The Crisis in Local Government Pensions in the United States*

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Abstract

We calculate the present value of local government employee pension liabilities as of June 2009 for approximately 2/3^{rds} of the universe of local government employees. Using local government accounting methods, the total unfunded liability in these areas is $190 billion or over $7,000 per municipal household. When government accounting is corrected by discounting already-promised benefits at zero-coupon Treasury yields, the total unfunded obligation is $383 billion or over $14,000 per local household. If on a per-member basis the unfunded liability is the same for the 1/3rd of workers covered by municipal plans not in our sample, the total unfunded liability for all municipal plans in the U.S. is $574 billion. This unfunded promise is above and beyond the roughly $3 trillion (or almost $27,000 per household) unfunded liability of all state-sponsored pension plans in the U.S. Many U.S. cities are therefore carrying substantial off-balance-sheet debt in the form of unfunded pension obligations. We also identify 6 major municipalities whose current pension assets would only be sufficient to pay already-promised benefits through 2020, and 20 whose current pension assets would only be sufficient to pay already-promised benefits through 2025.

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Introduction

State and local governments follow the same accounting framework for measuring the value of their pension promises. The statement that governs their disclosures is Government Accounting Standards Board (GASB) statement 25, which stipulates that benefit promises are to be discounted at an assumed return on pension plan assets. This assumed return determines how the future stream of cash benefits that the state or local government has promised gets 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 before (Novy-Marx and Rauh (2009, 2010a, 2010b)), this system misrepresents the value of pension promises. The field of financial economics is unified on the concept that the present value of a stream of cash flows is a function of the risk of the cash flows themselves. The value of a liability therefore depends on the risk 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 an investment in the stock market. By doing so, they would increase the expected rate of return on their assets, and get to use this 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 50 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 50 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 paper, we examine municipal pension promises. In particular, we apply financial valuation to 77 pension plans sponsored by 50 major cities and counties. This sample represents all non-state 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, there are a total of 3.03 million individuals covered by 2,332 local pension plans in the United States.[1] Thus, while we capture only 3% of municipal pension plans, we capture about 2/3rd of the universe of municipal workers.

According to the latest reports issued by the governments themselves, these municipalities have $488 billion in liabilities. When we reverse engineer the cash flows and limit the recognition to only those benefits that have been promised based on today's service and salary, this figure drops to $430 billion. When we use taxable AA+ municipal yield curves to discount them, we obtain liability measures that are around 18% larger. When we use the Treasury yield curve, we find a total liability of $681 billion, which is 39% above the stated level and 58% 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 not in our sample, the total unfunded liability for all municipal plans in the U.S. would be $574 billion.

The muni discounting method credits cities that experience ratings downgrades with lower liabilities. If local taxpayers could default, or put the responsibility to pay pensions back to some other entity, in the same states of the world as city municipal defaults, then muni discounting would represent

[1] See the 2008 survey of State & Local Government Employee Retirement Systems: http://www2.census.gov/govs/retire/2008ret05a.xls .

their 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 discounting using Treasury yields.

For the states, implementing Treasury discount rates increases total liabilities by around 66%, whereas in the municipalities we study the impact is somewhat smaller at 39%. This reflects the fact that the retired member share in the municipal plans averages 43%, while the retired member share in the state plans averages only 36%. 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 large. The 50 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 full 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 full years of revenue. Thus, relative to the public entity's current tax resources, the extent of the gap between assets and liabilities in the municipal is almost exactly the same as in state plans.

This paper proceeds as follows. In Section 1 we present the sample and our calculations of municipal pension liabilities under current reporting. In Section 2 we review the different methods of recognizing accruals and the arguments about appropriate discount rates. Section 3 presents our model for translating among liability concepts and for calculating municipal pension liabilities using different yield curves. In Section 4 we describe the present value calculations under alternative yield curves. In Section 5 we calculate the number of years that the existing assets of each municipality could pay benefits at currently promised levels. Section 6 summarizes and concludes.

1. Sample and Municipal Pension Obligations Under Current Reporting

The sample consists of 77 defined benefit pension systems sponsored by local governments. The sample was identified using the detailed 2006 data from the U.S. Census of Governments. We first selected all plans with more than $1 billion of assets as of 2006, the latest year for which the detailed census of state and local government retirement systems was available. This amounted to 78 plans. We then added any other plans sponsored by the same local government entities with at least $100 million in assets, yielding a total of 90 plans, so as to ensure that for any of the municipalities in our sample, all substantive pension plans would be counted.[2] We then constructed a unique dataset by searching the local government websites for the Comprehensive Annual Financial Reports (CAFRs) of these plans. Due to data availability issues, we were also forced to discard the plans from several major municipalities including Denver (CO), Austin (TX) and Minneapolis (MN). The final sample is 77 pension systems in 50 major municipalities.

Table 1 presents summary statistics on the membership of these 77 systems, as well as membership data for the largest 10 plans by total membership. There are 2.04 million workers in these plans, compared to 3.03 million total workers covered by local government pension plans in the U.S. Census of Governments. On average, 53% 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.

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 these 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

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

must be harmonized to a June 2009 reporting date.[3] Assuming a 6% benefit growth rate (which actually is conservative relative to the rate that stated benefits have been growing), we arrive at total liabilities of $488 billion as of June 2009 on a stated basis.

Re-discounting 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 a calibrated model and a series of assumptions. We explain the calibration itself in section 3.

2. 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. This method ignores two issues. First, it relies strictly on the liability concept that state actuaries choose without a consideration of what liabilities are actually being recognized. Second, adding liabilities disclosed in the CAFRs takes as given whatever discount rate the state actuaries have chosen.

A. Liability Concepts

There are four different liability concepts that we consider: Accumulated Benefit Obligation (ABO), Projected Benefit Obligation (PBO), Entry Age Normal (EAN), and Projected Value of Benefits (PVB). We begin this section by describing these concepts.

The narrowest measure is the ABO. It reflects benefits already promised and accrued. In other words, even if the pension plans could be completely frozen, a city would still contractually owe these benefits. The ABO is not affected by uncertainty about future wages and service, as the cash flows

[3] 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).

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, and in particular the magnitude of COLA adjustments in cities where COLAs are linked to official statistics such as CPI inflation.

The ABO is often thought of as a "termination liability," i.e. 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 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 will take benefits at the earliest advantageous date, which typically will be 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 wage 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 will 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 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 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. The PBO and the EAN are therefore 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 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 wages and future service.

Table 2 summarizes the liability concepts. Further details, including formulas, are provided in Novy-Marx and Rauh (2010a). We note that none of these methods account for the expected benefits that will be owed to workers who have not yet been hired.

B. Discount Rates

As explained in Novy-Marx and Rauh (2009, 2010), 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)), and in particular their covariance with priced risks (Treynor (1961), Sharpe (1964), Lintner (1965)).

Governments discount the liabilities at a flat rate, and usually this rate is very close to 8%. As shown in Table 3, the mean discount rate for the 77 systems in our sample is 8.03%, the median rate is 8.00%, and the standard deviation is 0.36%. The model rate is 8.00%, used by 33 of the 77 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% over the past decades. But again, this assumes that the 8% was obtained without any risk. In fact, these returns were obtained by taking investment risk, and if the assets had not returned 8%, 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) employ 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% 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 this defaultable liability from the perspective of the taxpayers under the assumption that the municipalities will default on these payments in the same states of the world as on their general obligation debt and with the same recovery rates. Alternatively, it is the value of the portfolio of local GO bonds 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 how big the shift is in the value of these 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 rule lets corporations discount pension obligations at high-grade corporate bond rates. Discounting local pension obligations at municipal bond rates bears similarity in that the creditworthiness of the asset class (municipal or corporate bonds) plays a role. In

this paper, we assume that the AA+ yield curve would be appropriate for all municipalities under this procedure.[4]

Crediting governments by reducing pension liabilities based on GO default premiums leads if anything to an understatement of the liability to the taxpayer. Most importantly, benefits are often given special protections in state constitutions as well as through 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, CA). Even if cities were to default on pension promises, pension obligations might well have a higher recovery rate than GO debt. Somewhat offsetting this is the possibility that municipalities might receive a bailout from state or federal government for these pension promises (consider Harrisburg, PA 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 US taxpayers.

Using the Treasury yield curve values the pension benefits as secure promises. The Treasury valuations begin 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 these transfers would reduce the value of the payments to the participants but also reduce the cost to the taxpayer. The 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

[4] 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 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.

discount at default-free rates. If a local pension system wanted to contract out the provision of the benefits to an insurer who would make the benefit payments even if the municipality in the future 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. This 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 these factors priced into the Treasury curve, default-free public pension obligations are not equivalent to Treasuries.[5]

3. Calculating Liabilities Under Different Accrual Concepts and Discount Rates

[5] 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.

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:

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

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 regarding the number of active, retired and separated workers, as well as the benefit factor (i.e., the fraction of salary which, when multiplied by years of service, determines a participant's initial benefit), cost of living adjustment (COLA) and inflation assumption employed by the plan. We collect this 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"), as well as salary growth and separation probabilities by age, and the relative number and average level of benefits for annuitants of each age.

The benefit calculations assume a full retirement age of 60, and that younger retirees can start taking benefits up to five years early by incurring a linear 6% benefit reduction for each year a participant retires before age 60. The calculation also requires the average salary of the working, which we estimate as $65,182 in 2009.

Benefits are projected assuming mortality rates from the RP-2000 tables, 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 at the time they retire to a spouse of the same age, and that plans allow for 50 percent survivor benefits.

We then calibrate each plan's cash flows by adjusting the average salary level of the employed and the average benefits of the non-active members. They are calibrated to simultaneously match both

1.) the plan's stated accounting liability when capitalized at the city-chosen discount rate using the actuarial method employed by the municipality; and 2.) the plan's expected first year cash flow, which we estimate at 107% 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 (an "age-service matrix"), and the average wages of employees in each cell. For this purpose we use the representative average age-service matrix of public plans used in Novy-Marx and Rauh (2010a).[6] We also require salary growth and separation probabilities, by age, for active workers, vectors that also come from Novy-Marx and Rauh (2010a).

For retired workers, we employ a distribution of retirees by age and the average annuity benefit in each age category. This information is only sporadically disclosed, but by sampling the local CAFRs we obtained an average distribution across 17 plans covering 274,063 million out of the 808,214 annuitants in our sample plans. Table 4 shows the average fraction of retirees and average annuity in each age group, and the note to Table 4 lists the plans from which this distribution was derived. Over 40% of the retirees are under age 65. The average annuity is highest for 55-59 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.

The total cash flows delivered by the model are illustrated in Figure 1. Discounting the dashed line (EAN) in Figure 1 at 8% by construction will yield a number very close to the stated liability (the only difference being that a few plans use a method different from the EAN). The solid line shows what

[6] This matrix was based on selecting the 10 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.

would happen to total cash flows across the 77 municipalities if the plans were all 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. This peak occurs slightly later than that 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.[7]

Figure 2 breaks these down into cash flows owed to currently active employees (top graph), the currently retired (bottom graph) and the remainder, who are neither currently in public employment nor drawing a pension but are entitled to draw a pension at some future date. 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.

4. The Present Value of Pension Promises

Figure 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 30 June 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.

Table 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

[7] For example, in our sample 11% of retired municipal workers are under 55, compared to 3.5% of retired state workers in Novy-Marx and Rauh (2010a).

municipally-chosen method, which is usually EAN, to an ABO reduces the liability to $430 billion. Moving to the expansive PVB results in a liability of $581 billion. 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% of the PVB and around 60% of the ABO is due to individuals who are already retired.

The middle column of Table 5 shows the results of discounting the cash flows using the AA+ municipal curve grossed up for a 25% tax preference. Focusing on the ABO, this raises the liability to $507 billion, which is 18% 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% higher than the liabilities on an as-stated basis.

The right column of Table 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 this 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) identify 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 U.S. would be $574 billion.

Table 6 breaks down this calculation by sponsoring city or county, and sorts in descending order of unfunded liability per household at Treasury rates.[8] 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 this 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 50 cities and counties in our study owes $14,165 to current and retired employees of local pension systems.

5. How Long Will the Systems Last?

In this section we examine the systems in the alternative way considered for states by 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 will fully fund all future benefit accruals but will not make progress towards correcting the unfunded legacy liabilities. To the extent that the cities do make progress towards correcting the unfunded liability with large future contribution increases, they can potentially delay the day of reckoning. To the extent that the 8% returns 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 could happen sooner if workers start retiring early in anticipation of problems, if taxpayers start moving out of troubled states, or if

[8] 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 (2 2/3rds) people per household, consistent with the 2000 census data on household composition.

contributions are deferred or not made. Run-outs could happen later if states make fundamental reforms or can borrow enough to fill the hole. The run-outs also would happen later if states use future contributions not to fund new benefits but rather to pay for the benefits of existing workers, although in that scenario the run-outs would be more likely to happen at some point as states are digging themselves into a deeper and deeper hole.

The first column of Table 7 takes a reduced-form approach and simply takes the ratio of 2009 benefits to 2009 assets. For example, the top line shows that this ratio for Philadelphia is 5. If neither benefits nor assets grow at all, Philadelphia could pay this level of benefits for 5 years out of existing assets. Boston and Chicago could pay for 8 years. At the other end of the spectrum, Fresno City could pay for 23 years.

Of course, benefit cash flows will grow, as shown in Figure 1, even for the ABO.[9] Assets are also likely to grow through investment returns. The second column of the table assumes that assets earn 8% returns, and that the assets currently under management plus these 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 these benefits under these 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 these municipalities tried to switch to a pay-as-you-go system of paying the promised benefits, substantial shares of revenue will be consumed by benefits. Expected benefits are 25% of 2006 city revenues for Philadelphia in 2015; they are 40% of 2006 city revenues for Boston in 2019; and they are 78% of 2006 city revenues for Chicago. Assuming city revenues grow at 3% per year, expected benefits are 19% of projected 2015 city revenues for

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

Philadelphia; they are 27% of projected 2019 city revenues for Boston; and they are 53% of projected 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 are relatively young, and its liability is disproportionally due to its current work force, not retirees. Its current pension payouts are consequently low, at least relative to its total liability, and this pushes the run-out farther into the future. Additionally, 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 give a sense of the adequacy of existing assets to pay for already promised benefits. Some cities may have plans in place by which future contributions will make up for unfunded legacy liabilities, but such plans are often abandoned in the face of a fiscal squeeze. For example, at the state level, Illinois and New Jersey have contribution requirements which at some point they promised they would meet. But Illinois is now paying them with borrowed money, and New Jersey is only paying a small fraction of the "required" amount. The city of Chicago has actually received a funding holiday in the context of a recent reform that affected new workers in Illinois state plans. 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.

6. Conclusion

When measured using Treasury yields, unfunded liabilities of municipal (city and county) pension plans add $574 billion to the $3 trillion in unfunded state-sponsored plans that we have documented in previous work. On average, each household in these cities and counties 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 this debt is even greater.

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

On the one hand, 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 just for the Chicago plans, plus an additional $29,000 for their share of the Illinois state plans, for a total of $71,000 per household, or around $76 billion. On the other hand, 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 this 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. In turn, if that would bankrupt Illinois, then the federal may 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 this is particularly stark, as residents can move to suburban areas in response to increased taxes and cut services in the urban areas. The fact that there is such a large burden of public employee pensions concentrated in urban metropolitan areas threatens the long-run economic viability of these cities.

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 particularly strong when the city borders on other cities, or even other states, that are in better

financial health. For example, New Hampshire is just over 30 miles from downtown Boston, MA; Delaware is only around 20 miles from downtown Philadelphia, PA; Indiana is less than 20 miles from downtown Chicago, IL; and Kentucky is only 5 miles from downtown Cincinnati, OH.

What is clear is that state and local governments in the US have massive public pension liabilities on their hands, and that we are not far from the point where these will impact the ability of state and local governments 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 these liabilities with benefit cuts for existing workers will only go so far (Brown and Wilcox (2009), Novy-Marx and Rauh (2010b)). The question going forward is one of how this 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 and federal governments. If this question remains unresolved, state and local fiscal crises may translate into losses for municipal bondholders.

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Figure 1: Projected Aggregate Cash Flows for 77 Major Municipal Pension Systems

This figure shows projected aggregate cash flows by local governments due to public pension promises, as would be recognized under different accrual methods. Cash flow projections for each local plan are made so that the local plan's reported liability equals the discounted value of these cash flows under the municipality's chosen accrual method and reported discount rate.

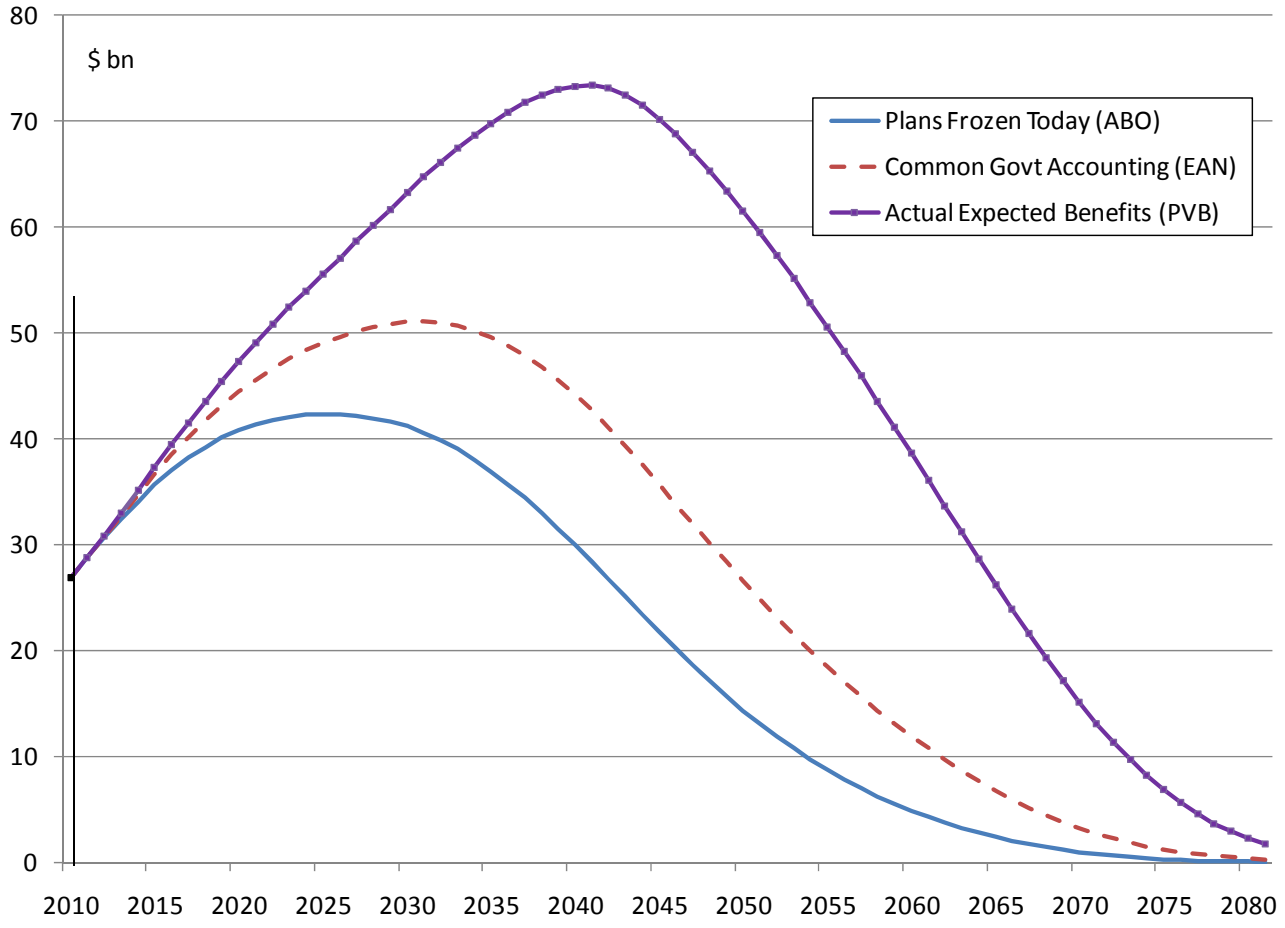
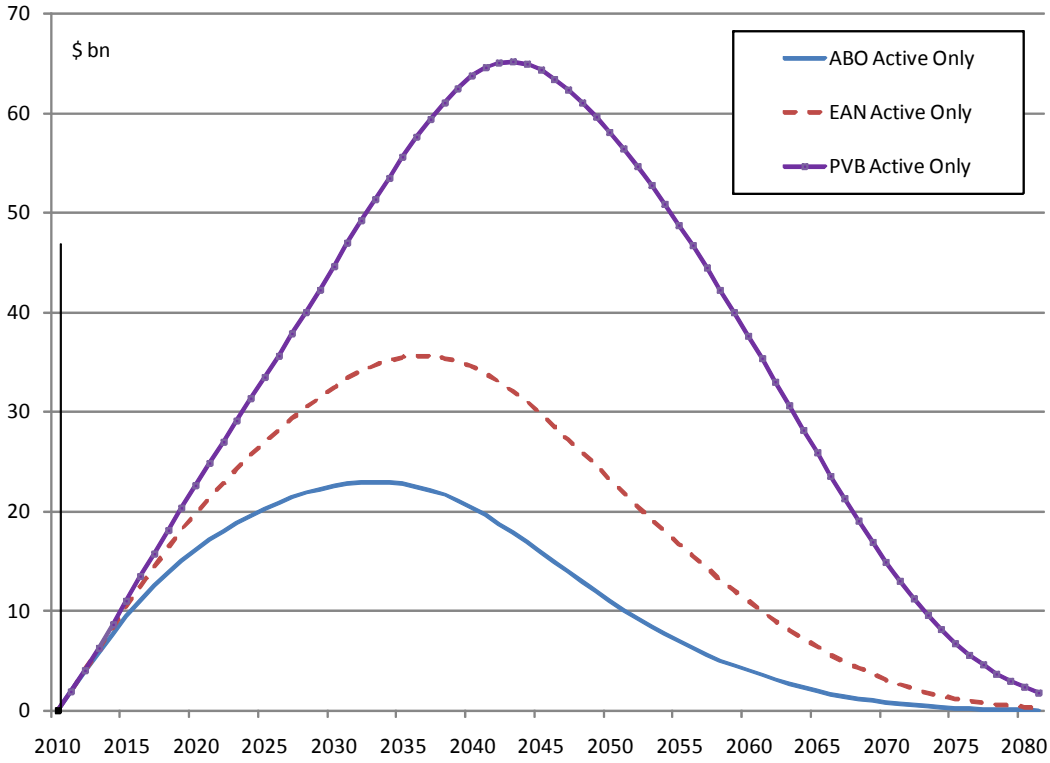


Figure 2: Projected Aggregate Cash Flows for Actives, Annuitants, and Separated



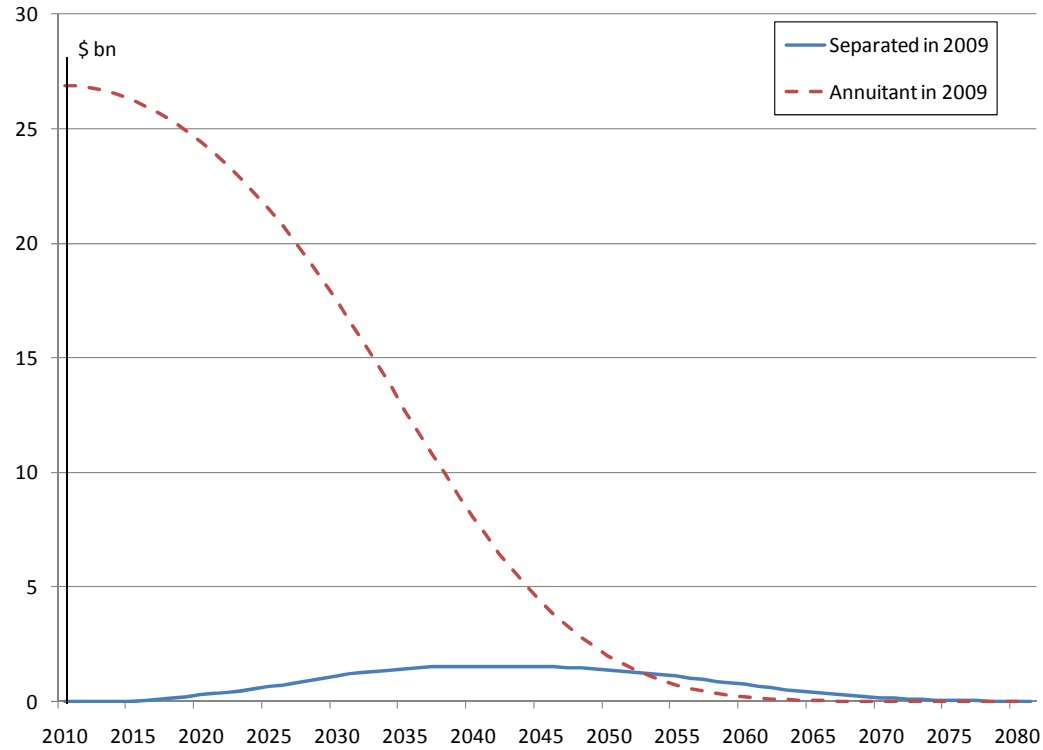


Figure 3: Zero-Coupon Yield Curves as of 30 June 2009

This graph shows zero-coupon yield curves for Treasuries, as well as AA+ municipal bonds as of 30 June 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.

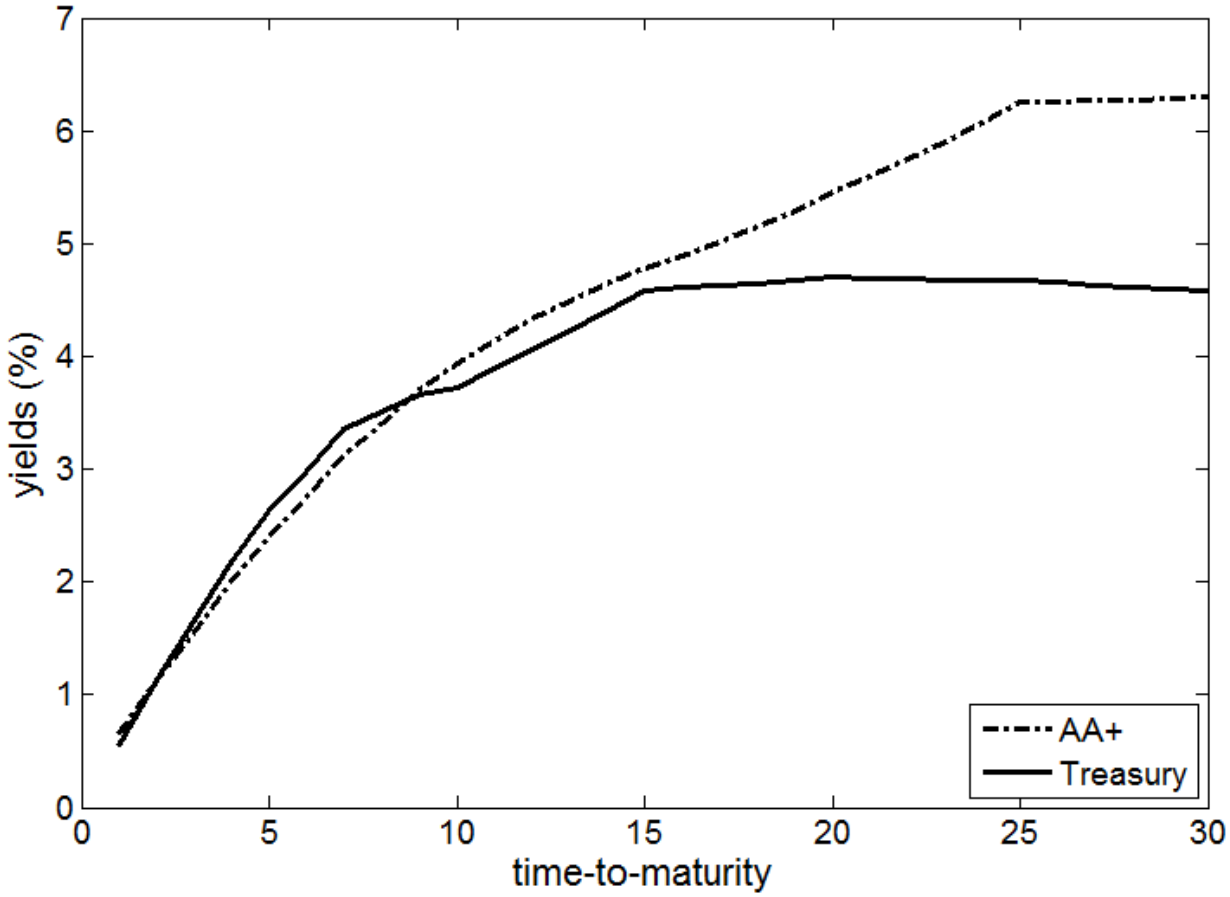


Table 1: Summary of Plans and Participants

The top panel summarizes the numbers 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 is 77 major city and county pension plans sponsored, covering 2/3rds of the universe of workers in municipal pension systems. All major plans in 50 major municipal systems are represented. The bottom panel lists these data for the 10 state-sponsored pension plans that are the largest by total members.

	Member Counts (Number of Plans = 77)				
	Active	Annuitants	Separated & Vested	Total	Active Share
Summary Statistics					
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%
Std Dev	26,675	18,363	2,581	46,840	8%
Largest 10 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%

Table 2: Description of Methods for Recognizing Accrued Liabilities

This 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 only reflects current service and salary and ending with the method that reflects a full projection of benefits that are expected to be paid.

Accumulated Benefit Obligation (ABO)	Represents promised benefits under current salary and years of service. Often used interchangeably with the concepts 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 into account in calculating today's liability, but not future years of service. 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 career.
Present Value of Benefits (PVB)	Full projection of what current employees are expected to be owed if their salary grows and they work/retire according to actuarial assumptions.

Table 3: Discount Rates Used By Municipal Plans (N = 77)

mean	8.03%
median	8.00%
stdev	0.36%
min	7.50%
max	10.00%
number of plans	77

Table 4: Distribution of Retirees and Average Annuity By Age

The CAFRs of the 77 sample plans were searched for distributions of retirees and average annuity by age. This information was provided in 17 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, Teachers' Retirement System of the City of New York. The statistics here represent equal-weighted averages across those plans.

Age Bracket	Fraction of Retirees	Average Annuity
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

Table 5: Municipal Liabilities Under Different Discount Rates and Actuarial Methods

Figures in billions of U.S. dollars	Discount Rate: Municipal-Chosen	Discount Rate: Taxable Muni	Discount Rate: Treasury
Total (Active + Annuitants + 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 Not Yet Receiving Benefits Only	$ 6	$ 6	$ 13

Table 6: Municipal Liabilities in Descending Order of Unfunded Liability Per Capita

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 detailed city and county revenues were available from the U.S. Census of Governments tables on State & Local Government finances. 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" for cities and "Resident Population Estimates for the 100 Largest U.S. Counties." We then assume 2.67 (2 2/3rds) people per household, consistent with the 2000 census data on household composition.

Name (Number of Plans)	Liabilities, Stated Basis, June '09 ($B)	Liabilities (ABO), Treasury Rate	Net Pension Assets ($B)	Unfunded Liability ($B)	Unfunded Liability / Revenue	Unfunded Liability per Household ($)
Chicago (7)	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	13.3	9.3	266%	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)	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
Nashville Davidson (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

Table 7: Years That Existing Assets Are Adequate to Pay Accrued Benefits

To be included, a system must pay out more than 20% of 2006 revenues at depletion year.

	2009 Benefits / Assets (Years)	Assets Earning 8% Pay ABO Cash Flows Through	Expected Benefits in Year Following		
			$ million	share of 2006 revenue	share of projected revenue (g=3%)
Philadelphia (1)	5	2015	827.2	25%	19%
Boston (1)	8	2019	695.1	40%	27%
Chicago (7)	8	2019	4551.1	78%	53%
Cincinnati (1)	9	2020	218.9	36%	24%
Jacksonville (2)	9	2020	437.8	31%	20%
St Paul (1)	8	2020	151.3	49%	32%
New York City (5)	9	2021	15976.2	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	242.0434	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%
Seattle (1)	12	2024	310.599	24%	14%
Contra Costa County (1)	14	2025	795.1	68%	39%
Cook County (2)	14	2025	1326.7	59%	34%
Montgomery County (1)	13	2025	441.8	14%	8%
Orange County (1)	15	2025	1508.8	98%	56%
Anne Arundel County (1)	14	2026	229.8	19%	10%
Dallas (2)	14	2026	1048.5	50%	28%
Fresno County (1)	14	2026	484.1	142%	78%
Houston (3)	16	2027	1726.2	67%	36%
Los Angeles (3)	14	2027	4586.5	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	1362.2	119%	62%
Stanislaus County (1)	15	2028	236.2	90%	47%
Fairfax County (4)	14	2029	1076.0	32%	16%
San Bernardino County (1)	17	2029	1116.1	90%	45%
Ventura County (1)	16	2029	531.2	76%	38%
Sacramento County (1)	19	2030	1099.7	110%	54%
Tacoma (1)	16	2031	159.8	47%	22%
San Francisco City and County (1)	16	2032	2595.1	74%	34%
Los Angeles County (1)	16	2033	6844.8	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			