A HOOVER INSTITUTION ESSAY

Hidden Debt, Hidden Deficits

HOW PENSION PROMISES ARE CONSUMING STATE AND LOCAL BUDGETS

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Most state and local governments in the United States offer retirement benefits to their employees in the form of guaranteed pensions. To fund these promises, the governments contribute taxpayer money to public systems. Even under states' own disclosures and optimistic assumptions about future investment returns, assets in the pension systems will be insufficient to pay for the pensions of current public employees and retirees. Taxpayer resources will eventually have to make up the difference.

Despite the implementation of new Governmental Accounting Standards Board (GASB) guidelines, most public pension systems across the United States still calculate both their pension costs and liabilities under the assumption that their contributed assets will achieve returns of 7.5–8 percent per year. This practice obscures the true extent of public sector liabilities. In order to target such returns, systems have taken increased investment positions in the stock market and other risky asset classes such as private equity, hedge funds, and real estate. The targeted returns may or may not be achieved, but public sector accounting and budgeting proceed under the assumption that they will be achieved with certainty.

Recent GASB statements require new disclosures by public pension systems that shed additional light on the extent of these promises and the rate at which they are growing. This paper uses these new GASB disclosures, known as GASB 67, for two purposes. First, I calculate total unfunded liabilities through fiscal year (FY) 2014 for states and cities using market valuation techniques, specifically estimating for each plan accrued liabilities under risk-free discounting. This exercise can be thought of as uncovering the present value of the debts to public employees that are obscured by flawed pension accounting. Second, I use the GASB 67 disclosures about the changes in the value of pension liabilities during the year to determine the implicit deficits that cities and states are running.

In aggregate, the 564 state and local systems in the United States covered in this study reported $1.191 trillion in unfunded pension liabilities (net pension liabilities) under GASB 67 in FY 2014. This reflects total pension liabilities of $4.798 trillion and total pension assets (or fiduciary net position) of $3.607 trillion. US Census Bureau data indicate that US state and local government retirement systems had $3.7 trillion in assets in FY 2014, so this

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study captures plans that hold 97 percent of the state and local government pension assets in the nation.

GASB procedures guide states and cities to measure their liabilities using their expected returns on the plans' assets. The governments then forecast investment returns on fundamentally risky assets and ignore the risk necessary to target hoped-for returns. The liability-weighted average expected return that plans in this study choose is 7.6 percent.

A 7.6 percent expected return implies that state and city governments are expecting the value of the money they invest today to double every 9.5 years. That means that a typical government would view a promise to make a worker a $100,000 payment in 2026 as "fully funded" even if it had set aside less than $50,000 in assets in 2016; and a payment in 2036 would be viewed as "fully funded" with less than $25,000 in assets in 2016.

What is in fact going on is that the governments are borrowing from workers and promising to repay that debt when they retire. The accounting standards allow the bulk of this debt to go unreported due to the assumption of high rates of return.

One feature of the GASB 67 disclosures is that municipal governments which project an exhaustion of their pension assets at some future date are no longer able to assume the full expected return when reporting the extent of their liabilities. Instead, these troubled plans must use a high-quality municipal bond rate for the pension cash flows that are not covered by the assets on hand and their expected investment returns. However, only 11 percent of the plans in the sample used a lower rate than their expected returns in FY 2014. These sixty-three plans used discount rates that were on average only 1.1 percent below the expected return. The average discount rate overall in the sample is 7.41 percent.

Remarkably, many systems with very low funding ratios assert that assets, investment returns, and future contributions will be sufficient so that their pension funds never run out of money, allowing them to continue to use the high rates under GASB 67.

The GASB disclosures provide interest rate sensitivities for each plan, allowing calculations of the unfunded liability under different discount rates. Among the 564 plans, the liability-weighted average sensitivity of total liabilities to a 1 percent change in the discount rate is 10.4 percent, which also reveals the average maturity of the pension cash flows as shorter-horizon than some observers had assumed previously. The appropriate discount rate for a guaranteed nominal pension is the rate on a government bond with a guaranteed nominal return of that same maturity, so for the average plan it would be a Treasury bond with a roughly ten-year maturity.

A rediscounting of the liabilities at the point on the Treasury yield curve that matches the reporting date and duration of each plan results in a liability-weighted average rate of

2.66 percent and unfunded liabilities of $4.738 trillion. Since not all of these liabilities are accrued, I apply a correction on a plan-by-plan basis (based on Novy-Marx and Rauh (2011a, 2011b)) that results in unfunded *accumulated* benefits of $3.412 trillion under Treasury yield discounting. These are the unfunded debts that would be owed even if all plans froze their benefits at today's promised levels. I refer to this measure as the unfunded market value liability, or UMVL.

The market value of unfunded pension liabilities is analogous to government debt, owed to current and former public employees as opposed to capital markets. This debt can grow and shrink as assets and liabilities evolve.

The way in which pension costs are often informally discussed is at odds with these underpinnings. Total revenue generated by state and local government own sources in 2014 was $1.487 trillion and total government contributions were $108.8 billion, so contributions were 7.3 percent of revenues in 2014. This was more than enough to keep net pension liabilities from rising in 2014. If that were the end of the story, states and cities would seem to be contributing enough at these levels to keep their pension debts from rising.

However, 2014 was a year in which systems realized average investment returns of 14.7 percent on beginning-of-year assets. If the expected rate of return of 7.6 percent had been achieved, but no more, total net pension liabilities would have risen by $28.1 billion. Under the risk-neutral discounting, liabilities would have risen by $151.7 billion. From an *ex ante* perspective, the true annual cost of keeping pension liabilities from rising is $260.5 billion (= $108.8 + $151.7), or 17.5 percent of state and local governments' own source revenues, before any attempt to pay down unfunded liabilities.

Review of Reasons for Risk-Free Discounting

In this section, I briefly review the intuition behind the use of default-free discount rates to measure unfunded accumulated pension liabilities. Brown and Wilcox (2009), Novy-Marx and Rauh (2009, 2011a), and Novy-Marx (2013) describe these points in detail.

The purpose of discount rates in pension calculations is to translate pension promises into a present-value figure that represents the debt that the city or state owes to public employees and retirees. The discount rate also has a large impact on the costs that a government ascribes to an employee working an additional year. The fact that the employee works for an additional year raises the pension that she expects to receive when she retires. The additional cost of providing that pension is a compensation cost that governments must take into account. The higher the discount rate, the lower the deferred compensation cost will appear to be.

The traditional GASB rules encourage state and local governments to consider pension promises fully funded, assuming that the expected return on pension fund assets is met.

The portfolio of risky assets that pension systems invest in, however, exposes the pension system to a distribution of outcomes. The outcome depends on the performance of securities such as stocks, private equity stakes, real estate investments, and hedge fund returns—and increasingly so in recent years as public pension portfolios have shifted toward these asset classes. If a state funds according to traditional GASB rules, it will be fully funded only if the "expected return" in this wide distribution of outcomes is achieved. Pensions must be paid regardless of the performance of the assets.

For example, a return assumption of 7.5 percent is equivalent to assuming that every dollar contributed to a pension system will be worth $2 in ten years' time, $4 in twenty years' time, and $8 in thirty years' time. Targeted returns of 7.5 percent can only be achieved if systems take on substantial investment risk, especially in today's investment environment where safe securities may yield only 2 percent per year over a ten-year horizon.

That a 7.5 percent compound annualized return is wildly optimistic and unlikely to be achieved is clear to most observers of financial markets today. This has been pointed out by investing luminaries such as Michael Bloomberg and Warren Buffett.[1] While some maintain that stocks in the long run are less risky and are likely to march ever upward, the experiences of other countries suggest that one cannot assume that time will bail out pension systems from the possibility of poor stock returns.

For example, the Japanese stock market as represented by the Nikkei 225 rose to a high of 38,916 points at the end of 1989. As of February 2016, the index stands at around 16,200, representing a capital loss of 58.3 percent.[2] In addition, finance academics have written extensively about the problem of parameter uncertainty (Pastor and Stambaugh 2012), or the fact that we simply do not have a long enough history of stock returns to know what the true distribution of stock returns really is.

Beyond the point that 7.5 percent is an optimistic forecast, however, there is a more fundamental point about the nature of pension promises that implies the need to measure pension liabilities using rates on default-free government bonds. A promise to pay retirees a pension is economically equivalent to a promise to make debt payments to investors. Regardless of how pension fund assets perform, the pension payments will still have to be made. Finance is clear that the value of a stream of payments is determined by the risk properties of those payments themselves, having nothing to do with the assets chosen to back them.

As an example, consider an individual who borrows $100,000, due in ten years at 0 percent interest. The individual spends half of the funds today on discretionary spending, such as a trip around the world. The remaining $50,000 is placed in a portfolio of stocks and bonds, which historically has had returns of around 7.5 percent, and these funds are in a dedicated trust to pay off the debt. The individual then goes to a bank to take out a mortgage on his

house and is asked to disclose all his assets and liabilities. Under logic analogous to GASB, this individual could state that his net debts are zero, on the grounds that the $50,000 is presumed to double to $100,000 in ten years to pay off the $100,000 debt. Of course, an individual who neglected to disclose this arrangement would have committed financial fraud, but a government with $50,000 in assets to pay a $100,000 pension payment in ten years is allowed to declare this promise to be "fully funded."

To see that a default-free rate is the correct rate for measuring the value of a promise, one need only put oneself in the shoes of the beneficiary of such a plan who is offered a lump sum buyout by her employer. Suppose an employee is owed a pension that will begin at $100,000 per year in ten years' time, and the employer wants to buy the employee out of one year of payments. That is, the employer wants to offer the employee money today to forgo the first payment that she would receive in ten years. The employer announces that since $50,000 can be invested at 7.5 percent over ten years to pay the first $100,000 payment, it is offering a lump sum payment of $50,000 to the employee in exchange for forgoing the $100,000 payment in ten years.

The only circumstance under which this would seem a good deal to the employee is if the employee believed she were unlikely to live for ten years. Otherwise, the employee is going to point out that the employer has *guaranteed* the pension payment of $100,000 in ten years, whereas investing in risky securities provides only a hope that such an amount can be obtained. Looking at the roughly 2 percent rate of return that can be earned on riskless assets over a ten-year horizon, an employee who was sure she would live for ten more years would demand a payment of around $82,034 (= $100,000/$1.02^{10}$) to forgo the first $100,000 payment.

This logic does not necessarily imply that governments should invest pension money in risk-free assets. It does, however, imply that when measuring the value of the liability, governments should reflect the fact that the liability is a debt that is guaranteed. In the above example, it would be a matter of public choice whether the government should fund the $100,000 payment with $82,034 of ten-year government bonds or whether it should instead invest a smaller amount in a risky portfolio, such as $50,000 in a portfolio with a 7.5 percent targeted return. It must be recognized, however, that the latter is a transfer from future taxpayers to today's taxpayers in the event that the targeted return is not achieved.

Data Sources

State and Local Government Revenue Data

Data on state and local government revenue come from the individual unit file of the US Census of State and Local Government Finance. These files contain detailed financial information on state and local government finances. Two measures of revenue were generated. The first measure is total own revenue, which includes all revenue sources

but excludes (1) the "insurance trust" revenues reflecting the returns of pension funds themselves and (2) intergovernmental revenues, which are primarily transfers from the federal government but also transfers from state governments to local governments and vice versa. The second measure is tax revenues alone. These exclude fees and charges, most of which are for services rendered. The idea here is to consider how state and local governments could pay for unfunded pensions through traditional taxation sources like income taxes, sales taxes, and property taxes. Compared to total own revenue, scaling by tax revenues assumes that states will not raise fees for services such as university tuition to pay for unfunded pension liabilities.

The latest individual unit file available was 2012. In order to estimate 2014 revenues, historical data for the US Census Quarterly Summary of State and Local Tax Revenue were obtained. The percent change in state taxes collected between the second quarter of 2012 and the second quarter of 2014 was applied to the individual government units, both for tax revenue and for total own revenue, to derive estimates for these quantities for 2014. This likely overstates 2014 total own revenues, as it assumes that all other sources of revenue such as charges for services grew at the same rate as tax revenues. It also ignores likely differences in revenue growth rates at the state and local level. The average revenue growth rate across the fifty states was 6.85 percent in total between 2012 and 2014, or a 3.36 percent compound annualized growth rate.

Pension Disclosures from GASB 67 Statements

We collected the GASB 67 disclosures of all state pension systems, plus a sample of local and other municipal plans. The local plans consisted of all municipal plans in the top 170 cities by population according to the US Census and the top seventy counties by population. Additionally, we collected associated school district and transportation authority pension systems where applicable. In order to obtain two state-level case studies, we also collected the full universe of pension plans in California and Connecticut. The result was 564 state and local funds: 266 state funds and 298 local funds. An appendix lists these funds.

The GASB 67 disclosures contain reconciliations of total pension liabilities from the beginning to the end of the fiscal year, as well as reconciliations of total pension assets from the beginning to the end of the fiscal year. The disclosure of total pension liability (TPL) evolves according to the following relation:

$$TPL_{2014} = TPL_{2013} + Service\ Cost_{2014} + Interest\ Cost_{2014} - Benefits\ Paid_{2014} + All\ Other\ Adjustments.$$

The service cost is the present value of new accruals under the GASB 67 discount rate. The interest cost is the cost derived from the fact that the benefits that had already been accrued at the end of FY 2013 come due one year sooner once the end of FY 2014 is reached. All

other adjustments include: Changes in Benefit Terms (+ or –), Differences Between Actuarial Assumptions and Experience (+ or –), Assumption Changes (+ or –).

The disclosure of total fiduciary pension assets, known as the fiduciary net position (FNP), evolves according to the following relation:

$$Assets(FNP)_{2014} = Assets(FNP)_{2013} + Employer\ Contributions_{2014} + Member\ Contributions_{2014} + Other\ Contributions_{2014} + Net\ Investment\ Income_{2014} - Administrative\ Expenses_{2014} + Transfers\ Among\ Employers\ and\ All\ Other\ Adjustments.$$

The unfunded liability under the GASB 67 standards, known as the net pension liability (NPL), is simply $NPL_{2014} = TPL_{2014} - Assets_{2014}$.

It is also straightforward to calculate the additional amount the city or state would have to contribute if only the expected return on assets had been attained (no higher) in order to keep the NPL from rising. This is calculated as:

$$Required\ Additional\ Contribution\ Under\ Expected\ Return = (Service\ Cost_{2014} + Interest\ Cost_{2014}) - (Employer\ Contributions_{2014} + Member\ Contributions_{2014} + Other\ Contributions_{2014}) - Expected\ Return\ \% * FNP_{2013}.$$

The required additional contribution can be thought of as the additional contribution that would have been required in a "normal" year: one in which returns were equal to the plan's expected returns and in which there were no additional changes such as changes in benefit terms or actuarial adjustments. In an *ex ante* sense, the state or city is only running a balanced budget if it contributes these additional contributions above and beyond the contributions already being made. If this required additional contribution is positive and unfunded liabilities did not rise between 2013 and 2014, then it is only the unusually higher investment returns that prevented the unfunded liabilities from rising.[3]

GASB 67 Discount Rates

One feature of the GASB 67 disclosures is that municipal governments which project an exhaustion of their pension assets at some future date are no longer able to assume the full expected return when reporting the extent of their liabilities, but instead must use a high-quality municipal bond rate for the pension cash flows that are not covered by the assets on hand and their expected investment returns. As such, there are sixty-three of the 564 systems covered in this study that used a lower discount rate than their expected return.

The choice to use a lower discount rate was not necessarily made by the systems with the worst funding ratios. For example, the Kentucky Employee Retirement System had only a 22 percent funding ratio for its Nonhazardous Employee Plan but maintained the 7.75 percent discount rate equal to the expected return because, "The projection of cash flows used to determine the discount rate assumed that local employers would contribute the actuarially determined contribution rate of projected compensation over the remaining 29 year amortization period of the unfunded actuarial accrued liability."

In contrast, the Kentucky Teachers Retirement System had a 46 percent funding ratio. It used an expected return of 7.5 percent, but a discount rate of 5.23 percent, stating: "The projection of cash flows used to determine the discount rate assumed that plan member contributions will be made at the current contribution rates and the Employer contributions will be made at statutorily required rates. Based on those assumptions, the pension plan's fiduciary net position was projected to be available to make all projected future benefit payments of current plan members until the 2036 plan year."

The data collection therefore shows that substantial discretion was used in the application of the GASB 67 standards.

Methodology for Unfunded Market Value of Liability

Calculation of the unfunded market value of the liability (UMVL) involves several steps.

Calculation of the Duration and Convexity of the Liability

The first step is to calculate the duration and convexity of the liability. These are parameters that allow for an approximation of the change in value of a bond or a liability when the interest rate used to discount that liability is changed. GASB 67 disclosures require plans to disclose the NPL under alternative assumptions of the discount rate being 1 percentage point higher ($TPL_{R+1\%}$) and 1 percentage point lower ($TPL_{R-1\%}$). The duration is then calculated as

$$Duration = \frac{TPL_{R+1\%} - TPL_{R-1\%}}{2 * TPL_R}$$

and the convexity can be calculated as

$$Convexity = \frac{TPL_{R+1\%} - TPL_{R-1\%} - 2 * TPL_R}{TPL_R * (0.01)^2}.$$

To determine the new value of the liability under a completely different interest rate R', the change in rate is calculate as

$$\Delta R = (R' - R)$$

and the new value of the liability is

$$TPL_{R'} = -Duration * \Delta R + 0.5 * Convexity * (\Delta R)^2.$$

This calculation was possible for all but twenty-one of the plans, for which sufficient information to calculate duration and convexity were not found in the disclosures. Plans in the sample turn out to have a weighted average duration of 10.4 years and an unweighted average duration of 10.8 years, considerably shorter than the often-assumed fourteen years.

Duration-Matched Treasury Yield

Ideally, the entire stream of cash flows would be available and each cash flow would be discounted using the yield at the point on the yield curve that matched that cash flow's maturity, as in Novy-Marx and Rauh (2011a). In the absence of the full cash flows, an approximation is to select a point on the Treasury yield curve that matches the duration of the liability and set R' equal to that rate.

For this purpose, the duration was rounded to the nearest one year; the twenty-one plans for which duration could not be calculated were assigned a value of the sample average of eleven years. Data on the zero-coupon Treasury yield curve were retrieved from Bloomberg for all of the possible fiscal year-end months in the sample. The yield curves were linearly interpolated between ten and fifteen years and between fifteen and twenty years.

For example, the Ohio State Employee Retirement System's fiscal year 2014 ended June 30, 2014, and the duration implied by the disclosures for the main system was 11.12. The duration-matched Treasury yield was the interpolated rate on the Treasury yield curve at eleven years as of June 30, 2014, or R' = 2.79 percent. This rate varies by plan with both the duration of plan liabilities and the fiscal year-end date of the plan.

Market Value of the Liability (MVL): Accumulated Benefits Only

Under GASB 67, the systems use a method of liability recognition known as entry age normal. This method recognizes some benefits that have not yet been formally earned under employee benefit factors. For a proper financial market valuation, the promised pensions should first be adjusted to reflect only accrued benefits, or retirement payments that employees would be entitled to receive under their current salaries and years worked.

Novy-Marx and Rauh (2011a, 2011b) calculate this adjustment for 234 of the larger plans in the sample. The average ratio of accumulated to entry age normal benefits is 0.851. For the

remaining plans, this sample average adjustment factor is applied. The purpose of this step is to reduce the benefits to reflect only liabilities that have been promised to workers based on service and salary in 2014.

Required Additional Contribution under Market-Value Concept

The service cost plus the interest cost can be viewed as the ongoing cost of the plan; these are both different under a default-free yield concept. The service cost will be considerably higher than reported under GASB 67, as the new benefits are being discounted at a much lower rate. However, the interest cost could be higher or lower under a lower rate. While the liability is much larger, the rate applied to that liability to measure the interest cost is much lower. It turns out that the effect of the lower rate on the interest cost dominates, and the interest cost is generally (but not always) smaller under the market-value concept.

To derive the required additional calculation under the market-value concept, I calculate:

$$\begin{aligned} &\textit{Required Addiitonal Contribution Under MVL} \\ &\quad = (\textit{Service Cost}^*_{2014} + \textit{Interest Cost}^*_{2014}) \\ &\quad - (\textit{Employer Contributions}_{2014} + \textit{Member Contributions}_{2014} \\ &\quad + \textit{Other Contributions}_{2014}) - R' * \textit{Assets}_{2013} \end{aligned}$$

where *Service Cost** is the service cost adjusted to the duration-matched Treasury rate *R'*, and *Interest Cost** is the interest rate *R'* times the total liability measured at that rate.

To conclude, under the MVL concept, the service cost is higher but the interest cost is generally lower. In most instances of plans in this sample, the effect of the higher service cost dominates the lower interest cost; moving from the expected return concept to the MVL concept raises the required additional contributions necessary to keep the liability from rising. In some instances, however, the cost of keeping the liability from rising can even be lower under the MVL concept than under the expected return concept.

Results

Aggregate Results

Panel I of Table 1 shows the summary totals for all pension systems in the United States covered in this study. The total pension liability under GASB 67 standards for all state and local funds is $4.798 trillion, which is covered by $3.607 trillion in assets, implying an unfunded liability of $1.191 trillion and a funding ratio of 75.2 percent. As shown in panel II of Table 1, the liability-weighted average discount rate was 7.41 percent.

Under market value standards, the total ABO liability is $7.019 trillion. Compared to the $3.607 trillion in assets, this implies a true unfunded market value liability (UMVL) of

Table 1: Summary Table

$ Amounts in Billions

Number of Plans Total	State Pensions 266	Local Pensions 298	State & Local Pensions 564
I. Assets and Liabilities			
GASB 67 Standards			
Total Pension Liability (TPL)	$4,050	$748	$4,798
Assets	$3,063	$544	$3,607
Net Pension Liability (NPL)	$987	$204	$1,191
Funding Ratio	75.6%	72.7%	75.2%
Market Value Standards			
Accumulated Benefit Obligation (ABO)	$5,920	$1,100	$7,019
Assets	$3,063	$544	$3,607
Unfunded Market Value Liability (UMVL)	**$2,857**	**$556**	**$3,412**
Funding Ratio	**51.7%**	**49.5%**	**51.4%**
II. Discount Rates			
GASB 67 Standards			
Average Discount Rate			
liability-weighted	7.43%	7.24%	7.41%
unweighted	7.29%	7.23%	7.26%
Number of Plans for Which			
Discount Rate < Expected Return	26	37	63
Average difference	0.18%	0.12%	0.15%
Market Value Standards			
Average Discount Rate			
liability-weighted	2.76%	2.73%	2.75%
unweighted	2.70%	2.57%	2.63%
III. Flows			
Benefits Paid	$216.1	$43.1	$259.2
Employer Contributions	$84.8	$24.0	$108.8
Member Contribtutions	$38.4	$5.7	$44.1
Total Contributions	$128.5	$29.9	$158.4
IV. Accrual Basis: Necessary Additional Contributions			
Additional Necessary Contributions			
to prevent rise in NPL under assumed return	$26.1	$2.0	$28.1
to prevent rise in NPL under Treasury rate	$132.7	$19.0	$151.7

$3.412 trillion and a funding ratio of 51.4 percent. The average liability-weighted Treasury discount rate used in this calculation is 2.75 percent.

Panel III of Table 1 shows actual flows into and out of state and local pension systems. These systems paid out $259.2 billion in benefits and collected contributions of $158.4 billion, of which $108.8 billion came from the sponsoring governments. Governments are relying on investment returns to pay for the difference.

However, as explained in the previous section, necessary additional contributions to prevent rising unfunded liabilities are generally larger than the contributions made. Assuming that the expected return had been realized in 2014 and not more, an additional $28.1 billion would have been required. If only the Treasury return is realized, an additional $151.7 billion would have been required. The difference can be thought of as representing the amount by which state and local governments are depending on strong performance of risky assets to keep their unfunded obligations from growing.

From an *ex ante* perspective, the true annual cost of keeping pension liabilities from rising is therefore $260.5 billion (= $108.8 + $151.7). The benefits are guaranteed and any hoped-for returns above a risk-free, guaranteed rate come at the expense of loading risk onto future tax years. These costs amount to 17.5 percent of state and local government own revenue, before any attempt to pay down unfunded liabilities.

Fifty US States

Figure 1 shows the NPL and UMVL liabilities for the twenty-five states for which the UMVL is the largest share of 2012 own revenue. These statistics are for state-sponsored funds only. The left side of the figure shows these unfunded liability measures in dollars, while the right side shows the unfunded liabilities as multiples of 2014 own revenue and tax revenue. Figure 2 shows the same for the twenty-five states for which the UMVL is the smallest share of own revenue. UMVL liabilities run from a minimum of 0.54 times 2014 revenue in North Dakota to 4.46 times 2014 own revenue in Illinois. As a share of tax revenue only, Ohio's UMVL is over six times its revenue.

The statistics in Figures 1 and 2 examine the stock of pension debt as measured by the UMVL. The next analysis examines the flow or "pension deficit," or how much new unfunded liabilities are accrued each year under the different measurement techniques. Figure 3 shows the share of own revenue actually contributed to pension systems in each state, as well as the share that would be required to be contributed to avoid an increase in the unfunded liability. The figure illustrates large differences between the amounts actually contributed and the amounts necessary to contribute to avoid rises in unfunded liabilities. In many states (the ones for which the square markers are to the right of the circular markers), states would have seen the NPL increase had they only realized the expected return on investments for fiscal 2014, as opposed to the higher-than-expected returns for that year. In all states, the contributions required to keep the UMVL from increasing outstripped those actually made, and in many cases substantially so.

For example, in Nevada contributions were 15.9 percent of own revenues in 2014. The NPL declined, as realized returns in Nevada were a full 17.5 percent of prior year fiduciary assets. However, had realized returns only achieved Nevada's assumed rate of return, the state would have had to contribute 22.2 percent of own revenues. Under the risk-neutral

Figure 1: State Pension Liabilities in Relation to Own Revenues: Top 25

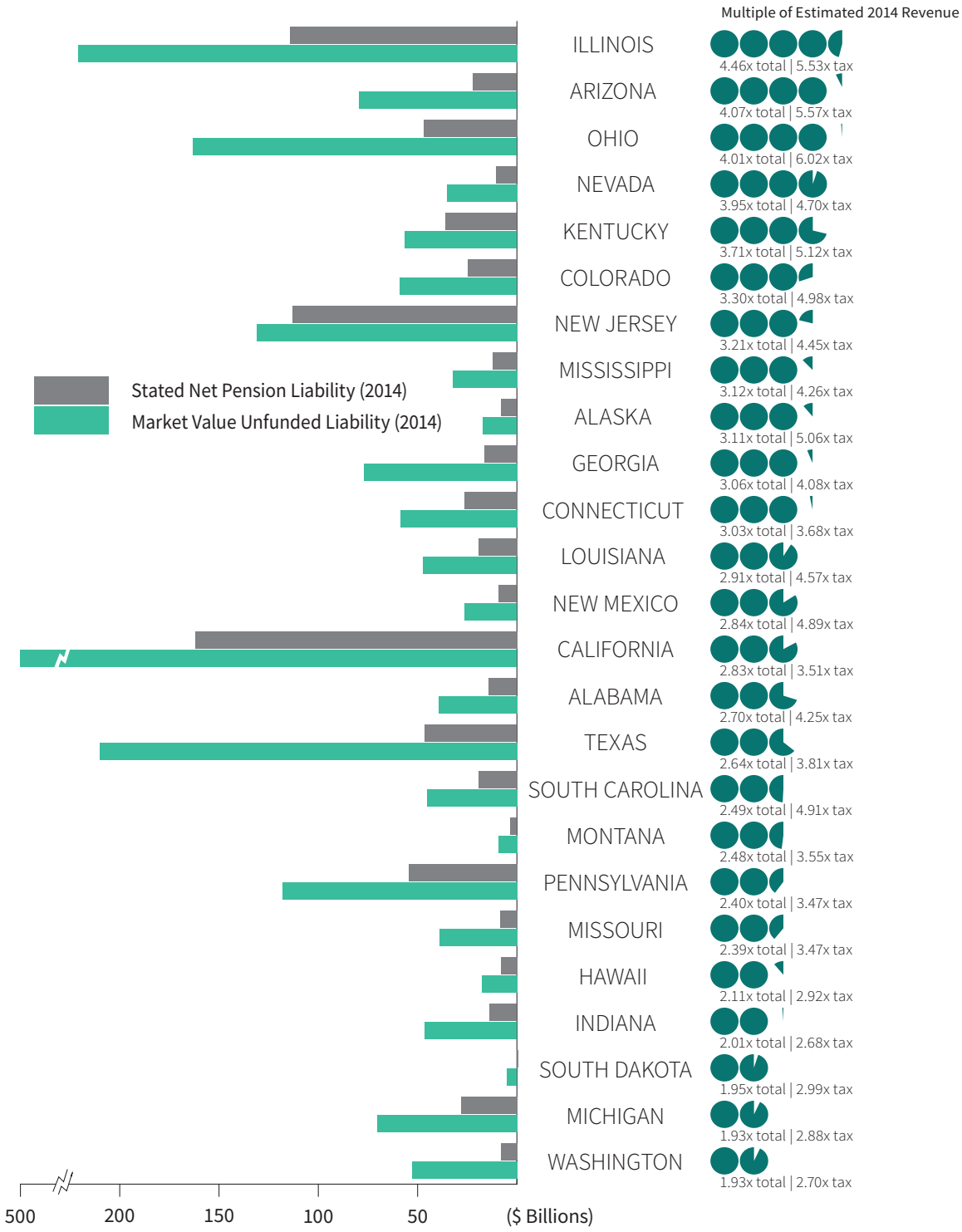


Figure 2: State Pension Liabilities in Relation to Own Revenues: Bottom 25

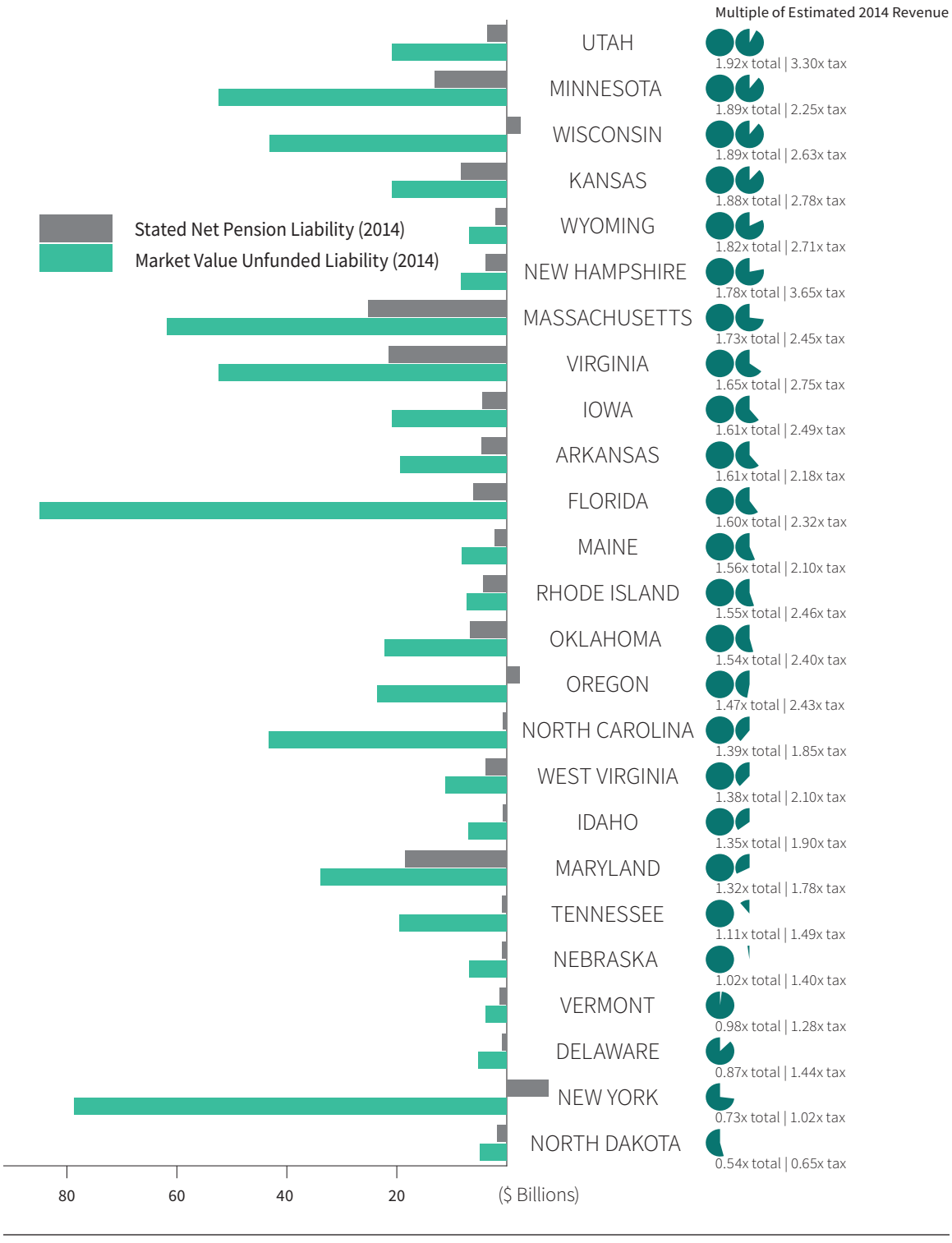
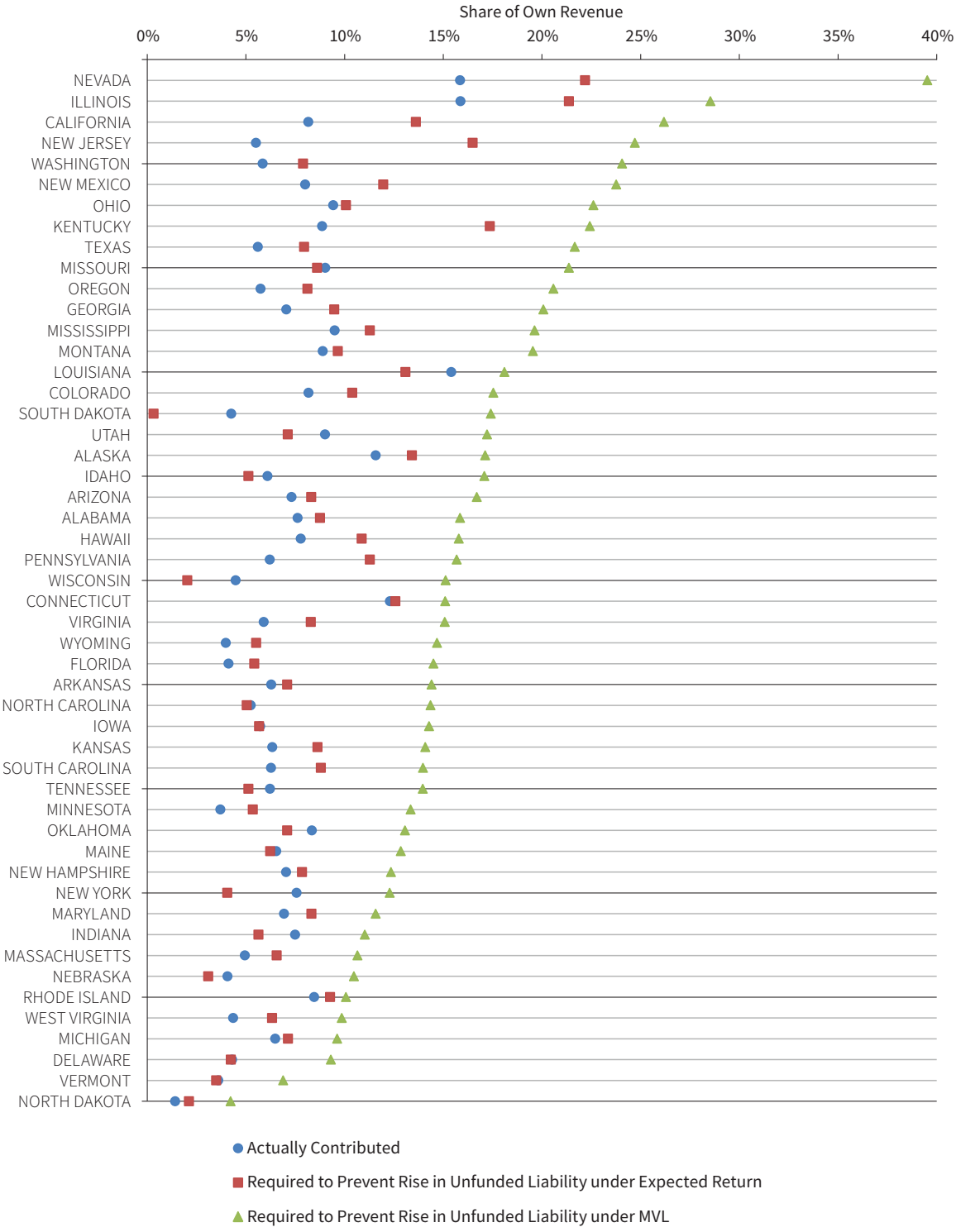


Figure 3: State Contributions: Actual vs Required to Prevent Rise in Unfunded Liability



MVL approach, the pension budget would be balanced (in the sense of non-increasing debt) if Nevada had contributed 39.5 percent of revenues, well over twice what it actually contributed. None of these calculations include any amounts to pay down unfunded liabilities.

States for which the pension deficit under the UMVL measure are close to the pension deficit under the expected return measure are generally those for which the present-value, newly accrued benefits are relatively small compared to the size of the interest cost, which is a function of the unfunded liability. These states fall into two categories. First, there are states that have undertaken substantial pension reforms, which typically slow the rate of future growth rather than reduce accrued liabilities. Second, there are states where interest costs are high relative to service costs because of the large extent of unfunded liabilities.

For example, Rhode Island requires 9.3 percent of own revenue under the expected return measure, but 10.1 percent of own revenue under the UMVL measure, a relatively small difference. This is because Rhode Island undertook a major pension reform in 2011 that reduced benefit accruals substantially by introducing a hybrid element to the pension system. For service beyond that date, employees' pensions would grow at a slower rate, and in addition they receive contributions to a defined contribution plan. As a result, service costs for Rhode Island are small relative to interest costs.

Largest Twenty-five US Cities

In this section, I show similar analysis for the twenty-five largest US cities, selected from statistics published by the US Census Department, with the exceptions of Columbus and Boston, which were omitted due to lack of data. This section considers only the city entities themselves, not including separate municipal entities such as school districts or water authorities.

Figure 4 shows the pension debt (NPL and UMVL) as a share of own revenue in descending order of this ratio. Among top-twenty-five US cities by population, Chicago's pension liabilities were the largest multiple of 2014 revenue, at 6.2 times total own-source revenue and 13.2 times tax revenue. Detroit, Dallas, Houston, and El Paso, Texas, are the other cities in the top five according to UMVL as a share of total own revenue, surpassing multiples of 2.5 times total own revenue and 4.9 times total tax revenue.

Figure 5 shows the pension deficits. The city of Chicago contributed 7.5 percent of its own revenues to pensions in 2014, but to prevent a rise in the UMVL (that is, to run a balanced pension budget on a market-value accrual basis), it would have had to contribute a full 32 percent of its own revenues. San Jose, Los Angeles, and Houston would all have had to contribute more than 15 percent of their budgets just to present the UMVL from rising.

Figure 4: Pension Liabilities in Relation to Own Revenues for the 25 Largest Cities

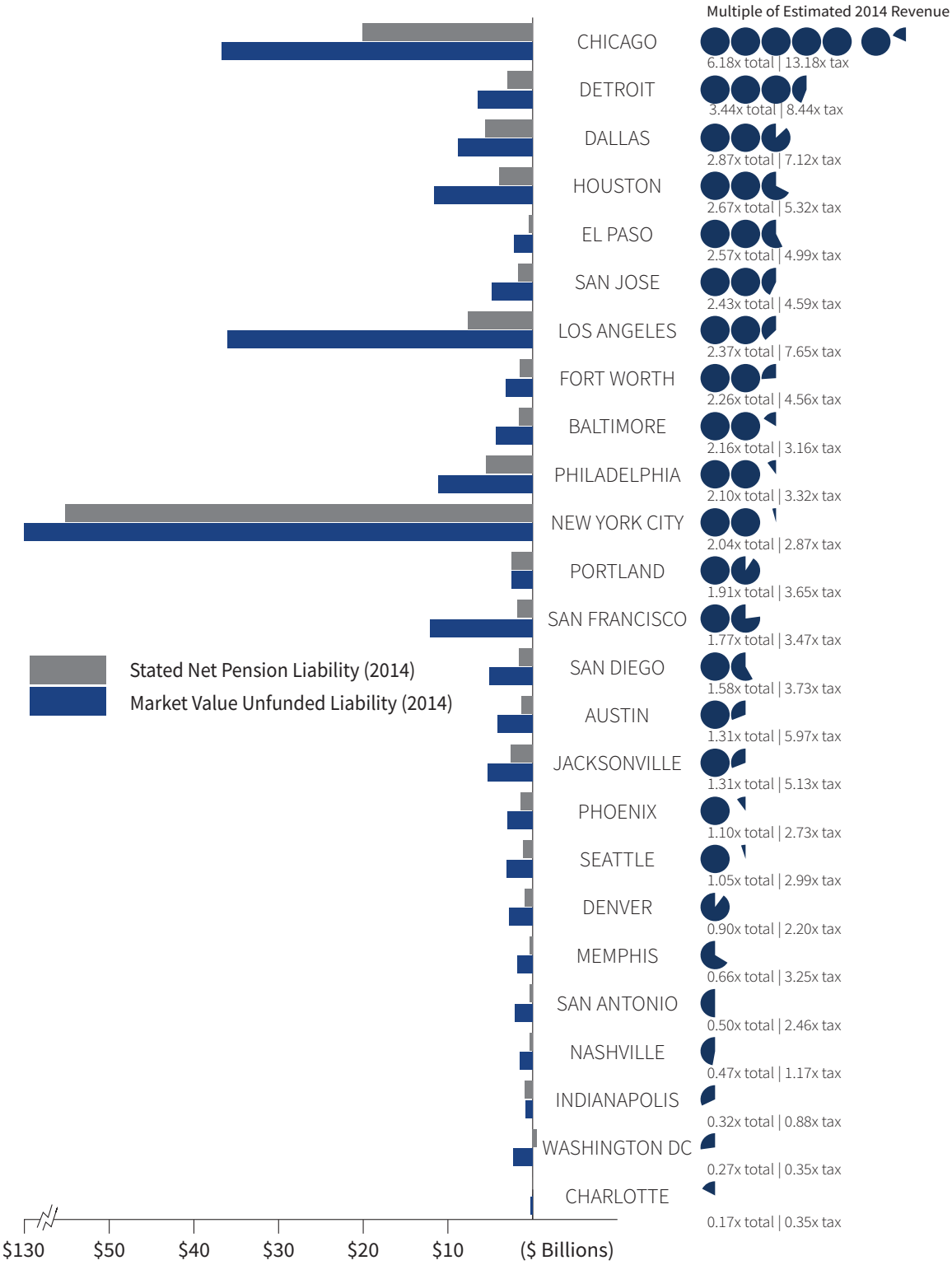
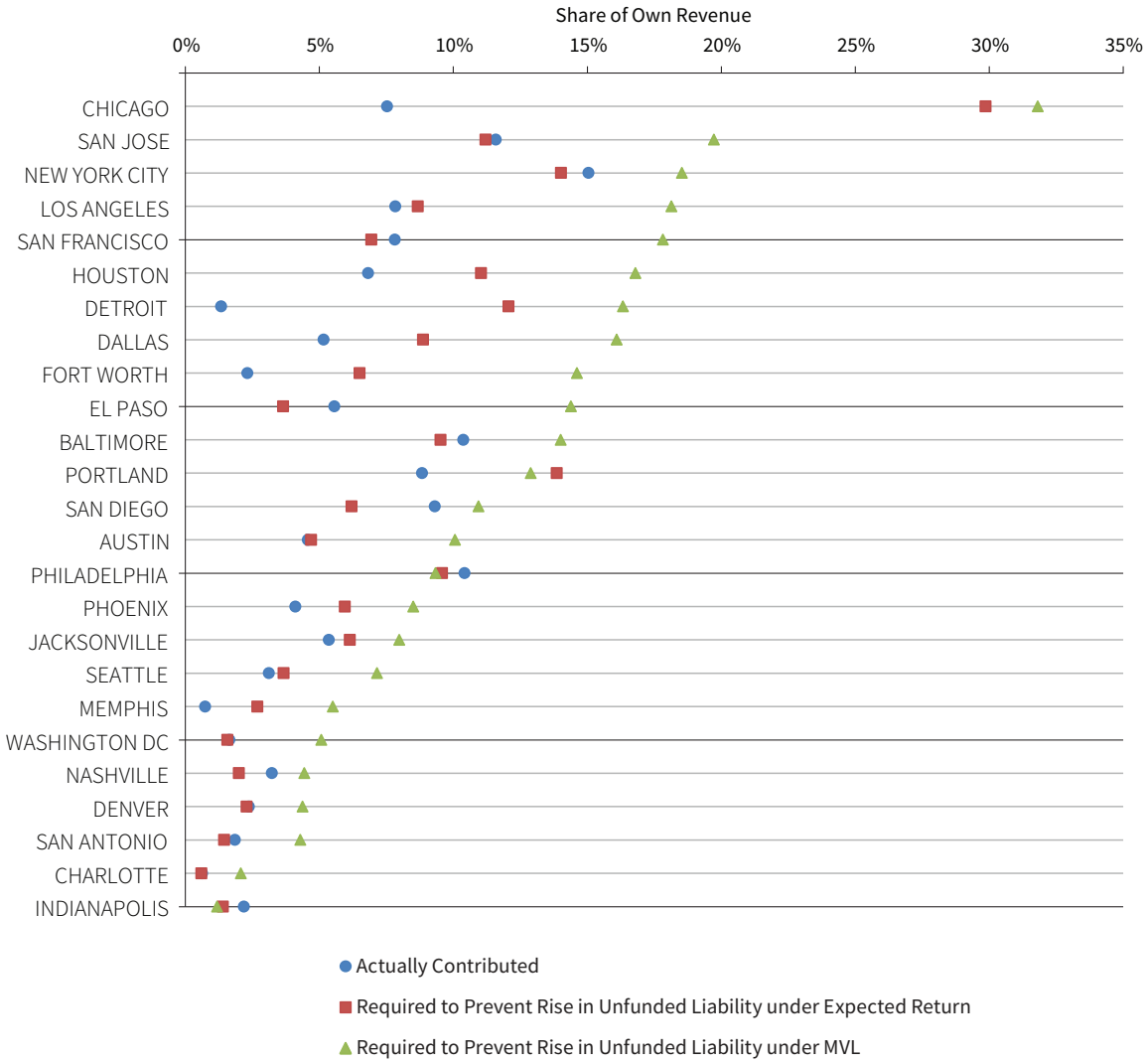


Figure 5: Actual vs Required Contributions to Prevent Rise in Unfunded Liability for the 25 Largest Cities



As was the case for states, cities that have undertaken pension reforms to slow the growth of new pension benefits show smaller differences between the pension deficit under the UMVL and the pension deficit under the expected return measures, as service costs will be small relative to interest costs. One example is Philadelphia, which introduced a new hybrid plan and requires employees who do not elect to participate to contribute more to the plan. As a result, the city only needs to contribute 6.5 percent of own revenues to prevent increases in unfunded liabilities, despite the fact that its unfunded legacy liability is quite large.

Another factor that generates differences in the extent to which the UMVL pension deficit exceeds the expected-return deficit is the choice of the expected return itself. Systems that

already assume a lower rate will have less distance between the measures, as is the case for the legacy systems of the city of Indianapolis, which use discount rates that are not far from Treasury rates due to their very low funding ratios. However, since the Indianapolis systems have long been closed to new workers, the pension deficits for the city overall are small relative to the city's resources. The pension costs for Oklahoma City and Charlotte are also small as a share of their budgets.

All Municipal Entities in California and Connecticut

The next figures show this analysis specifically for all of the municipal entities that sponsor pension systems in two states: California and Connecticut. These states have many pension systems sponsored not only by cities but also by counties and other authorities. Other states that also have many systems include Florida, Illinois, Pennsylvania, and Massachusetts.

Figure 6 shows that in California, unfunded liabilities of counties are substantially larger relative to their revenue bases than the unfunded liabilities of cities. For example, Merced County, Orange County, Fresno County, and San Joaquin County all have UMVL equal to at least 5.7 years of 2014 total own revenue and at least 9.6 years of 2014 tax revenue. All of the county pension systems in California have UMVL in excess of two years of 2014 own revenue and in excess of 3.7 years of 2014 tax revenue.

Figure 7 shows the pension deficit analysis for California. At the top, Fresno County contributed 31 percent of total own revenue to its county employee retirement system; it would have needed to contribute 60.6 percent to prevent a rise in the UMVL.[4] Orange County and Imperial County would also have to contribute more than 50 percent of their own revenues in order to prevent a rise in the UMVL. Running a balanced budget on a market-value accrual basis would cost more than 30 percent of own revenues for fourteen counties on the list.

Figure 8 shows a similar analysis for Connecticut. The cities and towns in Connecticut with the largest unfunded liabilities are Hamden and New Haven, each with UMVL over 3.7 times own revenue. Figure 9 shows the pension deficit analysis for Connecticut municipalities. East Hartford, Hartford, Hamden, and New Haven each require more than 15 percent of own revenues to keep the UMVL from rising. For Hamden, the funding ratio is so low (only 30.6 percent on an expected return NPL basis) that the pension deficit under expected return discounting is larger than under the UMVL approach.

Florida Municipal Entities

This section presents the results for the pension systems of all Florida municipal entities in the sample. In contrast to the previous section, these do not represent the full universe of pension systems in Florida but rather were selected from the top 175 US cities and top seventy US counties, of which twelve cities and five counties respectively are in Florida.

Figure 6: California Pensions in Relation to Own Revenues

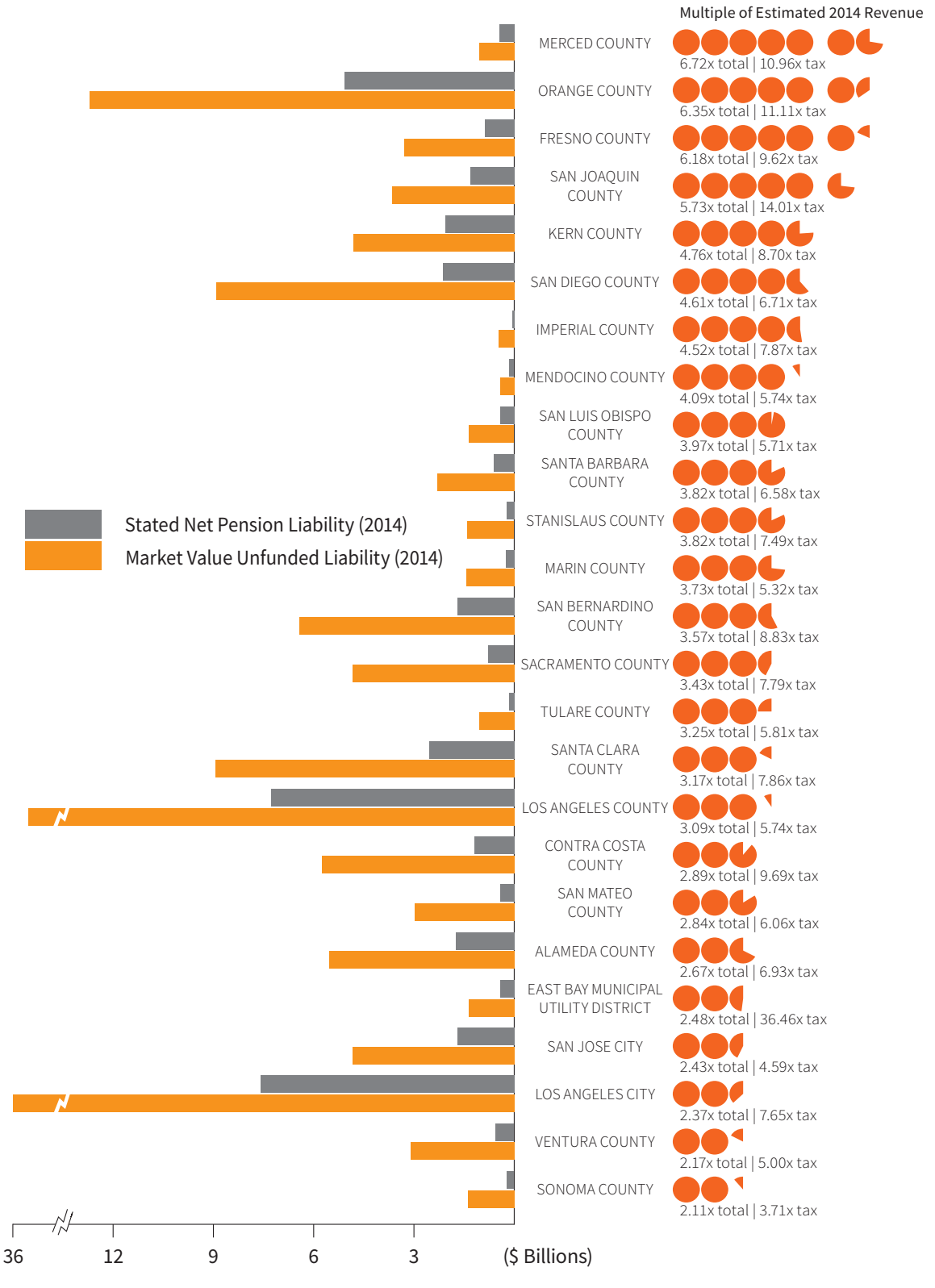


**Figure 7: California City and County Contributions:
Actual vs Required to Prevent Rise in Unfunded Liability**

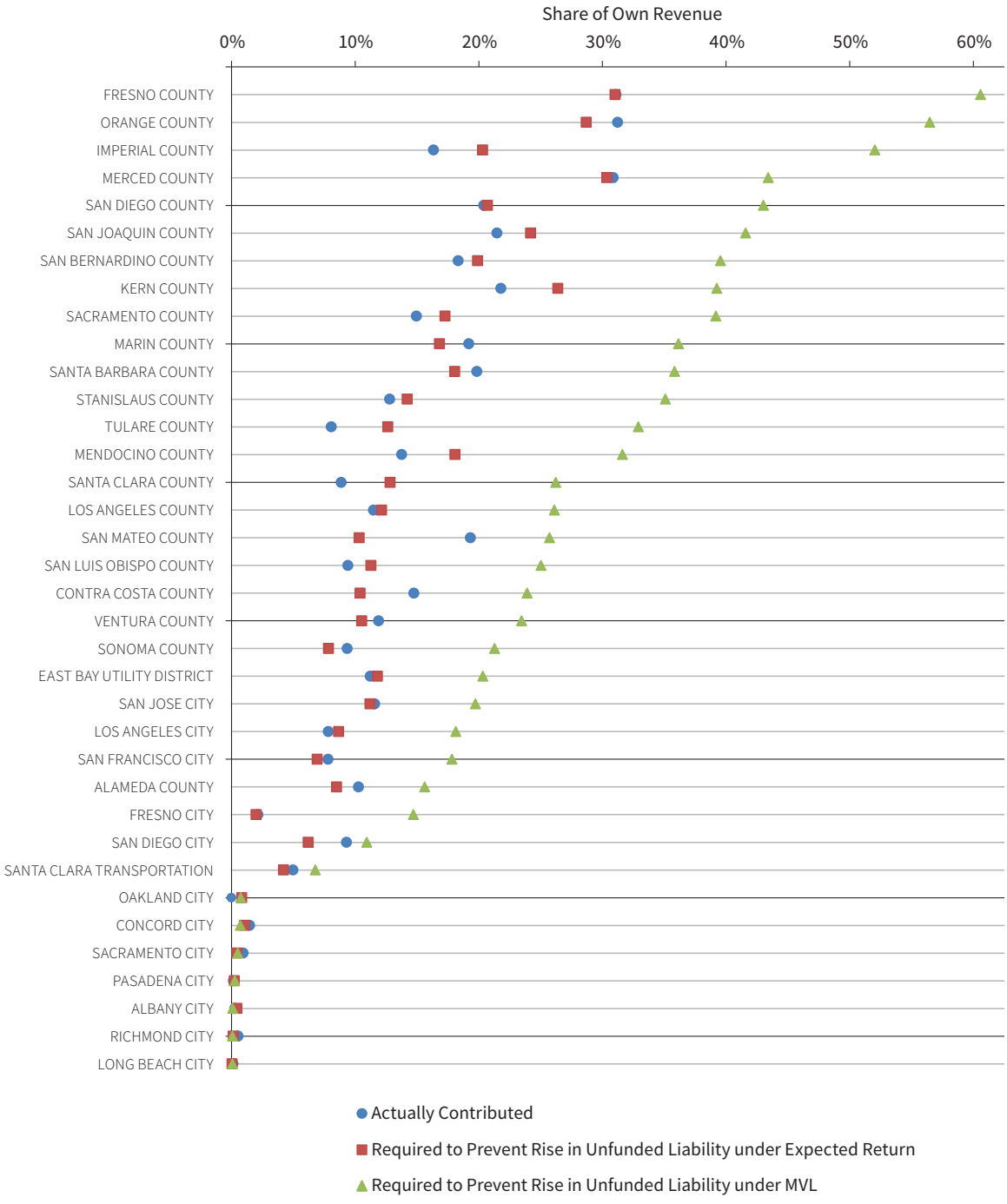


Figure 8: Connecticut Pensions in Relation to Own Revenues

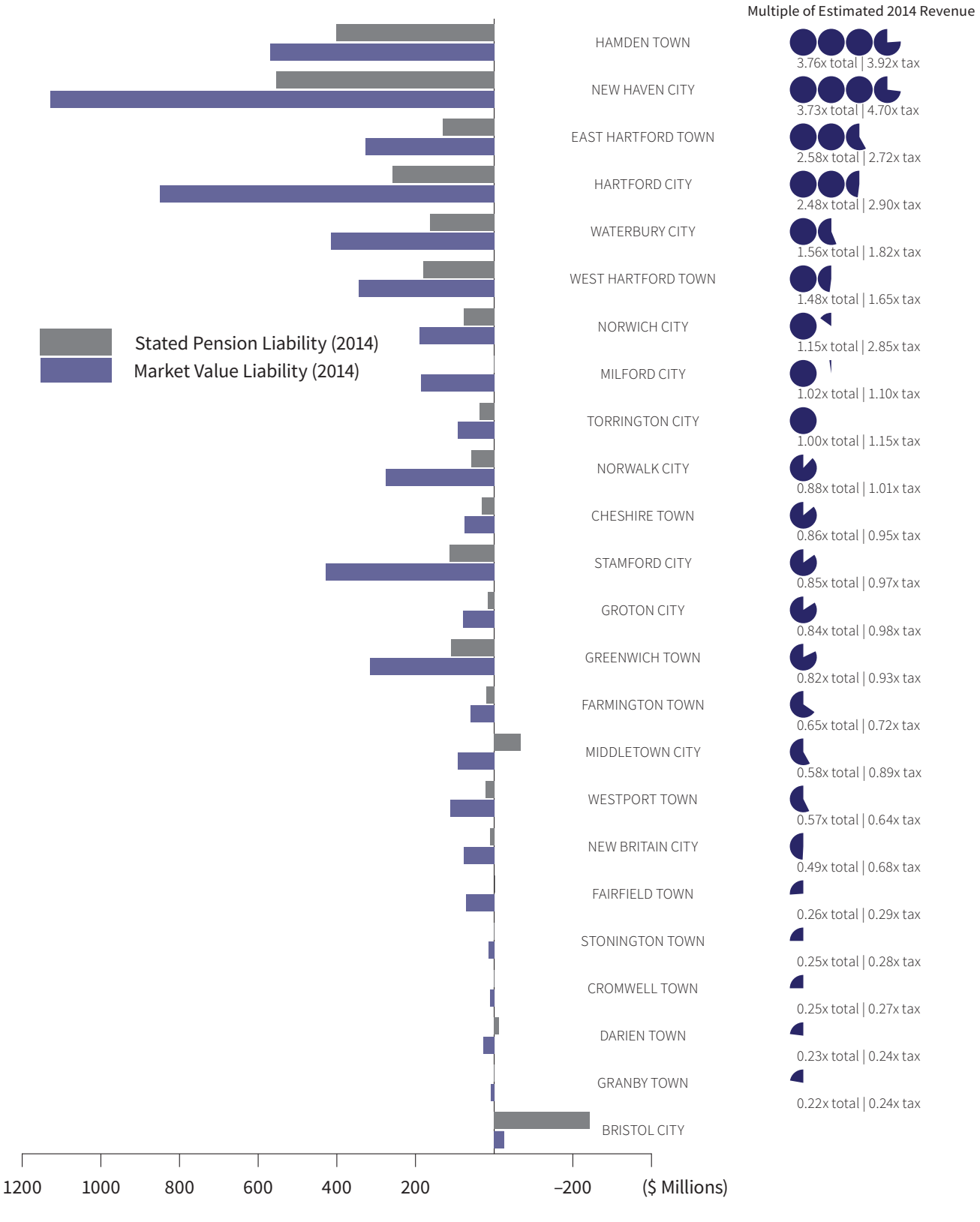


Figure 9: Connecticut City and County Contributions: Actual vs Required to Prevent Rise in Unfunded Liability

Along with California, Florida has a particularly large number of cities and counties among the cities and counties with the largest populations, which makes such a presentation possible in the context of the data collected for this study.

Figure 10 shows the Florida municipal entities with the largest unfunded liabilities as a share of total own revenues. Miami is at the top of the list with UMVL equal to 3.5 times own revenue and 4.7 times tax revenue. Other cities which depend heavily on non-tax revenues have UMVL that are even higher multiples of tax revenues, such as Tallahassee, which has UMVL equal to 7.9 times tax revenue.

Figure 11 shows actual contributions for Florida municipalities versus those that would run a balanced budget on an accrual basis. For fifteen Florida cities, contributions need to be more than 10 percent of own revenue for the pension system to run a balanced budget on a market-value basis.

All Other States: Cities and Counties with Largest Pension Debts and Deficits

Figure 12 shows cities, counties, and other municipal entities with the largest pension debts and deficits in all states except California, Connecticut, and Florida. The St. Paul School District in Minnesota has the largest UMVL compared to 2014 revenues, of 11.2 times total own revenues and 13.9 times tax revenues. The Chicago Public Schools district is second, with UMVL equal to 7.8 times total own revenues and 8.7 times tax revenues. The city of Chicago is third on the list, with UMVL equal to 6.2 times total own revenues and 13.2 times tax revenues. Other cities outside California, Connecticut, and Florida with high UMVL relative to city revenues include Milwaukee, Springfield in Massachusetts, Rockford and Joliet in Illinois, Detroit, Omaha, Nebraska, Pittsburgh, Dallas, and Houston. Other school districts outside of these states with high UMVL relative to district revenues include the school districts of Omaha, Kansas City, Missouri, and St. Louis.

Figure 13 shows the fifty cities with the largest contributions required to prevent a rise in the UMVL. The members of this list are similar to those in Figure 12, with twelve entities requiring contributions of more than 20 percent of city revenue to prevent increases in UMVL. The top four on the list are the St. Paul School District (57 percent of own revenue required), Chicago Public Schools (56.5 percent of own revenue required), the city of Chicago (31.8 percent of own revenue required), and Milwaukee (30.9 of own revenue required).

Figures 14 and 15 examine pension debt and pension deficits in the largest counties not covered in the California, Connecticut, and Florida analysis. Cook County in Illinois tops the list of unfunded liabilities, with UMVL equal to 6.2 times total own revenues and 8.6 times tax revenues, and a contribution required to prevent a rise in the unfunded

Figure 10: Florida Pension Liabilities in Relation to Own Revenues

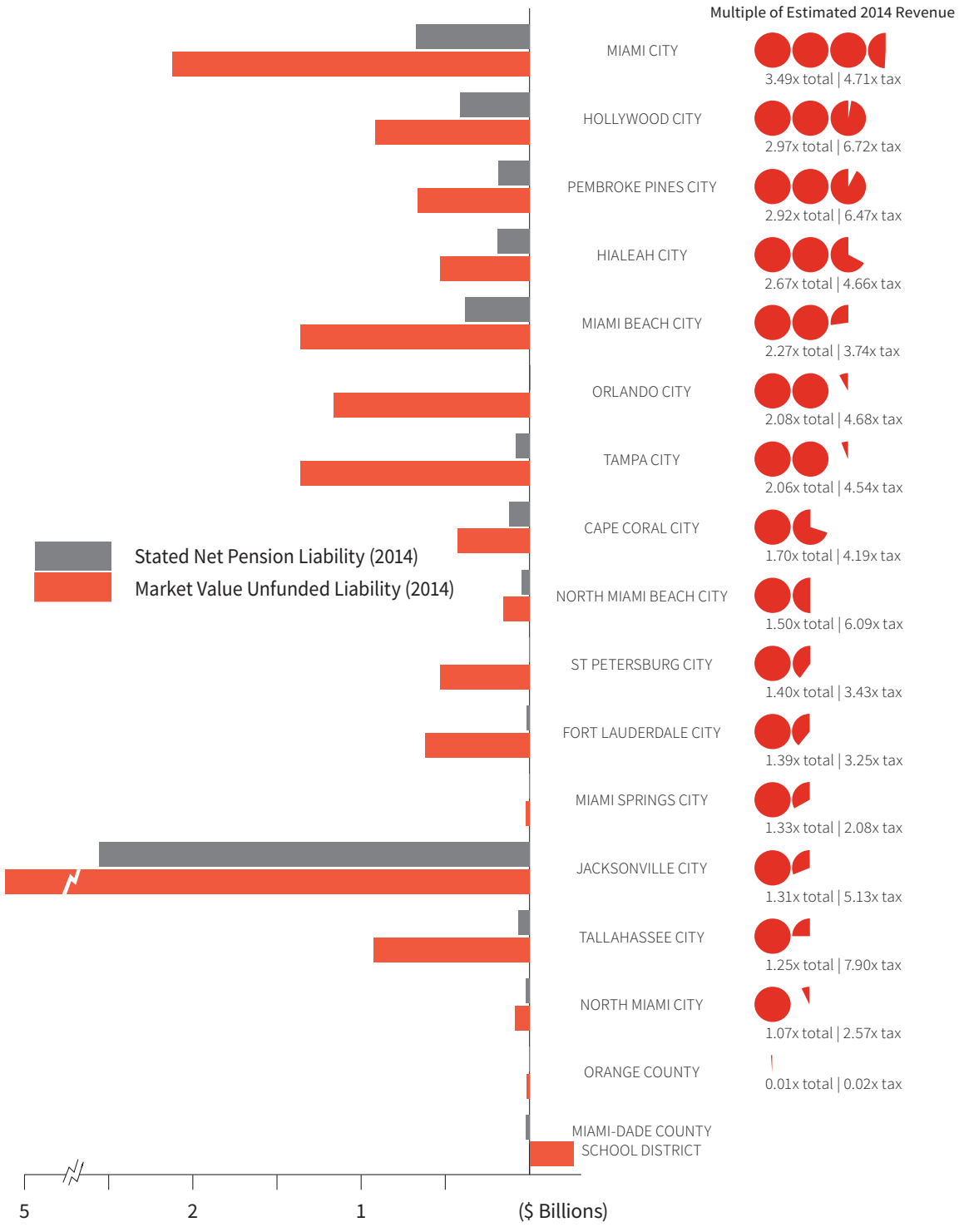


**Figure 11: Florida City and County Contributions:
Actual vs Required to Prevent Rise in Unfunded Liability**

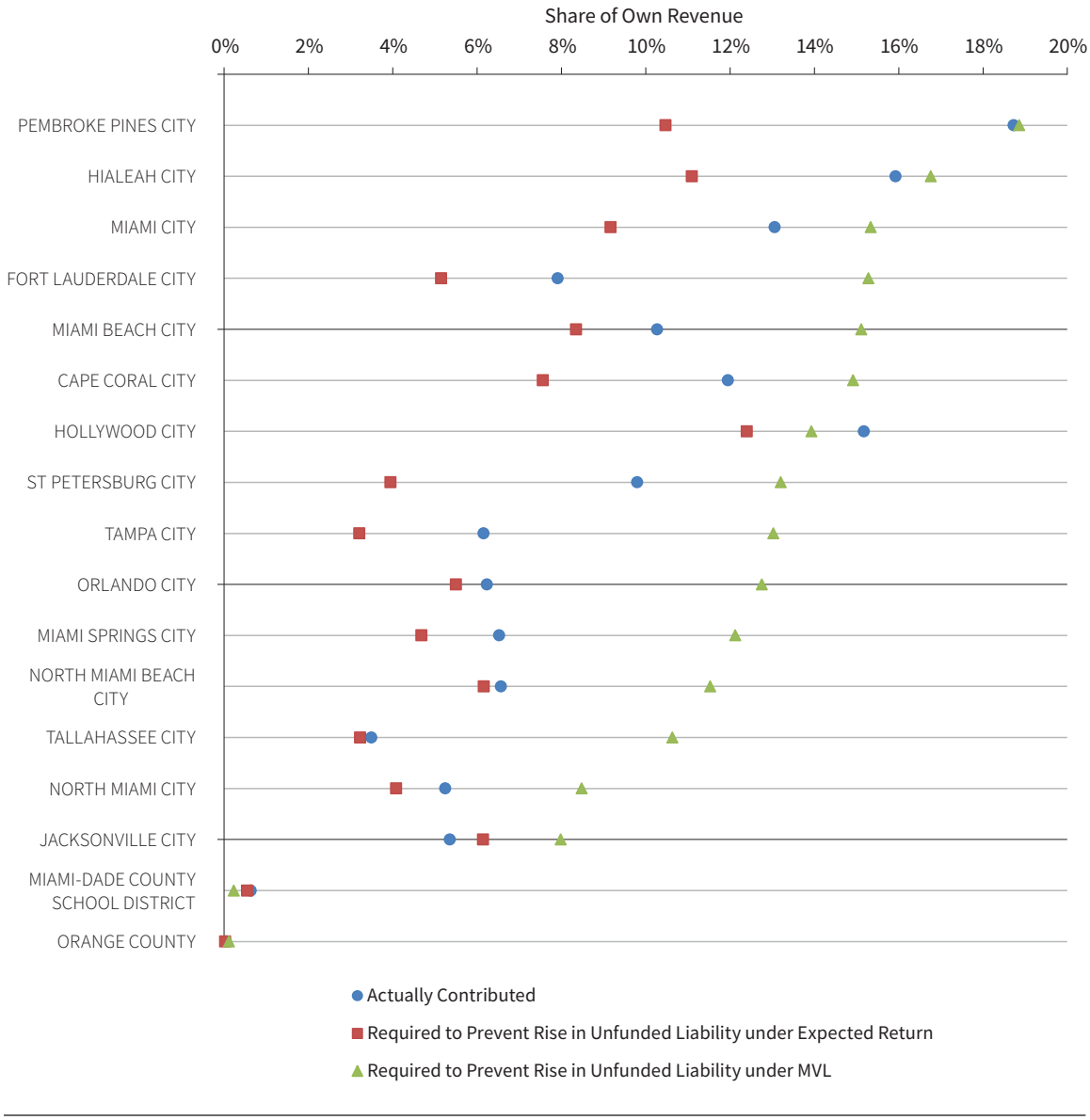


Figure 12: Local Pension Liabilities in Relation to Own Revenues

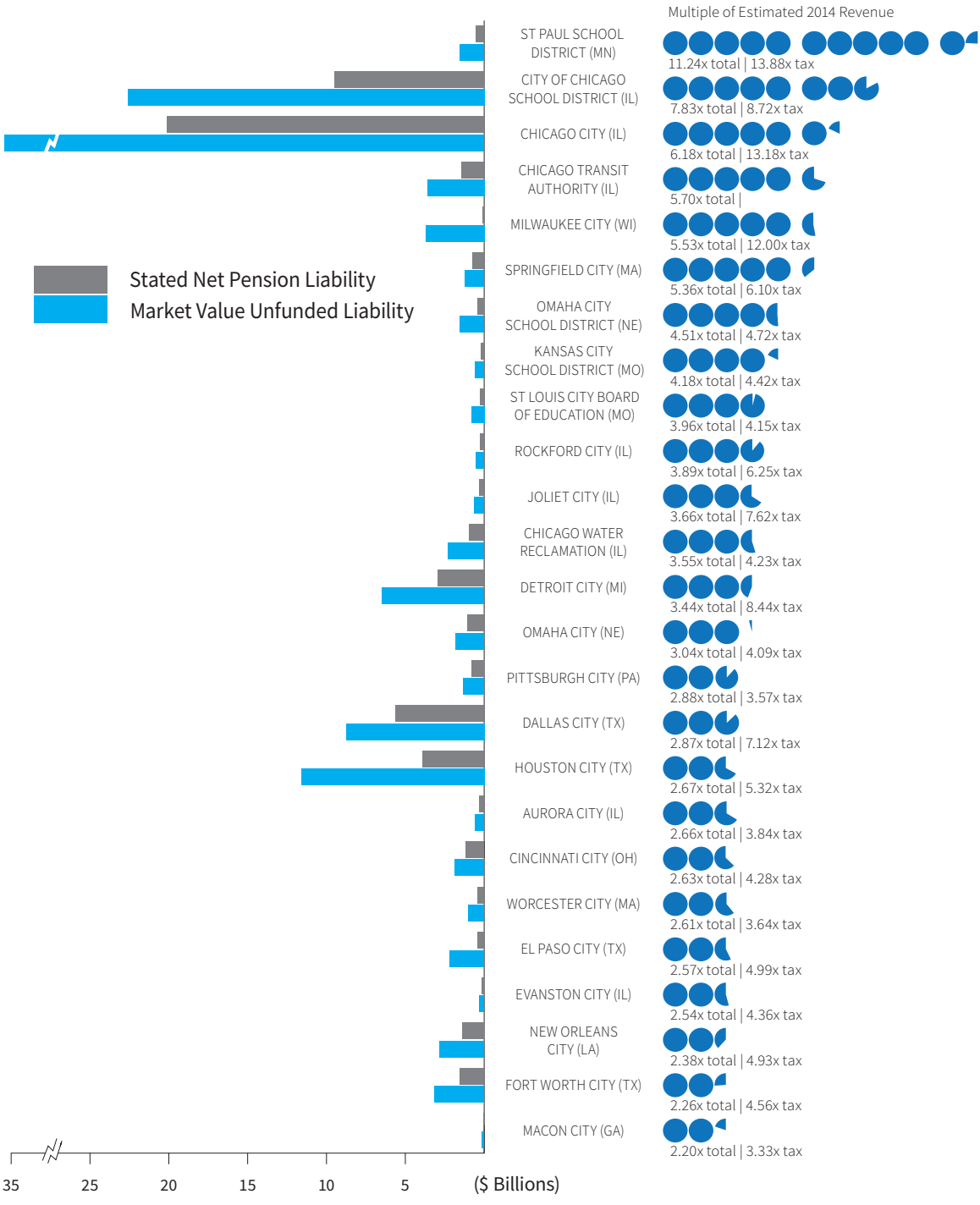


Figure 13: Worst 50 Cities: Actual vs Required Contributions to Prevent Rise in Unfunded Liability

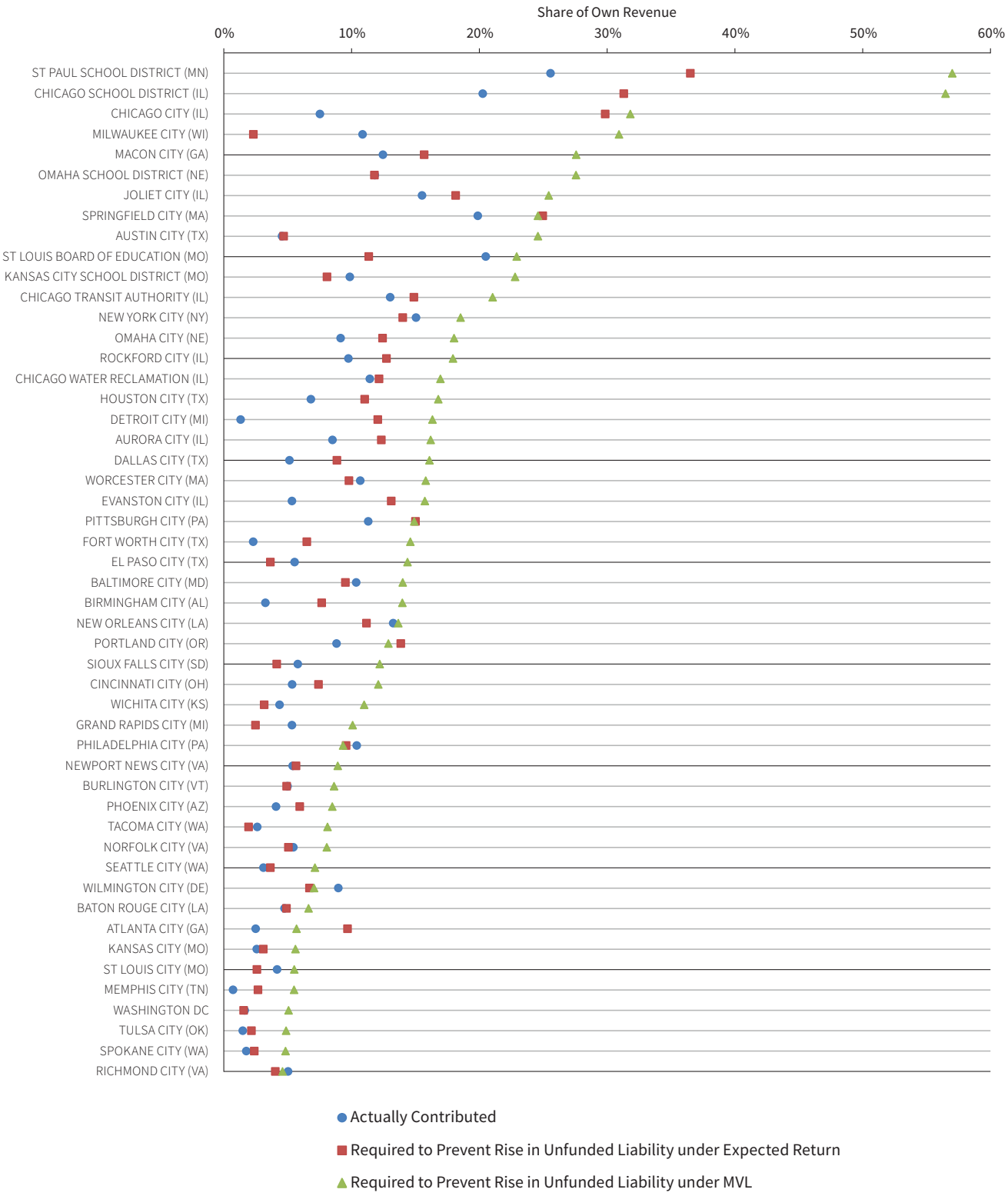


Figure 14: County Pensions in Relation to Own Revenues

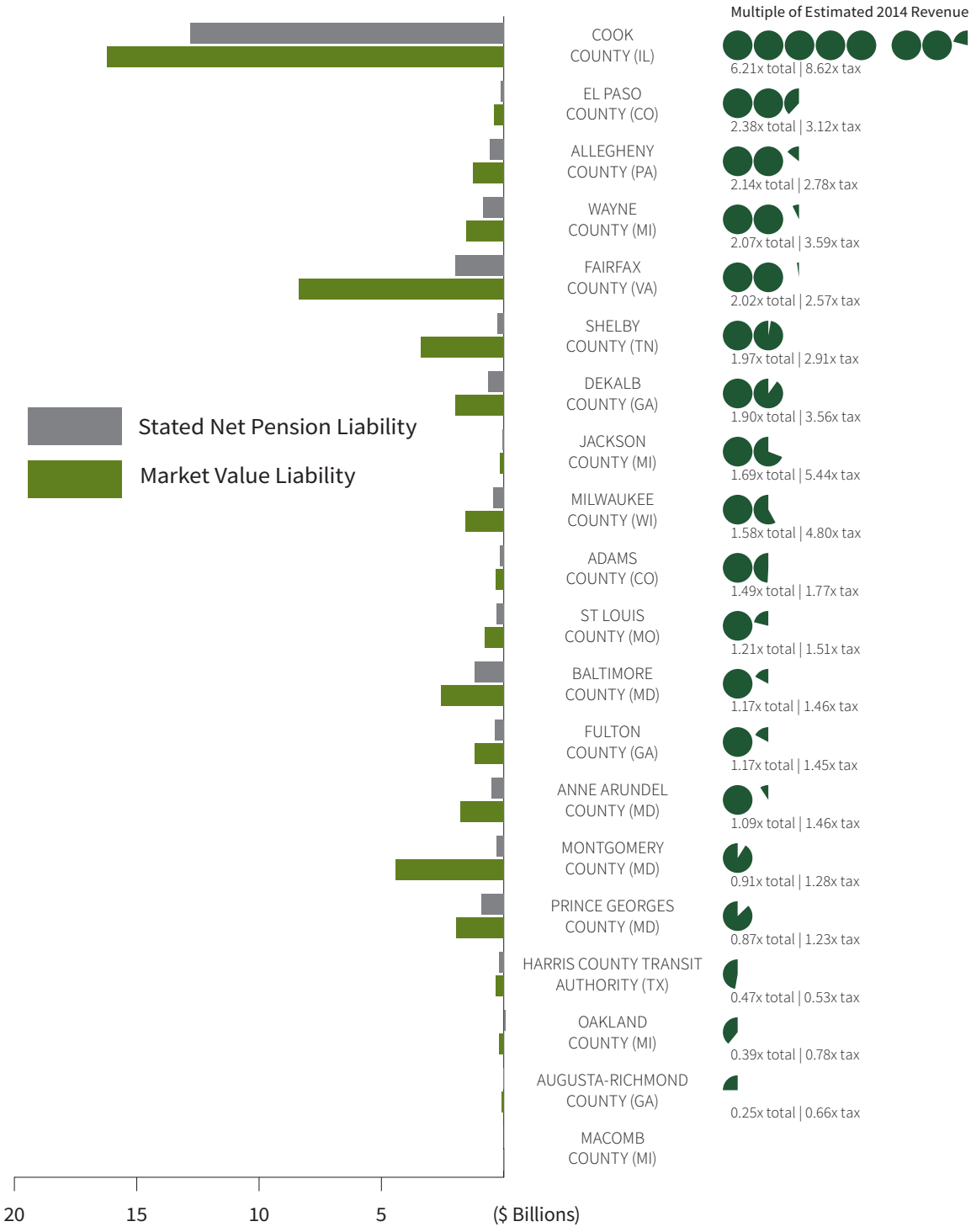
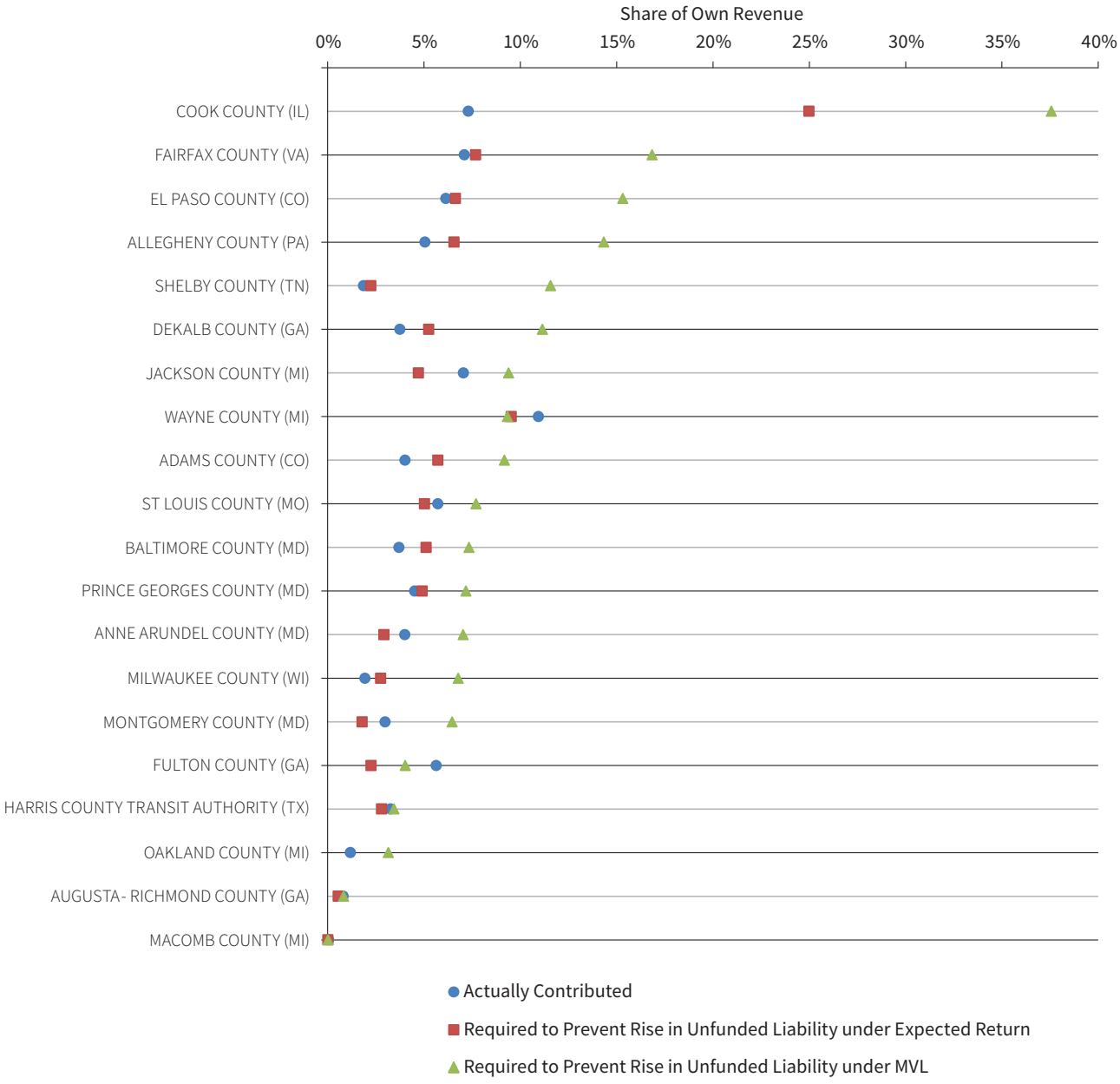


Figure 15: County Contributions: Actual vs Required to Prevent Rise in Unfunded Liability



liability on a market-value basis of 37.6 percent. Other troubled counties include El Paso County, Colorado; Allegheny County, Pennsylvania; and Wayne County, Michigan.

Conclusion

The new GASB 67 disclosures provide a considerably deeper look into the liabilities and costs of pension systems sponsored by state and local governments. In particular, the disclosures make it somewhat easier to conduct apples-to-apples comparisons of pension systems around the United States. They also allow analysts for the first time to see how pension liabilities are evolving from year to year and provide measures of ongoing costs of sponsoring defined benefit pension programs for government employees.

However, the new disclosures are still primarily based on discount rates that inappropriately credit state and local governments for future investment returns that are unlikely to be realized. Furthermore, they ignore the financial principles of valuation, which clearly tell us that both liabilities and costs of pension sponsors should be measured using government bond yields as discount rates.

The analysis in this report reveals that, despite markets that performed well during 2009–2014, state and local government pension systems are still underwater by $3.4 trillion. With relatively poor performance in fiscal years 2015 and the first part of 2016, this figure is likely to be even larger today.

Finally, the report reveals the extent to which state and local governments are in fact not running balanced budgets. While they contribute 7.3 percent of their own-generated revenue to pensions, the true annual *ex ante*, accrual-basis cost of keeping pension liabilities from rising is 17.5 percent of state and local budgets. Even contributions of this magnitude would not begin to pay down the trillions of dollars of unfunded legacy liabilities.

NOTES

1 Bloomberg: "The actuary is supposedly going to lower the assumed reinvestment rate from an absolutely hysterical, laughable 8 percent to a totally indefensible 7 or 7.5 percent" (Walsh and Hakim 2012). Buffett: "[State and local governments] use unrealistic assumptions . . . in determining how much they had to put in the pension funds to meet the obligations. The pension fund assumptions of most municipalities, in my view, are nuts. But there's no incentive to change them. It's much easier to get a friendly actuary than to face an unhappy public" (Summers 2011).

2 Dividends would have returned some of this capital to investors.

3 In eight instances, full GASB 67 liability disclosures were not available for plans that were organized at the state level but consisted of smaller local plans that participated in the system. One example is the CalPERS PERF A plans, consisting of state employers and large agencies. In these cases, imputations were made to some of the inputs to these calculations based on the systems' other pension disclosures, drawing on the accrued actuarial liability (AAL) and other figures of note. As GASB 67 and 68 become fully implemented in future years, these imputations will not be necessary.

4 This county, like many others, receives large amounts of state and federal aid. According to the Census of Governments (2012), Fresno County received $2.32 in transfers from the state and federal governments for every dollar of own revenue raised.

REFERENCES

Brown, Jeffrey, and David Wilcox. 2009. "Discounting State and Local Pension Liabilities." *American Economic Review* 99 (2): 538–542.

Novy-Marx, Robert, and Joshua Rauh. 2009. "The Liabilities and Risks of State-Sponsored Pension Plans." *Journal of Economic Perspectives* 23 (4): 191–210.

Novy-Marx, Robert, and Joshua Rauh. 2011a. "Public Pension Liabilities: How Big Are They and What Are They Worth?" *Journal of Finance* 66 (4): 1207–1246.

Novy-Marx, Robert, and Joshua Rauh. 2011b. "The Crisis in Local Government Pensions in the United States." In *Growing Old: Paying for Retirement and Institutional Money Management after the Financial Crisis,* edited by Robert Litan and Richard Herring. Washington, DC: Brookings Institution.

Novy-Marx, Robert. 2013. "Logical Implications of GASB's Methodology for Valuing Pension Liabilities." *Financial Analysts Journal* 69 (1): 26–32.

Pastor, Lubos, and Robert F. Stambaugh. 2012. "Are Stocks Really Less Volatile in the Long Run?" *Journal of Finance* 67 (2): 431–478.

Summers, Adam. 2011. "Warren Buffett on Public Pensions." *Out of Control Financial Blog.* Reason Foundation, http://reason.org/blog/show/warren-buffett-on-public-pensions.

Walsh, Mary Williams, and Danny Hakim. 2012. "Public Pensions Faulted for Bets on Rosy Returns." *New York Times,* May 27.

To view Appendices associated with this essay (which include a list of all pension systems studied, and data tables for the fifteen figures included in this essay), please visit the online resource at http://www.hoover.org/research/hidden-debt-hidden-deficits.

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Synopsis

Despite the introduction of new accounting standards, the vast majority of state and local governments continue to understate their pension costs and liabilities by relying on investment return assumptions of 7–8 percent per year. This report applies market valuation to pension liabilities for 564 state and local pension funds, representing around 97 percent of the U.S. universe. Considering only already-earned benefits and treating those liabilities as the guaranteed government debt that they are, I find that as of FY 2014 accrued unfunded liabilities of U.S. state and local pension systems are at least $3.412 trillion, or around three times more than the value reflected in government disclosures. Furthermore, while total government contributions to pension systems were $109 billion in 2014, or 7.3 percent of state and local government revenue, the true annual cost of keeping pension liabilities from rising would be approximately $261 billion or 17.5 percent of revenue. Applying the principles of financial economics reveals that states have large hidden unfunded liabilities and continue to run substantial hidden deficits by means of their pension systems.

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