MARKET RATES OF RETURN FOR EFFECTIVE FINANCIAL MANAGEMENT

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PIONEER INSTITUTE
PUBLIC POLICY RESEARCH

White Paper No. 123
November 2014

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TABLE OF CONTENTS

> "Compound interest is the eighth wonder of the world. He who understands it, earns it... he who doesn't... pays it."
>
> – Unknown

1. Introduction

The discount rates used by defined-benefit pension systems to value their liabilities and to determine annual contributions have long been a point of concern and contention. Until 2014, governmental accounting standards required that pension funds use the assumed rate of return (ARR) on their portfolio as the discount rate for both management and reporting purposes. With the implementation of Statement 68 of the Governmental Accounting Standards Board (GASB), the ARR will be applied as a discount rate only on the portion of liabilities covered by existing assets, but it will remain a critical metric for many institutional investors.

The ARR of a portfolio can be computed as the weighted sum of the ARRs of its component assets, but the straightforwardness of the process ends here. Current actuarial practice typically applies some form of a building-block method (BBM) to arrive at ARR estimates for each asset class. Those methods are based on a number of implausible assumptions, unreliable statistical techniques and more or less arbitrary expectations about the future. Most importantly, the governing actuarial standards are too vague to ensure objectivity, leaving too much leeway for bias – be it conscious or not – to enter the picture.

Even when a BBM is augmented or replaced by actual historical rates of return, those are rarely estimated on a long enough time horizon or a representative set of assets – i.e., by using all available data. A common practice is to look at the historical returns of the pension plan or investment manager without regard for the asset allocation itself or the peculiarities of the market cycle which inevitably have influenced the specific series of returns. This short-termism in the estimation also opens the door for subjectivity because the cutoff point for the time series can be chosen completely arbitrarily.

Apart from any claims of objectivity or ability to forecast future returns, common ARR practice effectively precludes any meaningful benchmarking of pension-plan solvency and performance. Because ARRs are determined based on a wide variety of approaches and assumptions, it is not particularly credible to compare plans' funding levels. More importantly, these inconsistent ARRs determine the estimated cost of the plans and the annual required contribution (ARC) of the plan sponsors, thus also making impossible a meaningful comparison of the fiscal burden of retirement obligations across jurisdictions.

These many problems can be mitigated by using instead a market rate of return (MRR) based on clear-cut computational techniques and all available long-term historical data rather than assumption and opinion. Making this more direct data-driven approach mandatory by statute and regulation would significantly improve financial management, especially in the context of public pensions, and boost transparency. The MRR Calculator, a simple spreadsheet template accompanying this report, illustrates how easily an objective methodology can be applied and provides numerical estimates for reasonable MRRs on specific portfolios.

2. Why ARRs Matter

Assumed rates of return (or, alternatively, costs of borrowing) are an essential tool in areas of financial planning ranging from capital investment to product pricing. They are particularly important in costing and funding retirement benefits such as pensions and healthcare services, where ARRs

are often used as a discount rate for future cash flows, because of the exceptionally long duration of these types of liabilities. Over the longer run, compounding produces dramatic differences in final values even with small changes in annual rates of return.

Figure 1 provides a straightforward illustration of this point by looking at the final value of a $1,000 investment with different rates of return. Over 15 years, the initial investment would grow more than threefold with an ARR of 8%, resulting in a final value which is some 32% larger than the one that would be generated if the investment grew at a 6% annual rate. Thus, if a retirement plan assumed an 8% return but realized only 6% annually instead, it would end up underestimating the cost of the benefit substantially and would suffer from chronic underfunding.

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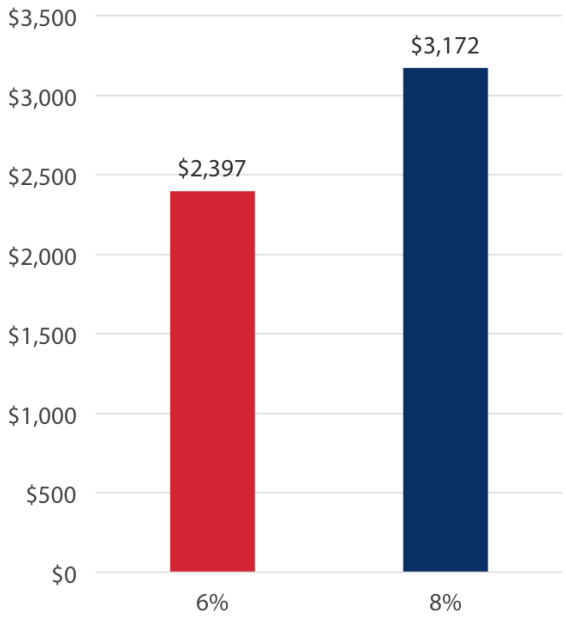
Figure 1. Value of $1,000 after 15 Years at Different Interest Rates



Financial professionals who are conscious of these effects of compounding attempt to forecast future rates of return in order to produce robust financial plans and projections. However, the wide variety of techniques they typically use are often inconsistent with other practices and assumptions, incomplete relative to the available data and almost invariably susceptible to biases because of the unwarranted amount of subjectivity involved. The output of these techniques lacks reliability because they are mostly based on subjective judgment rather than a robust process and thus do not produce results that can be readily replicated or compared.

While the more extensive use of subjective judgment in predicting portfolio returns may be justified in the context of daytrading or other short-term market speculation, any value it may add is dwarfed by the amount of information contained in long-series data spanning well beyond anyone's lifetime or professional career. And regardless of the forecasting effectiveness of any approach, fiduciary concerns can be minimized only with a simple and transparent decision-making process based on objective metrics rather than opinion. Recognizing that future returns cannot be predicted with a satisfactory level of accuracy, it is much better to take long-term historical returns as a proxy with the express goal of making them transparent and comparable across investment plans, rather than taking them as predictive of the future.

3. Short-Termism, Building-Block Methodologies and Minimizing Subjective Bias

In current practice, actuaries typically use some form of the Building-Block Methodology (BBM) to forecast the returns on the different asset classes constituting a fund's portfolio. This approach is based on the Capital-Asset Pricing Model (CAPM) or subsequent versions of Modern Portfolio Theory (MPT), a theoretical framework from the second half of the 20th century unsupported by long-term market data. Notably, MPT is manifestly susceptible to market

shocks such as the Asian crisis in the late 1990s, the subsequent dotcom bubble and the financial crisis of 2008-2009. BBMs failed to anticipate and correct for any of these market shocks, leaving plan principals with huge market losses – and ballooning unfunded liabilities to pay down.

To arrive at an expected nominal return for a particular asset class, a BBM typically uses as a baseline a so-called "risk-free" rate, which is typically taken to be the real return on one-year US Treasury bills or even more liquid instruments such as overnight deposits. Then, an inflation assumption is applied uniformly for every asset, which is problematic because the impact of monetary expansion on different market prices can remain lopsided for extended periods. For example, securities assets and real estate have appreciated substantially since the 2009 stock-market bottom in the US, while wages and durable goods have lagged far behind or remained altogether stagnant.

Depending on the specific asset, the BBM then adds a variety of "risk premia" and other adjustments to the uniform base composed of the risk-free rate and the inflation assumption. For example, a 20-year corporate bond yield expectation could consist of the baseline rate plus a duration premium, a risk premium based on the issuer's credit rating and a policy normalization component in anticipation of the Federal Reserve's expected monetary tightening in the next few years (Fig. 2).

FIGURE 2. EXAMPLE OF BBM DERIVATION OF THE EXPECTED NOMINAL YIELD ON A CORPORATE BOND

Building Block	Return
Risk-Free Rate	1.5%
Inflation	3.0%
Term Spread	2.0%
Credit Spread	2.7%
Fed Normalization	1.0%
Total	10.2%

In this example, the risk-free rate, inflation expectations and the spreads can be based on measurable data. The risk-free rate can be a recent market observation or a historical average of US Treasury yields, while the term and credit spreads can be derived algebraically from the current or historical yield curves of government and corporate bonds.

However, the inflation component may in fact be the forecaster's own expectation of future inflation or, at best, survey data from an "expert" community. The expected impact of a normalization of Fed policy, however, is strictly subjective because current monetary measures are unprecedented in history and there is no credible method to predict specific Fed action and its impact on the markets.

Thus, BBM's main weakness is hidden behind the numbers and even more dangerous than the many theoretical assumptions it is premised upon. Fundamentally, it is a *forecasting* model and its output is an *expected* return, which is strongly exposed to short-term and herding bias because it is often based on opinion, not on fact. The method creates the illusion of certainty and objectivity about future market performance, which in turn engenders a false sense of security for financial managers and for the policymakers underwriting pension obligations, without necessarily adding predictive value.

> *"The [building-block] method creates the illusion of certainty and objectivity about future market performance, which in turn engenders a false sense of security for financial managers and for the policymakers underwriting pension obligations, without necessarily adding predictive value."*

Whereas using data-driven MRRs instead does not completely obviate the risk of managers' taking past performance to be an indication of future returns, at least it prima facie and by its very name makes clear that it is merely a backward-looking

summary of prior experience. Scenario analysis of funding and costing a defined-benefit plan and stress-testing its solvency are indispensable regardless of what rate of return is used to value its liabilities,[1] yet these risk-management techniques seldom are part of public retirement funds' practice.

The pension world is still recovering from the consequences of the rampant availability bias (assuming returns will stay as high as in the atypical economic conditions of the past quarter century) and herding behavior (e.g., making such assumptions en masse and crowding into fizzy and faddish segments such as mortgage-backed securities and hedge funds) that caused huge portfolio losses during the most recent financial crisis. Rather than using the same flawed practices that helped aggravate many a fund's market debacle, managers ought to consider eliminating their exposure to such biases to the extent possible. The first step on that way is to adopt standards of practice that remove the subjective elements of the process which can be replaced by actual data.

One such approach is to use long-term historical rates of return for the portfolio components rather than trying to construct them from MPT or any other theoretical model. A method minimizing subjectivity must use, in order of priority:

1) data obtained directly (rather than derivatively) from the market (to minimize measurement error);
2) indicators that are consistent over time with the least exposure to survival and other biases (to avoid cherry-picking units and metrics that produce the most optimistic projections);
3) annualized returns based on the longest available data series that contains at least two depressionary or stagflationary periods (to avoid cherry-picking historical periods with favorable returns).

Taken together, these criteria result in a methodology of arriving at a discount rate which is much less prone to bias or outright tampering and expressly recognizes that the future is uncertain and cannot be predicted, especially for decades in advance.

As an example of these criteria in practice, an MRR on US equities should, respectively, be based on:

1) the total market return on US stocks rather than a summation of a risk-free rate, inflation and the equity risk premium obtained through statistical regression or other indirect methods;
2) all traded stocks rather than a narrow arbitrary index such as the Dow Jones Industrial Average;
3) market data going back to the 19th century rather than just the last 10 or 50 years, where the world has experienced a historically unprecedented period of geopolitical and economic stability.

Finally, it is important to repeat the mantra that past performance is no guarantee of future return by emphasizing that this is an actuarial estimation method and not a forecasting technique. It is intended to be appropriate for very-long-term financial planning, rather than daytrading on the securities markets or making economic forecasts for the next few years. The prudent fund manager and the fiscal authority underwriting the pension benefit would have to prepare additionally for the short-term impact of the inevitable market shocks that can imperil fund and employer liquidity and solvency.

The distinction between forecasting and contingency planning (or hedging) is seminal to any argument about a retirement plan's sustainability. One cannot predict the future, but can prepare for a reasonable range of possible outcomes without necessarily knowing which one will obtain. Focusing on forecasting all but guarantees insolvency sooner rather than later. Costing the contingency protection can not only help protect the plan, but also actually indirectly predict whether the plan is sustainable at all in the long run (and potentially have it replaced before

disaster strikes). The real cost of the plan is the cost of meeting the conceivable contingencies, not of any one projection.

The exclusive use of long-term historical rates of return does not preclude or replace active asset and risk management; it simply helps obviate the false premise that fund managers or actuaries need a crystal ball predicting the future in order to be effective. The actuary provides the MRRs and the corresponding estimates for fund liabilities; the fund manager adjusts asset allocation based on those inputs and the target return set by the employer; and the fiscal authority paying for the plan hedges the attendant risks by adjusting benefits, hiring decisions and/or its own portfolio, while stress-testing the plan with regard to sharp deviations from the MRR. No change in metrics can replace stress-testing the plan and hedging its liabilities as possible.

4. The MRR Calculator

Market rates of return can be relatively easily computed from publicly available data. The MRR Calculator is a straightforward tool to update ARRs that only requires inputting basic portfolio allocation percentages into a Microsoft Excel spreadsheet. It is available from Pioneer's website as an Excel workbook and uses nominal-return data from Deutsche Bank's "Long-Term Asset Return Study"[2] with annualized total returns computed through 31 July 2010 (Fig. 3).

Long-term return data are not available for some popular market segments such as emerging economies, hedge funds and private equity. Time series for these asset classes are barely three or four decades old. However, the main focus of an objective determination of the MRR is not "accuracy" but transparency and objectivity. Thus, the tool uses US equity returns as a proxy for global equities, hedge funds and private equity. The portfolio holdings within the two latter segments can hardly be disentangled on a geographic or asset-class basis because they often include both global and domestic instruments, including not only equities and fixed income but also various derivatives and currency positions.

Figure 3. Long-Term Market Return Data

Asset Class	Description	From Year	Return (Gross of Fees)
Equity	US equities	1800	8.26%
Treasury (10-year)	US government bonds maturing in 10 years	1800	5.1%
Corporate Bond	US corporate bonds	1900	6.65%
Property (price only)	Realty excluding rental income and maintenance expenses	1900	3.42%

Hedge-fund and private-equity indices are still in their infancy and thus subject to short-term bias, so they should not be used directly.

The first spreadsheet of the Excel workbook contains the MRR Calculator template. Users only need to insert the percentages for the asset allocation and a recent or historical fund expense ratio (bottom right cell of Fig. 4). They can add rows for more detailed information by asset class and update return data to the most recent year as they see fit, but must make sure that cell formulas are maintained and that time-series extend at least until 1900. A half-percent expense is suggested as a ceiling on fund expenses; managers experiencing consistently higher expenses ought to review their investment fees and operating costs.

The second sheet contains an application of the MRR Calculator to a typical pension-fund portfolio with large fixed-income and hedge-fund holdings (Fig. 4). The sample portfolio of 40% equities, 30% fixed income and 10% each in hedge funds, private equity and property results in an ARR of about 6.64%, significantly below prevalent nominal return assumptions across the United States, which are typically in the range 7.5-8% and rarely incorporate an accurate picture of investment and operating expenses.

Figure 4. MRR of a Sample Portfolio

ASSET CLASS	LONG-TERM RETURN	ASSET ALLOCATION (percent share)
Equity		
Stocks	8.26%	*40.00%*
Hedge Funds	8.26%	*10.00%*
Private Equity	8.26%	*10.00%*
Fixed Income		
Treasury Bond (10-year)	5.10%	*10.00%*
Corporate Bond	6.65%	*20.00%*
Property (price only)	3.42%	*10.00%*
		100%
PORTFOLIO MRR	6.64%	Fund Total Expense Ratio
		0.50%

5. Policy Implications

ARRs as utilized by public pension systems in the US must be set in accordance with the respective actuarial standards of practice (ASoPs), regulations and statutes. Presently, none of these policy documents include clear enforceable rules for objective determination of the ARR. State and federal statutes are largely mute on the subject and impose few constraints on regulators, fund managers and actuaries. Despite several rounds of revisions in recent years, the relevant ASoPs still do not set strict enough guidelines for estimation and leave too much ambiguity and leeway for firms and practitioners.

In Massachusetts, for example, the prevalent ARRs have been set largely at the behest of the Public Employee Retirement Administration Commission (PERAC), which has recently been steering retirement boards and their actuarial consultants towards a gradual reduction in their ARRs from levels, which not so long ago reached as high as 8.5%. In many cases, retirement board members made wary by recent experience have been more than willing to initiate and expedite these ARR adjustments.

While policy seems to be shifting in the right direction, the current ARR adjustment process leaves too much to the imagination – it is unnecessarily subjective and opaque. This amorphousness creates too much risk. ASoPs are adopted at the national level, which makes them too difficult to amend, and do not have the legally binding authority that would be needed to ensure the enforcement of objective ARR methodologies. State leaders and regulators must step up and create clear rules.

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Massachusetts law[3] gives PERAC sweeping powers to regulate the activities of the commonwealth's retirement systems and especially their financial operations and reporting standards. The agency can adopt specific and legally binding guidelines requiring that boards use objective metrics. Fiscally responsible and prudent state

leaders would direct PERAC and other state regulators to do so or, better, will enshrine those guidelines into law.

A robust method would specify historical data to be used to determine the MRR for each asset class, that the data series must be at least 80 years long and that the entire available data series must be used in the calculation (preventing retirement boards from fudging the numbers by selecting the most convenient interval). When no data of such length are available, boards can use the nearest existing indicator based on the underlying assets and investment strategy for the segment. Regulators can publish a substitution table for approximating the historical returns on assets which do not have long-term return data available. The MRR for each asset class must be derived from the data series by calculating its geometric mean, not by averaging, regression or approximation. The aggregate portfolio MRR must be based on these asset-class estimates weighted according to the portfolio allocation in the most recent fiscal year and must include the fund's expenses based on actual experience over a period extending no more than five years in the past.

The specific methodology (including data sources) and a data summary similar to the tables in the MRR Calculator must be a required part of the disclosures to every system's annual financial statements and valuation studies. To ensure compliance, the law can impose fines on board members who vote to adopt financial statements that do not disclose this information accurately. Regulators can be given authority to remove such individuals permanently from serving or being employed at any retirement system in the state.

These robust standards can be implemented gradually over a period of up to five years, allowing retirement systems to put in place the necessary internal processes and giving the governmental units ample time to anticipate the budgetary impact of the new MRR rules, during which period they will also be able to digest the implementation of GASB 68.

6. Public Retirement Systems in Select States

Applying the baseline assumptions of the MRR Calculator to real-world data from Pennsylvania, New York, New Jersey, Illinois, Connecticut and Massachusetts paints a grim picture of the financial condition of the retirement systems in these states. New York stands out as the single state in the sample (and the only one in the Northeast besides Delaware) whose public retirement systems are fairly well funded both by its own metrics and historically derived discount rates. Unfortunately, this upbeat view does not extend to New York City, whose pension funds are doing considerably worse than the eponymous state's.

Even though these are all postindustrial and predominantly Progressive states, their defined-benefit public-pension systems vary widely in the way they are organized, covering most of the arrangements observable among states with defined-benefit plans for public employees. It should be noted that comparisons between states and systems should be made with caution because the differences in the actuarial and accounting standards they use extend far beyond those discussed in this study.

The data for the analysis that follows are based on a combination of the most recent actuarial valuation for the system and the most recent asset allocation data available online.[4] This often implies that valuation and allocation data are from different periods (usually within no more than two years from one another). Estimated liability, unfunded liability and funded ratio based on the asset-allocation MRR were all recalculated relative to market value of assets, rather than the actuarial value, which may be based on a number of other assumptions. Some systems look better and others worse as a result of this approach.[5] Because MRRs apply to existing assets, less funded systems are affected less by re-estimation of the discount rate, but that is no consolation when retirement benefits are funded at an essentially insolvent 20-30% ratio.

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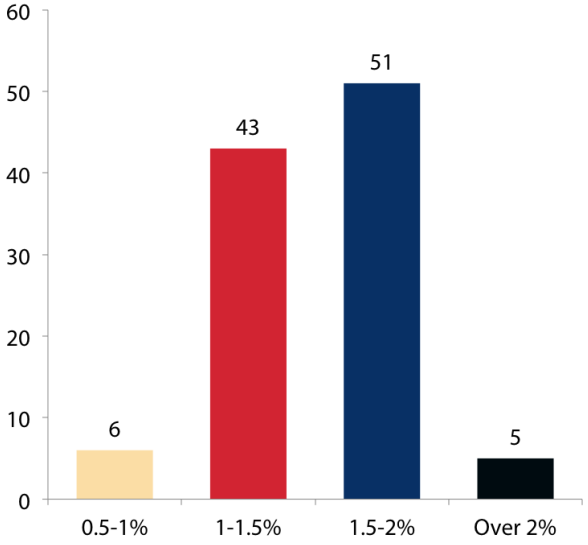
6.1. Massachusetts

The Bay State has 105 officially public retirement systems with some 500,000 members and beneficiaries. The state and teachers' retirement systems as well as local systems that do not meet certain investment-performance criteria are required to invest their assets through the commonwealth's Pension Reserves Investment Management (PRIM) Board. Other systems may also choose to invest in some of its segment portfolios (e.g., real estate) or become full members. However, all pension benefits are largely set by state legislation and there is very little flexibility for the local systems, including Boston's. Retiree healthcare benefits within the state are managed separately and do not factor in this analysis.

Because PERAC stopped publishing allocation data in 2011, the allocations for 2010 were the best available approximation for the systems that were not invested in PRIM. For PRIM-participant systems as of 2010, the midyear 2014 actual asset allocation of PRIM was used, resulting in an MRR of 6.12% net of investment fees. The return on cash is assumed to be zero and investment fees are assumed to be 40 basis points for all funds and systems analyzed.

The estimated MRRs for Massachusetts ranged from 5% to just over 7% with a mean and median of about 6.4%, showing a slightly positively skewed sample distribution.[6] The difference between the historical estimates and the actual ARR used in valuation by 2012 ranged from 84 to 252 basis points, with 77 retirement systems overshooting by more than 1%, a discrepancy that can be considered substantial (Fig. 5). Only two systems were within 50 basis points of the implied MRR. Given their asset allocations, some 45 systems

Figure 5. Distribution of Massachusetts Public Retirement Systems by Overestimate of ARR Relative to MRR



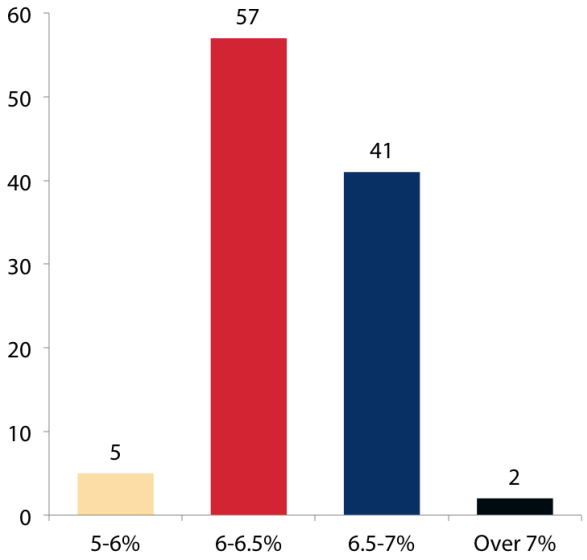
should have been discounting their liabilities at an MRR of no more than 6.5% and only 27 qualified for a discount rate higher than 7% (Fig. 6).

"Given their asset allocations, some 45 systems should have been discounting their liabilities at an MRR of no more than 6.5% and only 27 qualified for a discount rate higher than 7%."

Leominster, North Adams, Holyoke and Swampscott had the highest implied MRRs – around 7% net of assumed investment fees. Adams, with an MRR of just over 5%, and Southbridge, with about 5.5%, were the outliers in terms of having a very ineffectual asset allocation because of large holdings of cash and fixed income. Those same six systems also overshot their implied MRR by the most, about 2.5%. Medford, MassPort, Belmont, Lexington, Leominster and North Adams were closest – within less than 1% – to their implied MRR.

Of course, the elephants in the room are the state and teachers' systems, which account for about 2/3 of the total assets and liabilities. They had an ARR of 8% as of 2013 rather than the 6.12%

FIGURE 6. DISTRIBUTION OF MASSACHUSETTS RETIREMENT SYSTEMS BY MRR



suggested by PRIM's allocation and market return data. If liabilities have a modified duration of 15 years, that would lead to underestimating the total liability by roughly a third (Fig. 7). The situation is particularly dire for the teachers' retirement system, whose funded ratio drops to 43% with the re-estimated ARR as of the beginning of 2013. Overall, using the more appropriate MRR increases the state's unfunded liability associated with the two systems from $26.4 billion to $46.3 billion. State pension liabilities in Massachusetts were undervalued by some $20 billion – which equals about 2/3 of official state debt as of fiscal yearend 2013.

The state and teachers' systems paid out nearly $4.3 billion in benefits during FY 2013, while the state contributed well below its total required contribution towards the two funds (Fig. 8). The commonwealth has been one of many states that have allowed the chronic underfunding of their pension systems by not making the ARC even after switching away from pay-as-you-go to an advance-funded contributory system. For context, in 2009 and 2010 Massachusetts made less than 64% of the ARC, which was anyway calculated on the basis of overly optimistic return assumptions of 8.5% annually. Then the state extended its funding deadline to 2040 to lower the ARC to what it could more easily contribute.

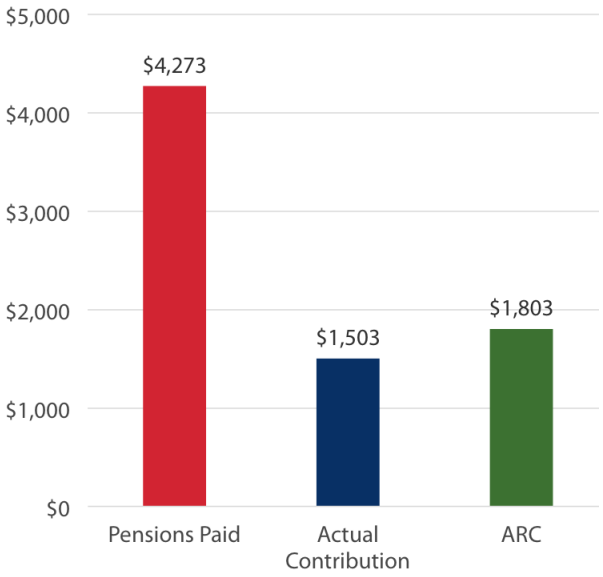
> *"State pension liabilities in Massachusetts were undervalued by some $20 billion – which equals about 2/3 of official state debt as of fiscal yearend 2013."*

Boston's retirement system, by far the largest among the independent municipal ones in Massachusetts, had an ARR of 7.75% but an MRR of only 6.63%, which puts the grievously underfunded plan at serious risk. While Boston has been consistent in making the ARC in the past six years, it should be noted that such a record has only been made possible after the state allowed local systems as well to extend their funding schedules through 2040. The city fully took advantage of that extension, thereby almost halving its ARC in FY 2011. Nevertheless, the FY 2013 contribution was nearly 9% of budget revenues for the city. The sustained discrepancy between ARR and MRR implied by the city fund's assets will likely put further pressure on its coffers over time.

FIGURE 7. MASSACHUSETTS STATE AND TEACHERS' SYSTEMS AT LAST ACTUARIAL VALUATION[7] (DOLLARS IN MILLIONS)

	Market Value of Assets	AAL Reported	UAAL Reported	AAL Re-estimate	UAAL Re-estimate	UAAL Increase	Funded Ratio Reported	Funded Ratio Re-estimate
MSERS[8]	$22,721	$30,680	$9,098	$39,951	$17,230	$8,132	70.3%	56.9%
MTRS[9]	$21,934	$39,135	$17,348	$50,961	$29,027	$11,679	55.7%	43.0%
Total	$44,655	$69,815	$26,446	$90,912	$46,257	$19,811	62.1%	49.1%

Figure 8. Massachusetts State Pension Payments FY 2013 (dollars in millions)



6.2. Illinois

In recent years, Illinois has been universally held as a public-pension basket case, but there is quite a bit of diversity within the state, whose public retirement system is rivaled only by California's in terms of its complexity. Many of the hundreds of local retirement systems are fairly well funded by comparison with other pension funds in the state and elsewhere. Most of them are members of the Illinois Municipal Retirement Fund (IMRF), which has had one of the more aggressive and less expensive asset allocations in the state.

IMRF's asset allocation from the first quarter of 2014 suggested an MRR of 6.79% gross, or 6.39% net of assumed fees and expenses of 40 basis points (Fig. 9). Thus, the fund's funded ratio falls from almost full funding on a market basis with its ARR of 7.5% to about 88% based on its asset-allocation MRR of 6.39%. The total unfunded liability is estimated to be $4.7 billion, which is almost entirely due to the ARR change. The relatively good fiscal position of some Illinoisan municipal systems is largely due to state statutes imposing strict pension-funding requirements.

However, the Heartland State has granted itself and the City of Chicago many years of exemptions from contribution requirements, resulting in a very different picture at their pension systems. The Windy City pays directly into the Municipal Employees' Annuity and Benefit Fund (MEABF), the Laborers' Annuity & Benefit Fund (LABF), the Police Annuity & Benefit Fund (PABF) and the Fire Annuity & Benefit Fund (FABF), while its taxpayers also contribute to the Chicago Teachers' Pension Fund (CTPF), the Cook County Pension Fund (CCPF) and the Park Employees' Annuity & Benefit Fund (PEABF).[10]

The situation of Chicago's funds is grim. Estimated funded ratios for the city's pension funds (Fig. 10) as of yearend 2013 suggest that its police and firefighters' retirement systems are essentially insolvent, while the municipal employees' system is firmly headed that way. Simply by association (sharing the same plan provider), the laborers' benefits are also under threat even though their funding level is substantially better. It is hard to imagine how Chicago can avoid a full-blown Detroit scenario (involving *both* bankruptcy and urban decay) within the next 10-15 years unless the city both (1) finds a way to cut *existing* benefits and obligations and (2) starts contributing substantially more to its pension plans right away.

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In fiscal 2013, Chicago made a pension contribution that barely covered the interest on its existing net pension obligation (an accounting measure of the cumulative difference between the ARC and actual contributions up to that time). It reported outstanding bond debt of $9.3 billion as of fiscal 2013 and its retirement obligations totaled $23.1 billion (Fig. 11). For context, the unfunded retirement liability alone is almost three times the city's 2013 revenues of $7.8 billion and

FIGURE 9. PUBLIC RETIREMENT FUNDS IN ILLINOIS[11] (DOLLARS IN MILLIONS)

	ARR	MRR	Market Value of Assets	AAL Reported	UAAL Reported	AAL Re-estimate	UAAL Re-estimate	UAAL Increase	Funded Ratio Recorded	Actual Funded Ratio
MUNICIPALITIES DOWNSTATE										
IMRF	7.50%	6.79%	$33,284	$34,357	$4,274	$37,946	$4,662	$388	87.6%	87.7%
CHICAGO										
MEABF	7.50%	6.52%	$5,422	$13,856	$8,742	$15,907	$10,485	$1,743	36.9%	34.1%
LABF	8.00%	7.10%	$1,458	$2,383	$1,029	$2,702	$1,244	$215	56.7%	54.0%
PABF	7.75%	7.04%	$3,262	$10,081	$7,027	$11,131	$7,869	$842	30.3%	29.3%
FABF	8.00%	7.10%	$1,117	$4,089	$3,098	$4,633	$3,516	$418	24.2%	24.1%
Subtotal Chicago	7.69%	6.80%	$11,259	$30,409	$19,896	$34,372	$23,113	$3,217	34.6%	32.8%
COOK COUNTY AREA										
CTPF	8.00%	6.51%	$9,674	$19,045	$9,622	$23,446	$13,772	$4,150	49.5%	41.3%
CCPF	7.50%	6.66%	$8,927	$14,812	$6,431	$16,661	$7,734	$1,303	56.6%	53.6%
PEABF	7.50%	6.61%	$412	$972	$550	$1,101	$689	$139	43.4%	37.4%
Subtotal Cook County	7.77%	6.58%	$19,013	$34,829	$16,603	$41,207	$22,194	$5,453	52.3%	46.1%
STATE										
ISRS	7.75%	6.59%	$12,177	$34,721	$22,843	$40,816	$28,639	$5,796	34.2%	29.8%
ITRS	8.00%	6.32%	$39,859	$93,887	$55,732	$118,744	$78,885	$23,153	40.6%	33.6%
SURS	7.75%	6.70%	$16,296	$34,373	$20,111	$39,837	$23,541	$3,430	41.5%	40.9%
Subtotal State	7.89%	6.46%	$68,332	$162,981	$98,686	$199,397	$131,065	$32,379	39.4%	34.3%
ILLINOIS AGGREGATES										
All Illinois	7.80%	6.59%	$131,888	$262,576	$139,459	$312,922	$181,034	$41,437	46.9%	42.1%

the municipal contribution to the four pension funds was a meager $467 million that year, while benefits in excess of $1.8 billion were paid out (Fig. 12). What investment returns need to be to allow this pattern to continue would defy even the wildest of imaginations. Note further that the revaluation based on asset-driven MRRs only reduced the city's aggregate funded ratio from 34.6% to 32.8%.

Chicago's dire situation was precipitated by almost three decades of following a contribution schedule determined by fiat by the state legislature, rather than the lenient (until recently) GASB requirements. Current Illinois statutes require Chicago to more than double its payments in 2016 and continue increasing its contribution rate thereafter – a $600 million bump that will grow rapidly to gut the city's budget (this number excludes the normal cost of newly earned benefits). But here context is in order again. The GASB ARC for fiscal 2013 was almost $2.2 billion (including $464 million in interest on prior insufficient contributions); the 2016 statutorily required contribution, which Chicago says it cannot pay, would barely be half of that.

Getting out of the pension hole by tax increases alone does not seem viable because Chicagoans are also responsible for paying down most of the $22 billion unfunded liability of the three county-level pension funds (Fig. 12). While the estimated aggregate funded ratio for these systems is 46.1% (well over the city funds' aggregate of 32.8%), the spread between their ARRs and MRRs is larger than that of the city funds, which means the county systems are on their way to catching up with the much lower funded level of the city's. The seven Chicago-area systems altogether had an estimated unfunded liability of about $45.3 billion as of 2013.

Figure 10. Re-estimated Chicago City Pensions' Funded Levels

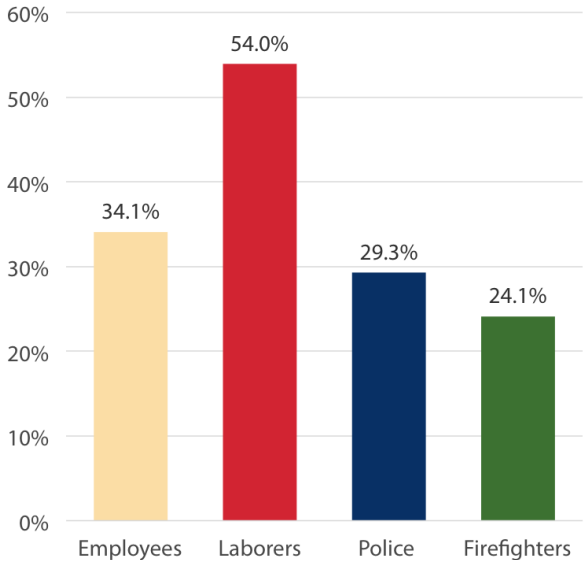
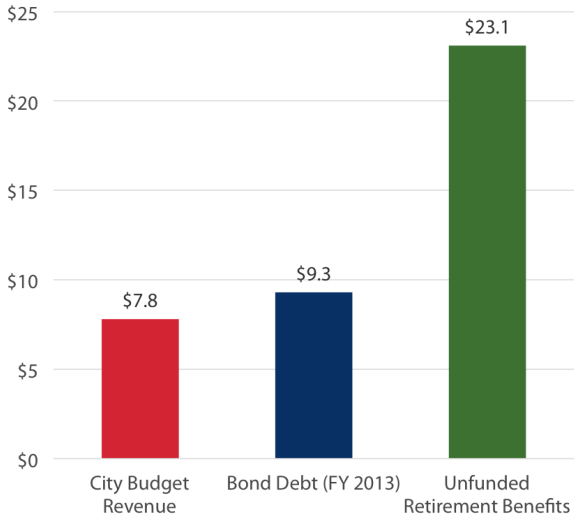


Figure 11. Chicago Bond Debt Reported and Unfunded Retirement Benefits by MRR (dollars in billions)



Furthermore, a bailout by the state seems unlikely since Illinois's own public-pension situation is quite dire. A pattern of nonpayment of the ARC similar to Chicago's has produced an aggregate funded level of 34.3% for Illinois's three largest retirement systems[12] and an overall unfunded liability of $131 billion (over $32 billion more than official numbers) as of midyear 2013. The state only contributed about $5.9 billion out of $70.5 billion in annual revenue towards an official ARC of $7 billion. With net pension cost at nearly $9.2 billion in fiscal 2013, Illinois would have to nearly double its payment, to some 13% of revenue, in order to put a perceptible dent in its unfunded liability.

The overall unfunded liability for the 11 Illinoisan systems reviewed using their respective MRR as the discount rate was estimated to be $181 billion versus $139.5 billion reported in official valuations. But the $42 billion upward adjustment to the liability based on MRR is only the tip of the iceberg. Most of Illinois's systems, especially the worst-funded ones, calculate ARCs based on a 30-year open schedule which is all but fundamentally insolvent; GASB has stated that "the open method, when coupled with an amortization period of 30 to 40 years, produces no perceptible amortization of the unfunded actuarial liability."[13]

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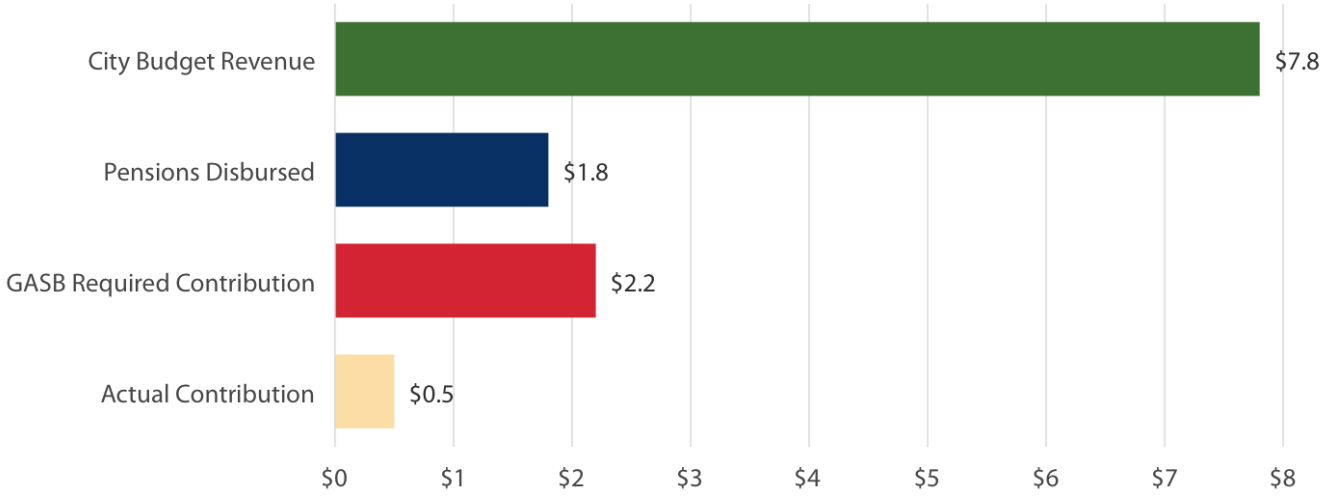
FIGURE 12. CHICAGO FY 2013 PENSION FLOWS AND BUDGET REVENUE (DOLLARS IN BILLIONS)



6.3. CONNECTICUT

The Constitution State has the most centralized public retirement management among the six states reviewed. The six statutorily established retirement systems' assets are managed by the Pension Funds Management Division of the Office of the State Treasurer (Fig. 13).[14] However, the state sponsors only the State Employees' Retirement System (CSERS), the Teachers' Retirement System (CTRS) and the Judicial Retirement System (CJRS), whereas the Municipal Employees' Retirement System (CMERS), the Probate Judges and Employees' Retirement System (CPJERS) are funded by the respective jurisdictions.

The asset allocation of Connecticut public pension reserves suggested an aggregate MRR of 6.57%, resulting in funded ratios substantially lower than the ones reported, particularly for the teachers' retirement system, which used a discount rate of 8.5%, some 193 basis points above what invested assets suggested in the aggregate. The state itself was directly responsible for an unfunded liability of $38.7 billion out of an estimated total of $39.9 billion – more than 125% of FY 2013 revenues and nearly twice the state's bonded debt (Fig. 14).

Connecticut's FY 2013 pension contribution was nearly $1.9 billion, well over interest and debt charges of $888 million for the year (Fig. 15). Baseline benefit payments from the three state systems totaled over $3.1 billion, which can be taken as a baseline cash outflow in a case where continued inability to make the ARC erode assets closer to naught. The state's net pension obligation

FIGURE 13. CONNECTICUT PUBLIC RETIREMENT PLANS[15] (DOLLARS IN MILLIONS)

	ARR	Market Value	AAL Reported	UAAL Reported	AAL Re-estimate	UAAL Re-estimate	UAAL Increase	Funded Ratio Reported	Funded Ratio Re-estimate
CSERS	8.00%	$8,468	$23,019	$13,274	$28,109	$19,641	$6,367	42.3%	30.1%
CJRS	8.00%	$157	$320	$149	$391	$234	$85	54.7%	40.2%
CTRS	8.50%	$13,474	$24,862	$11,127	$32,538	$19,064	$7,937	55.2%	41.4%
CMERS	8.00%	$1,683	$2,151	$322	$2,627	$944	$622	85.0%	64.1%
CPJERS	8.00%	$87	$83	-$5	$101	$14	$19	105.9%	85.8%
Total	8.25%	$23,869	$50,435	$24,867	$63,766	$39,897	$15,030	50.7%	37.4%

Figure 14. Connecticut State Debt and Pension Liabilities (Dollars in Billions)

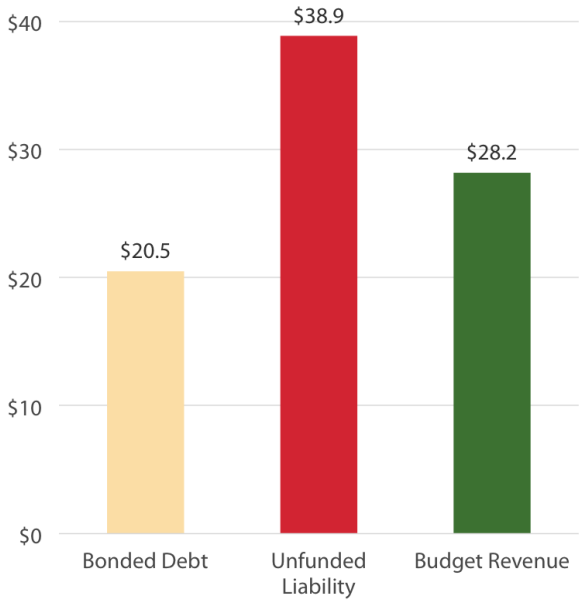
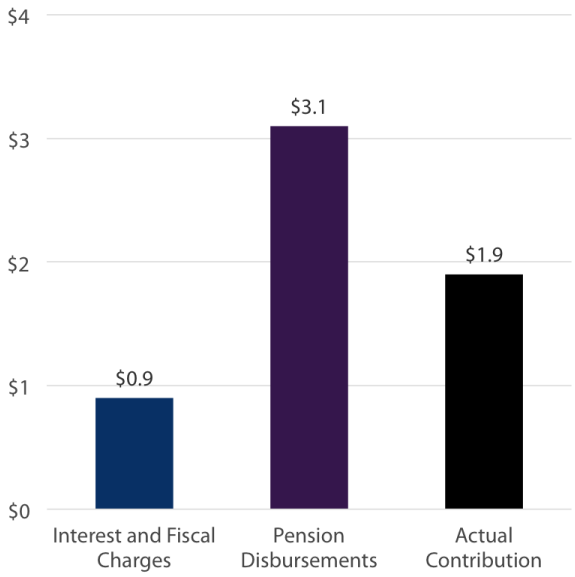


Figure 15. Connecticut State Debt and Pension Payments (Dollars in Billions)



(NPO) increased by $37 million (due to interest on existing NPO), indicating some progress towards paying down the unfunded liability, but only on the basis of the overly optimistic return assumptions. A nondecreasing NPO and maintaining excessive ARRs are inexorably going to lead to ever lower funded levels in the long run.

6.4. Pennsylvania

By contrast, the Keystone State probably has the most fragmented public pension system in the country – in some respects more so even than that of Illinois because its hundreds of local retirement boards typically are not participating in the Pennsylvania Municipal Retirement System (PMRS). Indeed, PMRS is the great outlier among the systems reviewed with its aggressively low ARR of 5.5%, which falls comfortably below the MRR of 6.4% that its asset allocation implies (Fig. 16). Combined with the market-value adjustment, this results in a nearly full funding for the system at 99%. The City of Philadelphia Municipal Retirement System (CPMRS) is at the opposite extreme of the spectrum. Adjusting to market value with 131 basis points lower MRR than assumed as of its last valuation yields a funded ratio of 36.5% and an additional UAAL of $2.3 billion.

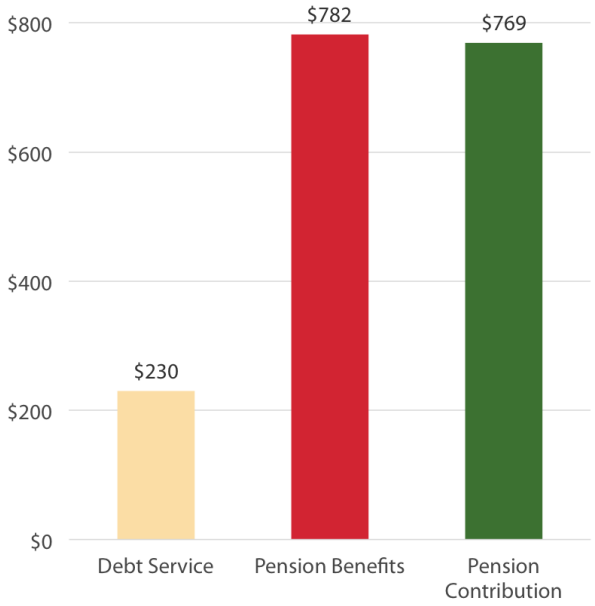
While Philadelphia made its required contribution and more in FY 2013, it still was not enough to outstrip the benefits paid out of its two pension funds (Fig. 17). Debt service expenditures for the year amounted to 3.9% of revenues, while pension contributions reached 13%, or over three times more. Adjusting the ARC to the unfunded liability implied by the MRR would likely increase those contributions to at least 17% of revenue for the year.

Due to their conservative asset mix, the two large state-sponsored systems are near the bottom of the sample in terms of the MRR they generate – just over 6% in expected return. Along with unamortized adjustments to the actuarial value of their assets, this return leads to an almost 17% plunge in the aggregate funded level of Pennsylvania's State Employees' Retirement System (PSERS) and Public-School Employees' Retirement System (PPSERS). If Pennsylvania's state pension funds do not take action to adjust their asset allocations, they would effectively be wasting taxpayer money equivalent to at least 50 basis points return on pension assets annually – about $380 million as of FY 2013 – for no good reason.

FIGURE 16. KEY PENNSYLVANIAN PUBLIC RETIREMENT SYSTEMS' FISCAL STATUS (DOLLARS IN MILLIONS)

	ARR	MRR	Market Value of Assets	AAL Reported	UAAL Reported	AAL Re-estimate	UAAL Re-estimate	UAAL Increase	Funded Ratio Recorded	Actual Funded Ratio
CPMRS	7.85%	6.54%	$4,444	$10,126	$5,327	$12,159	$7,715	$2,388	47.4%	36.5%
PMRS	5.50%	6.39%	$1,662	$1,904	$242	$1,679	$17	-$225	99.1%	99.0%
PSERS	7.50%	6.18%	$27,390	$43,875	$17,899	$52,794	$25,404	$7,505	59.2%	51.9%
PPSERS	7.50%	6.02%	$48,764	$87,854	$29,533	$108,106	$59,342	$29,809	66.4%	45.1%
Both State Systems	7.50%	6.08%	$76,154	$131,729	$47,432	$160,900	$84,746	$37,314	64.0%	47.3%

FIGURE 17. PHILADELPHIA PENSION AND DEBT PAYMENTS AND EXPENDITURES IN FY 2013 (DOLLARS IN MILLIONS)



6.5. NEW JERSEY

The five primary state-administered systems of New Jersey score an MRR of 6.23% versus a weighted-average ARR of 7.9%, which is at the high end of discrepancy between asset allocation and assumptions among all state and large-city pension systems examined. The Public Employees' Retirement System (NJPERS) and the Police and Firemen's Retirement System (NJPFRS) are jointly funded by the state and localities, whereas the Teachers' Pension and Annuity Fund (NJTPAF), the State Police Retirement System (NJSPRS) and the Judicial Retirement System (NJJRS) are the sole responsibility of the state (and employees). The state also operates several closed pension funds of negligible size, whose financials are omitted here.

Although followed closely by Massachusetts, New Jersey is the only state where the overall unfunded liability doubles when re-estimated with asset-based MRRs, spiking from $49 to $101 billion (Fig. 18). Assuming the UAAL increase is equally apportioned among the state and localities, New Jersey's pension contribution would have to increase in the order of billions from the official annual pension cost of $2.8 billion for the five funds.

New Jersey contributed only $1.1 billion in fiscal 2013 (Fig. 19), less than half the ARC for that year. The insufficient contributions resulted in a roughly $1.7 billion NPO increase on its balance sheet. And New Jersey, too, is using the fundamentally imprudent 30-year open schedule criticized by GASB.

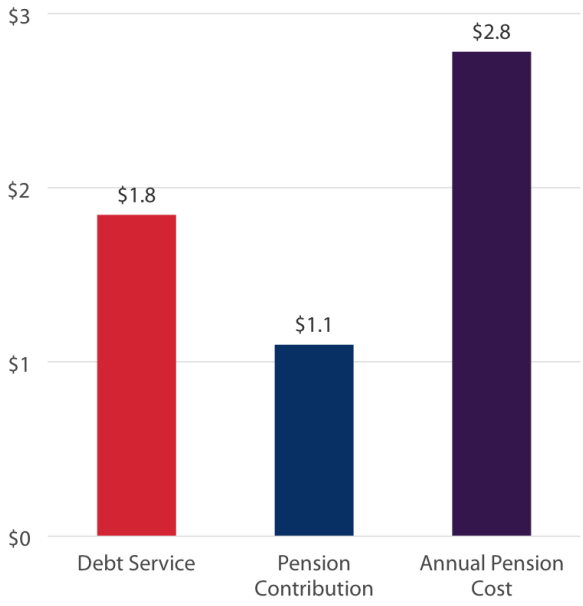
6.6. NEW YORK

The New York State and Local Retirement System (NYSLRS) and the New York State Teachers' Retirement System (NYSTRS) are unusual among state-sponsored systems in the sample in that they have been fairly consistently funded through the years. The estimated MRR for the two systems suggests a less stark than elsewhere, but still very concerning discrepancy between allocations and return assumptions of

Figure 18. Main Public Pension Funds with Assets Managed by New Jersey's Department of the Treasury (Dollars in Millions)

	Market Value	AAL Reported	UAAL Reported	AAL Re-estimate	UAAL Re-estimate	UAAL Increase	Funded Ratio Reported	Funded Ratio Re-estimate
NJPERS	$26,760	$47,000	$17,406	$59,365	$32,605	$15,199	63.0%	45.1%
NJTPAF	$26,860	$52,367	$21,897	$66,143	$39,283	$17,386	58.2%	40.6%
NJPFRS	$22,631	$33,000	$8,703	$41,681	$19,050	$10,347	73.6%	54.3%
NJSPRS	$1,833	$2,871	$880	$3,626	$1,793	$913	69.4%	50.5%
NJJRS	$244	$620	$343	$783	$539	$196	44.6%	31.2%
Aggregate	$78,328	$135,858	$49,229	$171,599	$93,271	$44,042	63.8%	45.6%

Figure 19. New Jersey Debt and Pension Outlays for FY 2013 (Dollars in Billions)



about 100 basis points, which is a threat to the systems' long-term stability. The reason that the MRR adjustment does not impact the re-estimated funded ratio as much as might be expected is because market-value gains had not yet been reflected in the official funded ratios reported by the two funds. Overall, New York's state government looks at an estimated unfunded liability of about $52 billion, given current asset allocations, some $19 billion more than its pension funds have last reported (Fig. 20).

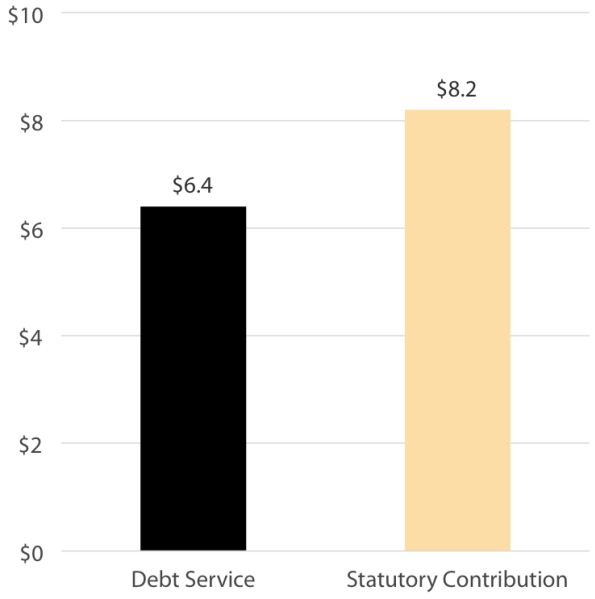
The four New York City funds for which data are available score some of the highest MRR estimates in the sample with aggressively equity-focused portfolios. The NYC Police Pension Fund (NYCPPF) sports the highest MRR in the entire sample studied – 7.04%. Additionally, alongside the Teachers' Retirement System (NYCTRS), the Employees' Retirement System (NYCERS) and the Board of Education Retirement System (NYCBERS), NYCPPF assumes an atypically low ARR of 7%, which means that there is minimal discrepancy between the assumption-based discount rate and the MRR implied by the asset allocation. Thus, the revaluation adds "just" $9.1 billion to their collective unfunded liability estimate, only minimally affecting the aggregate funded ratio, and the overall UAAL ends up above the city's FY 2013 annual revenue of $72.2 billion (note that the firefighters' retirement system not included here would add another $8-10 billion to the total). Not all of that amount is directly attributable to the city government, as NYCERS, NYCTRS and NYCBERS are multiemployer plans, but the underlying taxpayer base is more or less the same.

This is both good and bad news. Whilst the asset allocation seems to be more lucrative than most other systems' (at least on the face of it), the small amount of slack also means that there is not much left to be gained by overweighting equities further. The large underfunding hole that has opened up is due to a revaluation of liabilities with more

FIGURE 20. NEW YORK PENSION FUNDS[16]

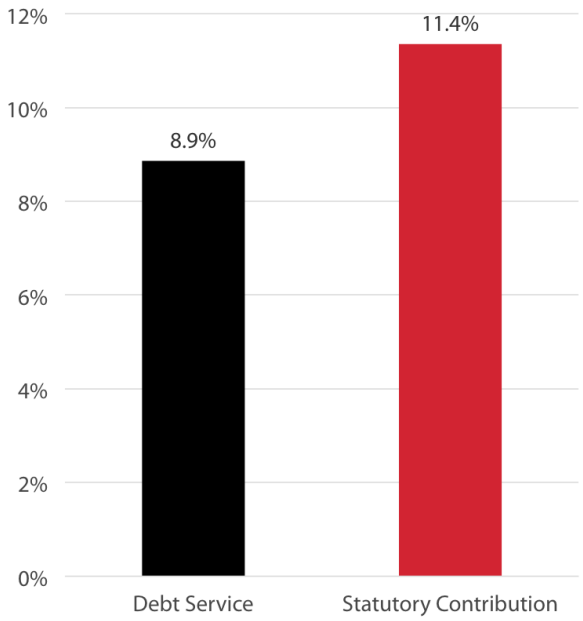
	ARR	MRR	Market Value of Assets	AAL Reported	UAAL Reported	AAL Re-estimate	UAAL Re-estimate	UAAL Increase	Funded Ratio Recorded	Actual Funded Ratio
NYSLRS	7.5%	6.42%	$164,222	$175,131	$21,457	$203,868	$39,646	$18,189	88.7%	80.6%
NYSTRS	8.0%	7.04%	$95,367	$94,584	$11,841	$108,191	$12,824	$983	87.5%	88.1%
NYS Total	*7.7%*	*6.64%*	*$259,589*	*$269,715*	*$33,298*	*$312,059*	*$52,470*	*$19,172*	*87.7%*	*83.2%*
NYCERS	7.0%	6.51%	$42,655	$67,417	$22,740	$72,243	$29,588	$6,848	66.3%	59.0%
NYCTRS	7.0%	6.83%	$32,775	$58,783	$24,912	$60,167	$27,392	$2,480	57.6%	54.5%
NYCPPF	7.0%	7.04%	$25,480	$42,016	$15,239	$41,805	$16,325	$1,086	63.7%	61.0%
NYCBERS	7.0%	6.81%	$2,311	$3,763	$1,392	$3,864	$1,553	$161	63.0%	59.8%
NYC Total	*7.0%*	*6.75%*	*$103,221*	*$171,979*	*$64,283*	*$178,079*	*$74,858*	*$10,575*	*62.6%*	*58.0%*

FIGURE 21. FY 2013 NEW YORK CITY DEBT AND PENSION PAYMENTS (DOLLARS IN BILLIONS)



cautious actuarial assumptions beginning in 2010 (until that time the five funds appeared about fully funded), not just the financial crisis. The city has been paying in the full statutorily required contribution, which was nearly $8.2 billion in FY 2013 (Fig. 21) – some 11.4% of revenues for the year. This did not cover the entire APC and, together with debt service, gobbled up over 20% of annual receipts (Fig. 22).

FIGURE 22. NEW YORK CITY DEBT AND PENSION SERVICE AS PERCENT OF REVENUE IN FY 2013



6.7. SUMMARY OF OBSERVATIONS

While the sample of retirement systems examined is neither entirely representative nor complete, it does cover the gamut of public retirement systems that exist across the several states. Some observations about discount-rate-related policies can be drawn from this sample, with important

implications regarding the fiscal condition of states and municipalities.

Obviously – and most prominently – there are pervasive discrepancies between ARRs used to determine financial plans and MRR estimates. This disconnect between actual asset allocations and ARRs may have added to the severity of the funding crisis associated with the Great Recession.

Whereas it is hard to attribute causality to one factor or another, systems with larger spreads between their MRR and the actuarial ARR they are using tend to be substantially less well funded that those with smaller margins between assumed and historical asset returns. On one hand, there is pressure to make a higher ARR assumption when the employer is not interested in making a larger contribution and/or wants to promise further unfunded benefits. Because these adverse factors tend to correlate, it is not surprising that ARR discrepancies vary alongside them. This may also relate to the sophistication of system and fund managers, who are less likely to have relevant knowhow the more politicized pension administration is.

Secondly, it should be noted that in some states smaller municipal plans seem to have done better overall not just in positioning portfolios more aggressively, but also in making more cautious return assumptions and more consistent contributions. One could surmise that because state governments are more likely to modify funding requirements in order to bail out temporarily the budgets of politically powerful entities such as big cities and the states themselves, smaller municipalities are more constrained in terms of shortchanging their plans and, therefore, also have a stronger incentive to professionalize pension administration in order to avoid fiscal crises.

As a result, big cities often face larger pension payments than their debt service, frequently in excess of 10% of annual revenues. The situation of New York and Chicago public retirement systems is very different, even though both cities' plans are in crisis territory. Chicago is facing underfunding and a very heavy debt burden across its coterminous jurisdictions as well as the clear and present danger of suburban flight if it tries to make up the difference in its pension contributions with tax increases. Not only are Cook County and the State of Illinois unlikely to bail out the city, but they are even compelled to compete for the same tax base because of the dire condition of their own pension plans. Meanwhile, New York City can lean on a booming economy, a growing and more affluent population and a real estate market that is going stratospheric again. Let alone the fact that its pension fund could hardly have a more direct access to investment opportunities and has shifted to both a more prudent ARR and generally more equity-loaded allocation.

Philadelphia and Boston provide a no-less-stark contrast. While both have overestimated the returns of their pension plans over time, its booming innovation and healthcare economy has allowed Boston to continue making the contributions required by statute, even if only marginally so, while also lowering its return assumption. Meanwhile, Philadelphia is still struggling with the transition of a typical postindustrial city and, in a much more precarious budgetary situation, cannot afford to prop its pension plans as well as Boston may be able to.

However, the tables are turned when one looks at the systems of smaller municipalities in the two states - few retirement boards in Massachusetts are even anywhere near the 5.5% ARR of PMRS. A firm statutory requirement to establish market rates of return for financial planning based on asset allocations rather than staring in a crystal ball could reduce underfunding and discrepancies between states and localities. Meanwhile, the disciplining effects of statutorily required contributions have been rather absent in both Connecticut and New Jersey, which are each mired in a swamp of unfunded liabilities.

7. Conclusion

Presently, the actuarial methods used to set retirement systems' liability discount rates are lacking in robustness and objectivity; the

existing standards and enforcement mechanisms are opaque and pliant. The situation can be remedied relatively easily by state regulators and governments. Reform will foster greater transparency and evidence-based financial management, which would benefit taxpayers and public employees. Most importantly, the adoption of clear and robust guidelines will make it easy for bondholders and plan members alike to benchmark and compare the financial condition of pension plans.

To reiterate, the main advantage of an objective methodology based on historical returns is not that it is necessarily more "accurate" in forecasting than current practice, but that it constrains some of the inherent biases of the estimation. Although a fund's discount-rate-setting process can never be insulated completely from undue influence by political interests or individual predilections, having a clear exclusively data-driven methodology makes those influences more readily observable because they are constrained to changing the asset allocation or formally modifying the discount-rate methodology itself.

Meanwhile, the MRR method discards a number of additional assumptions required by the building-block approach, notably divorcing the effect of inflation on asset returns from its impact on another important actuarial assumption – wage growth. The technique also produces much more stable discount rates than so-called "fair market valuation" because even large swings in market returns take decades before they can have a significant impact on long-term aggregates. This result confers a substantial advantage because it eliminates some of the instability in expectations about required contributions. Even so, it is not a substitute for stress-testing plans under different market scenarios in order to gain an accurate measure of their cost and ensure their long-term sustainability.

The MRR Calculator utility provides some examples of how such objective methods work in practice. Using publicly available data on asset returns, the utility shows that the typical asset allocation of a pension fund justifies an MRR of about 6.5% rather than the prevailing 8%. Some reasonable adjustments in the portfolio can help raise the discount rate estimate to 7%, but hardly any further. It is high time pension plans and their sponsors accepted that fact.

Appendix I. Estimation of MRR Liabilities and Objective Funded Ratios

A discount rate based on the MRR method can be calculated using reported asset allocations and long-term asset returns. Because the present value of the liabilities is contingent on their duration, which is affected by funding schedules and various actuarial assumptions, it was necessary to assume a cautious 15-year duration for all systems to make calculations tractable. This 15-year assumption is close to the duration of liabilities commonly encountered in pension systems' financial statements and valuation reports, although by no means the only one or always available.

As an additional point of caution, it should be noted that the MRR estimates for each system are based on asset allocations provided by its fund and those data vary widely in their classification of assets and level of detail. Every effort was made to establish a correct classification within the four buckets of equity, fixed income, real assets (property) and cash. In most cases, corporate bonds and mortgages had to be lumped together with government bonds, which produces an understatement of about 115 basis points on their return, but these assets are a sufficiently small proportion of most bond holdings to make for only a slight distortion. The most recent and detailed allocation data were generally provided by Illinoisan systems; Massachusetts data, while even more granular, were dated – as of 2010.

If r' is the historically derived rate of return MRR and r is the ARR assumed by the system, the future value (FV) of the liability after 15 years' duration can be expressed as

$$FV = AAL(1 + r)^{15}$$
$$FV = AAL'(1 + r')^{15}.$$

Thus, working backwards with the historical rate produces the alternate valuation of the accrued actuarial liability AAL':

$$AAL' = \frac{FV}{(1 + r')^{15}} = AAL\left(\frac{1 + r}{1 + r'}\right)^{15}.$$

Thus, the re-estimated funded ratio φ based on the market value of assets MV would be

$$\varphi = \frac{MV}{AAL}\left(\frac{1 + r'}{1 + r}\right)^{15}.$$

Appendix II. Dates of Record for Retirement Systems

For Massachusetts, the actuarial data are current as of the 2012 PERAC annual report and asset allocation data are from 2010 with the exception of PRIM, which is updated to the end of June 2014, and the state and teachers' systems whose actuarial data are updated to the end of 2013 and 2012 respectively. For other systems, the table below provides a summary of source dates.

System	State	Actuarial	Allocation
CCPF	IL	2013.12.31	2013.12.31
CJRS	CT	2012.06.30	2013.06.30
CMERS	CT	2012.07.01	2013.06.30
CPJERS	CT	2013.12.31	2013.06.30
CPMRS	PA	2013.07.01	2014.06.30
CSERS	CT	2012.06.30	2013.06.30
CTPF	IL	2013.07.01	2013.06.30
CTRS	CT	2012.06.30	2013.06.30
FABF	IL	2013.12.31	2014.03.31
IMRF	IL	2013.12.31	2014.03.31
ISRS	IL	2013.06.30	2014.07.31
ITRS	IL	2013.06.30	2013.06.30
LABF	IL	2013.12.31	2013.12.31
MEABF	IL	2013.12.31	2014.03.31
NJJRS	NJ	2013.07.01	2013.06.30
NJPERS	NJ	2013.07.01	2013.06.30
NJPFRS	NJ	2013.07.01	2013.06.30
NJSPRS	NJ	2013.07.01	2013.06.30
NJTPAF	NJ	2013.06.30	2013.06.30
NYCBERS	NY	2012.06.30	2013.06.30
NYCERS	NY	2012.06.30	2013.06.30
NYCPPF	NY	2012.06.30	2013.06.30
NYCTRS	NY	2012.06.30	2013.06.30
NYSLRS	NY	2013.03.31	2013.03.31
NYSTRS	NY	2013.06.30	2013.03.31
PABF	IL	2013.12.31	2014.06.31
PEABF	IL	2012.12.31	2014.03.31
PMRS	PA	2013.01.01	2014.03.31
PPSERS	PA	2012.06.30	2013.06.30
PSERS	PA	2013.12.31	2014.03.31
SURS	IL	2013.06.31	2014.07.31

Appendix III. Massachusetts Public Retirement Systems

The table below provides the data underlying the summary statistics in the Massachusetts section of the paper. The ARR 2012 column shows the actual ARR used in the last valuation available as of yearend 2012. The MRR reflects the results of the calculation using historical returns and is followed by a ranking of highest to lowest MRR. The next column shows by how much the 2012 ARR overshoots the MRR implied by 2010 asset allocation. The rightmost column ranks the boards from the largest to the smallest discrepancy between ARR and MRR.

Retirement System	ARR 2012	MRR by 2010 Allocation	Rank by MRR	ARR Difference	Rank by Difference
Adams	7.50%	5.43%	104	2.07%	6
Amesbury	8.25%	6.36%	49	1.89%	16
Andover	7.75%	6.30%	69	1.45%	55
Arlington	7.50%	6.31%	68	1.19%	68
Athol	8.00%	5.72%	103	2.28%	2
Attleboro	8.00%	7.07%	19	0.93%	83
Barnstable County	7.88%	6.33%	65	1.55%	50
Belmont	7.75%	7.20%	8	0.55%	103
Berkshire County	8.00%	6.17%	89	1.83%	22
Beverly	8.00%	6.30%	69	1.70%	31
Blue Hills Regional School	8.00%	6.30%	69	1.70%	31
Boston	7.75%	7.03%	25	0.72%	96
Braintree	7.88%	6.46%	48	1.42%	61
Bristol County	8.00%	7.05%	23	0.95%	80
Brockton	8.00%	6.62%	44	1.38%	63
Brookline	7.75%	6.53%	46	1.22%	67
Cambridge	8.00%	7.23%	6	0.77%	91
Chelsea	8.00%	6.30%	69	1.70%	31
Chicopee	8.00%	6.92%	29	1.09%	76
Clinton	8.00%	7.06%	22	0.94%	81
Concord	7.50%	6.35%	62	1.15%	72
Danvers	8.00%	7.23%	5	0.77%	92
Dedham	8.00%	6.36%	49	1.64%	41
Dukes County	8.00%	6.55%	45	1.45%	57

Retirement System	ARR 2012	MRR by 2010 Allocation	Rank by MRR	ARR Difference	Rank by Difference
Easthampton	8.00%	6.30%	69	1.70%	31
Essex Regional	8.25%	6.34%	64	1.91%	13
Everett	8.00%	6.30%	69	1.70%	31
Fairhaven	8.00%	6.11%	94	1.89%	14
Fall River	8.00%	6.29%	83	1.71%	28
Falmouth	8.00%	7.22%	7	0.78%	90
Fitchburg	7.95%	6.23%	87	1.72%	27
Framingham	8.00%	6.30%	69	1.70%	31
Franklin County	7.88%	6.71%	42	1.17%	70
Gardner	8.00%	5.91%	100	2.09%	4
Gloucester	7.88%	6.30%	69	1.58%	49
Greater Lawrence Sanitary District	8.00%	7.04%	24	0.96%	79
Greenfield	8.00%	6.30%	69	1.70%	31
Hampden County	8.00%	6.29%	82	1.71%	30
Hampshire County	7.88%	7.19%	9	0.69%	97
Haverhill	8.00%	6.87%	31	1.13%	74
Hingham	8.00%	6.36%	49	1.64%	41
Holyoke	8.00%	7.35%	2	0.65%	100
Hull	7.75%	6.36%	49	1.39%	62
Lawrence	7.75%	6.04%	96	1.71%	29
Leominster	8.00%	7.17%	10	0.83%	89
Lexington	7.75%	7.17%	11	0.58%	102
Lowell	8.25%	6.32%	67	1.93%	12
Lynn	8.00%	6.14%	91	1.86%	21
Malden	8.00%	6.94%	28	1.06%	77
Marblehead	8.00%	6.36%	49	1.64%	41
Marlborough	8.00%	6.51%	47	1.49%	52
Mass Housing Finance Agency	8.00%	6.78%	38	1.22%	66

Retirement System	ARR 2012	MRR by 2010 Allocation	Rank by MRR	ARR Difference	Rank by Difference
Mass Port Authority	7.63%	7.16%	12	0.47%	104
Mass State	8.25%	6.36%	49	1.89%	16
Mass Teachers	8.25%	6.36%	49	1.89%	16
Mass Water Resources Authority	8.00%	6.71%	41	1.29%	65
Maynard	8.00%	7.03%	26	0.97%	78
Medford	7.50%	7.06%	21	0.44%	105
Melrose	8.00%	5.98%	99	2.02%	7
Methuen	8.00%	6.12%	92	1.88%	20
Middlesex County	8.00%	6.12%	93	1.88%	19
Milford	8.00%	6.04%	96	1.96%	9
Milton	8.00%	6.30%	69	1.70%	31
Minuteman Regional School District	8.00%	6.36%	49	1.64%	41
Montague	8.00%	6.36%	49	1.64%	41
Natick	8.00%	7.06%	20	0.94%	82
Needham	8.00%	6.17%	89	1.83%	22
New Bedford	7.75%	6.84%	33	0.91%	85
Newburyport	8.00%	6.04%	96	1.96%	9
Newton	7.75%	6.33%	66	1.42%	60
Norfolk County	8.25%	6.80%	37	1.45%	58
North Adams	8.00%	7.41%	1	0.59%	101
North Attleboro	8.00%	6.84%	34	1.16%	71
Northampton	7.75%	7.09%	17	0.66%	99
Northbridge	8.00%	6.36%	49	1.64%	41
Norwood	8.25%	6.78%	38	1.47%	54
Peabody	8.25%	6.30%	69	1.95%	11
Pittsfield	8.00%	6.34%	63	1.66%	40
Plymouth	8.00%	6.85%	32	1.15%	73
Plymouth County	8.25%	6.80%	36	1.45%	59

Retirement System	ARR 2012	MRR by 2010 Allocation	Rank by MRR	ARR Difference	Rank by Difference
Quincy	8.00%	6.82%	35	1.18%	69
Reading	7.75%	6.23%	87	1.52%	51
Revere	8.00%	5.91%	100	2.09%	4
Salem	8.00%	5.82%	102	2.18%	3
Saugus	8.00%	6.30%	69	1.70%	31
Shrewsbury	8.00%	6.65%	43	1.35%	64
Somerville	8.25%	6.77%	40	1.48%	53
Southbridge	8.00%	5.41%	105	2.59%	1
Springfield	8.13%	6.35%	61	1.78%	24
Stoneham	8.00%	6.36%	49	1.64%	41
Swampscott	8.00%	7.32%	3	0.68%	98
Taunton	8.00%	7.08%	18	0.92%	84
Wakefield	8.00%	6.36%	49	1.64%	41
Waltham	8.25%	6.28%	84	1.97%	8
Watertown	8.00%	7.10%	15	0.90%	87
Webster	8.00%	7.10%	16	0.90%	86
Wellesley	7.75%	6.30%	69	1.45%	55
West Springfield	7.75%	7.01%	27	0.74%	93
Westfield	8.00%	7.28%	4	0.72%	94
Weymouth	7.88%	7.16%	13	0.72%	95
Winchester	8.00%	6.25%	85	1.75%	26
Winthrop	8.00%	6.11%	94	1.89%	14
Woburn	8.00%	7.14%	14	0.86%	88
Worcester	8.00%	6.87%	30	1.13%	75
Worcester Regional	8.00%	6.24%	86	1.76%	25

About the Author

Iliya Atanasov is Pioneer's Senior Fellow on Finance, leading the research tracks on pension portfolio management, infrastructure and municipal performance. Iliya is a PhD candidate in Political Science and Government and a former Presidential Fellow at Rice University. He also holds BAs in Business Administration, Economics and Political Science/International Relations from the American University in Bulgaria.

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Endnotes

1. This has been argued repeatedly, cf. Iliya Atanasov, "Improving the Investment Performance of Massachusetts Retirement Funds," Pioneer Institute White Paper 94 (November 2012).
2. Reid, Jim & Nick Burns. (2010). "Long-Term Asset Return Study." Deutsche Bank Special Report, 2010.09.10, London, UK.
3. 7 MGL § 50.
4. For specific dates of record, please refer to Appendix II.
5. For a more detailed discussion of estimation methods, refer to Appendix I.
6. The full data are available in Appendix III.
7. The underlying MRR is estimated on PRIM's asset allocation as of 2014.06.30; an estimate involving the asset allocation at the exact times of valuation would have produced an even lower MRR.
8. As of valuation dated 2014.01.01.
9. As of valuation dated 2013.01.01.
10. Cook County covers most of Chicago and its suburbs, but its pension system is not funded directly by the city government.
11. Does not include all public pension funds in the state.
12. Two smaller systems are omitted here for simplicity because their liabilities are fairly negligible by comparison.
13. Governmental Accounting Standards Board, *Statement No. 27* (Norwalk, CT, November 1994), http://www.gasb.org/cs/BlobServer?blobkey=id&blobnocache=true&blobwhere=1175824062508&blobheader=application%2Fpdf&blobcol=urldata&blobtable=MungoBlobs. ¶ 37, p. 24.
14. The liabilities of the State Attorneys' Retirement System are negligible and are not discussed here.
15. Data are as of midyear 2012 with the exception of CPJERS, which is updated to yearend 2013.
16. New York City firefighters' pension system is not listed because information was not readily available online.

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