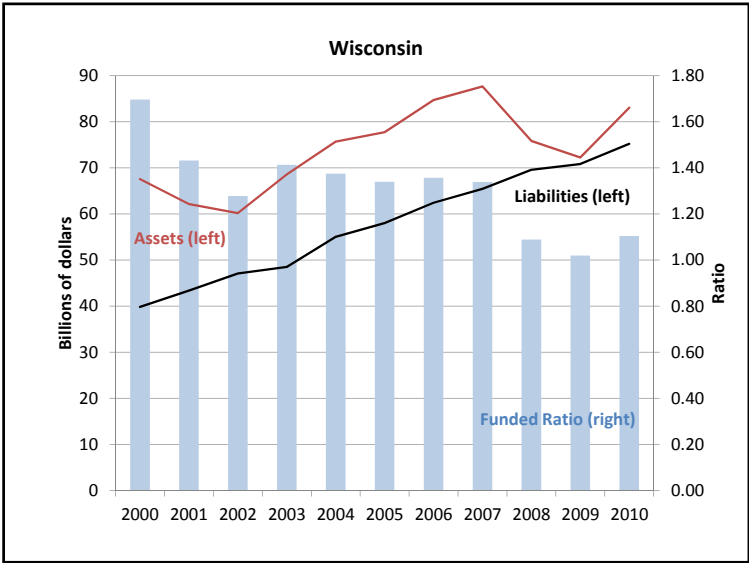
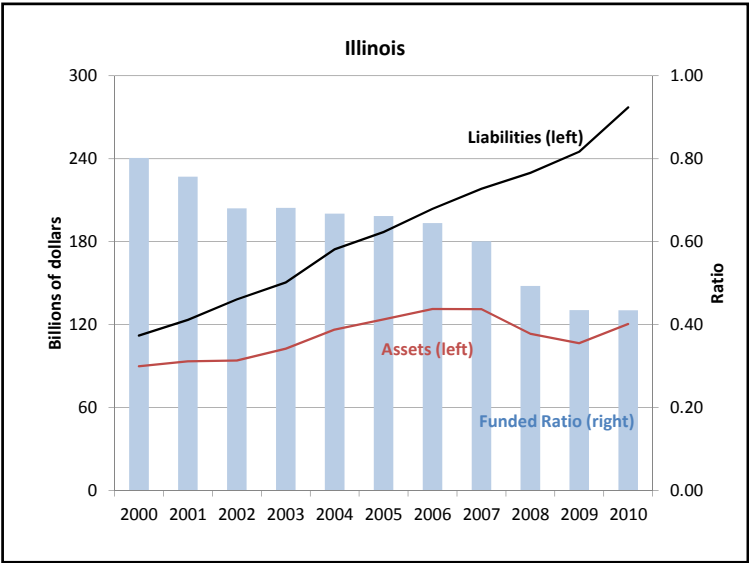
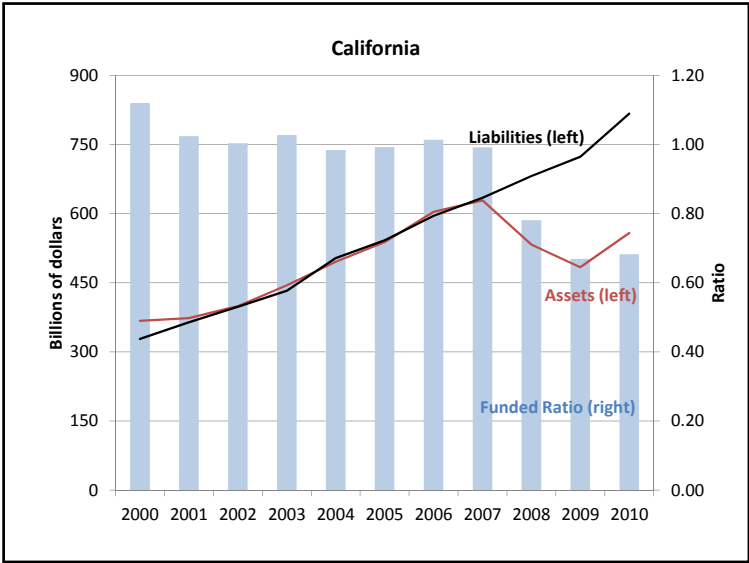
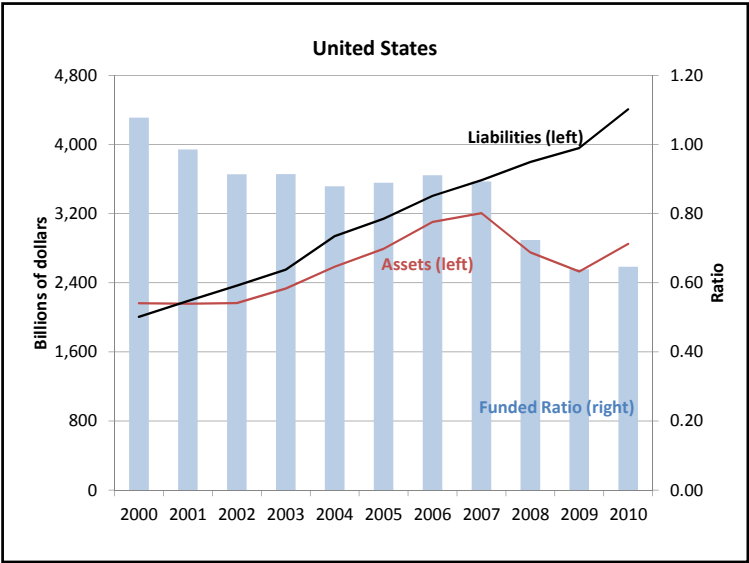


Chart 2. Assets, Liabilities, and Funded Ratio



Appendix A

Compiling Employer Normal Cost Data

The most difficult data to obtain from state and local government pension plans are the employer normal costs. Currently, GASB does not require pension plans to publish the normal cost and so generally it must be obtained from the plan's actuarial valuation report. Since the New York City pension plans do not publish normal cost they are discussed separately below.

There are also major challenges in making the published numbers consistent with other financial and actuarial data for the pension plans and in making them comparable across plans. First, we discuss three alternative approaches to obtaining employer's normal cost. Then we discuss two adjustments to enforce consistency and comparability.

Employer's Normal Cost Method 1

Perhaps the most useful estimates of normal cost were obtained from those pension plans which published a schedule of changes in the actuarial accrued liability (or the unfunded actuarial accrued liability) from the beginning of the year to the end of the year in terms of normal cost, interest cost, and other changes.¹¹

It is important to recognize that the normal cost from such a schedule was originally calculated by the actuary and published in an actuarial valuation report (AVR) one or more years prior to the date of the AVR in which the schedule of changes is published. For this reason, in what follows we sometimes combine the normal cost from such a schedule with information from an AVR for a previous year.

One of the chief advantages of obtaining normal cost from such a schedule is that one can be sure that the normal cost is assigned to the correct fiscal year and aligned with the appropriate actuarial liability. When the schedule of changes is not published, there can be some ambiguity about which year the normal cost refers to. This is especially problematical when the normal cost is calculated two or more years in advance of the year to which it applies. Another advantage is that one can determine whether the normal cost is a beginning-of-year, mid-year, or end-of-year value by comparing the interest in the schedule of changes with the liabilities, normal costs, and contributions (or benefits paid) in that schedule. Oftentimes pension fund reports do not explicitly state when the published normal cost includes interest costs.

Sometimes normal cost and sometimes employer normal cost was reported in the schedule of changes. When the normal cost was reported, we obtained employer normal cost in one of the following ways (a) sometimes the dollar amount of the member contribution included in normal cost was published in the previous year's actuarial valuation report. Subtracting the member contribution leaves the employer normal cost, (b) other times employer normal cost was calculated using published values of the employer normal cost rate and the member contribution rate from the previous year's actuarial valuation report, (c) in two cases the present value of future employer and future member normal contributions from the actuarial balance sheet were used to calculate the employer and member shares of normal cost, (d) a few times it was

¹¹ See, for example, the 2011 actuarial valuation report for the General Employees Retirement Fund of the Public Employees Retirement Association of Minnesota (p.26).

necessary to subtract actual member contributions from normal cost to obtain employer normal cost.¹²

Employer's Normal Cost Method 2

About half of the pension plans did not publish a schedule of changes in the actuarial accrued liability or unfunded liability. For these plans, we obtained employer normal cost in one of the following ways (a) as the product of covered payroll as of the current actuarial valuation date and the employer normal cost rate published in the actuarial valuation report for the previous year, (b) as the present value of future normal cost contributions divided by the present value of future salaries less the member contribution rate, i.e. by calculating an employer normal cost rate using data from the actuarial balance sheet and then multiplying it by covered payroll, or (c) as published in the actuarial valuation report or financial statements. As noted earlier, a published employer normal cost (employer normal cost rate), by itself, can be ambiguous because of uncertainty about which fiscal year it applies to and whether it is a beginning-of-year or mid-year amount.

Employer's Normal Cost Method 3

None of the variations of method 1 or method 2 could be used for the New York City pension plans. We estimated normal cost for these plans by attributing all of the change in the actuarial accrued liability, other than benefits paid and interest expense, to normal cost. The employer normal cost rate was then obtained by subtracting actual member contributions from normal cost and dividing by covered payroll. Because the rate calculated in this manner fluctuated too much, we discarded extreme values and then calculated an average employer normal cost rate. This average was used for all years.

Two Adjustments

Two adjustments were sometimes necessary to enforce consistency in normal costs across all pension plans. (1) Sometimes a pension plan included administrative expenses in normal cost. We removed those expenses. (2) About a quarter of the pension plans reported normal cost as of the valuation date, another quarter reported a "mid-year" or "end-of-year" normal cost. The mid-year normal cost includes interest for one half of a year. This makes it more comparable with member contributions which are typically paid periodically throughout the plan's fiscal year rather than as a lump sum as of the valuation date. The other plans gave no indication as to whether normal cost was beginning of year or mid-year. We assumed that they were mid-year. Therefore to enforce consistency we added a half year of interest to the normal cost of those plans that reported normal cost as a beginning-of-year amount and subtracted a half year of interest from reported end-of-year normal costs.

¹² Method (1d) is undesirable because actual member contributions can include voluntary purchase of service credit. These purchases are sometimes one or more percent of covered payroll and can spike when an employer offers a temporary early retirement incentive. Subtracting these purchases from normal cost leads to a downward bias in the estimate of employer normal cost. In addition, any errors in normal cost (e.g. due to errors in predicting covered payroll) would fall entirely on the estimate of employer normal cost. Method (1d) was used only as a last resort.

Appendix B
State and Local Government Retirement Systems in Sample

Alabama Employees' Retirement System
Alabama Teachers' Retirement System
Alaska Teachers' Retirement System
Alaska Public Employees' Retirement System
Arizona Public Safety Personnel Retirement System
Arizona State Retirement System
Arkansas Public Employees' Retirement System
Arkansas Teacher Retirement System
California Public Employees' Retirement Fund
California Teachers' Retirement System
University of California Retirement Plan
Contra Costa County Employees' Retirement Association
Los Angeles County Employees' Retirement Association
Orange County Employees' Retirement System
Sacramento County Employees' Retirement System
San Bernardino County Employees' Retirement Association
San Diego County Employees' Retirement Association
Los Angeles City Water and Power Employees' Retirement Plan
Los Angeles City Employees' Retirement System
Los Angeles City Fire and Police Pension System
San Francisco City and County Employees' Retirement System
Colorado Public Employees' Retirement Association
Denver Employees' Retirement Plan
Connecticut State Teachers' Retirement System
Connecticut State Employees' Retirement System
Connecticut Municipal Employees' Retirement System
Delaware Public Employees' Retirement System
District of Columbia Police Officers and Firefighters' Retirement Fund
District of Columbia Teachers' Retirement Fund
Florida Retirement System
Georgia Employees' Retirement System
Georgia Teachers' Retirement System
Hawaii Employees' Retirement System
Idaho Public Employee Retirement System
Illinois State Employees' Retirement System
Illinois Teachers' Retirement System
Illinois State Universities Retirement System
Illinois Municipal Retirement Fund
Cook County Employees' and Officers' Annuity and Benefit Fund
Chicago Municipal Employees' Annuity and Benefit Fund
Chicago Public School Teachers' Pension and Retirement Fund
Indiana Public Employees' Retirement Fund
Indiana State Teachers' Retirement Fund

Iowa Public Employees' Retirement System
Kansas Public Employees' Retirement System
Kentucky Teachers' Retirement System
Kentucky County Employees' Retirement System
Kentucky Employees' Retirement System
Louisiana School Employees' Retirement System
Louisiana State Employees' Retirement System
Louisiana Parochial Employees' Retirement System
Louisiana Municipal Police Employees' Retirement System
Louisiana Teachers' Retirement System
Maine Public Employees' Retirement System
Maryland State Retirement and Pension System
Montgomery County Employee Retirement Plans
Massachusetts Teachers' Retirement System
Massachusetts State Employees' Retirement System
State-Boston Retirement System
Michigan Public School Employees' Retirement System
Michigan State Employees' Retirement System
Michigan Municipal Employees' Retirement System
Detroit Police and Fire Retirement System
Minnesota General Employees' Retirement Fund
Minnesota Public Employees' Police and Fire Fund
Minnesota State Employees' Retirement Fund
Minnesota Teachers' Retirement Association Fund
Mississippi Public Employees' Retirement System
Missouri Public School Retirement System
Missouri State Employees' Retirement System
Missouri Local Government Employees' Retirement System
University of Missouri Retirement, Disability, and Death Benefit Plan
Montana Public Employees' Retirement System
Montana Teachers' Retirement System
Nebraska Public Employees' Retirement Systems, School Retirement System
Nevada Public Employees' Retirement System
New Hampshire Retirement System
New Jersey Police and Firemen's Retirement System
New Jersey Public Employees' Retirement System
New Jersey Teachers' Pension and Annuity Fund
New Mexico Public Employees' Retirement Fund
New Mexico Educational Retirement Board
New York Employees' Retirement System
New York Police and Fire Retirement System
New York State Teachers' Retirement System
New York City Teachers' Retirement System
New York City Employees' Retirement System
New York City Fire Pension Fund
New York City Police Pension Fund

North Carolina Teachers' and State Employees' Retirement System
North Dakota Public Employees' Retirement System
North Dakota Teachers' Fund for Retirement
Ohio Police and Fire Pension Fund
Ohio Public Employees' Retirement System
Ohio School Employees' Retirement System
Ohio State Teachers' Retirement System
Oklahoma Firefighters' Pension and Retirement System
Oklahoma Teachers' Retirement System
Oklahoma Public Employees' Retirement System
Oregon Public Employees' Retirement System
Pennsylvania Public School Employees' Retirement System
Pennsylvania State Employees' Retirement System
Rhode Island Employees' Retirement System
South Carolina Retirement System
Tennessee Consolidated Retirement System
Nashville and Davidson County Metropolitan Employees' Benefit Trust Fund
Texas Employees' Retirement System
Texas Teacher Retirement System
Utah Public Employees' Noncontributory Retirement System
Utah Public Safety Retirement System
Vermont State Employees' Retirement System
Vermont State Teachers' Retirement System
Virginia Retirement System
Washington Public Employees' Retirement System
Washington Teachers' Retirement System
Washington Law Enforcement Officers' and Fire Fighters' Retirement System
West Virginia Public Employees' Retirement System
West Virginia Teachers' Retirement System
Wisconsin Retirement System
Wyoming Public Employees' Pension Plan