ROBERT NOVY-MARX
JOSHUA RAUH

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The Crisis in Local Government Pensions in the United States

STATE AND LOCAL GOVERNMENTS follow the same accounting framework for measuring the value of their pension promises. The value of those promises is disclosed in accordance with Government Accounting Standards Board (GASB) statement 25, which stipulates that benefit promises are to be discounted at an assumed return on pension plan assets. That assumed return determines how the future stream of cash benefits that the state or local government has promised is converted into a present value liability measure. It also governs the actuarial recommendation for the annual amount that state and local governments set aside to fund newly promised benefits. The higher the assumed return, the lower the present value of recognized benefit cash flows and the less money the government entity sets aside on a flow basis to cover a given benefit stream.

As we have pointed out previously (Novy-Marx and Rauh 2009, 2010a, and 2010b), this system misrepresents the value of pension promises. The field of financial economics is unified in agreeing that the present value of a stream of cash flows is a function of the risk of the cash flows themselves. The pension payments promised to government workers do not depend on the performance of pension fund assets. The value of the liability therefore depends on the risk

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of the stream of cash flows associated with that liability, not on the assets that back the liability.

If households could use the GASB accounting system, then they could write down the value of their mortgages by simply reallocating their savings from a money market account to the stock market. By doing so, they would increase the expected rate of return on their assets and get to use that higher rate to discount their debts. If state and local governments took further advantage of this system, they could make their liabilities essentially disappear by taking on risky investments with high average returns and high risk.

In previous work we have shown that the total liability for the major pension plans sponsored by the fifty U.S. state governments is approximately $5 trillion using Treasury discount rates, contrary to government accounting, which would point to total liabilities of only $3 trillion. The unfunded liability for the major pension plans sponsored by the fifty U.S. state governments is approximately $3 trillion using Treasury discount rates, contrary to government accounting, which would point to unfunded liabilities of only $1 trillion.

In this chapter, we examine municipal pension promises. In particular, we apply financial valuation to seventy-seven pension plans sponsored by fifty major cities, counties, and other local government entities. This sample represents all nonstate municipal entities with more than $1 billion in pension assets, covering 2.04 million local public employees and retirees. According to the U.S. Census of Governments, a total of 3.03 million individuals is covered by 2,332 local pension plans in the United States.[1] Thus, while we capture only 3 percent of municipal pension plans, we capture about two-thirds of the universe of municipal workers.

Ftn. 1

According to the latest reports issued by the local governments themselves, they have $488 billion in liabilities. When we reverse engineer the cash flows and limit recognition to only those benefits that have been promised based on today's service and salary and use the plan-chosen discount rates, that figure drops to $430 billion. When we use taxable AA+ municipal yield curves to discount those benefits, we obtain liability measures that are around 18 percent larger. When we use the Treasury yield curve, we find a total liability of $681 billion, which is 39 percent above the stated level and 58 percent above the already promised benefit at municipally chosen rates. Net of the assets in the plans, the unfunded liability is $383 billion using Treasury discounting, or over $5,300 per capita and over $185,000 per member. If on a per-member basis the unfunded liability is the same for the approximately 1 million local workers covered by municipal plans

1. See the 2008 survey of State and Local Government Employee Retirement Systems (U.S. Census Bureau 2008).

not in our sample, the total unfunded liability for all municipal plans in the United States is $574 billion.[2] Ftn. 2

The method of discounting using municipal yield curves credits cities that experience rating downgrades with lower liabilities. If local taxpayers can default on pensions in the same circumstances that they can default on bonds, then muni discounting would represent the city's exposure. However, given the legal protections that exist for state and local government pensions in many states—as well as the political reality that in past municipal crises the pensions have been paid while the localities' bonds have been impaired—a better measure of overall taxpayer liability is obtained by treating accrued pension benefits as a default-free promise and by discounting using Treasury yields.

For the states, implementing Treasury discount rates increases total liabilities by around 66 percent, whereas in the municipalities that we study the impact is smaller, at 39 percent. This reflects the fact that the retired member share in the municipal plans averages 43 percent, while the retired member share in the state plans averages only 36 percent. As a result, the municipal plans have shorter duration than the state plans and are less affected by the correction of the discount rates.

The $0.6 trillion unfunded liability in major municipalities obviously is much smaller than a $3 trillion unfunded liability for state governments. Relative to the municipalities' resources and taxes, however, the unfunded liability is substantial. The fifty municipalities with the $382 billion unfunded liability that we measure had 2006 revenues of $120 billion. The unfunded liability is therefore equivalent to 3.2 years of revenue. For the comparable time period, the 116 state-sponsored plans had a $2.52 trillion unfunded liability and $0.78 trillion in revenues, for a ratio of 3.2 years of revenue. Thus, relative to current tax resources, the extent of the gap between assets and liabilities in the municipal plans is almost exactly the same as in state plans.

In this chapter we first present the sample and our calculations of municipal pension liabilities under current reporting. We then review the different methods of recognizing accruals and the arguments about appropriate discount rates. Next we present our model for translating among liability concepts and for calculating municipal pension liabilities using different yield curves. Following that we describe the present value calculations under alternative yield curves and calculate the number of years that the existing assets of each municipality could pay benefits at currently promised levels. We close with a summary and our conclusions.

2. Since we used an asset cutoff in selecting the sample, the unfunded liability on a per-member basis is in fact likely to be somewhat larger for the plans not in our sample than for the plans in our sample.

Sample and Municipal Pension Obligations under Current Reporting

The sample consists of seventy-seven defined benefit pension systems sponsored by local governments. The sample was identified using detailed 2006 data from the U.S. Census of Governments. We first selected all plans with more than $1 billion in assets as of 2006, the latest year for which the detailed census of state and local government retirement systems was available. That amounted to seventy-eight plans. We then added any other plans sponsored by the same local government entities with at least $100 million in assets, for a total of ninety plans, to ensure that for any of the municipalities in our sample, all substantive pension plans would be counted.[3] We then constructed a unique dataset by searching the local government websites for the Comprehensive Annual Financial Report (CAFR) for each of the plans. Due to data availability issues, we were forced to discard the plans from several major municipalities including Denver (Colorado), Austin (Texas) and Minneapolis (Minnesota).

Ftn. 3

The final sample encompasses seventy-seven pension systems in fifty major municipalities. The census of governments classifies each plan according to the type of local entity that sponsors the plan. Twenty-eight of the seventy-seven systems are sponsored by county governments, and forty-five are sponsored by city governments. Of the remaining four plans, two (the Chicago Teachers' Pension Fund and the St. Paul Teachers' Association Retirement Fund) are sponsored by school districts that are coterminous with cities but may receive funding from a variety of sources. The last two plans are Chicago plans sponsored by special districts—the water district and the Chicago Transit Authority—which also receive funding from a variety of sources. To the extent that there is substantial overlap between the taxpayers of the school districts or special districts and the municipalities with which they overlap, we combine the pension funds of these entities with any local municipal systems that may exist.

Tab. 1

Table 3-1 presents summary statistics on the membership of the seventy-seven systems as well as membership data for the ten plans that are largest in total membership. There are 2.04 million workers in these plans; according to the U.S. Census of Governments, a total of 3.03 million total workers is covered by all local government pension plans. On average, 53 percent of the workers in the sample plans are current employees. Systems that have a larger share of active workers will face larger benefit cash flows further in the future and the duration of their cash flows will be longer.

3. There were 277 total plans with more than $100 million in assets as of 2006.

Table 3-1. *Summary of Plans and Participants*[a]

	Number of members				
Summary and plans	*Active*	*Annuitant*	*Separated and vested*	*Total*	*Active (percent)*
Summary statistic					
Total	1,109,095	809,214	122,944	2,042,253	54
Mean	14,404	10,496	1,597	26,497	53
Median	6,277	5,322	595	11,810	53
Standard deviation	26,675	18,363	2,581	46,840	8
Ten largest plans					
New York City Employee Retirement System	187,327	133,277	8,949	329,554	57
Teachers' Retirement System of the City of New York	114,307	71,259	6,247	191,812	60
Los Angeles County Employees' Retirement System	96,382	53,397	12,071	161,850	60
New York City Police Pension Fund	36,044	45,176	829	82,049	44
Municipal Employees' Annuity and Benefit Fund of Chicago	33,214	23,185	12,324	68,723	48
City of Philadelphia Municipal Retirement System	28,632	35,694	1,336	65,662	44
Chicago Teachers' Pension Fund	32,728	24,398	3,549	60,675	54
San Francisco Employees' Retirement System	31,263	21,944	4,841	58,048	54
Boston Retirement System	22,512	14,408	9,896	46,817	48

Source: Authors' calculations based on the Comprehensive Annual Financial Report for each of seventy-seven plans.

a. The top panel summarizes the number of individual members in each of three main categories: active workers, annuitants, and those who are vested but no longer in public employment. The sample includes seventy-seven major city- and county-sponsored pension plans, covering two-thirds of the universe of workers in municipal pension systems. All major plans in fifty major municipal systems are represented. The bottom panel lists these data for the ten state-sponsored pension plans that are the largest by total number of members.

Each municipality reports a measure of total liabilities in the CAFR. A starting point for total liabilities would be simply to take a raw sum of liabilities from the reports, which yields a total of $464 billion. However, the date of the latest available CAFR is not the same for each system, so the liabilities must be harmonized to a June 2009 reporting date.[4] Assuming a 6 percent benefit growth rate (which actually is conservative relative to the rate at which stated benefits have been growing), we arrive at total liabilities of $488 billion as of June 2009 on a stated basis.

Ftn. 4

Rediscounting of cash flows under different actuarial accrual concepts and different yield curves requires an estimate of the cash flows themselves. Unfortunately, the local governments do not provide the cash flows that they use to derive the liabilities that they report. To derive estimates of cash flow streams based on the information provided in the CAFRs therefore requires using a calibrated model and making a series of assumptions. We explain the calibration itself later in the chapter.

Accrual Methods and Discount Rates

Most estimates of liabilities that are not conducted by economists simply add up the liabilities that are disclosed in the CAFRs. That method ignores two issues. First, it relies strictly on the liability concept that state actuaries choose without considering what liabilities are actually being recognized. Second, adding liabilities disclosed in the CAFRs takes as given whatever discount rate the state actuaries have chosen.

Liability Concepts

We consider four different liability concepts: accumulated benefit obligation (ABO), projected benefit obligation (PBO), entry age normal (EAN), and projected value of benefits (PVB). The narrowest measure is the ABO, which reflects benefits already promised and accrued. In other words, even if a pension plan could be completely frozen, the city would still contractually owe those benefits. The ABO is not affected by uncertainty about future wages and service, as the cash flows associated with the ABO are based on information known today: plan benefit formulas, current salaries, and current years of service. One source of uncertainty in the ABO is inflation, in particular the magnitude of cost of living

4. The distribution of latest reporting dates is as follows: June 2007 (1), September 2007 (1), December 2007 (3), June 2008 (23), September 2008 (5), December 2008 (17), June 2009 (22), September 2009 (2), December 2009 (3).

adjustments (COLAs) in cities where such adjustments are linked to official statistics such as CPI inflation.

The ABO is often thought of as a "termination liability"—that is, the liability that would be owed today even if plans were frozen completely or all workers were fired. In fact, the ABO actually could be somewhat less than a termination liability, as it assumes that an employee does not start taking benefits until his retirement date, which might be later than the full retirement age. A termination liability assumes that employees take benefits at the earliest advantageous date, which typically is earlier than the full retirement age given the fact that actuarial adjustments for early retirement are generally less than actuarially fair.

If workers receive their marginal product in total compensation (wages plus pension benefits), the ABO is the only concept that should be considered since it measures the benefits that employees have actually earned (Bulow 1982; Brown and Wilcox 2009). The ABO is a "narrow" measure in that it does not recognize any future wage increases or future service that employees are expected to provide, even though such increases and service are to some extent predictable. Moreover, the ABO obligation is independent of wage risk, which simplifies the valuation.

The three broader measures (PBO, EAN, and PVB) all account to varying extents for the fact that benefits continue to accrue due to the future salary and/or service of existing workers. They assume that the pension system will not be frozen today, and they all aim to reflect some portion of actual expected benefits.

The broadest measure, the PVB, represents a discounted present value of the full projection of the cash flows that actuaries expect the city to owe. The PVB method does not credit the government for the fact that it might have some ability to limit benefit accruals. Both the EAN and the PBO recognize a fraction of the PVB; therefore they are intermediate measures between the ABO and the PVB.

The PBO accounts fully for expected future wage increases for existing workers but not expected future service. Mathematically, the PBO formula recognizes the PVB in a way that is prorated by service. Note that Financial Accounting Standards Board (FASB) accounting for publicly traded corporations requires the calculation of a PBO.

The EAN is broader than the PBO but not as broad as the PVB. Mathematically, the EAN method recognizes the PVB in proportion to discounted wages earned to date relative to discounted expected lifetime wages. In practice, this procedure accounts for some portion of future benefit accruals due to both future wages and future service.

Table 3-2 summarizes the liability concepts. Further details, including formulas, are provided in Novy-Marx and Rauh (2010a). We note that none of these

Tab. 2

Table 3-2. *Description of Methods for Recognizing Accrued Liabilities*[a]

Method	*Broadness*
Accumulated benefit obligation (ABO)	Represents promised benefits under current salary and years of service. Often used interchangeably with the concept of "termination liability," or liability if the plan were frozen, although there are some differences (see text).
Projected benefit obligation (PBO)	Takes projected future salary increases but not future years of service into account in calculating today's liability. Used in FASB accounting for corporations.
Entry age normal (EAN)	Reflects a portion of future salary and service by allowing new liabilities to accrue as a fixed percentage of a worker's salary throughout his or her career.
Present value of benefits (PVB)	Presents a full projection of what current employees are expected to be owed if their salary grows and they work and retire according to actuarial assumptions.

Source: Authors' compilation.

a. The table summarizes the four main methods for recognizing pension liabilities. The methods differ in their treatment of expected future salary increases and service that is yet to be performed. The methods are listed in increasing order of broadness, starting with the method that reflects only current service and salary and ending with the method that reflects a full projection of benefits that are expected to be paid.

methods account for the expected benefits that will be owed to workers who have not yet been hired.

Discount Rates

As explained in Novy-Marx and Rauh (2009; 2010a), the discount rate that state and local governments use under GASB accounting procedures does not reflect the risk of the liabilities. Discounting liabilities at an expected rate of return on the assets in the plan runs counter to the entire logic of financial economics: financial streams of payment should be discounted at a rate that reflects their risk (Modigliani and Miller 1958), in particular their covariance with priced risks (Treynor 1961; Sharpe 1964; Lintner 1965).

Governments discount the liabilities at a flat rate, and usually that rate is very close to 8 percent. As shown in table 3-3, the mean discount rate for the seventy-seven systems in our sample is 8.03 percent, the median rate is 8.00 percent,

Tab. 3

Table 3-3. *Discount Rates Used By Municipal Plans*
Percent

Mean	8.03
Median	8.00
Standard deviation	0.36
Minimum	7.50
Maximum	10.00
Number of plans	77

Source: Authors' calculations based on the Comprehensive Annual Financial Report for each of seventy-seven plans.

and the standard deviation is 0.36 percent. The model rate is 8.00 percent, used by thirty-three of the seventy-seven systems. Governments justify their discount rates with the argument that they are discounting liabilities at the expected rate of return on the assets in their pension fund. Such a procedure ignores the risk of the assets completely and treats returns above the risk-free rate as a free lunch.

The GASB procedures have survived criticism in part because observers have noted that many pension systems have earned average returns of around 8 percent over the past decades. But again, that assumes that the 8 percent was obtained without any risk. In fact, those returns were obtained by taking investment risk, and if the assets had not returned 8 percent, taxpayers would have been on the hook for additional shortfalls. If systems want to be able to tell their employees that the benefit stream is safer than a portfolio of stocks and bonds, they should discount the cash flows in a way that reflects that safety.

Novy-Marx and Rauh (2010a) employs two primary discounting procedures. The first uses the taxable muni rate, defined as the local municipal yield grossed up for a tax preference on muni debt, assuming a 25 percent marginal rate for the marginal municipal bond holder (Poterba and Verdugo 2008). The second method uses the Treasury yield curve.

Using the muni rate admits and quantifies a probability of default. The liability is a measure that calculates the present value of the defaultable liability from the perspective of the taxpayers under the assumption that the municipalities will default on those payments in the same states of the world as those in which they would default on their general obligation (GO) debt, and with the same recovery rates. Alternatively, it is the value of the portfolio of local GO bonds that the municipalities would need to deliver to the plan to defease the obligation. When assessing the difference in the liability under different policy measures, the

comparative statics quantify the size of the shift in the value of those uncertain payments.

Discounting a liability at the taxable muni rate captures some of the spirit of the FASB rules for corporate pension discounting. The FASB rules let corporations discount pension obligations at high-grade corporate bond rates. Discounting local pension obligations at municipal bond rates is similar in that the creditworthiness of the asset class (municipal or corporate bonds) plays a role. In this chapter, we assume that the AA+ yield curve would be appropriate for all municipalities under this procedure.[5]

Ftn. 5

Crediting governments by reducing pension liabilities based on GO default premiums leads if anything to understatement of the liability to the taxpayer. Most important, benefits often are given special protections in state constitutions as well as in statutory and common law (Brown and Wilcox 2009). The priority accorded to public pension cash flows suggests that they should be discounted at rates lower than the GO bond yield. In most local government situations, a pension default is less likely than a GO debt default (consider Vallejo, California). Even if cities were to default on pension promises, pension obligations might well have a higher recovery rate than GO debt. Somewhat offsetting the limitations on municipal pension defaults is the possibility that municipalities might receive a bailout from the state or federal government for pension promises (consider Harrisburg, Pennsylvania, for example), in which case taxpayers of a given city might view the pension liabilities as less certainly owed by them. However, because our focus is on an aggregate liability calculation across municipalities, this issue would affect the distribution of liabilities across cities and states but not the total liability to all U.S. taxpayers.

Using the Treasury yield curve values the pension benefits as secure promises. The Treasury valuations start from the premise that the benefits will be paid. To the extent that they are not paid, there is a transfer from participants to taxpayers. The expected value of the transfers would reduce the value of the payments to the participants but also reduce the cost to the taxpayer. Treasury discounting can therefore be viewed as valuing the benefits as a default-free promise. If local pension systems want to present to their employees the idea that the benefits are default free, they must discount at default-free rates. If a local pension system wanted to contract out the provision of the benefits to an insurer that would

5. There are some additional important differences. First, FASB rules require firms to recognize the PBO, whereas our primary focus is on the ABO. Second, a firm will owe little beyond the assets in the pension fund if the firm becomes insolvent, since the Pension Benefit Guaranty Corporation (PBGC) will take over the plan and become an unsecured creditor in bankruptcy. States are not insured by the PBGC, and even if the state defaults on its debt, there is a high likelihood that it will have to pay pensions.

make the benefit payments even if in the future the municipality defaulted on some of its obligations, the insurance company would presumably value the liability at a default-free rate.

There are important caveats about using the Treasury yield curve as a measure of risk in a default-free pension liability. Although the Treasury yield curve is generally viewed as default free, it reflects other risks that may not be present in the pension liability. State employee pensions typically contain COLAs. If inflation risk is priced (Fisher 1975; Barro 1976), then an appropriate default-free pension discount rate would involve a downward adjustment of nominal yields to remove the inflation risk premium. That adjustment would further increase the present value of ABO liabilities. However, a countervailing factor is the fact that Treasuries trade at a premium due to their liquidity (Woodford 1990; Duffie and Singleton 1997; Longstaff 2004; Krishnamurthy and Vissing-Jorgensen 2008). Pension obligations are nowhere near as liquid as Treasuries. Therefore a liquidity price premium should ideally be removed from Treasury rates before using them to discount default-free but illiquid obligations.

Given the lack of consensus over the relative size of the liquidity price premium and inflation yield premium, we use unadjusted Treasury rates to calculate our default-free liability measures. However, we note that due to the factors priced into the Treasury curve, default-free public pension obligations are not equivalent to Treasuries.[6] Ftn. 6

Calculating Liabilities under Different Accrual Concepts and Discount Rates

Novy-Marx and Rauh (2010a), which considers state plans, provides a detailed account of our methodology. The basic challenge is that plans are discounting cash flows using a simple discounted cash flow formula:

$$L_{i,\text{stated}} = \sum_{t=1}^{T} \frac{C_{i,t}}{\left(1 + r_{i,\text{stated}}\right)^{t}}.$$

However, plans do not report the cash flows ($C_{i,t}$), which appear in the numerator.

Our model delivers a forecast of each plan's cash flow each year in the future under the different accrual concepts. The model uses plan-level information

6. Novy-Marx and Rauh (2010a) also note that if wages are correlated with the stock market over long horizons, some correction for that correlation might be useful in the discount factor, but only for the broader measures. The ABO is independent of future wage growth.

regarding the number of active, retired, and separated workers as well as the benefit factor (that is, the fraction of salary that, when multiplied by years of service, determines a participant's initial benefit), cost of living adjustment, and inflation assumption employed by the plan. We collected that information individually from the CAFRs. The calculation also employs assumptions regarding the relative number of employees and average wages by age and years of service (an "age-service matrix"); salary growth and separation probabilities by age; and the relative number of annuitants and average level of benefits for annuitants of each age.

The benefit calculations assume that the full retirement age is sixty and that a younger retiree can start taking benefits up to five years early by incurring a linear 6 percent benefit reduction for each year that he or she retires before age sixty. The calculation also requires the average salary of the working plan members, which we estimate as $65,182 in 2009.

We project benefits by assuming mortality rates from the RP-2000 tables (Society of Actuaries 2000), which are employed by many state and local governments. We use the tables' combined (employee/retired) healthy rates and assume that participants are evenly divided by gender, that 60 percent are married to a spouse of the same age at the time that they retire, and that plans allow for 50 percent survivor benefits.

We then calibrate each plan's cash flows by adjusting the average salary of the employed and the average benefits of the non-active members. They are calibrated to simultaneously match both the plan's stated accounting liability when capitalized at the city-chosen discount rate using the actuarial method employed by the city and the plan's expected first-year cash flow, which we estimate at 107 percent of the cash flow for the year ending June 2009, based on recent historical cash flow growth.

Some of these calculations require additional data, which we explain here, reflecting assumptions about salaries, years of service, and wages. In particular, we need the distribution of plan participants by age and years of service (age-service matrix) and the average wages of employees in each cell. For that purpose we use the representative average age-service matrix of public plans used in Novy-Marx and Rauh (2010a).[7] We also require salary growth and separation probabilities, by age, for active workers, vectors that also come from Novy-Marx and Rauh (2010a).

Ftn. 7

7. That matrix was based on selecting the ten states with the largest total liabilities and then searching the CAFRs for age-service matrices. The age-service matrices were available for New York, Illinois, Pennsylvania, Ohio, and Texas. While this is the age-service matrix for workers in state-sponsored plans, we expect the age-service profile of local plans to be similar.

Table 3-4. *Distribution of Retirees and Average Annuity, by Age*[a]

Age bracket	*Percent of retirees*	*Average annuity (dollars)*
Under 50	5	22,568
50–54	6	33,457
55–59	11	38,092
60–64	19	37,020
65–69	17	31,908
70–74	14	27,685
75–79	11	25,684
80–84	9	23,159
85–89	5	20,045
90+	3	17,440
Total	100	30,091

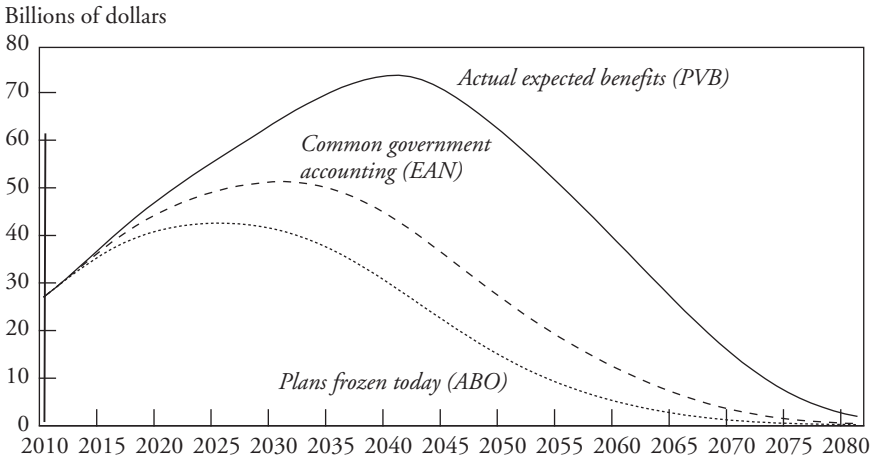
Source: Authors' calculations based on the seventeen Comprehensive Annual Financial Reports mentioned above.

a. The Comprehensive Annual Financial Report for each of the seventy-seven sample plans was searched for distribution of retirees and average annuity by age. That information was provided in seventeen plans: Anne Arundel County Retirement System, Baltimore Employees' Retirement System, City of Philadelphia Municipal Retirement System, Fire and Police Employees' Retirement System of Baltimore, Laborers' and Retirement Board Employees' Annuity and Benefit Fund of Chicago, Metropolitan Water Reclamation District Fund of Greater Chicago, New York City Board of Education Retirement System, New York City Employee Retirement System, New York City Fire Pension Fund, New York City Police Pension Fund, Retirement Plan for Chicago Transit Authority Employees, Retirement System for Employees of the City of Cincinnati, San Joaquin County Employees' Retirement Association, Santa Barbara County Employees' Retirement System, Seattle City Employees' Retirement System, Tacoma Employees' Retirement System, and Teachers' Retirement System of the City of New York. The statistics here represent equal-weighted averages across those plans.

For retired workers, we employ a distribution of retirees by age and the average annuity benefit in each age category. That information is only sporadically disclosed, but by sampling the local CAFRs we obtained an average distribution across seventeen plans covering 274,063 of the 808,214 annuitants in our sample plans. Table 3-4 shows the average fraction of retirees and average annuity in each age group, and the note to the table lists the plans from which the distribution was derived. Over 40 percent of the retirees are under age sixty-five. The average annuity is highest for fifty-five- to fifty-nine-year-olds, at over $38,000, and lowest for the oldest retirees, who presumably retired under less generous benefit regimes. The overall average annuity is $30,000. Tab. 4

The total cash flows delivered by the model are illustrated in figure 3-1. By construction, discounting the dashed line (EAN) in the figure at 8 percent yields a number very close to the stated liability (the only difference being that a few Fig. 1

Figure 3-1. *Projected Aggregate Cash Flows for Seventy-Seven Major Municipal Pension Systems*[a]



Source: Authors' calculations based on our model and inputs from seventy-seven Comprehensive Annual Financial Reports.

a. This figure shows projected aggregate local government cash flows under different accrual methods given public pension promises. Cash flow projections for each local plan are made so that the plan's reported liability equals the discounted value of the cash flow under the municipality's chosen accrual method and reported discount rate.

plans use a method different from the EAN). The solid line shows what would happen to total cash flows across the seventy-seven municipalities if all the plans were frozen today. The benefits would peak at around $42 billion annually in 2025. If plans are not frozen, however, the top line is the best estimate of what actual benefits will be, peaking at over $70 billion around the year 2040. That peak occurs slightly later than the peak calculated for state defined benefit pension plans calculated in Novy-Marx and Rauh (2010a), primarily because retired municipal workers are younger than retired state workers.[8]

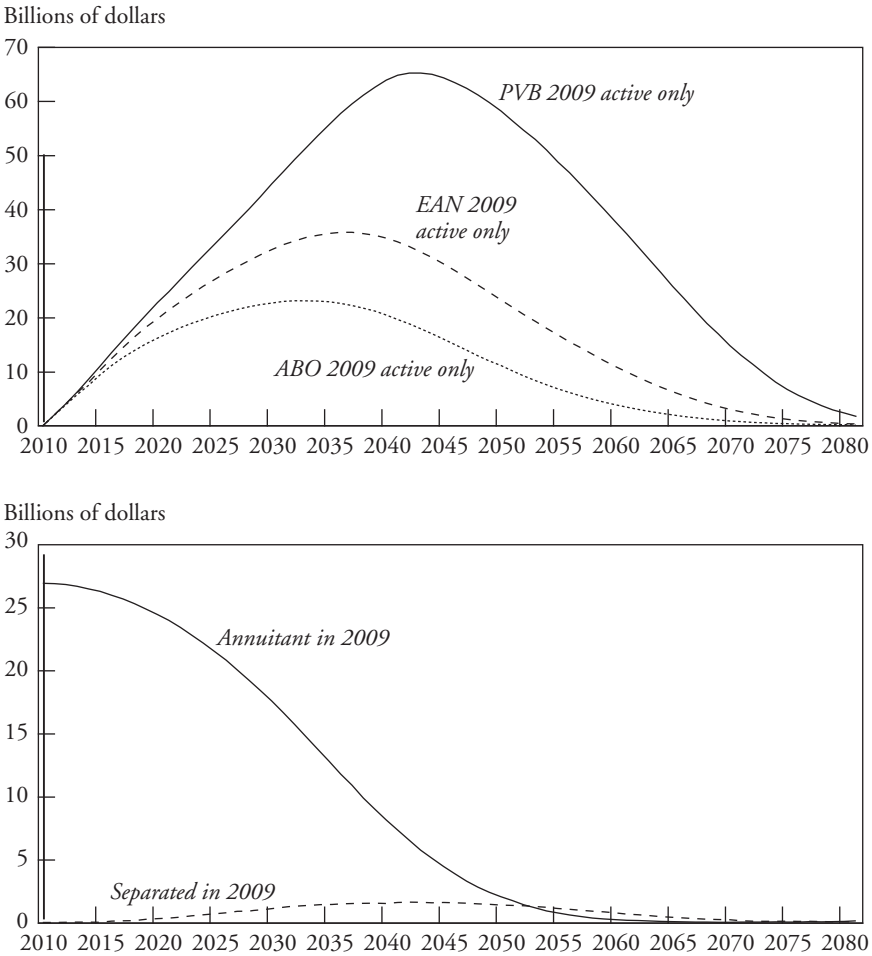
Ftn. 8

Fig. 2

Figure 3-2 breaks the benefits down into cash flows owed to currently active employees (panel A) and to currently retired employees and the remainder, who currently are neither in public employment nor drawing a pension but are entitled to draw a pension at some future date (panel B). The liability due to current annuitants and separated workers is insensitive to the accrual method,

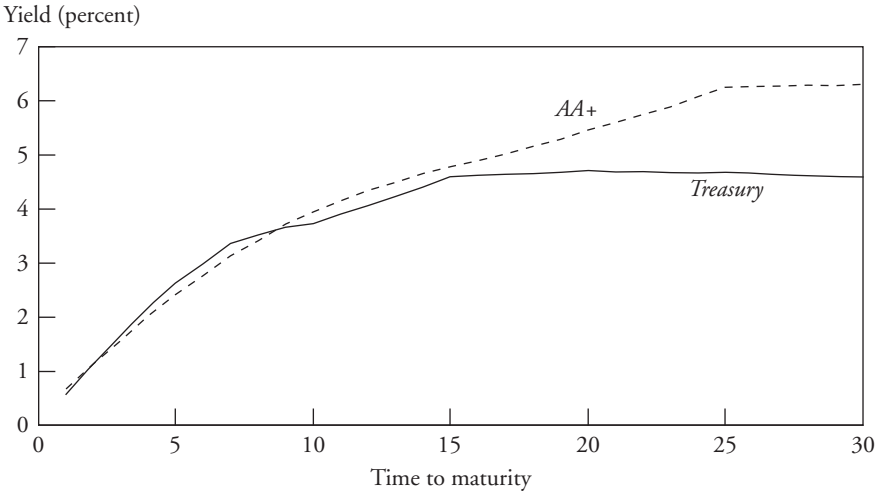
8. For example, while in our sample 11 percent of retired municipal workers are under fifty-five, that is true for only 3.5 percent of retired state workers in Novy-Marx and Rauh (2010a).

Figure 3-2. *Projected Aggregate Cash Flows for Active, Annuitant, and Separated Participants*



Source: Authors' calculations based on our model and inputs from seventy-seven Comprehensive Annual Financial Reports.

Figure 3-3. *Zero-Coupon Yield Curves as of June 30, 2009*[a]



Source: Underlying data were downloaded from the Bloomberg YCRV screen.

a. This graph shows zero-coupon yield curves for Treasuries as well as AA+ municipal bonds as of June 30, 2009. Yields on coupon bonds were collected from Bloomberg. The zero-coupon yields were calculated from strip prices, which we obtained by constructing long-short portfolios of the coupon bonds.

since the accrual method is a question of how to treat future wage growth service by the employees who are currently in active employment.

The Present Value of Pension Promises

Fig. 3 Figure 3-3 shows the alternative discount rates that we apply. This graph shows zero-coupon yield curves for Treasuries as well as AA+ municipal bonds as of June 30, 2009. Yields on coupon bonds were collected from Bloomberg. The zero-coupon yields were calculated from strip prices, which we obtained by constructing long-short portfolios of the coupon bonds.

Tab. 5 Table 3-5 shows the present value of municipal liabilities under the different methods. The first cell in the upper left represents the raw sum of liabilities on an as-reported basis harmonized to June 2009. As explained previously, this starting point for the liability is $488 billion. The other figures in the left column of the table show the sensitivity of the liability to the use of different accrual methods while retaining the municipally chosen discount rate. Moving from the municipally chosen method, which is usually the EAN, to the ABO reduces the liability to $430 billion. Moving to the expansive PVB results in a liability of $581 billion.

Table 3-5. *Municipal Liabilities under Different Discount Rates and Actuarial Methods*
Billions of dollars

	Discount rate		
Participant type and method	*Municipal-chosen*	*Taxable muni*	*Treasury*
Total participants (active + annuitant + separated)			
As stated, unharmonized	$488		
Accumulated benefit obligation (ABO)	430	507	681
Projected benefit obligation (PBO)	477	557	784
Entry age normal (EAN)	489	571	810
Projected value of benefits (PVB)	581	662	1.047
Active participants only			
Accumulated benefit obligation (ABO)	165	190	292
Projected benefit obligation (PBO)	211	240	395
Entry age normal (EAN)	224	254	421
Projected value of benefits (PVB)	315	345	658
Annuitants only	260	310	376
Separated but not yet receiving benefits only	6	6	13

Source: Authors' calculations based on our model and inputs from seventy-seven Comprehensive Annual Financial Reports.

The lower panel of the left column decomposes the total into the member status as of 2009, where the categories are active participants, annuitants, and separated (no longer city-employed) participants not yet drawing benefits. Again, the liability due to current annuitants and separated workers is insensitive to the accrual method, since the accrual method is a question of how to treat future wage growth service by the employees who are currently in active employment. Around 45 percent of the PVB and around 60 percent of the ABO is due to individuals who already are retired.

The middle column of table 3-5 shows the results of discounting the cash flows using the AA+ municipal curve grossed up for a 25 percent tax preference. Focusing on the ABO, that raises the liability to $507 billion, which is 18 percent above the ABO at municipally chosen rates and only slightly above the liabilities on an as-stated basis (since the effect of the higher discount rate is mostly offset by the effect of the narrower accrual method). The PVB at the taxable muni rate is $662 billion, or 36 percent higher than the liabilities on an as-stated basis.

The right column of table 3-5 uses the procedure of discounting at Treasury rates, which we argued above is the preferred procedure for the ABO. Now the ABO is $681 billion. The PVB at Treasury rates is over $1 trillion, but that does not credit states at all for the ability to change the parameters on pensions owed to current employees. Of course, in states that Brown and Wilcox (2009) identifies as having strict constitutional guarantees (including Illinois, New York, and Louisiana), this method may in fact be the most appropriate reflection of the fact that some U.S. taxpayers will ultimately end up paying the expected benefits of all current employees.

Net of the assets in the plans, the unfunded liability is $383 billion using Treasury discounting, or over $5,300 per capita and over $185,000 per member. If on a per-member basis the unfunded liability is the same for the approximately 1 million local workers that are covered by municipal plans not in our sample, the total unfunded liability for all municipal plans in the United States is $574 billion.

Tab. 6 Table 3-6 breaks down that calculation by sponsoring city or county and sorts the cities and counties in descending order of unfunded liability per household at Treasury rates.[9] Chicago is at the top of the list, with unfunded liabilities of $41,966 per city household, based on a per-person unfunded liability of $15,718. Note that represents the unfunded liability that would be owed even if all the Chicago plans were frozen today. New York City comes in second, with $38,886 per household; San Francisco third, with $34,940 per household; and Boston fourth, with $30,901 per household. In aggregate, each municipal household in the fifty cities and counties in our study owes $14,165 to current and retired employees of local pension systems.

Ftn. 9

Solvency Horizons for Local Systems

Here we examine the systems in the alternative way considered for states in Rauh (2010). We calculate how long the assets in the funds as of June 2009 could pay for benefits that were already promised as of 2009, assuming that targeted investment returns are in fact achieved. This method assumes that cities fully fund all future benefit accruals but do not make progress toward correcting the unfunded legacy liabilities. To the extent that the cities do make progress toward correcting the unfunded liability with large future contribution increases, they can potentially delay the day of reckoning. To the extent that the 8 percent returns

9. To calculate these figures, we collect 2009 population figures from the U.S. Census Bureau table "Annual Estimates of the Resident Population for Incorporated Places over 100,000" for cities and "Resident Population Estimates for the 100 Largest U.S. Counties." We then assume 2.67 people per household, consistent with the 2000 census data on household composition.

Table 3-6. *Municipal Liabilities in Descending Order of Unfunded Liability per Capita*[a]

Local government (number of plans)	*Liabilities, stated basis, June 2009 (billions of dollars)*	*Liabilities (ABO), Treasury rate*	*Net pension assets (billions of dollars)*	*Unfunded liability (billions of dollars)*	*Unfunded liability/revenue (percent)*	*Unfunded liability perhousehold (dollars)*
Chicago (7[b])	46.3	66.6	21.8	44.8	763	41,966
New York City (5)	155.8	214.8	92.6	122.2	276	38,886
San Francisco (1)	16.3	22.6	11.9	8.7	306	34,940
Boston (1)	7.4	11.0	3.6	7.5	430	30,901
Detroit (2)	8.1	11.0	4.6	6.4	402	18,643
Los Angeles (3)	34.6	49.3	23.2	26.1	378	18,193
Philadelphia (1)	9.0	13.0	3.4	9.7	290	16,690
Cincinnati (1)	2.2	3.2	1.2	2.0	321	15,681
Baltimore (2)	4.4	6.4	2.7	3.7	260	15,420
Milwaukee (1)	4.4	6.7	3.3	3.4	687	14,853
Fairfax County (4)	8.3	11.1	5.5	5.6	169	14,415
Hartford (1)	1.2	1.6	0.9	0.7	249	14,333
St. Paul (1[c])	1.5	2.2	0.8	1.4	464	13,686
Jacksonville (2)	4.1	6.0	2.0	4.0	278	12,994
Dallas (2)	7.4	10.8	4.6	6.3	298	12,856
Contra Costa County (1)	6.3	8.7	3.7	5.0	425	12,771
Santa Barbara County (1)	2.3	3.3	1.4	1.8	329	11,995
Kern County (1)	4.2	5.6	2.0	3.6	612	11,919
San Jose (2)	5.4	7.5	3.4	4.1	321	11,391
Houston (3)	11.1	16.4	7.2	9.1	356	10,804

(continued)

Table 3-6. *Municipal Liabilities in Descending Order of Unfunded Liability per Capita*[a] (continued)

Local government (number of plans)	*Liabilities, stated basis, June 2009 (billions of dollars)*	*Liabilities (ABO), Treasury rate*	*Net pension assets (billions of dollars)*	*Unfunded liability (billions of dollars)*	*Unfunded liability/revenue (percent)*	*Unfunded liability perhousehold (dollars)*
Nashville/Davidson County (1)	2.9	4.1	1.8	2.3	151	10,048
Arlington County (1)	1.5	2.0	1.2	0.8	103	10,000
Miami (2)	2.3	3.3	1.7	1.6	318	9,689
San Mateo County (1)	3.0	4.1	1.6	2.5	413	9,415
Seattle (1)	2.6	3.6	1.5	2.1	165	9,125
San Joaquin County (1)	2.7	3.8	1.5	2.3	525	9,119
Tacoma (1)	1.1	1.4	0.8	0.7	198	9,082
Sacramento County (1)	6.7	8.9	4.4	4.5	452	8,582
Memphis (2)	3.5	4.6	2.5	2.1	291	8,432
Fresno County (1)	3.6	5.1	2.3	2.9	843	8,401
Sonoma County (1)	2.0	2.6	1.1	1.5	397	8,394
Orange County (1)	11.5	15.6	6.2	9.3	604	8,233
Ventura County (1)	3.5	4.9	2.4	2.5	352	8,195
Montgomery County (1)	3.5	5.1	2.1	3.0	91	8,118
Alameda County (1)	5.7	8.0	3.8	4.2	353	7,579
Los Angeles County (1)	44.5	60.0	32.4	27.6	367	7,473
Fort Worth (1)	2.3	3.3	1.4	2.0	300	7,212
Anne Arundel County (1)	1.7	2.4	1.0	1.4	111	7,081
San Bernardino County (1)	7.0	9.6	4.5	5.1	407	6,716

Stanislaus County (1)	1.6	2.4	1.1	1.3	486	6,698
Baltimore County (1)	2.6	3.5	1.6	1.9	113	6,577
San Diego County (1)	9.2	13.4	6.2	7.2	631	6,329
DeKalb County (1)	1.8	2.3	1.0	1.4	186	4,873
Cook County (2)	10.9	14.3	6.1	8.2	365	4,112
Tulare County (1)	1.0	1.4	0.8	0.7	392	4,068
Fresno City (2)	1.6	2.4	1.7	0.7	172	3,647
Fulton County (1)	1.5	2.1	0.9	1.3	142	3,276
San Antonio (1)	2.4	3.4	1.8	1.7	140	3,201
Phoenix (1)	2.5	3.3	1.4	1.9	111	3,176
Tampa (2)	1.3	2.0	1.7	0.3	57	2,309
Total (78)	488.3	681.0	298.3	382.7		
Value-weighted					320	14,165
Equal-weighted					337	11,421

Source: Authors' calculations based on our model and inputs from seventy-seven Comprehensive Annual Financial Reports.

a. The first column shows liabilities on a stated basis as aggregated from government reports. The second column shows our calculation of accumulated liabilities discounted using the Treasury yield curve as of June 2009. The third column shows net pension asset. The fourth column shows the unfunded liability in dollar terms as of June 2009. The fifth shows the June 2009 unfunded liability as a share of 2006 revenue, where 2006 is the latest year for which detailed city and county revenues were available from the U.S. Census of Governments Tables on State and Local Government Finances (U.S. Census Bureau 2006). To calculate per household figures, we collect 2009 population figures from the U.S. Census Bureau table "Annual Estimates of the Resident Population for Incorporated Places over 100,000" (U.S. Census Bureau 2009a) for cities and "Resident Population Estimates for the 100 Largest U.S. Counties" (U.S. Census Bureau 2009b). We then assume 2.67 (two and two-thirds) people per household, consistent with the 2000 census data on household composition.

b. Included in the seven Chicago plans are three plans that are legally sponsored by districts related to Chicago and not fully by the city itself: the Chicago Teachers' Fund, the Metropolitan Water Reclamation District Retirement Fund of Greater Chicago, and the Retirement Plan for Chicago Transit Authority Employees.

c. The plan is the St. Paul Teachers' Association Retirement Fund, sponsored by a school district that is coterminous with the city of St. Paul and that receives funding from a variety of local and state sources.

that governments are hoping for are not achieved, the horizons on which existing assets are sufficient to pay already promised benefits are even shorter.

Various risk factors affect actual run-out dates. Run-outs can happen sooner if workers start retiring early in anticipation of problems, if taxpayers start moving out of troubled states, or if contributions are deferred or not made. Run-outs can happen later if states make fundamental reforms or borrow enough to fill the hole. Run-outs also will happen later if states use future contributions not to fund new benefits but to pay for the benefits of existing workers, although in that scenario run-outs are more likely to happen at some point because states are digging themselves into a deeper and deeper hole.

Tab. 7 The first column of table 3-7 takes a reduced-form approach and simply takes the ratio of 2009 benefits to 2009 assets. For example, the top line shows that for Philadelphia this ratio is 5. If neither benefits nor assets grew at all, Philadelphia could pay that level of benefits for five years out of existing assets. Boston and Chicago could pay for eight years. At the other end of the spectrum, Fresno City could pay for twenty-three years.

Ftn. 10 Of course, benefit cash flows will grow, as shown in figure 3-1, even for the ABO.[10] Assets also are likely to grow through investment returns. The second column of the table assumes that assets earn 8 percent returns and that the assets currently under management plus the annual returns are used to pay benefits that have already been promised under the 2009 ABO. The year listed in column 2 is the year in which the assets will no longer be sufficient to pay the benefits under those assumptions. In Philadelphia, the assets would run out in 2015; in Boston and Chicago, they would run out in 2019.

The remaining columns show that if at that point the municipalities tried to switch to a pay-as-you-go system of paying the promised benefits, substantial shares of revenue would be consumed by benefits. Expected benefits are 25 percent of 2006 city revenues for Philadelphia in 2015; 40 percent of 2006 city revenues for Boston in 2019; and 78 percent of 2006 city revenues for Chicago in 2019. Assuming that city revenues grow at 3 percent a year, expected benefits are 19 percent of projected 2015 city revenues for Philadelphia; 27 percent of projected 2019 city revenues for Boston; and 53 percent of projected 2019 city revenues for Chicago.

Somewhat surprisingly, San Francisco, the city with the third-largest unfunded liability per household, avoids running out of funds until 2032. Its plan members

10. That is, even if promises were frozen at today's levels of service and salary, benefits would still grow because increasing numbers of people are retiring with increasingly generous benefits relative to the numbers and benefits of retirees who are dying.

Table 3-7. *Years That Existing Assets Are Adequate to Pay Accrued Benefits*[a]

Local government	*2009 ratio of benefits to assets*	*Year through which assets earning 8 percent pay ABO cash flows*	*Expected benefits in year following*		
			Millions of dollars	*Percent of 2006 revenue*	*Percent of projected revenue (revenue growth = 3 percent)*
Philadelphia (1)	5	2015	827.2	25	19
Boston (1)	8	2019	695.1	40	27
Chicago (7[b])	8	2019	4,551.1	78	53
Cincinnati (1)	9	2020	218.9	36	24
Jacksonville (2)	9	2020	437.8	31	20
St. Paul (1[c])	8	2020	151.3	49	32
New York City (5)	9	2021	15,976.2	36	23
Baltimore (2)	9	2022	480.1	34	21
DeKalb County (1)	12	2022	215.1	29	18
Fulton County (1)	10	2022	169.1	19	12
Kern County (1)	12	2022	480.4	82	51
Baltimore County (1)	11	2023	308.7	18	11
Detroit (2)	10	2023	872.7	55	33
Fort Worth (1)	12	2023	289.7	44	27
Phoenix (1)	11	2023	305.5	18	11
Sonoma County (1)	12	2023	242.0	65	39
Nashville/Davidson County (1)	11	2024	318.5	21	12
San Joaquin County (1)	14	2024	340.6	78	46
San Mateo County (1)	14	2024	360.7	59	35

(continued)

Table 3-7. *Years That Existing Assets Are Adequate to Pay Accrued Benefits*[a] (continued)

			Expected benefits in year following		
Local government	*2009 ratio of benefits to assets*	*Year through which assets earning 8 percent pay ABO cash flows*	*Millions of dollars*	*Percent of 2006 revenue*	*Percent of projected revenue (revenue growth = 3 percent)*
Seattle (1)	12	2024	310.6	24	14
Contra Costa County (1)	14	2025	795.1	68	39
Cook County (2)	14	2025	1,326.7	59	34
Montgomery County (1)	13	2025	441.8	14	8
Orange County (1)	15	2025	1,508.8	98	56
Anne Arundel County (1)	14	2026	229.8	19	10
Dallas (2)	14	2026	1,048.5	50	28
Fresno County (1)	14	2026	484.1	142	78
Houston (3)	16	2027	1,726.2	67	36
Los Angeles (3)	14	2027	4,586.5	66	36
Miami (2)	12	2027	251.4	51	27
San Jose (2)	16	2027	777.4	61	33
Santa Barbara County (1)	16	2027	330.2	59	32
Alameda County (1)	15	2028	824.4	69	36
Hartford (1)	11	2028	126.2	47	25
Memphis (2)	12	2028	390.9	53	28
Milwaukee (1)	13	2028	612.2	125	65

San Diego County (1)	15	2028	1,362.2	119	62
Stanislaus County (1)	15	2028	236.2	90	47
Fairfax County (4)	14	2029	1,076.0	32	16
San Bernardino County(1)	17	2029	1,116.1	90	45
Ventura County (1)	16	2029	531.2	76	38
Sacramento County (1)	19	2030	1,099.7	110	54
Tacoma (1)	16	2031	159.8	47	22
San Francisco City and County(1)	16	2032	2,595.1	74	34
Los Angeles County (1)	16	2033	6,844.8	91	41
San Antonio (1)	19	2033	431.7	37	16
Tulare County (1)	17	2034	157.0	93	41
Arlington County (1)	17	2038	254.5	32	12
Fresno City (2)	23	Never			
Tampa (2)	14	Never			

Source: Authors' calculations based on our model and inputs from seventy-seven Comprehensive Annual Financial Reports.

a. To be included, a system must pay out more than 20 percent of 2006 revenues at depletion year. The table shows the number of years that existing assets are adequate to pay for already promised benefits. The first column is a simple ratio of benefits to assets. The second column uses ABO cash flows and considers how long the existing assets in the funds can pay for benefits assuming the investment returns are 8 percent.

b. Included in the seven Chicago plans are three plans that are legally sponsored by districts related to Chicago and not fully by the city itself: the Chicago Teachers Fund, the Metropolitan Water Reclamation District Retirement Fund of Greater Chicago, and the Retirement Plan for Chicago Transit Authority Employees.

c. The plan is the St. Paul Teachers' Association Retirement Fund, sponsored by a school district that is coterminous with the city of St. Paul and that receives funding from a variety of local and state sources.

are relatively young, and its liability is disproportionally due to its current work force, not to retirees. Consequently its current pension payouts are low, at least relative to its total liability, and that pushes the run-out farther into the future. In addition, despite San Francisco's extremely large unfunded pension liability, its plan is *relatively* well funded. Only the two municipalities at the bottom of the run-out list, Fresno City and Miami, report higher funding levels than San Francisco.

These measures are meant to convey a sense of the adequacy of existing assets to pay for already promised benefits. Some cities may have plans in place under which future contributions will make up for unfunded legacy liabilities, but such plans often are abandoned in the face of a fiscal squeeze. For example, at the state level, Illinois and New Jersey have contribution requirements that at some point they promised that they would meet. But Illinois is now paying them with borrowed money, and New Jersey is paying only a small fraction of the "required" amount. The city of Chicago has actually received a funding break in the context of a recent reform that affected new workers in Illinois state plans, so that Chicago does not have to contribute $1.2 billion to the fund that it would have had to contribute otherwise (Chicago Tribune 2010). To the extent that cities create and adhere to plans to set aside money to pay for unfunded liabilities, the depletion of the funds can be delayed.

Conclusion

When measured using Treasury yields, the unfunded liabilities of municipal (city and county) pension plans in our sample add $574 billion to the $3 trillion in unfunded state-sponsored plans that we have documented in previous work. On average, each household in the cities and counties involved owes $14,165 in the form of off-balance sheet debt to current and former municipal public employees, under the narrowest accounting measures, calculated strictly on the basis of work already performed and current levels of public employee wages and salaries. Under broader measures the debt is even greater.

Each of these households already owes almost $27,000 for its share of the $3 trillion state pension debt. The $14,165 of local debt raises the burden for each household in our sample by over 50 percent. If each metropolitan household were responsible for an equal share of the aggregate city and state unfunded liability, then each household in these areas would owe over $41,000.

These average statistics mask the fact that some cities and states are considerably worse off than others. For example, each household in Chicago owes $42,000 for the Chicago plans plus an additional $29,000 for its share of the Illinois state plans, for a total of $71,000 per household, or around $76 billion. It seems infeasible

that Chicago, a city with approximately $0.3 billion in annual sales tax revenue and $0.8 billion in annual property tax revenue, can come up with payments for legacy liabilities of that magnitude. It seems more likely that the state of Illinois will end up bailing out Chicago, in which case all Illinois households will end up owing around $42,000. If that would in turn bankrupt Illinois, then the federal government might have to backstop the Illinois liabilities. The distribution of the unfunded liability across different types of taxpayers is an unresolved matter.

Part of the uncertainty stems from the fact that residents of one metropolitan area can move to another area in response to tax increases or spending cuts. At the metropolitan level the situation is especially stark, as residents can move to suburban areas in response to increased taxes and service cuts in urban areas. The fact that such a large burden of public employee pensions is concentrated in urban metropolitan areas threatens the long-run economic viability of those areas.

County tax systems and state allocation formulas may play a role in reallocating resources, which might limit the ability of households to flee to nearby suburbs. However, the economic incentives are especially strong when a city borders on other cities, or even other states, that are in better financial health. For example, New Hampshire is just over thirty miles from downtown Boston; Delaware is only around twenty miles from downtown Philadelphia; Indiana is less than twenty miles from downtown Chicago; and Kentucky is only five miles from downtown Cincinnati.

What is clear is that state and local governments in the United States have massive public pension liabilities on their hands and that they are not far from the point where those liabilities will impact their ability to operate. Given the legal protections that many states accord to liabilities, which in a number of cases derive from state constitutions, attempts to limit liabilities with benefit cuts for existing workers will go only so far (Brown and Wilcox 2009; Novy-Marx and Rauh 2010b). The question going forward is how the burden will be distributed between urban and non-urban areas, between state and local governments, among the more and less fiscally responsible states, and between local governments and the federal government. If that question remains unresolved, state and local fiscal crises may translate into losses for municipal bondholders.

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