

Hidden Debt, Hidden Deficits: 2017 Edition

HOW PENSION PROMISES ARE CONSUMING STATE AND LOCAL BUDGETS

JOSHUA D. RAUH

The unfunded obligations of the pension systems sponsored by state and local governments in the United States continue to grow. In this second annual report on the off-balance-sheet pension promises of state and local governments, we study in detail 649 pension systems around the United States, including all of the main pension systems of the states, the largest U.S. cities, and the largest U.S. counties. We report on both their own measurements of their costs and obligations, and how these differ from market valuations that are consistent with the principles of financial economics.

As of fiscal year 2015, the latest year for which complete accounts are available for all cities and states, governments reported unfunded liabilities of \$1.378 trillion under recently implemented governmental accounting standards. However, we calculate using market valuation techniques that the true unfunded liability owed to workers based on their current service and salaries is \$3.846 trillion. These calculations reflect the fact that accrued pension promises are a form of government debt with strong rights. These unfunded liabilities represent an increase of \$434 billion over 2014, as realized asset returns fell far short of their targets.

Governmental accounting standards for pensions underwent some changes in 2014 and 2015 with the implementation of Governmental Accounting Standards Board (GASB) statements 67 and 68, procedures which require state and local governments to report on the assets and liabilities of their systems with a greater degree of harmonization. However, these standards still preserved the basic flaw in governmental pension accounting: the fallacy that liabilities can be measured by choosing an expected return on plan assets. This procedure uses as inputs the forecasts of investment returns on fundamentally risky assets and ignores the risk necessary to target hoped-for returns.

Specifically, the liability-weighted average expected return chosen by systems in 2015 was 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 approximately every 9.5 years. That means that a typical government would view a promise to make a worker a \$100,000 payment in 2026

Joshua Rauh is a senior fellow at the Hoover Institution and a professor of finance at the Stanford Graduate School of Business. The author thanks Zachary Christensen, Zachary Glazier, and Jeremy Padgett for excellent research assistance.



as “fully funded” even if it had set aside less than \$50,000 in assets in 2016; a similar payment in 2036 would be viewed as “fully funded” with less than \$25,000 in assets in 2016.

The new governmental accounting standards tempered the effects of this assumption slightly by requiring some systems (fifty-eight plans, or 9 percent of the sample) to use somewhat lower rates in their liability measurement for GASB 67 purposes, so that the liability-weighted average discount rate that plans in this study chose as of 2015 for the purposes of their GASB 67 and GASB 68 disclosures was 7.36 percent. This is because 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. 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.

Clearly, whether we are talking about the full 7.6 percent expected return or the somewhat reduced 7.36 percent GASB 67 rate, this practice obscures the true extent of public sector liabilities. In order to target high 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. Furthermore, while systems face somewhat stricter disclosure requirements under the new GASB standards, these standards will not directly affect funding decisions.

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

The GASB disclosures provide interest-rate sensitivities for each plan, allowing calculations of the unfunded liability under different discount rates. Among the 649 plans, the liability-weighted average sensitivity of total liabilities to a 1 percent change in the discount rate is 11.2 years. 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.

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 2.77 percent and unfunded liabilities of \$4.967 trillion. Since not all of these liabilities are accrued, we apply a correction on a plan-by-plan basis (based on Novy-Marx and Rauh 2011a, 2011b) that results in unfunded *accumulated* benefits of \$3.846 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. From an ex ante perspective, the economic cost of the pension system to the sponsor is the present value of the increase in pension promises (service cost) plus the cost incurred because existing liabilities come due a year sooner (interest cost). Under lower discount rates, the service cost is higher but the interest cost is lower.

The way in which pension costs are often informally discussed is at odds with these underpinnings. The total of general revenue from own sources for all state and local government entities in the United States is \$2.268 trillion and total government contributions were \$111 billion, so contributions were 4.9 percent of revenue in 2015. While this would have been approximately enough contributions to prevent the GASB unfunded liability from rising if the expected return targets had been realized, they in fact fell short by \$182 billion due to the difference between expected and realized returns. In 2015, systems realized average investment returns of only 2.87 percent on beginning-of-year assets. Similarly, under the risk-neutral discounting procedure, liabilities would have risen by \$178 billion.

From an ex ante perspective, the true annual cost of keeping pension liabilities from rising is therefore \$288.7 billion ($= \$111.1 + \178.6). This amounts to 12.7 percent of all state and local government general revenue from own sources, including that of governments that do not themselves sponsor pension plans, before any attempt to pay down unfunded liabilities. That annual cost for just fiscal year 2015 is equal to 18.2 percent of all state and local tax revenue.

Review of Reasons for Risk-Free Discounting

In this section, we 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, county, 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 an employee works for an additional year raises the pension that one expects to receive when one 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 assets. 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 April 2016, the index stands around 18,500, representing a capital loss of 52.5 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. The GASB concept of expected return discount is equivalent to this individual stating 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 a beneficiary of such a plan who is offered a lump sum buyout by their 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 one 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 they 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' time, 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 they 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 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 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 files 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 used. The first measure is “general revenue from own sources,” which is defined by the Census as general revenue less intergovernmental revenue. From here on, we will refer to this measure as “own revenue.” Importantly, this measure excludes insurance trust revenues (which are mostly the returns of pension funds themselves), intergovernmental revenues (which are primarily transfers from the federal government but also transfers from state governments to local governments and vice versa), and revenue from public utilities. The second



measure is tax revenue alone. The idea behind the latter 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 own revenue, scaling by tax revenue assumes that states will not raise fees for services such as university tuition and waste management services to pay for unfunded pension liabilities—or at least not raise sufficient revenue from such fee increases considering the possibility of private economy competition in the provision of such services.

The latest individual unit files available were from 2014. In order to estimate 2015 revenues, historical data from the US Census Quarterly Summary of State and Local Tax Revenue were obtained. The percent change in state taxes collected during fiscal year 2015 over fiscal year 2014 was calculated, where the fiscal year is defined as running from the third calendar quarter of one calendar year through the second calendar quarter of the following calendar year. This growth rate was then applied to the individual government units for tax revenue to derive an estimate for 2015. This method ignores likely differences in revenue growth rates at the state and local level. The average tax revenue growth rate across the fifty states was 4.39 percent in total between 2014 and 2015.

In order to estimate a growth rate for own revenue, historical data from the individual unit files were used. For each state, a regression was run between the aforementioned growth rate in taxes and a similar growth rate for own revenue over the years 1977 to 2014. These results were then used to estimate own revenue growth rates from 2014 to 2015. Each estimated rate was then applied to the individual government units. Again, this method does not account for likely differences in revenue growth rates at the state and local level. The average own revenue growth rate used across the fifty states was 3.77 percent between 2014 and 2015.

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 one hundred counties by population. Additionally, we collected associated school district and transportation authority pension systems where applicable. The result was 649 state and local funds: 263 state funds and 386 local funds. These funds are listed in the appendix.

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:

$$\begin{aligned}
 TPL_{2015} = & TPL_{2014} + Service\ Cost_{2015} + Interest\ Cost_{2015} \\
 & - Benefits\ Paid_{2015} \\
 & + All\ Other\ Adjustments.
 \end{aligned}$$

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 2014 come due one year sooner once the end of FY 2015 is reached. All other adjustments include: changes in benefit terms (+ or -), differences between actuarial assumptions and experience (+ or -), and assumption changes (+ or -).

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

$$\begin{aligned} \text{Assets(FNP)}_{2015} = & \\ & \text{Assets(FNP)}_{2014} + \text{Employer Contributions}_{2015} + \text{Member Contributions}_{2015} \\ & + \text{Other Contributions}_{2015} \\ & + \text{Net Investment Income}_{2015} - \text{Administrative Expenses}_{2015} \\ & + \text{Transfers Among Employers and All Other Adjustments} \end{aligned}$$

The unfunded liability under the GASB 67 standards, known as the net pension liability (NPL), is simply $NPL_{2015} = TPL_{2015} - \text{Assets}_{2015}$.

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:

$$\begin{aligned} \text{Required Additional Contribution Under Expected Return} = & \\ & (\text{Service Cost}_{2015} + \text{Interest Cost}_{2015}) \\ & - (\text{Employer Contributions}_{2015} + \text{Member Contributions}_{2015} + \text{Other Contributions}_{2015}) \\ & - \text{Expected Return \%} * FNP_{2014} \end{aligned}$$

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 city or state is only running a balanced budget if it contributes these additional contributions above and beyond the contributions already being made.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 fifty-eight of the 649 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 19 percent funding ratio for its nonhazardous employee plan but maintained the 7.5 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 42 percent funding ratio. It used an expected return of 7.5 percent but a discount rate of 4.88 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 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 calculated 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 thirty of the plans, for which sufficient information to calculate duration and convexity was not found in the disclosures. Plans in the sample turn out to have a weighted average duration of 10.85 years and an unweighted average duration of 11.17, 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. 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 California State Teachers' Retirement System fiscal year 2015 ended June 30, 2015, and the duration implied by the disclosures for the main system was 12.13. The duration-matched Treasury yield was the interpolated rate on the Treasury yield curve at twelve years as of June 30, 2015, or $R' = 2.9$ 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 salary and years worked.

Novy-Marx and Rauh (2011a, 2011b) calculate this adjustment for 234 of the larger plans in the sample. The liability-weighted average of the ratio of accumulated to entry age normal benefits is 0.851 and the unweighted average is 0.797. For the remaining plans, the average adjustment factor of 0.797 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 2015.



Required Additional Contribution under Market-Value Concept

The service cost plus the interest cost can be viewed as the ongoing cost of the plan, and 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:

$$\begin{aligned}
 & \text{Required Additional Contribution Under MVL} \\
 & = (\text{Service Cost}^*_{2015} + \text{Interest Cost}^*_{2015}) \\
 & - (\text{Employer Contributions}_{2015} + \text{Member Contributions}_{2015} \\
 & + \text{Other Contributions}_{2015}) - R' * \text{Assets}_{2014}
 \end{aligned}$$

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, and 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 \$4.967 trillion, which is covered by \$3.589 trillion in assets, which implies an unfunded liability of \$1.378 trillion and a funding ratio of 72.3 percent. As shown in Panel II of Table 1, the liability-weighted average discount rate was 7.36 percent.

Under market value standards, the total ABO (accumulated benefit obligation) liability is \$7.435 trillion. Compared to the \$3.589 trillion in assets, this implies a true unfunded market value liability (UMVL) of \$3.846 trillion and a funding ratio of 48.3 percent. The average liability-weighted Treasury discount rate used in this calculation is 2.77 percent.

Panel III of Table 1 shows actual flows into and out of state and local pension systems. These systems paid out \$259.5 billion in benefits and refunds while collecting contributions

Table 1: Summary Table

\$ Amounts in Billions			
Number of Plans Total	State Pensions 263	Local Pensions 386	State & Local Pensions 649
I. Assets and Liabilities			
<i>GASB 67 Standards</i>			
Total Pension Liability (TPL)	\$4,160	\$807	\$4,967
Assets	\$3,034	\$555	\$3,589
Net Pension Liability (NPL)	\$1,126	\$252	\$1,378
Funding Ratio	72.9%	68.8%	72.3%
<i>Market Value Standards</i>			
Accumulated Benefits Obligation (ABO)	\$6,228	\$1,206	\$7,435
Assets	\$3,034	\$555	\$3,589
Unfunded Market Value Liability (UMVL)	\$3,194	\$651	\$3,846
Funding Ratio	48.7%	46.0%	48.3%
II. Discount Rates			
<i>GASB 67 Standards</i>			
Average Discount Rate			
Liability Weighted	7.42%	7.06%	7.36%
Unweighted	7.24%	7.21%	7.22%
<i>Expected Return</i>			
Average Discount Rate			
Liability Weighted	7.64%	7.39%	7.60%
Unweighted	7.43%	7.31%	7.36%
Number of Plans for Which			
Discount Rate < Expected Return	30	28	58
Average Difference	0.20%	0.09%	0.14%
Difference Between Expected Return and Discount Rate $\Delta \neq 0$			
Liability Weighted	1.48%	2.52%	1.63%
Unweighted	1.71%	1.30%	1.51%
<i>Market Value Standards</i>			
Average Discount Rate			
Liability Weighted	2.78%	2.71%	2.77%
Unweighted	2.72%	2.52%	2.60%
Average Duration			
Liability Weighted	11.16	11.21	11.17
Unweighted	11.08	10.68	10.85
III. Flows			
Benefits and Refunds	\$222.5	\$37.0	\$259.5
Employer Contributions	\$84.8	\$26.3	\$111.1
Member Contributions	\$39.6	\$6.4	\$46.0
State Contributions	\$14.5	\$0.2	\$14.8
Total Contributions	\$138.9	\$32.9	\$171.8
IV. Accrual Basis: Necessary Additional Contributions *			
Additional Necessary Contributions			
to prevent rise in NPL under expected return	\$5.2	(\$3.6)	\$1.7
to prevent rise in NPL under Treasury rate	\$154.6	\$23.0	\$177.6
to prevent rise in NPL under the realized return	\$144.7	\$22.3	\$167.0

*Note - These calculations exclude transfers among employers from contributions



of \$171.8 billion, of which \$111.1 billion came from the sponsoring governments. This calculation reveals the extent to which state and local governments are relying on investment returns to pay for pension benefits.

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 2015 and not less, an additional \$1.7 billion would have been required. Given the much lower returns that were actually realized, an additional \$182 billion would have been required to keep the GASB NPL from rising. Under the market-valuation method based on Treasury returns, an additional \$177.6 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.

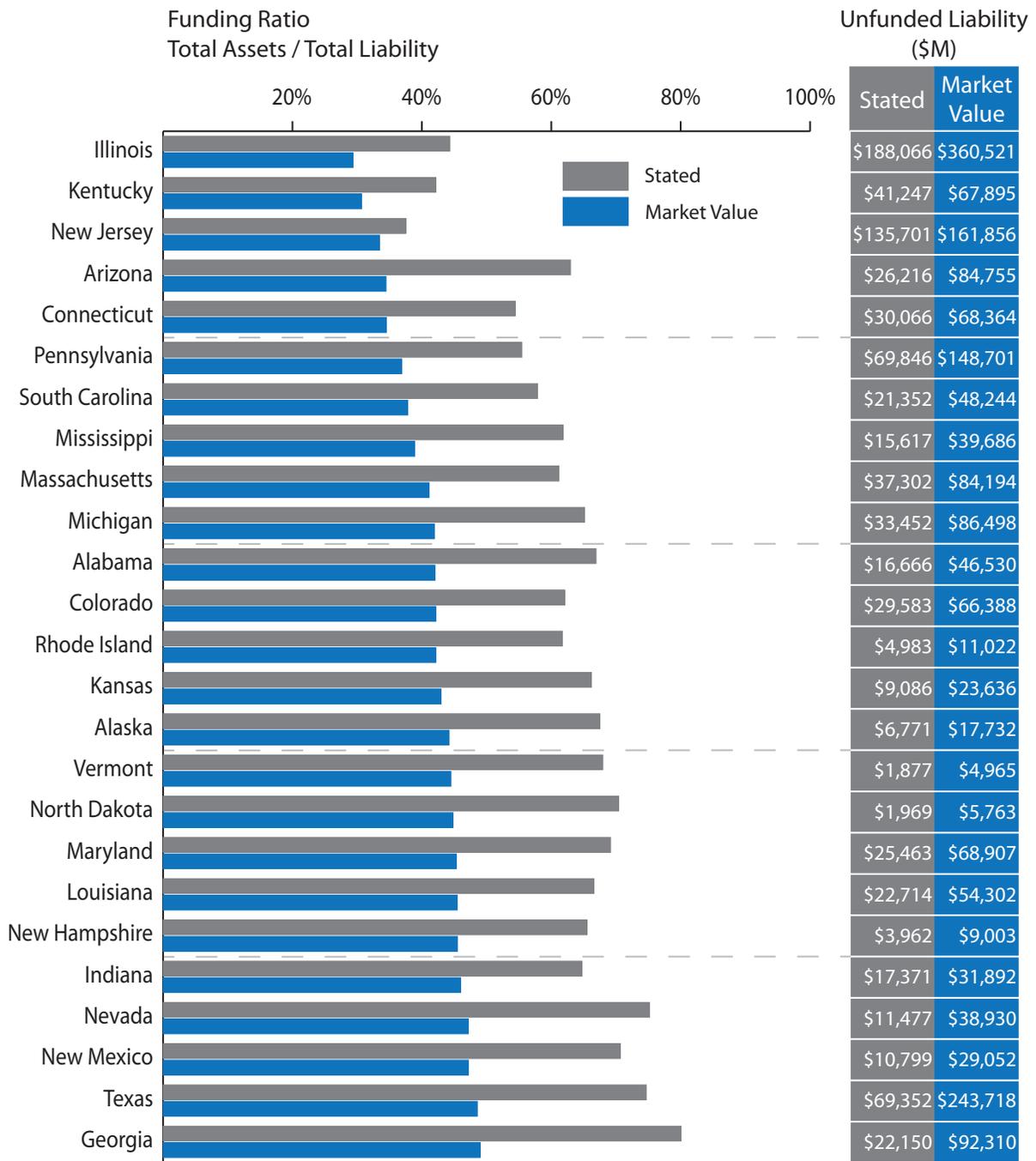
From an ex ante perspective, the true annual cost of keeping pension liabilities from rising is therefore \$288.7 billion ($=\111.1 contributed + $\$177.6$ additional). This amounts to 12.7 percent of state and local government own revenue, including that of governments that do not themselves sponsor pension plans, before any attempt to pay down unfunded liabilities. Focusing on tax revenue, that one-year cost is equal to 18.2 percent of all state and local revenue that comes from taxation as opposed to fees for government services and other sources.

The Fifty States

Funding ratios, defined as total pension assets over total pension liabilities, were calculated for each state, using both reported values and values calculated under the risk-neutral MVL approach. Figure 1 shows these funding ratios for the twenty-five states with the lowest percentages in 2015, while Figure 2 shows the twenty-five states with the highest. These statistics are for state-sponsored funds only. Market-valuation funding ratios vary widely and run from a minimum of just 29 percent in Illinois to a maximum of 77 percent in Delaware. The difference in stated funding ratios and those calculated using the risk-neutral market value approach is also often significant. For example, South Dakota's stated funding ratio is 102.9 percent, leading one to believe that it is over-funded. However, its market value funding ratio is only 64.8 percent.

Figures 3 and 4 examine unfunded liabilities as multiples of estimated 2015 own revenue and tax revenue, at the state and local level. Figure 3 includes the twenty-five states with the highest multiples of state-only tax revenues, while Figure 4 includes the twenty-five states with the lowest. Multiples of state-only tax revenue also range extensively, where Alaska's multiple is over nineteen and Delaware's multiple is less than one. While Alaska's extreme multiple is in part caused by the effect that petroleum price shocks had on the state's revenue, high multiples are still seen in other states. Illinois and Ohio, with the second and third highest multiples respectively, both have unfunded liabilities over six times their estimated 2015 state-only tax revenues.

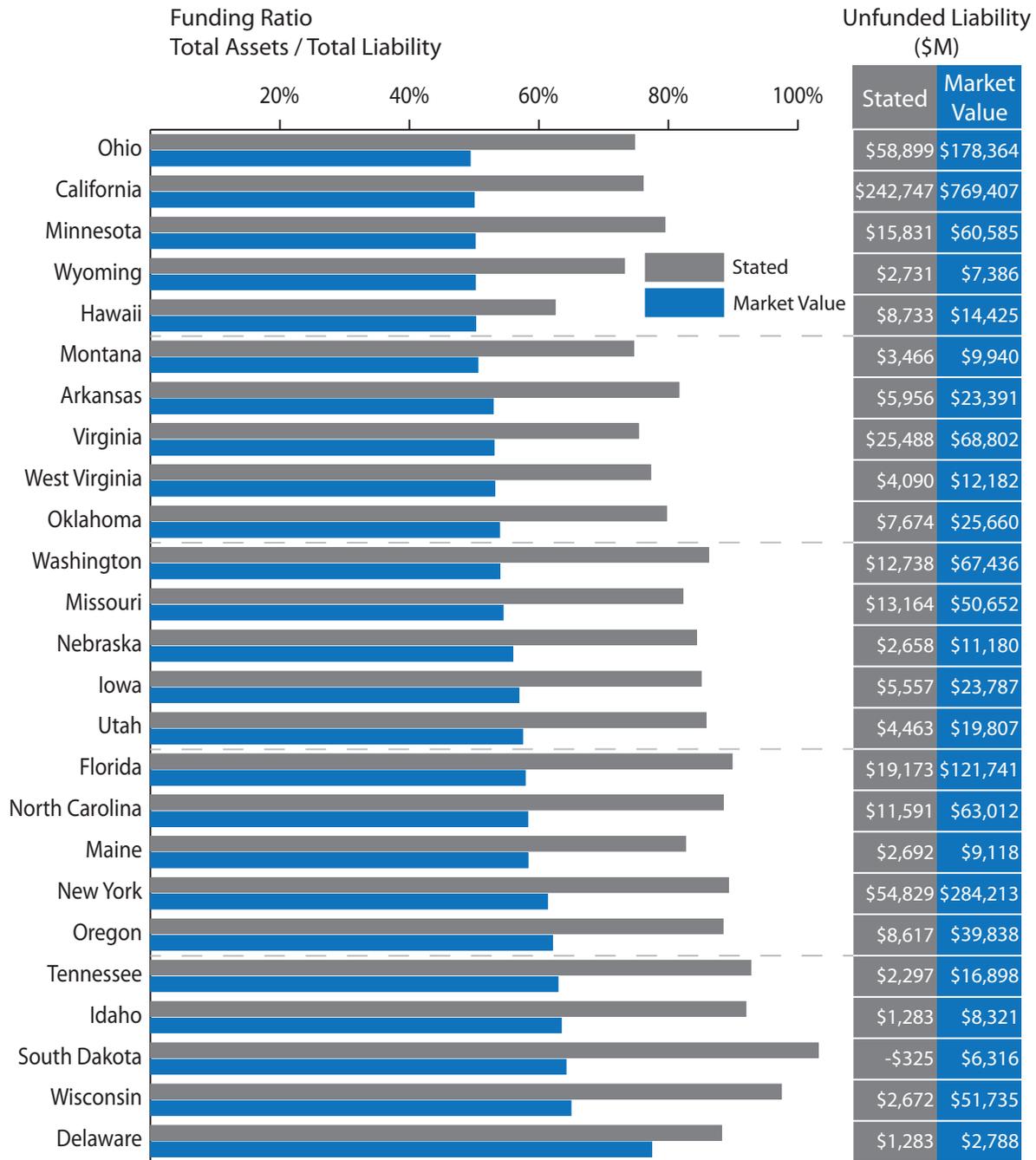
Figure 1: State Funding Ratios—Lowest 25



The next analysis examines the flow, or “pension deficit”—how much new unfunded liabilities are accrued each year under the different measurement techniques. Figures 5 and 6 show the share of own revenue actually contributed to pension systems in each state, as well as the share required to be contributed to avoid an increase in the unfunded liability. Figure 5 shows the twenty-five states with highest required shares while Figure 6 shows the twenty-five states with the lowest.

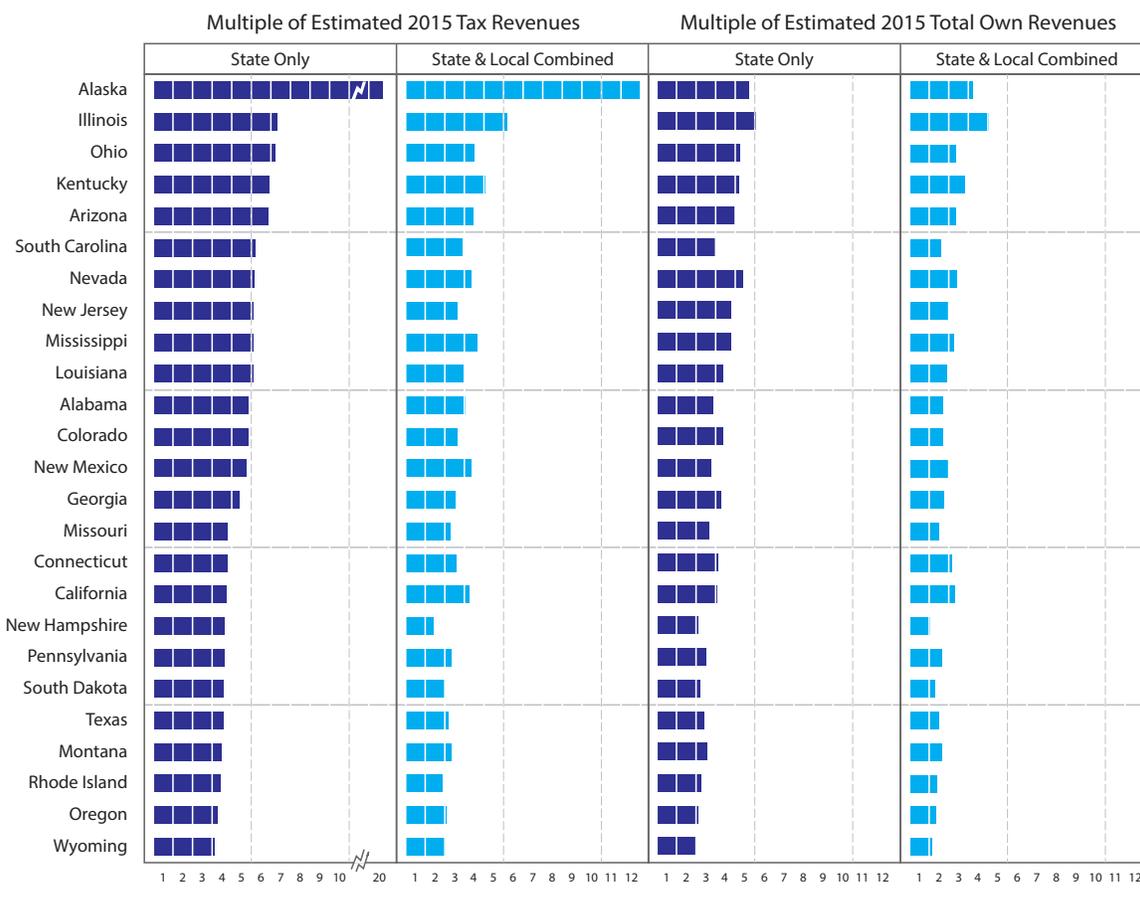


Figure 2: State Funding Ratios—Highest 25



These figures illustrate large differences between the amounts actually contributed and the amounts necessary to contribute to avoid rises in unfunded liabilities. In many states, GASB NPL increases even under the assumption of expected return—that is, the bottom bar is larger than the top bar. In all states except Alaska, the contributions required to keep the UMV from increasing outstrip those actually made, and in many cases substantially

Figure 3: State Pension Liabilities in Relation to Own Revenues—Top 25



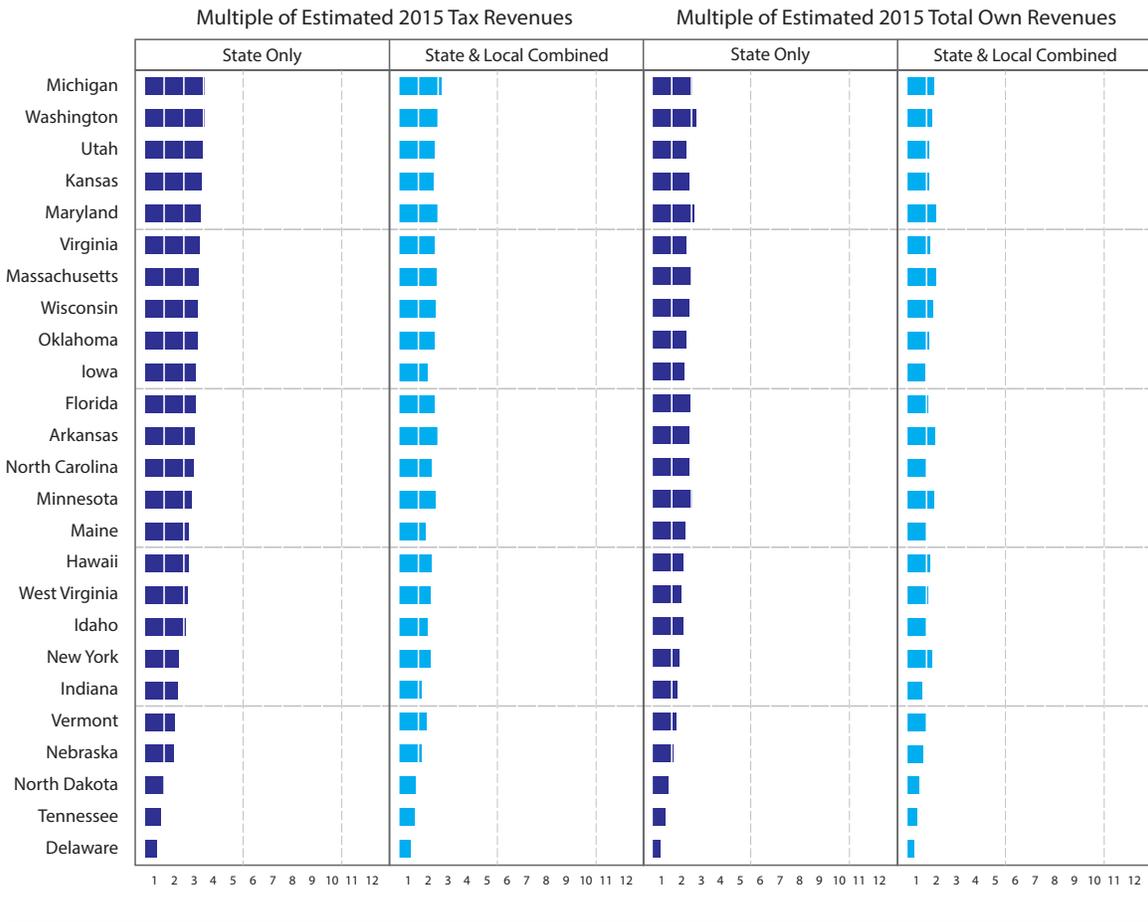
so. Alaska is again an outlier in this category, as the state government contributed \$1 billion to the Alaska Public Employees' Retirement System and \$1.66 billion to the Alaska Teachers' Retirement System, dramatically increasing their contributions for the 2015 year.

In other states, one sees even more troubling statistics. For example, in Illinois contributions were 11.1 percent of own revenue in 2015. Even if Illinois had reached its assumed rate of return, the state would have had to contribute 16.4 percent of own revenue in order to prevent a rise in the NPL. Under the MVL approach, the pension budget would be balanced (in the sense of non-increasing debt) if Illinois had contributed 23.4 percent of own revenue, well over twice of 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 is close to the pension deficit under the expected return measure are generally those for which the present value of newly accrued benefits is 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



Figure 4: State Pension Liabilities in Relation to Own Revenues—Bottom 25



that have undertaken 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 4.9 percent of own revenue under the expected return measure but 7.3 percent of own revenue under the MVL 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 its pension system. For service beyond that date, employees’ pensions would grow at a slower rate; in addition, they receive contributions to a defined contribution plan. As a result, service costs for Rhode Island are small relative to interest costs.

Connecticut and Louisiana also show a relatively small difference between the pension deficit measures, but this rather reflects the fact that the pension systems in these states have very poor funding ratios. The return on assets in these states therefore has a less important impact because there are comparatively few assets to begin with.

Figure 5: State Contributions: Actual vs. Required to Prevent Rise in Unfunded Liability—Top 25

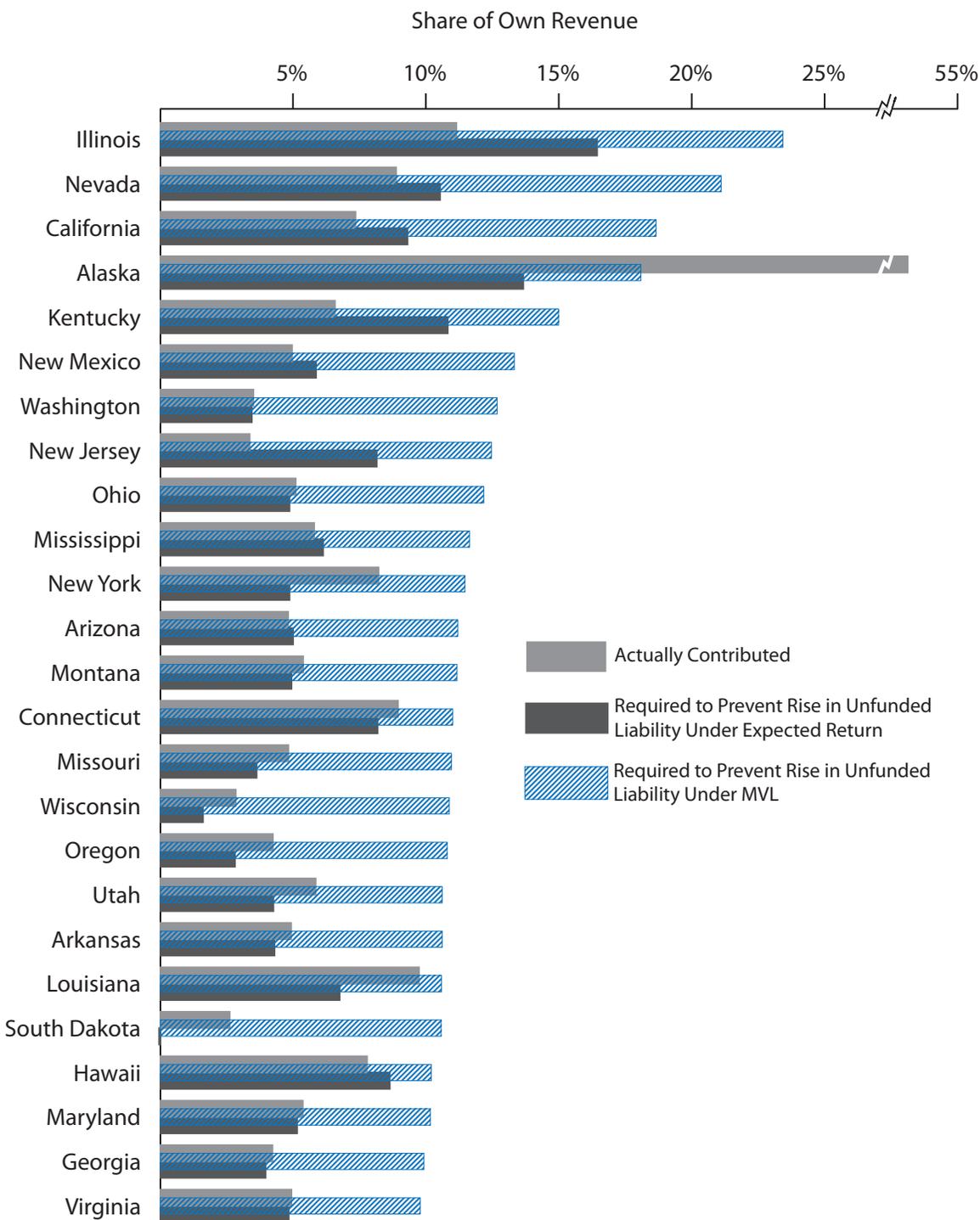
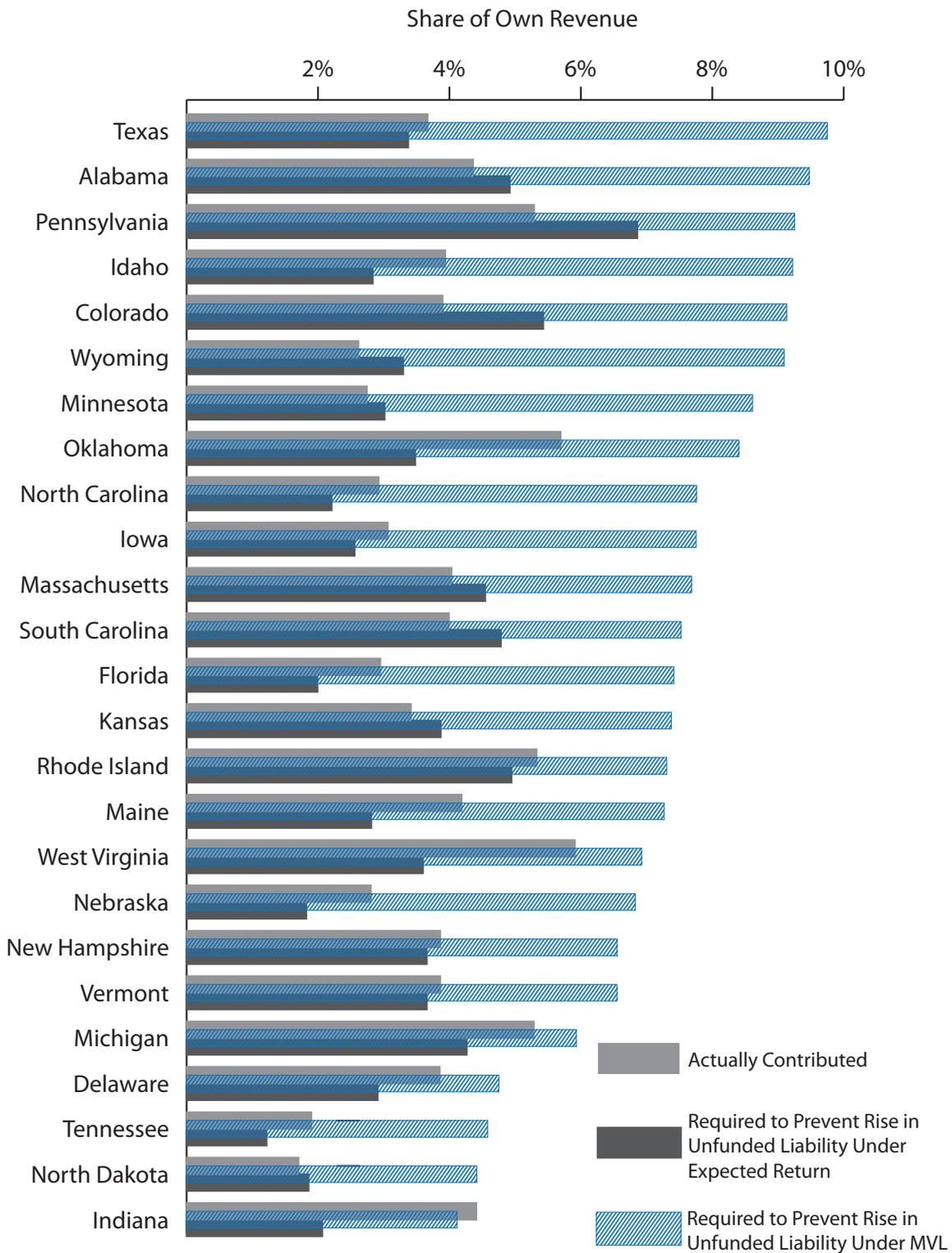


Figure 6: State Contributions: Actual vs. Required to Prevent Rise in Unfunded Liability—Bottom 25



Largest Forty US Cities

In this section, I show a similar analysis for the forty most populated US cities, selected from statistics published by the US Census Department, with the exceptions of Columbus, Ohio; Boston; Las Vegas; Louisville, Kentucky; Mesa, Arizona; Colorado Springs, Colorado; Virginia Beach, Virginia; Raleigh, North Carolina; Minneapolis; Cleveland; and Bakersfield, California. For most of the cities, these are omitted because they do not sponsor their own pension systems. In other cases they are omitted because we were unable to obtain data.

Figure 7 shows the twenty cities with the lowest funding ratios in 2015, while Figure 8 shows the twenty cities with the highest ratios. Similarly to the states' ratios, cities' MVL funding ratios vary widely, from a minimum of just 19.9 percent in Chicago to a maximum

Figure 7: City Funding Ratio—Lowest 20

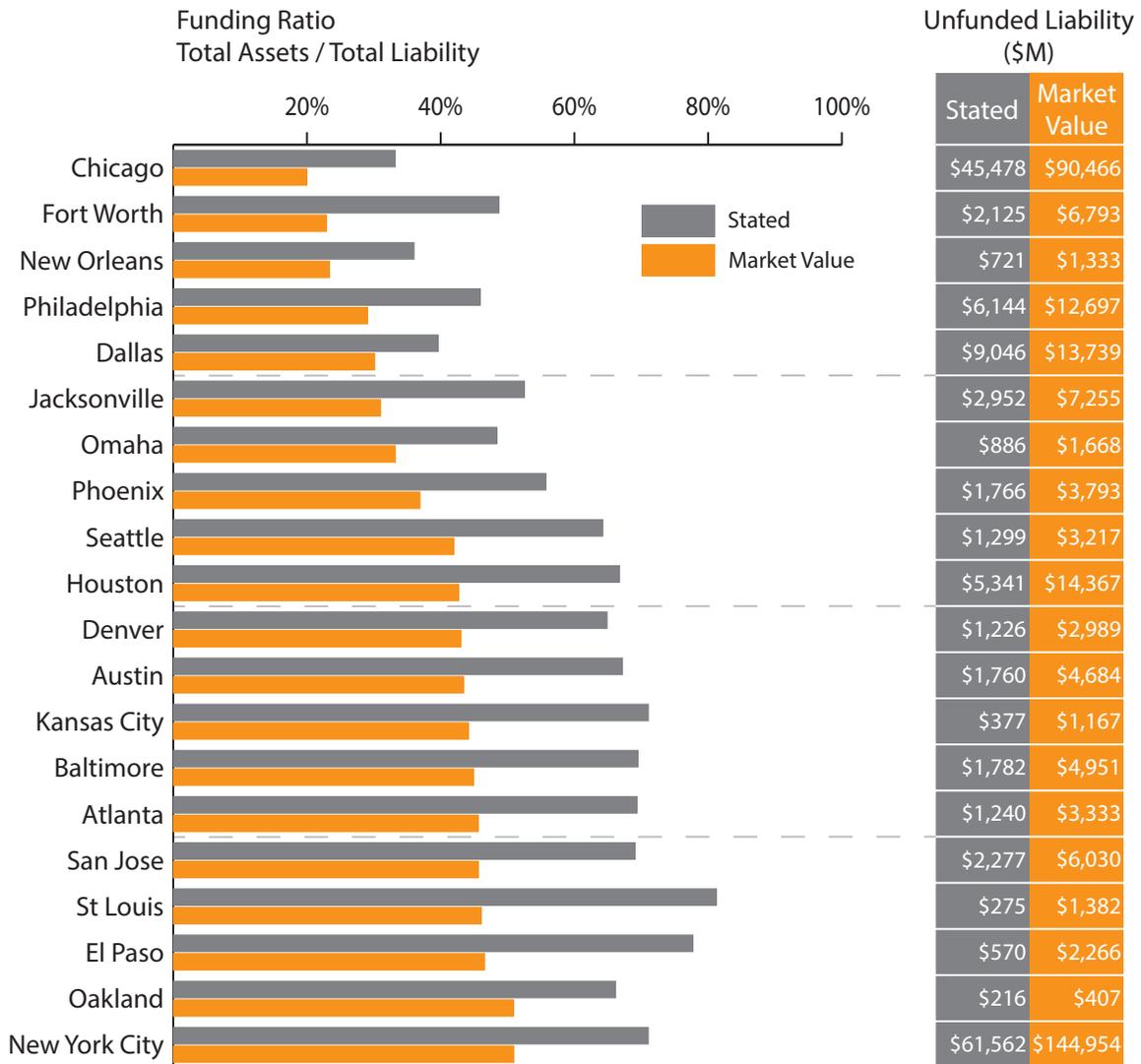
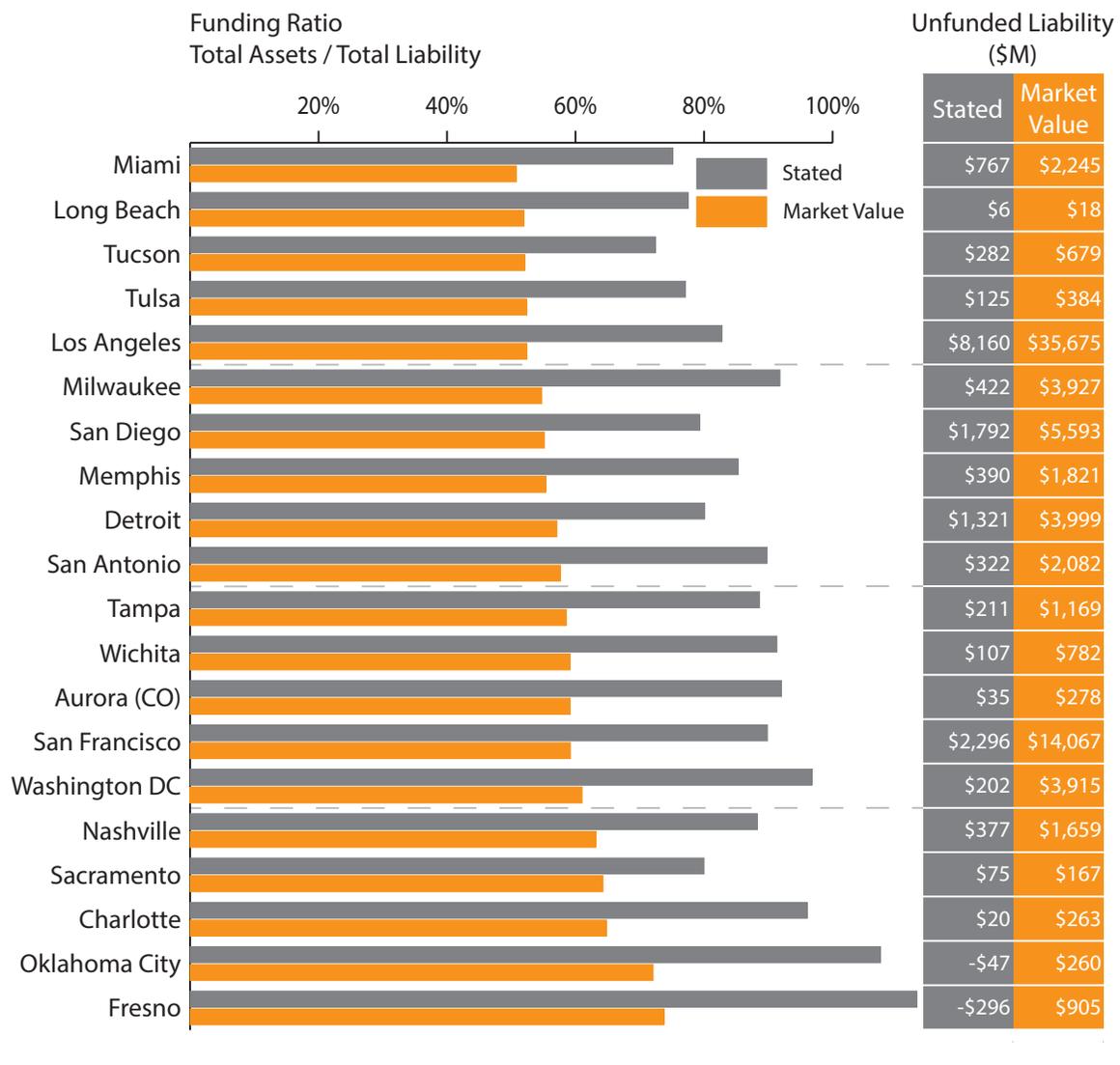


Figure 8: City Funding Ratio—Highest 20



of 73.8 percent in Fresno, California. Large differences in stated and market value are again prevalent as well. For example, Fresno's stated funding ratio is 112 percent.

Figure 9 shows the pension debt (NPL and UMVL) as a multiple of own revenue and tax revenue, in descending order of the latter. Among top-forty US cities by population, Chicago's pension liabilities were the largest multiple of 2015 revenue, at 12.3 times own source revenue and 19.0 times tax revenue. Milwaukee, Dallas, Fort Worth, Texas, and Jacksonville, Florida, are the other cities in the top five according to UMVL as a share of total own revenue, surpassing multiples of 4.3 times total own revenue and 7.9 times total tax revenue.

Figures 10 and 11 show the pension deficits. The City of Chicago contributed 23.1 percent of its own revenue to pensions in 2015; but to prevent a rise in the UMVL (that is, to run

Figure 9: City Pension Liabilities in Relation to Own Revenue—Top 40

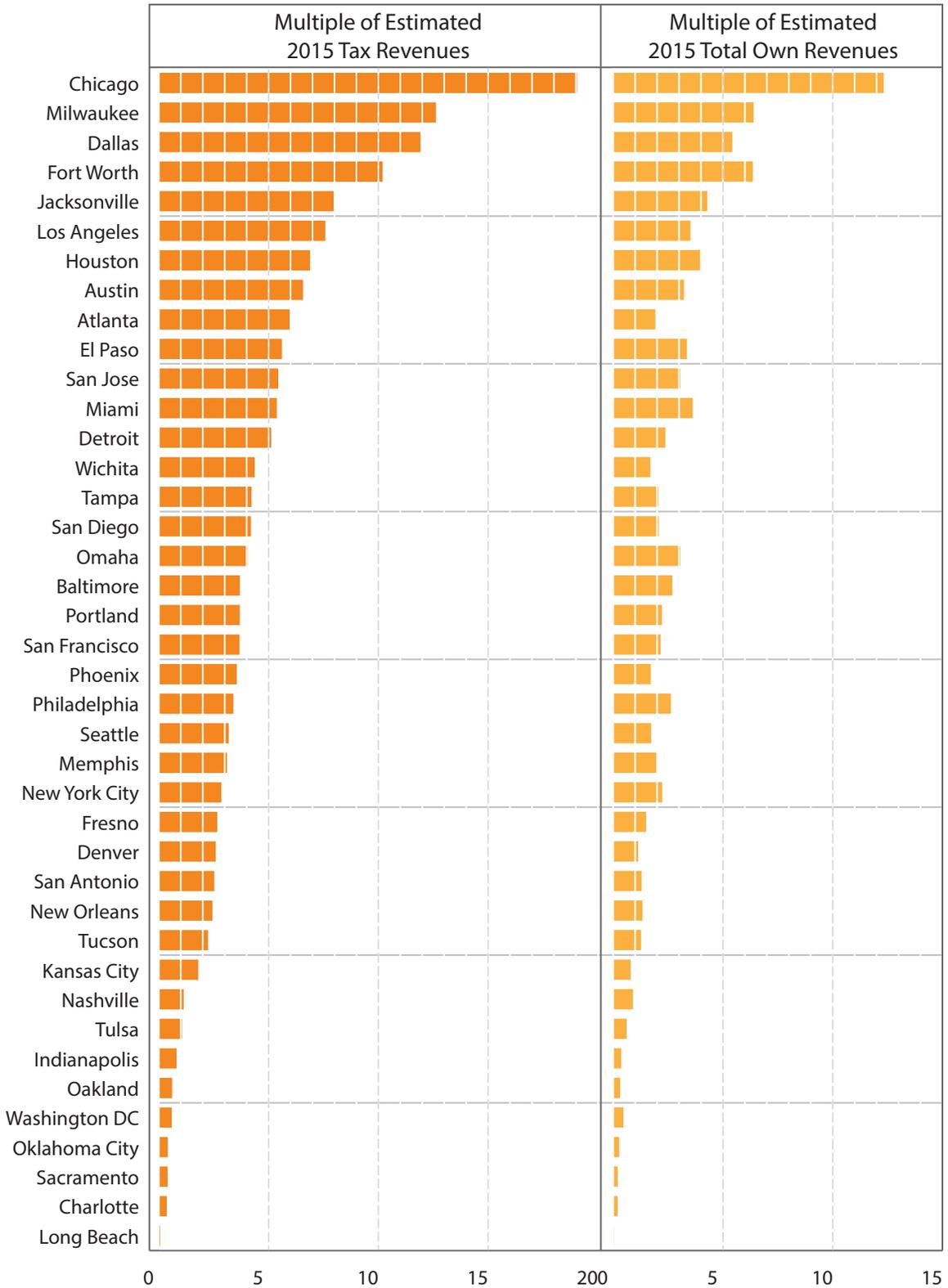
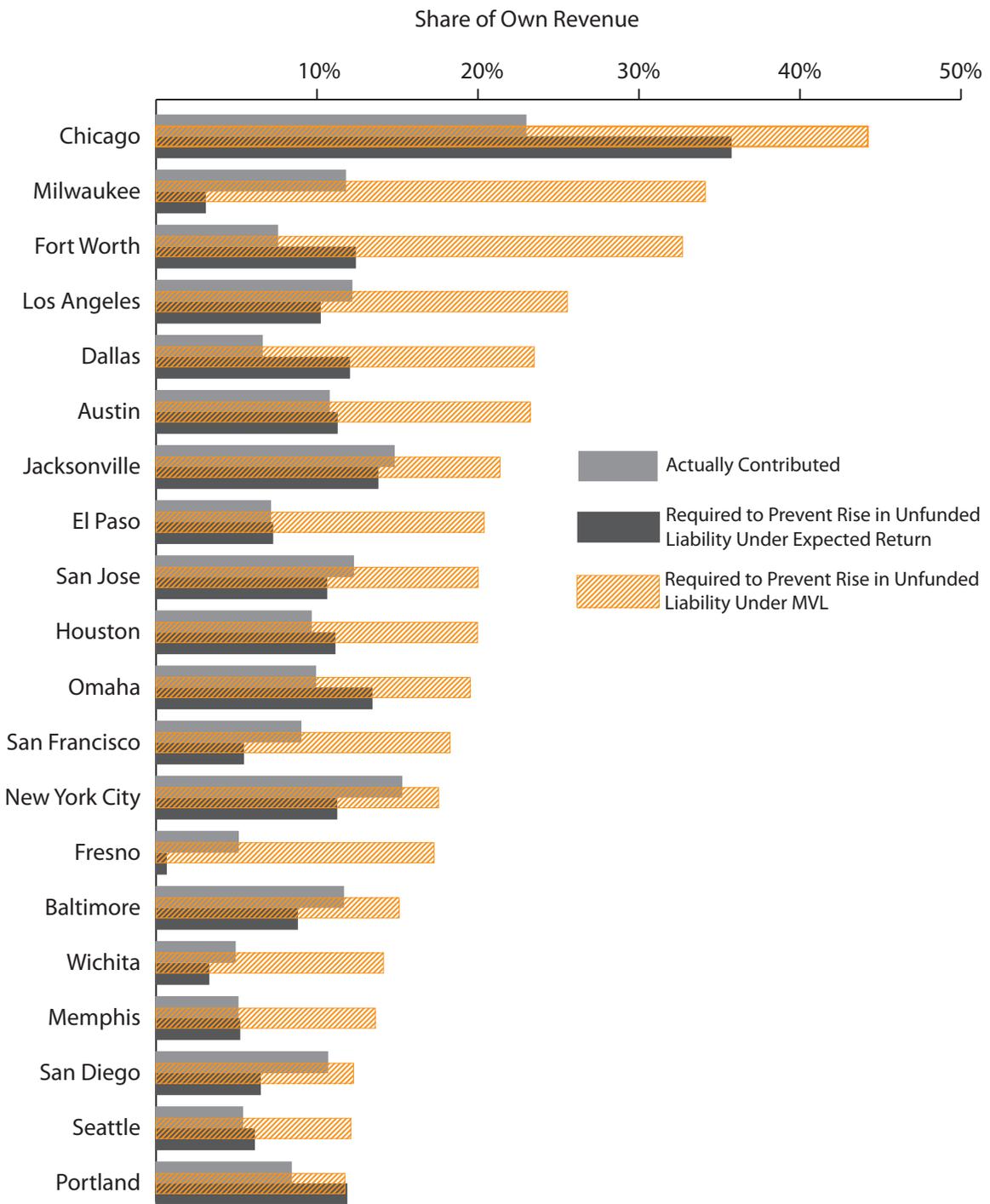
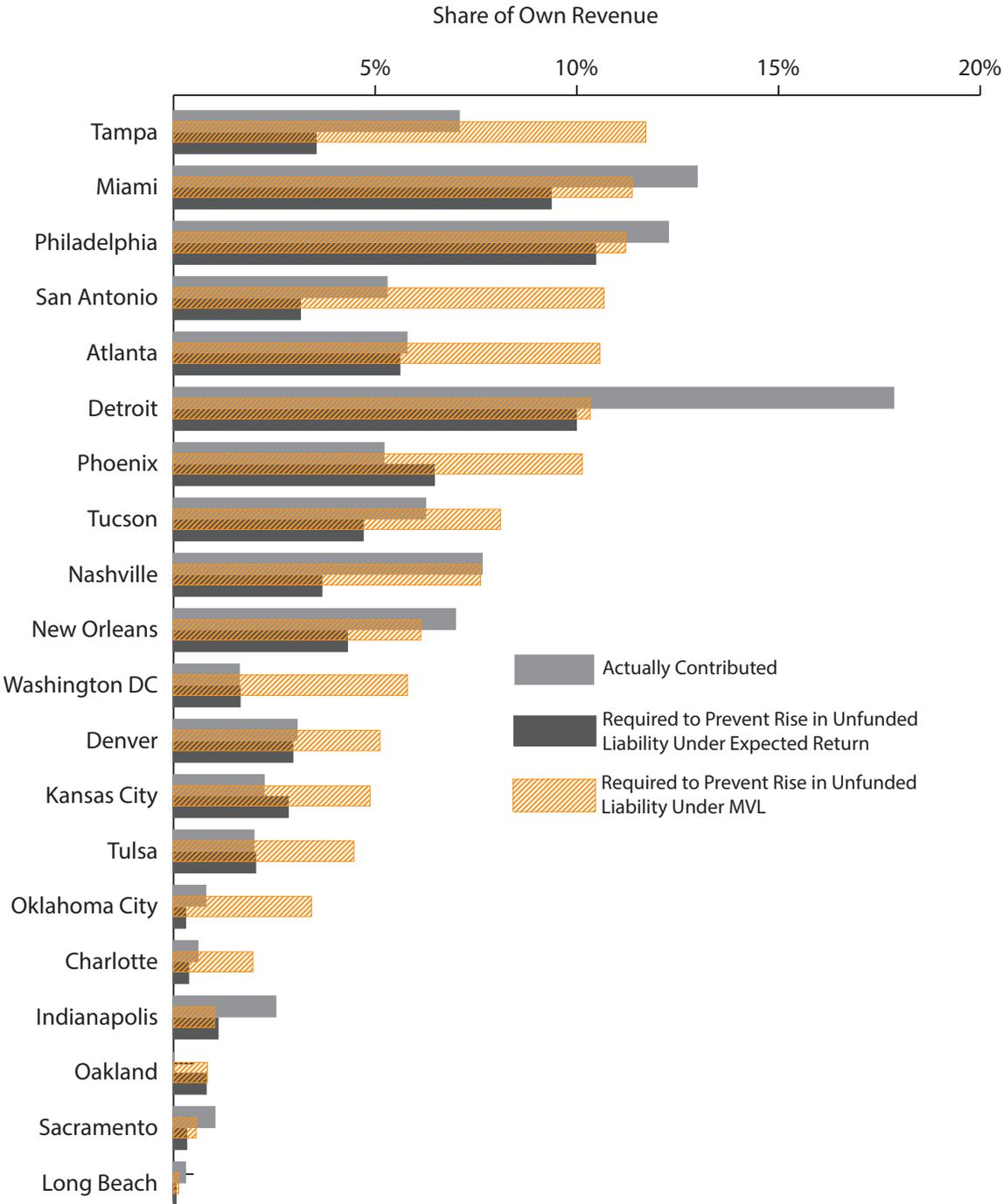


Figure 10: City Contributions: Actual vs. Required to Prevent Rise in Unfunded Liability—Top 20



a balanced pension budget on a market-value accrual basis), it would have had to contribute a full 44.5 percent of its own revenue. Milwaukee, Fort Worth, Los Angeles, and Dallas would all have had to contribute more than 23 percent of their budgets just to prevent the UMVL from rising.

Figure 11: City Contributions: Actual vs. Required to Prevent Rise in Unfunded Liability—Bottom 20



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 MVL 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 11.2 percent of own revenue 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. Some examples include the Portland, Oregon, Fire & Police Disability & Retirement Fund and 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.

Largest Twenty-five Counties

In this section, I continue this analysis for the twenty-five counties selected from the eighty-five most populated US counties, as published by the US Census Department. The counties included were the largest counties in the United States that had municipal pension funds.

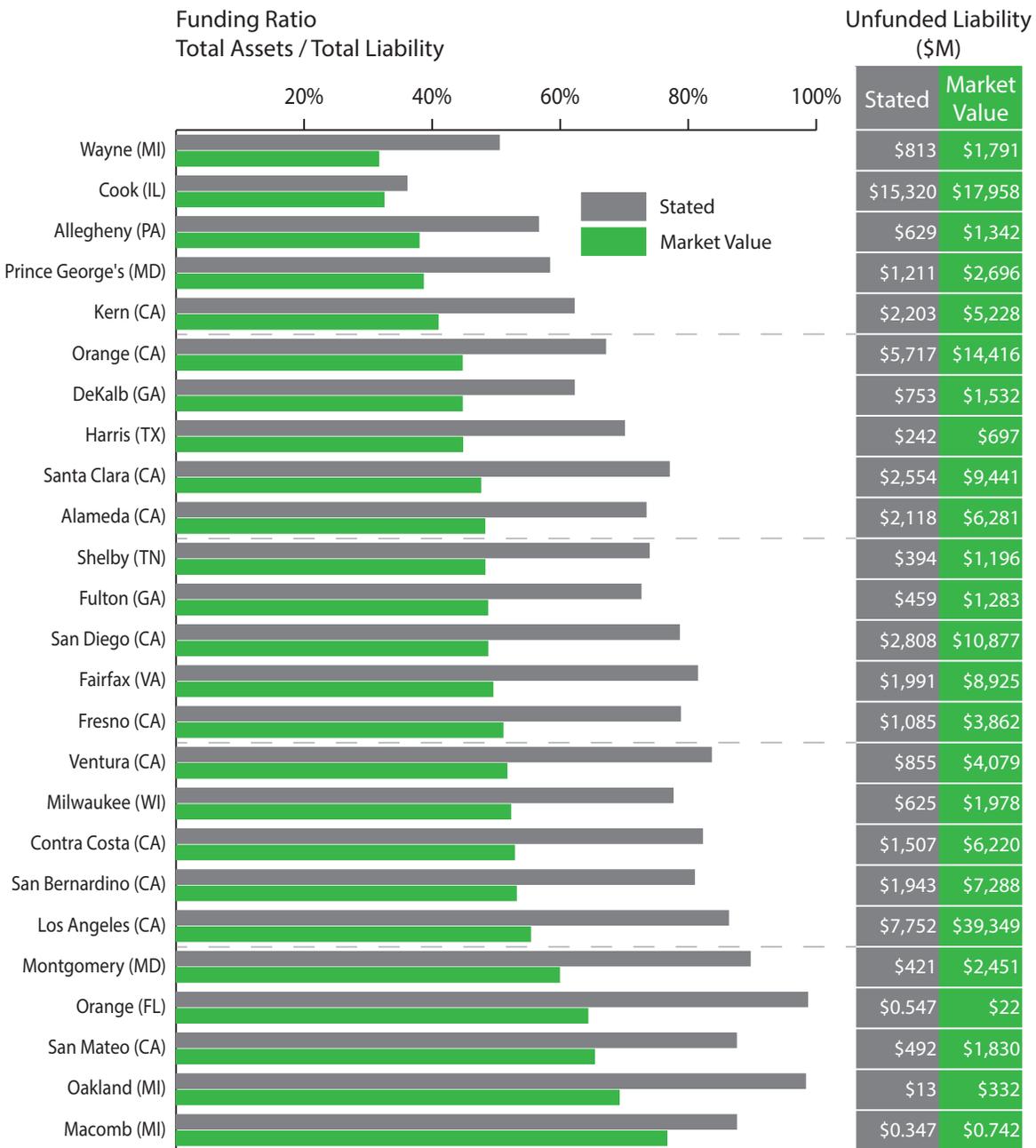
Figure 12 shows the twenty-five counties' funding ratios, ranging from a minimum of 31.6 percent in Wayne County, Michigan, to a maximum of 76.7 percent in Macomb County, Michigan. Figure 13 shows pension debt as a multiple of own revenue and tax revenue, in descending order of the latter. Orange County, California, had the largest multiple, at 7.7 times own source revenue and 13.6 times tax revenue. Fresno County, California, Cook County, Illinois, and Contra Costa County, California, are the three counties with the next highest multiples, and all three surpass multiples of three times total own revenue and ten times total tax revenue.

Figure 14 shows the counties' pension deficits. Fresno County contributed 37.6 percent of its own revenue to pensions in 2015, but under MVL it would have had to contribute more than 1.5 times that amount, a full 61.3 percent of its own revenue, to prevent a rise in unfunded liability. Cook County, Illinois, and three counties in California—Orange, San Diego, and Kern—also would have had to contribute more than 40 percent of their own revenue budgets just to prevent the UMVL from rising.

Detroit: A Case Study

The City of Detroit presents an interesting case of the potential consequences to pension recipients when governments fail. The debt that was hidden in the pension systems came to light with the financial distress that was facing Detroit. In 2005 and 2006 then mayor Kwame Kilpatrick undertook risky investments in the form of credit swaps, in addition to massive loans, to bolster the underfunded pension systems. These unsecured debts ultimately generated losses and are estimated to have increased Detroit's unfunded liabilities by \$45 million per year over ten years, contributing to the insolvency facing Detroit.⁴ In its

Figure 12: County Funding Ratio—25 Largest Counties with Pension Systems



2013 Chapter 9 bankruptcy filing, Detroit cited \$18 billion in debt that included \$3.5 billion in unfunded liabilities from the Detroit Employees General Retirement System (GRS) and the Detroit Police and Fire Retirement System (PFRS). Using market valuation standards, the unfunded pension liability would have been around \$7 billion.

In Michigan, as in a number of other states, pension promises to public employees are ostensibly protected under state constitutions. Article 9, § 24 of the Michigan State



Figure 13: County Pension Liabilities in Relation to Own Revenues

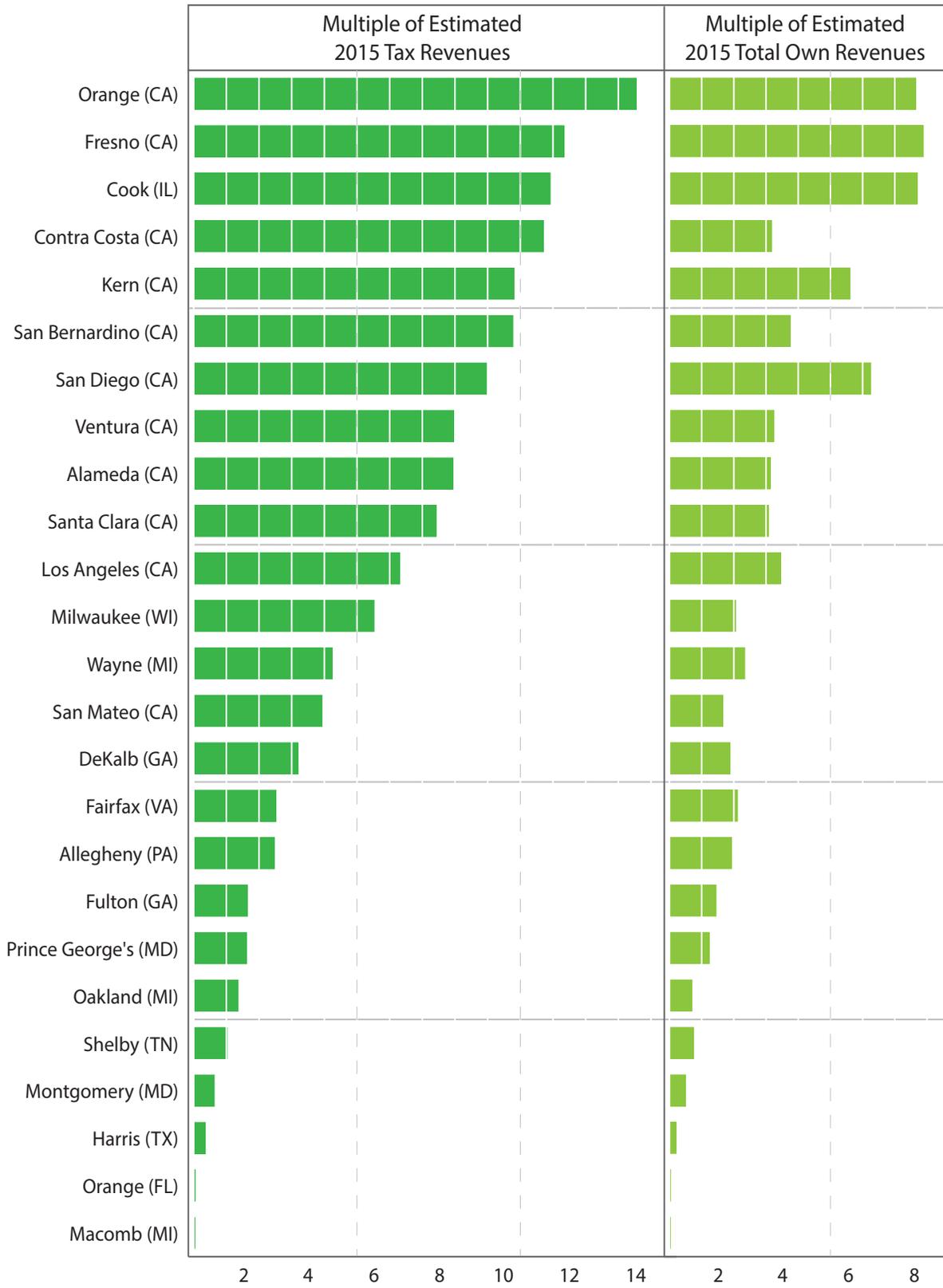
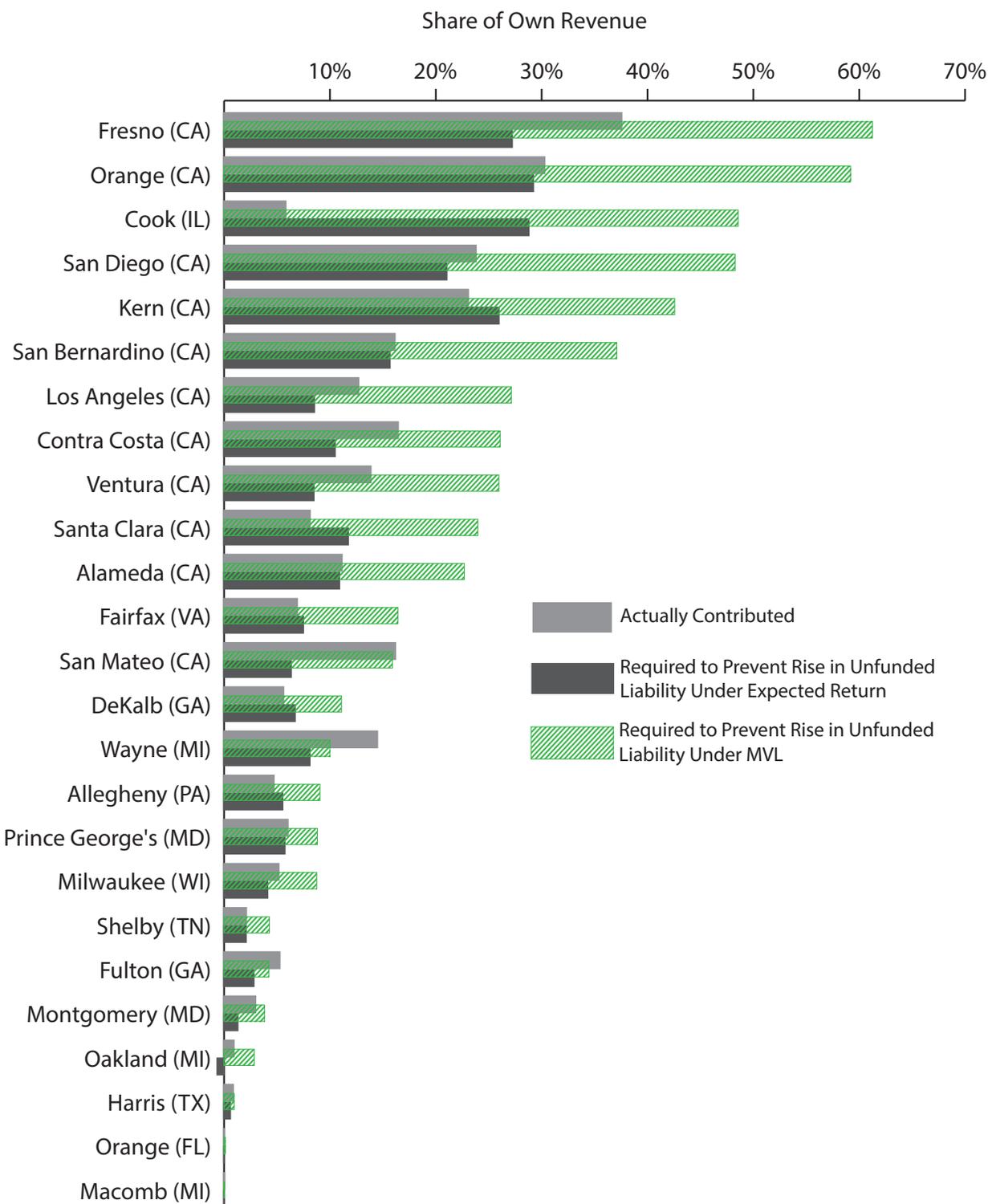


Figure 14: County Contributions: Actual vs. Required to Prevent Rise in Unfunded Liability



Constitution reads as follows, “The accrued financial benefits of each pension plan and retirement system of the state and its political subdivisions shall be a contractual obligation thereof which shall not be diminished or impaired thereby.” Nevertheless, the pension system’s benefits were cut by 4.5 percent as part of the bankruptcy, which also cost pension recipients inflation adjustments.⁵

In addition, the city implemented a new plan that applies to all accruals after June 30, 2014. The new plan for GRS requires employees to pay 4–6 percent of their base pay into the retirement fund while the city covers 5 percent of the base pay, with somewhat higher amounts for PFRS. The conditions necessary to qualify for defined benefits are much more restrictive and remove higher payout conditions to seniority (long-term) employees. Furthermore, the city’s liability to pay the formula benefit may be limited.

Another important aspect to these systems is the GRS annuity savings fund (ASF), which is separate from the pensions. The ASF was available to employees at a guaranteed return of 7.9 percent, which was cut to 6.75 percent.⁶ While the public pensions and the ASF are different systems, they are both run by the Detroit General Retirement System, which allowed for funds to cross over from one system into the other. Specifically, when the 7.9 percent guaranteed return was not met for the ASF, funds from the already underfunded public employee pension systems (GRS and PFRS) were used to cover the loss, totaling \$756.2 million.⁷ However, in some years the investment return exceeded the 7.9 percent guarantee and the excess return was paid out as benefits. The recipients of these benefits are now being required to pay back this surplus, totaling \$212 million. Those payments will go toward funding the public pensions to compensate for the unaccompanied, single-direction transfer of funds between these systems.⁸ A similar situation played out in Oregon in 2011, where pensioners were required to pay back \$156 million for overpayment from 1999.

Beyond cuts to pensioners and repayment requirements, pension systems have been kept afloat through contributions from other institutions. To alleviate the pension cuts, the state of Michigan contributed \$103.8 million in 2014. In addition, a group of philanthropists and charitable organizations promised to donate roughly \$800 million over the next twenty years, an arrangement dubbed the Grand Bargain that protected the assets of the Detroit Institute of Art from liquidation.⁹ The reported contribution from these groups totaled \$137.7 million for 2015.

These changes led to a reduction of \$1.7 billion in pension liabilities from 2014 to 2015 and were the primary factor in the reduction of the total stated net pension liability for the two Detroit plans by \$1.597 billion. The expected return used to calculate the return on investments increased from 7.2 percent (in 2014) to 7.61 percent for the general fund and 7.47 percent for the police and fire fund, in 2015. Though private and state contributions were made, the amount contributed by members decreased from 2014 to 2015 by \$16.823 million. In addition, returns from investments totaled \$215.8 million, for a return of

4.05 percent, much lower than return targets. Due to these changes, total contributions in fiscal year 2015 were well above what would have been necessary to keep liabilities from rising (see figure 11). As shown in Figure 8, the combination of reduced liabilities, changes in contributions, and unmet returns on investment ultimately yielded a market value funding ratio of 57.1 percent (up from 45 percent in 2014) and a stated value of 80.1 percent (up from 64.46 percent in 2014).

It is important to note that while the liabilities were reduced, at the cost of pension recipients, the structure and accounting practices remain the same. While this debt is hidden from the books, its impact to the financial situation of governments can be crucial. Even where constitutional protections are in place, pensioners may be susceptible to loss of benefits when their governments fail. The restructuring left pensioners on the hook; while the pension systems have a longer lifeline, the underlying issues are still present. These pension funds remain underfunded and are potentially another failed, risky investment away from collapse.

Conclusion

The 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 GASB 67 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 were still underwater at the end of fiscal year 2015 by \$3.846 trillion. Given flat market performance in 2016, even with the relatively good performance of the stock market in early 2017, the situation is very unlikely to have improved. Unfunded accrued liabilities are likely more than \$4 trillion.

Finally, the report reveals the extent to which state and local governments are in fact not running balanced budgets. Government contributions to pension systems amounted to 4.9 percent of the total own revenues of state and local governments in fiscal year 2015, and the vast majority of state and local governments claimed balanced budgets. However, the true annual ex ante, accrual-basis cost of keeping pension liabilities from rising is



12.7 percent of state and local revenues, or 18.2 percent of tax revenue. 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.” Mary Williams Walsh and Danny Hakim, “Public Pensions Faulted for Bets on Rosy Returns,” *New York Times*, May 27, 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.” Adam Summers, “Warren Buffett on Public Pensions,” *Out of Control Policy Blog*, Reason Foundation, March 26, 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 California Public Employees’ Retirement System (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 In re City of Detroit, 504 B.R. 191, 192 (Bankr. E.D. Mich. 2013).

5 In re City of Detroit, No. 13-53846-swr Docket No. 8045, p. 58 (Bankr. E.D. Mich. October 22, 2014).

6 Ibid.

7 Ibid.

8 Chris Christoff, “Detroit Pension Cuts from Bankruptcy Prompt Cries of Betrayal,” *Bloomberg*, February 4, 2015, <https://www.bloomberg.com/news/articles/2015-02-05/detroit-pension-cuts-from-bankruptcy-prompt-cries-of-betrayal>.

9 Randy Kennedy, “‘Grand Bargain’ Saves the Detroit Institute of Arts,” *New York Times*, November 7, 2014, <https://www.nytimes.com/2014/11/08/arts/design/grand-bargain-saves-the-detroit-institute-of-arts.html>.

REFERENCES

- Brown, Jeffrey, and David Wilcox. 2009. "Discounting State and Local Pension Liabilities." *American Economic Review* 99 (2): 538–42.
- 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 Promises: How Big Are They and What Are They Worth?" *Journal of Finance* 66 (4): 1207–46.
- 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 Yasuyuki Fuchita, Richard Herring, and Robert Litan. Washington, DC: Brookings Institution.
- Novy-Marx, Robert. 2013. "Logical Implications of the 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): 431–78.

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



The publisher has made this work available under a Creative Commons Attribution-NonCommercial license 3.0. To view a copy of this license, visit <http://creativecommons.org/licenses/by-nc/3.0>.

Hoover Institution Press assumes no responsibility for the persistence or accuracy of URLs for external or third-party Internet websites referred to in this publication, and does not guarantee that any content on such websites is, or will remain, accurate or appropriate.

Copyright © 2017 by the Board of Trustees of the Leland Stanford Junior University.

First Printing, May 2017.

23 22 21 20 19 18 17 5 4 3 2 1



About the Author



JOSHUA D. RAUH

Joshua D. Rauh is a Senior Fellow at the Hoover Institution and the Ormond Family Professor of Finance at the Stanford Graduate School of Business. He formerly taught at the University of Chicago and Northwestern University. His research on state and local pension systems in the United States has received national media coverage in outlets such as the *Wall Street Journal*, the *New York Times*, the *Financial Times*, and *The Economist*.

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 649 state and local pension funds. Considering only already-earned benefits and treating those liabilities as the guaranteed government debt that they are, I find that as of FY 2015 accrued unfunded liabilities of U.S., state, and local pension systems are at least \$3.846 trillion, or 2.8 times more than the value reflected in government disclosures. Furthermore, while total government employer contributions to pension systems were \$111 billion in 2015, or 4.9 percent of state and local government own revenue, the true annual cost of keeping pension liabilities from rising would be approximately \$289 billion or 12.7 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.