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A Looming Crisis

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INTRODUCTION

In Missouri and around the country, elected officials, taxpayers, and financial markets have expressed concerns about the financial health of defined benefit pension plans for state and local government workers. Public employees also are concerned, as many rely heavily upon these plans for income in retirement.

These pension plans have come under increased scrutiny as funding levels have dropped and required contributions have risen. According to standard actuarial accounting, the average public pension funding fell to about 75 percent in 2011, versus 103 percent in 2000.[1] The Annual Required Contributions that state and local governments make to public pensions have more than doubled in nominal terms since 2001, a period in which prices rose by only about 25 percent.[2] Public sector pensions, as of mid-2011, were underfunded by approximately $885 billion, based on accounting rules that the Governmental Accounting Standards Board established and applied to a large sample of plans from the Public Plans Database.[3]

A similar pattern holds for the Missouri public employee pensions, which serve state and local government employees. Annual required contributions have risen and measured funding health has declined. Most Missouri public employees participate in one of five retirement plans:

- Missouri State Employees Retirement System (MOSERS)
- Highway and Transportation Employees' and Highway Patrol Retirement System (MPERS)
- Missouri Local Government Employees Retirement System (MOLAGERS)

According to standard actuarial accounting, the average public pension funding fell to about 75 percent in 2011, versus 103 percent in 2000.

- Public School Retirement System of Missouri (PSRS)
- Public Education Employee Retirement System of Missouri (PEERS)

Together, they report unfunded liabilities as of 2012 of $11.1 billion and a combined funding ratio of 81 percent.

However, reports from academic economists and nonpartisan government agencies imply that the true state of public sector pension funding is far worse than suggested in official plan disclosures.[4] The accounting rules U.S. public sector pensions follow are more forgiving than those required for private sector pensions or public sector plans in other countries. So-called "fair market valuation" more fully reveals the value of public sector plan liabilities and shows that public employee plans are far less well-funded than commonly understood. In Missouri, the market valuation approach shows combined public employee plans to be only 46 percent funded, with unfunded liabilities approaching $54 billion.

While state and local governments around the country have enacted reforms to public sector pension plans — including contribution increases, less generous benefits for newly hired employees, and in some cases, reductions in cost of living adjustments (COLAs) for current beneficiaries — accurate accounting of public employee pension liabilities shows that elected officials must do much more to make these plans financially sustainable. Even if policymakers change the terms upon which future benefits are earned — a step which is both politically and legally problematic — the fact that existing pension liabilities are all but guaranteed implies that their true value is significantly higher than reported in public pension financial statements.

This paper describes how public employee pensions currently measure their financial health; discusses the consensus among economists that current accounting rules significantly understate pension liabilities and overstate pension funding levels; and describes how pension financing would appear using accounting rules similar to those required for private sector pensions or for public employee plans in other countries. Following that is discussion of objections to fair market valuation. Finally, we discuss the costs and benefits of potential reforms, including shifting to defined contribution or cash balance pension structures.

BACKGROUND ON PUBLIC EMPLOYEE PENSION PLANS

Most state and local governments provide a defined benefit pension plan for public employees as part of their overall compensation. These plans generally provide for retirement, disability, and survivors' benefits, and may either supplement or substitute for Social Security benefits. Defined benefit (DB) plans base retirement benefits upon a formula deriving from the employee's earnings and years of service; the plan sponsor bears any investment risk. DB pensions differ from the "defined contribution" (DC) 401(k)-type plans predominant in the private sector. In a DC plan, the employee is not guaranteed a fixed benefit at retirement. Rather, the employer contributes to the employee's

retirement account and the employee accepts any market risk associated with his investments.

Missouri's state and local pensions operate similarly to defined benefit pensions in the private sector. Once vested — usually after five years in Missouri — an employee becomes entitled to a benefit based upon a percentage of final salary. For MOSERS, for instance, "final salary" actually equals the average of the highest 36 consecutive months of compensation. This percentage of final salary is multiplied by the employees' number of years of service. Public pensions typically pay benefits equal to about 2 percent of final earnings per year of employment, although these replacement factors can differ from place to place, in particular, based upon whether the employee also participates in Social Security. In Missouri, teachers do not pay into Social Security so their replacement factor is higher, at 2.5 percent. Other Missouri plans in which workers do participate in Social Security receive a lower replacement of final salary, generally 1.6 percent to 1.7 percent.[5]

One important difference between public sector and private sector defined benefit pensions is that adjustment for inflation is virtually absent in private plans but common in public sector programs. Provisions for inflation adjustment vary significantly from plan to plan. In some cases, such as Missouri, adjustments to changes in the Consumer Price Index (CPI) are automatic. MOSERS, for instance, pays an annual COLA equal to 80 percent of the change in the CPI; the COLA is capped at 5 percent, and it cannot be negative even if prices fall. In some other states, post-retirement benefit increases are based on different formulas, and in others, they are discretionary or based on plan funding health.

Public sector pensions generally allow earlier retirement than in the private sector, in particular for public safety officers. Reductions in benefits for early retirement are usually smaller than actuarially fair, meaning that early retirees tend to receive higher total lifetime benefits over the course of their retirements.[6] As a result, public sector employees tend to retire at a younger age than private sector workers. In 2012, the average age of new retirees in MOSERS was 59.9 years, which is fairly typical of public plans across the country.[7] The typical age for first claiming Social Security benefits, by contrast, is closer to 63.

Public sector pensions are financed through a combination of employee and employer contributions and investment earnings. Nationwide, the average employee contribution rate as of 2009 was 6.4 percent of wages, according to the Public Plans Database, although contributions vary significantly from place to place. In Missouri, most non-education employees contribute relatively little toward their pensions. For instance, for many local employees, MOLAGERS is entirely non-contributory, while others pay about 4 percent of wages into the program. Newer MPERS employees hired since 2010 must contribute 4 percent of their pay, although MOSERS's actuarial report notes that rebates lowered the net employee contribution rate to 2.76 percent of pay.[8] Older MPERS employees do not contribute. Missouri teachers, by contrast, contribute

Reports from academic economists and nonpartisan government agencies imply that the true state of public sector pension funding is far worse than suggested in official plan disclosures.

14.5 percent of their pay toward pensions. In addition, state employees contribute 6.2 percent of pay to Social Security alongside a similar match from their employers.

Employer and employee contributions are invested in a range of assets, which are used as needed to fund benefits. The MOSERS portfolio consists of 45 percent stocks (equities), 30 percent fixed income investments, and 25 percent "alternative investment." This latter class consists of private equity, commodities, real estate, and other types of investments that generally produce higher returns than equities, though with greater risk.[9]

HOW PENSIONS VALUE THEIR LIABILITIES

Pensions compare their assets to their liabilities to calculate their financial health; that is, the investments they hold today relative to the benefits they must pay in the future. Using these figures, they calculate the funding ratio — that is, assets divided by liabilities — and the plan's unfunded liability, which is the net of assets and liabilities.

The key question for pension valuation is how to assign a value today to benefit liabilities that will be paid years or decades in the future. Because investments can earn interest, it is not necessary to contribute a full dollar today to fund each dollar of future liabilities. Without such a so-called "present value" it is impossible to accurately compare a pension's liabilities to the assets the plan holds today and thereby determine how well-funded it is.

In Missouri, the market valuation approach shows combined public employee plans to be only 46 percent funded, with unfunded liabilities approaching $54 billion.

The present value of a plan's liabilities is calculated using a method known as discounting, which is equivalent to compound interest in reverse. While compound interest involves taking a current dollar amount and adding interest each year, discounting begins with the future dollar amount and subtracts interest each year until a present value is determined.

The present value of a future dollar amount depends crucially upon the interest rate at which the liability is discounted. For instance, consider a debt of $1 to be paid 20 years from now. Assuming an 8 percent discount rate produces a present value of only 21 cents. At a 4 percent discount rate, however, the present value more than doubles to 46 cents.

Under current pension accounting rules, which the Governmental Accounting Standards Board establishes, a public pension plan discounts its liabilities using the rate of return the plan assumes will be generated by the portfolio of assets it holds. The average expected return on assets used in such valuations is close to 8 percent, with a range from 6 percent to 8.5 percent. Until recently, MOSERS assumed an 8.5 percent annual return, but today assumes a value of 8 percent. Missouri teachers and public school employees also assume 8 percent returns, while the Missouri Local employees' plan utilizes a 7.25 percent discount rate.

The discounted value of plan liabilities is then compared to the value of assets to calculate the plan's funding ratio (assets divided by liabilities) and its unfunded liability (assets minus liabilities). Table 1 uses figures from

the MOSERS 2012 actuarial valuation. The plan's liabilities, calculated using an 8 percent discount rate, equal approximately $10.8 billion. Its assets, by contrast, are worth only about $7.9 billion. This leaves an unfunded liability of nearly $2.9 billion and a funding ratio of slightly more than 73 percent.

Discount rates are also used to calculate the plan's Annual Required Contribution (ARC). The ARC consists of two separate costs: the "normal cost," which represents the cost of benefits accruing in a given year, and the cost of amortizing (or paying off) unfunded liabilities from prior years. Again, assuming an 8 percent discount rate, MOSERS has a total normal cost of 8.04 percent of employee payroll, 0.66 percentage points of which is offset by employee contributions. In addition, the cost of amortizing unfunded liabilities equals 9.60 percent of payroll, for a total employer contribution rate, or ARC, of 16.98 percent of pay.

Employer contributions to MOSERS have risen significantly over the past decade, from 9.35 percent of payroll in 2002 to 12.84 percent of payroll in 2006 to nearly 14 percent in 2011-12. While the contribution rate is calculated to be constant over time, it is likely contribution rates will increase to almost 17 percent in the 2013-14 fiscal year. The reason is that most plans, including Missouri's, calculate their funding ratios and the contributions necessary to reach full funding using a measure known as "actuarial assets." This measure "smooths" investment returns from year to year to produce a less volatile measure of plan financing. For instance, currently, the actuarial value of MOSERS assets exceeds the market value of those assets by about 4 percent, according to the plan's actuarial valuation. Over the next several years, the actuarial value of assets should be brought into line with the market value; this process should increase required contribution rates somewhat.

Even if policymakers change the terms upon which future benefits are earned — a step which is both politically and legally problematic — the fact that existing pension liabilities are all but guaranteed implies that their true value is significantly higher than reported in public pension financial statements.

TABLE 1

SUMMARY FINANCING INFORMATION FOR MOSERS AS OF JUNE 2012

Total Actuarial Accrued Liability	**$10,793,651,577**
Actuarial Value Of Assets	**$7,897,167,203**
Unfunded Actuarial Accrued Liability	**$2,896,484,374**
Funded Ratio	**73.20%**

Source: 2012 Actuarial Valuation

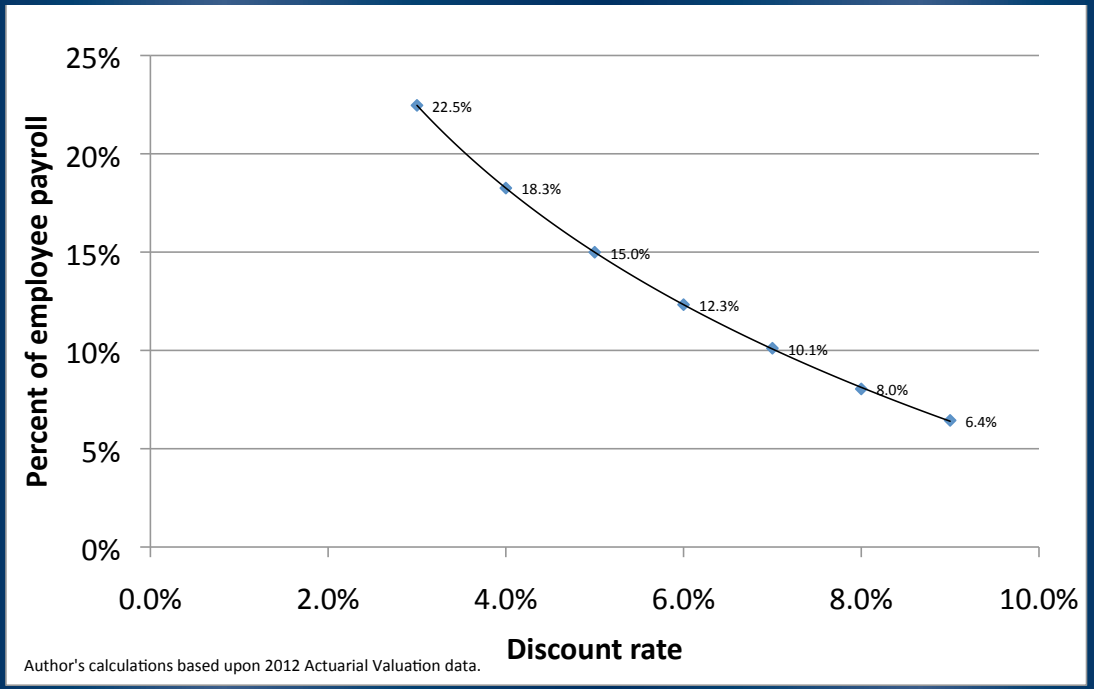
Most state and local governments provide a defined benefit pension plan for public employees as part of their overall compensation. These plans generally provide for retirement, disability, and survivors' benefits, and may either supplement or substitute for Social Security benefits.

As noted previously, the reported funding health of a plan is extremely sensitive to the discount rate chosen. Figure 1 shows estimates of the variation in normal costs along with the discount rate, based upon a limited sensitivity analysis contained in the MOSERS 2012 actuarial valuation. As Figure 1 shows, the total normal cost of the plan rises rapidly as the discount rate falls. At the assumed return of 8 percent, the normal cost equals 8.04 percent of employee pay, all but 0.66 percentages of which the employer bears. At a 6 percent rate, the normal cost rises to 12.3 percent of pay; at a 4 percent rate, it reaches 18.3 percent of wages.[10]

Amortization costs also would increase, though by a slightly smaller rate than the employer's normal costs. This difference occurs for two reasons. First, because the employee contribution toward normal costs is generally fixed, the employer is responsible for all increases in the total normal cost, not merely the proportionate share that it ordinarily pays. Second, the effect of the discount rate depends upon the duration of the plan's liabilities. New benefits earned this year have a longer average duration than unfunded benefits that already have been earned, so the effects of changes in the discount rate are slightly smaller.

The MOSERS and other Missouri pension reports do not provide data to easily estimate the effect of a changing discount rate on amortization costs. For that reason, I turn to an analysis of the Florida Retirement System (FRS), which its actuaries conducted on behalf of the program. In that analysis, the FRS actuaries calculated normal costs and amortization costs for the various FRS plans using a wide range of discount rates.[11] On average, normal costs in the FRS increased by about 30 percent

FIGURE 1: Total Normal Cost of MOSERS at Different Discount Rates



Author's calculations based upon 2012 Actuarial Valuation data.

for each percentage point the discount rate was reduced. This pattern is similar across the FRS plans, as well as similar to calculations that actuaries conducted for plans in the states of Washington, California, and Colorado. While the applicability of the Florida simulations to MOSERS depends upon the specifics of the plans, the average age of active employees is almost identical in both plans. Other factors may differ, however. With those caveats in mind, lowering the discount rate from 8 percent to 4 percent would raise annual amortization costs from 9.6 percent of total employee wages to approximately 68 percent of pay. Under GASB's newly issued Rules 67 and 68, beginning in 2013, pensions will be required to publish actuarial figures using discount rates 1 percentage point above and 1 percentage point below the plan's chosen rate. Thus, Missouri plans soon may be publishing similar calculations themselves. The variation in the plan's costs as the discount rate changes illustrates the degree to which a plan's funding health depends upon the higher returns generated by risky investments.

Combining the effects on normal costs and amortization costs, a lower discount rate or investment return could easily make Missouri pension plans appear unaffordable to the taxpayer. Thus, the importance of a seemingly arcane debate about the proper pension discount rate should not be underestimated.

THE FAIR MARKET VALUATION CRITIQUE

At first glance, the current approach to measuring pension liabilities that GASB established makes perfect sense: if you expect plan assets to appreciate 8 percent per year, then discounting the plan's liabilities at 8 percent will tell you the exact assets the plan would need to hold today in order to meet its liabilities in the future. If the plan is underfunded, it will tell you the extra contributions you must make in order to bring the plan back to full funding. In this way, the current GASB rules may appear to be more "realistic" than alternative approaches.

For this reason, many — including many pension actuaries and plan managers — are puzzled that financial economists believe the discount rate applied to a benefit liability should have *nothing* to do with how the plan's assets are invested. Pension insiders often are surprised to hear that this is how the vast majority of economists view the valuation argument, and it is also how private financial markets assign values to liabilities. This section discusses why that is the case.

To economists, the discount rate you apply to a liability should be based on the risk of the liability itself, *not* of any assets used to fund the liability.[12] If public pension benefits are guaranteed — as they are intended to be, and as legal rulings and state constitutions have determined them to be — then they should be discounted using the interest rates that the markets pay on guaranteed investments, such as U.S. Treasury securities.[13] Even if the Missouri government were capable of changing the terms on which future benefits are accrued — a step which is politically difficult and in many cases legally problematic — benefits that already have been earned are effectively guaranteed under contract provisions of the Missouri Constitution. These accrued benefits constitute the liabilities that pension valuations seek to quantify.

Defined benefit (DB) plans base retirement benefits upon a formula deriving from the employee's earnings and years of service; the plan sponsor bears any investment risk.

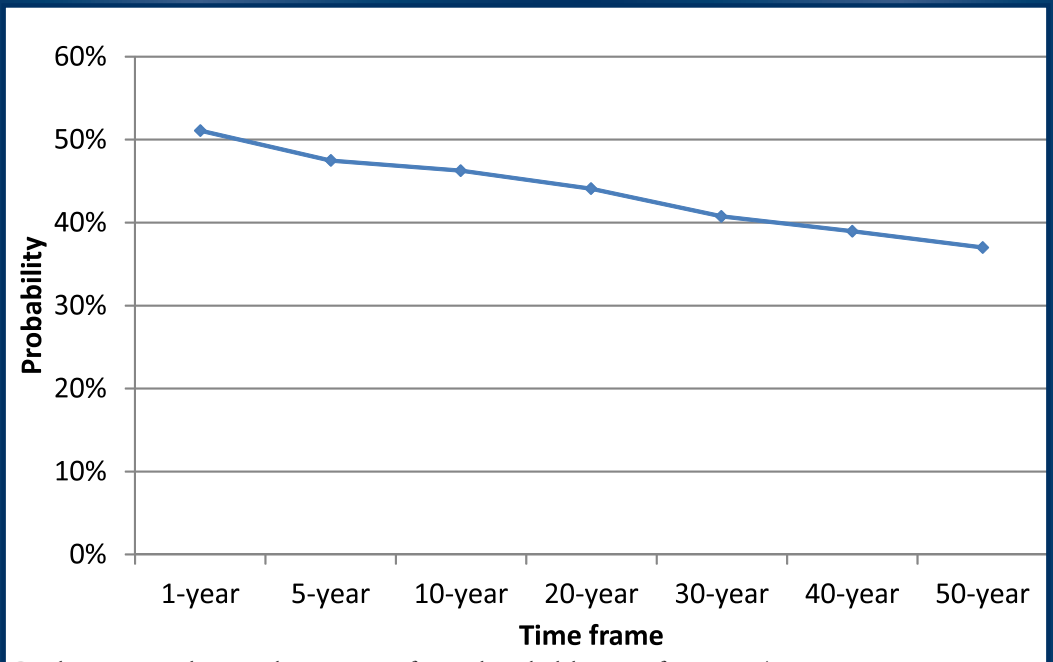
In a DC (defined contribution) plan, the employee is not guaranteed a fixed benefit at retirement. Rather, the employer contributes to the employee's retirement account and the employee accepts any market risk associated with his investments.

While stocks, bonds, and alternative investments have high expected returns, they also can be very risky. In fact, their high expected returns are nothing other than compensation for the fact that, while these returns may be *expected*, they are not guaranteed. An analysis of MOSERS investments easily demonstrates this fact.

MOSERS assumes an 8 percent annual return on its investment portfolio. While there are reasons to believe this assumption may be over-optimistic, for these purposes we will take it as a given.[14] This portfolio, according to a 2009 analysis for MOSERS by the Summit Strategy Group, has an expected standard deviation of annual returns of 10.4 percent. The standard deviation is a measure of risk of how far year-to-year returns tend to vary from the long-term average return. Using these assumptions, it is possible to simulate how MOSERS investments will fare over certain periods of time.

For instance, what is the probability that MOSERS will achieve its projected 8 percent return over the next 10 years? 20 years? 50 years? The results illustrated in Figure 2 show that the plan has an almost 50-50 chance of earning 8 percent returns over a single year — that result is essentially by definition — but over longer time periods, the chance of meeting or exceeding 8 percent average returns falls well below 50 percent. Over 20 years, the probability is only 44 percent and over 50 years, it is 37 percent. These results should not be in dispute, because they closely mimic those of the 2009 Summit report. They occur because the 8 percent return that Missouri pensions assume is an "arithmetic mean," which denotes a simple average of a number of annual

FIGURE 2: Probability of MOSERS Portfolio Achieving 8% Return Over Varying Time Periods



Based on 5,000 simulations with mean return of 8% and standard deviation of returns 10.4%.

returns. An 8 percent discount rate applied to pension liabilities, by contrast, is a "geometric mean" or "compound return" that abstracts from the volatility of year-to-year returns. So long as annual returns are volatile, the arithmetic mean will be below the geometric mean. This demonstrates the degree to which public pension accounting ignores risk. Under GASB rules, a Missouri public pension could call itself "fully funded" even if it had a less than 50 percent probability of being able to meet its current obligations with the assets it has on hand.

Yet, while MOSERS has a less than 50 percent probability of meeting its projected investment returns, it nevertheless has a 100 percent legal *obligation* to pay the benefits that those returns finance. Missouri courts have ruled that vested pension benefits are protected by constitutional protections for contracts.[15] As the Summit investment report notes, "Because the benefit is a legal obligation of the state, any shortfall must be paid for by higher future investment returns [and/or] higher contributions."

The mismatch between the high risk of the pension portfolio and the low risk of the pension's benefits creates a *contingent liability* to pay full benefits even if the pension's investments do not produce the expected returns. This obligation represents an additional cost to the taxpayer over and above the cost of current contributions. The fair market valuation approach is designed to capture the value of benefits not simply expected to be paid, but *guaranteed* to be paid. Current pension accounting standards ignore the value of this contingent liability.

The way to calculate the full value of public pension liabilities is through a risk-adjusted discount rate; that is, an interest rate derived from investments that have approximately the same risk as the liability to which the discount rate is being applied.

UNDERSTANDING MARKET RISK AND CONTINGENT LIABILITIES

Economists agree that a risk-adjusted discount rate is the best way to capture the true value of public pension liabilities. But why? The following section illustrates one way of understanding this issue.

Consider a pension that owes a guaranteed lump sum payment of $1 million in 15 years' time. Under GASB accounting rules, if the plan invests $301,194 today — the current value of $1 million discounted at an 8 percent interest rate[16] — it can call itself fully funded. This investment path is illustrated using the blue line in Figure 3.

But according to market valuation, if this payment is indeed riskless, it should be discounted at a riskless interest rate. If the riskless return is 4 percent, the true value of the liability is $548,812, almost twice as much up front as is required under the actuarial approach. This is represented as the red line in Figure 3. This illustration should demonstrate why most pension interests — governments, public employees, plan managers, and so on — prefer the actuarial approach.

If the pension's assets have an expected return of 8 percent, then investing $301,194 today will deliver an *expected* payoff of $1 million in 15 years.

Changing plan structures, to either a defined contribution or cash balance approach, will not eliminate existing unfunded liabilities.

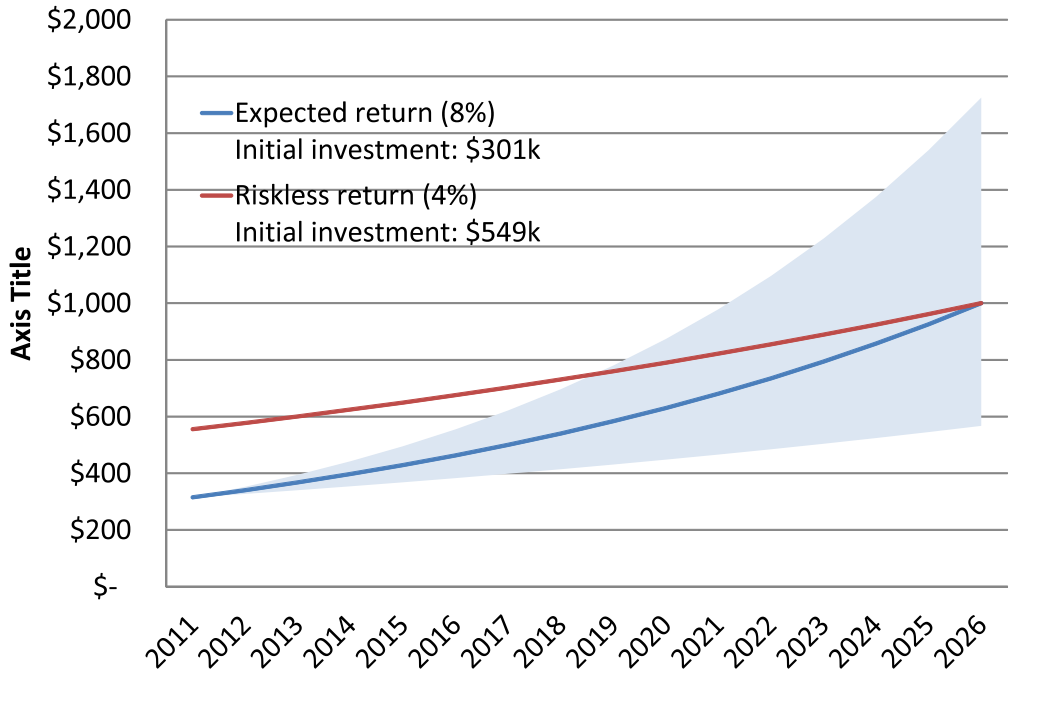
One important difference between public sector and private sector defined benefit pensions is that adjustment for inflation is virtually absent in private plans but common in public sector programs.

The problem is that assets with an expected return of 8 percent cannot produce such a return with certainty, meaning that the portfolio's value after 15 years will almost certainly end up being higher or lower than the desired $1 million. In other words, rather than a single blue line in Figure 3 representing investment in risky assets, a better representation is through an area (shown in light blue) illustrating a range of possible outcomes — approximately half of which exceed the $1 million goal, with the remaining half falling short.[17] No matter how well a pension plan manages its investments, it cannot generate 8 percent returns with certainty. The actual return the plan receives is based on the luck of the draw. Given that the benefits must be paid 100 percent of the time, a plan that has, at best, a 50 percent chance of being able to meet its obligations is not "fully funded" in the way that most laymen or policymakers would interpret the term.

In reality, a plan seeks neither to overshoot nor undershoot. If the plan's investments exceed their projected return, that means the initial contribution could have been smaller. Alternately, if the investments come up short of their goal, the plan will not be able to pay what it owes and must turn to the taxpayer for additional funds.

However, there are financial products — called "options" — that provide a solution. A "call option" allows the pension plan to sell off any surplus if the plan's investment turns out to be worth more than $1 million. A plan that sells a call option can use the proceeds to offset the cost of the initial

FIGURE 3: Illustrating Fair Market Valuation of Liabilities



investment, thereby eliminating the costs of overshooting the pension's goal.

Likewise, a "put option" can be purchased to top up the difference between the assets' actual value and $1 million if the investment comes up short. The put option protects against outcomes in which the plan's investments fall short. So, barring some catastrophic collapse of financial markets, the plan will *always* be able to pay *exactly* the promised $1 million, with no wasted money, if it invests $301,194 in safe assets and sells a call option to dispose of any surplus *and* purchases a put option to cover any shortfall.

This means that the cost of truly fully funding the $1 million future liability — meaning, funding it so that it is guaranteed to be paid without recourse to a taxpayer bailout and without any wasted surplus — is the $301,194 initial investment *minus* the $11,436 proceeds from selling the call option, *plus* the $259,053 cost of purchasing the put option. The net cost is $548,812, precisely the same as if the liability had been discounted and funded using the 4 percent riskless rate of return.[18]

The net cost of the put and call options represents the value of the contingent liabilities that have been placed upon future taxpayers based upon funding decisions made today. This cost is *not* a worst-case scenario, as some believe. Rather, it represents the price that future taxpayers would willingly pay to rid themselves of the *risk* of being called on to made good on promises that were made, and should have been paid for, by today's taxpayers.

This example also helps explain a number of points that are raised in the debate about pension valuation. First, the total cost of the liability will always be the same regardless of how the plan chooses to invest. A more conservative pension might invest larger amounts in more conservative assets, increasing costs for current taxpayers but leaving smaller contingent liabilities on future generations. Alternately, a more aggressive plan might make smaller upfront contributions but invest them in riskier assets. This reduces costs today, but generates a matching increase in the value of the contingent liability on future taxpayers. It is not a result unique to the plan investing in a portfolio with an 8 percent expected return. Investing in portfolios with greater or lesser risk will change the values of the initial contribution and of the put and call options, but the total liability cost will not change. Importantly, the total liability will have the same value regardless of how the pension plan chooses to invest.[19]

Second, this example illustrates that fair market valuation is not an academic exercise with no relevance to the actual investments public pensions make. The cost of the put and call options is determined in the market and is based upon the riskless return available in the market and upon the risk of the investments the plan holds. In other words, it makes sense to discount riskless pension liabilities using a riskless interest rate.

In Missouri, most non-education employees contribute relatively little toward their pensions.

HOW DOES MISSOURI PENSION FINANCING LOOK UNDER FAIR MARKET VALUATION?

The first step to determining an accurate estimate of public pension liabilities is to choose the appropriate discount rate. We know from the previous discussion that discounting guaranteed benefit liabilities using an interest rate derived from risky portfolio investments is incorrect. We also know that the discount rate used to value government guaranteed benefits should be derived from an investment whose risk matches that of the pension liabilities being valued. Thus, while there is little disagreement among economists regarding how to choose an appropriate discount rate, there is some controversy among economists regarding a specific interest rate to use.

Perhaps the simplest approach is to use bond yields from the government sponsoring the pension plan. After all, both pension benefits and bond payments represent future payments of cash, which the same government guarantees. Currently, Missouri municipal bonds with a duration of 15 years — about the average for public pension liabilities — have a yield of about 2.8 percent.[28] If you consider Missouri pension benefits to have

WHAT DO EXPERTS SAY ABOUT GASB PENSION ACCOUNTING RULES?

The preceding sections summarize the economic argument against the current GASB pension accounting rules and how they disguise the value of public employee compensation. It is worth noting that the vast majority of academic economists and nonpartisan government agencies take the same position regarding how to value public pension liabilities.

Donald Kohn, then-vice chairman of the Federal Reserve Board, declared in 2008:

> While economists are famous for disagreeing with each other on virtually every other conceivable issue, when it comes to this one there is no professional disagreement: The only appropriate way to calculate the present value of a very-low-risk liability is to use a very-low-risk discount rate.[20]

Similarly, the Fed's director of research and statistics, David W. Wilcox, testified in 2008 that:

> These [public pension benefits] happen to be really simple cash flows to value. They're free of credit risk. There's only one conceptually right answer to how you discount those cash flows. You use discount rates that are free of credit risk. This is one of those things where it just really is that simple.[21]

In a 2009 research paper, two economists from the federal Bureau of Economic Analysis (BEA) noted:

> If the assets of a defined-benefit plan are insufficient to pay promised benefits, the plan sponsor must cover the shortfall. This obligation represents an additional source of pension wealth for participants in an underfunded plan.[22]

Based on this logic, the BEA recently stated that, "Contributions aren't always a good approximation for the value of benefits accrued through service."[23]

Beginning in 2013, the national income and product accounts, which are the official "books" of the United States economy, will measure public pension liabilities using a market-based tool that captures the value of benefit guarantees to employees. This means that liabilities that the pension plans report will now be inconsistent with those same liabilities as reported in the official ledger books of the United States.

In 2011, the Congressional Budget Office issued a report that was widely taken as a confirmation of the market valuation approach:

> By using the expected return on a pension plan's assets to discount future payments to beneficiaries, the guidelines issued by the Government Accounting Standards Board (GASB) implicitly reflect an assumption that the risk to workers that states and localities will fail to pay future retirement benefits is the same as

about the same risk as explicit debt that Missouri governments issue, this is the appropriate discount rate to use.[29]

It is worth noting, however, that the discount rate appropriate to value pension benefits is time-specific: that is, if bond rates rise or fall in the future, then the appropriate discount rate — and the value of liabilities and the cost of funding accruing benefits — will shift up or down as well, and by a significant margin. This is sometimes portrayed as a failing of market valuation. This objection is incorrect for several reasons. First, any year-to-year fluctuation in liabilities based on changing interest rates is real: if you wish to guarantee payment of some given dollar amount in the future, it actually is cheaper to do it when interest rates are high instead of when they are low — just as it actually *is* cheaper to purchase a house when mortgage interest rates are low. Pretending otherwise does not make sense. Alternately, to put it in the context of a pension's current investment policy of attempting to target an 8 percent annual return, it is easier to do so — meaning, it can be done with less risk — when interest rates on low-risk assets are high rather than when they are low.

> the risk that expected returns on the plan's assets will not be realized. In fact, because the risk to future payments to beneficiaries is generally much less than the risk to the returns on typical assets held by pension plans, standard financial principles of valuation suggest that future benefit payments be discounted at a lower rate than under GASB's guidelines… By accounting for the different risks associated with investment returns and benefit payments, the fair-value approach provides a more complete and transparent measure of the costs of pension obligations…[24]

In October 2012, the IGM Forum at the University of Chicago's Booth School of Business surveyed 39 professional economists with regard to public pension discount rates. This group of highly respected economists represents differing areas of expertise and a wide variety of outlooks on the role of government. They were asked to express their agreement or disagreement with the following statement:

> By discounting pension liabilities at high interest rates under government accounting standards, many U.S. state and local governments understate their pension liabilities and the costs of providing pensions to public-sector workers.

Ninety-eight percent of the economists surveyed agreed with this proposition, with 49 percent agreeing strongly. None of the economists surveyed disagreed (a small percentage were unsure).[25]

Also in 2012, the Moody's Investor Services announced that its ratings of state and local government debt would no longer incorporate pension liabilities as measured under GASB rules. Instead, Moody's would discount pension liabilities using a corporate bond yield, similar to the way in which private pension liabilities are measured.

Indeed, in response to criticism of its standards methods, GASB recently announced revisions to its rules that would lower the discount rate applied to public pension liabilities, albeit not nearly so far as most independent analysts would advocate. Under these new rules, pensions could apply the expected rate of return on assets only to liabilities that could be expected to be funded by those assets. Liabilities taking place in years after which assets are expected to be depleted would be discounted using a municipal bond rate.

GASB's proposed revisions have both theoretical and practical flaws.[26] The State Budget Crisis Taskforce, co-chaired by former New York State Lieutenant Governor Richard Ravitch and former Federal Reserve Board Chairman Paul Volker, stated that even GASB's proposed rules would "fall far short of what finance experts argue is appropriate and reported unfunded liabilities will not increase anywhere near as much as they would under a pure finance approach."[27]

Pensions compare their assets to their liabilities to calculate their financial health; that is, the investments they hold today relative to the benefits they must pay in the future. Using these figures, they calculate the funding ratio — that is, assets divided by liabilities — and the plan's unfunded liability, which is the net of assets and liabilities.

Second, plans can easily hedge against interest rate risks by holding low-risk bonds in their investment portfolios; if interest rates on newly issued bonds fell, thereby increasing the value of the plan's liabilities, a portfolio of existing bonds would rise in value due to their higher prices, keeping plan funding levels about constant. The fact that public pensions choose not to hedge their interest rate risk is not a reason for accounting rules to cover it up. Finally, a central point of fair market valuation is that how a plan is funded is distinct from the value of its liabilities. If a plan chooses to fund its liabilities on a smoothed basis to avoid year-to-year fluctuations in contribution rates, that is a policy decision distinct from the value of those liabilities at any given time.

While municipal bonds may appear to be the appropriate source for pension discount rates, Brown and Wilcox (2009) point out that in practice, accrued public pension liabilities have proven to be safer than explicit state/local government debt.[30] Even when localities have effectively defaulted on their obligations, such as with New York City in the 1970s or Orange County, Calif., in the 1990s, pension benefits continued to be paid. Thus, Brown and Wilcox argue that a derivative of U.S. Treasury yields is the most appropriate.[31]

For simplicity, the calculations in Table 2 are based upon a 4 percent discount rate. This rate is above current Treasury or Missouri municipal yields, but might be thought of as approximating rates over a longer period of time.

In all cases, funding ratios decline and unfunded liabilities grow. For instance, MOSERS falls from a funding ratio of 73 percent to only 42 percent, while unfunded liabilities rise from $2.9 billion to $11.1 billion. Under fair market valuation, MPERS is particularly poorly funded; it began with a GASB funding ratio of only 43 percent, itself based upon an aggressive 8.25 percent discount rate. Under fair market valuation, MPERS's funding ratio falls to below 24 percent.

While all plans suffer, the effects of fair market valuation on unfunded liabilities and funding ratios are smaller for the Missouri local plan than the others, because MOLAGERS's 7.25 percent assumed return is lower than the 8 to 8.25 percent rates that other plans assumed. In other words, MOLAGERS depends less upon market risk to derive its baseline GASB funding results, so it suffers less from a shift to fair market valuation.

Overall, the five Missouri pensions together are 46 percent funded using a risk-adjusted 4 percent discount rate. Unfunded liabilities total nearly $54 billion, far above the $11 billion figure calculated using GASB assumptions. The difference between the two represents the degree to which Missouri pension plans depend upon an investment risk premium to make their financing viable. This difference also represents the size of the contingent liabilities imposed on future taxpayers.

WHY DOES IT COST SO MUCH TO GUARANTEE FUTURE PENSIONS?

The results already presented may strike some as counterintuitive. Yes, the idea of contingent liabilities makes sense, and guaranteeing against them presumably

increases the cost of pension funding. But does it double the cost? Why are these results so extreme?

We first point out that these results are not derived simply from theory, or from how much some academic says a fully funded pension "should" cost. These results are consistent with the choices investors make every day as they buy and sell risk in financial markets. So there should not be much question that they are true. Rather, it is a question of understanding why individuals value risk the way they do.

The answer is that uncertainty regarding pension financing poses significant costs for the taxpayer. Not simply because they cannot plan ahead, nor because they would rather pay a single constant contribution rate rather than high rates in some years and low rates in others. It is because stock prices are correlated with the state of the economy. This means that plans will become underfunded during bad economic times. Contributions to pensions will need to rise at the same time that tax revenues are low, unemployment is high, and taxpayers have already seen their own 401(k) balance hit. As the state of Washington's actuary has written with regard to its own plans' experiences, "Weak economic environments were correlated with weak investment returns. Lower investment returns created the need for increased contributions at a time when employers and members could least afford them."[32]

This has been the experience around the country: amidst a recession, scarce government resources have been reallocated to pension funding, demanding either higher taxes or reduced expenditures on other government programs. This helps illustrate why a market valuation approach

Under current pension accounting rules, which the Governmental Accounting Standards Board establishes, a public pension plan discounts its liabilities using the rate of return the plan assumes will be generated by the portfolio of assets it holds.

TABLE 2: Missouri Pension Financing Under GASB Accounting and Fair Market Valuation

	MOSERS	MOLAGERS	MPERS	PSRS	PEERS	Total
Expected return	8%	7.25%	8.25%	8%	8%	8%
Liabilities	$10,793,651,577	$5,120,274,198	$3,297,589,869	$34,383,430,575	$3,549,348,463	$57,144,294,682
Assets	$7,897,167,203	$4,274,440,345	$1,427,290,718	$29,387,486,429	$3,028,757,171	$46,015,141,866
UAAL	$2,896,484,374	$845,833,853	$1,870,299,151	$4,995,944,146	$520,591,292	$11,129,152,816
Funding ratio	73.2%	83.5%	43.3%	85.5%	85.3%	80.5%
Risk-adjusted discount rate	4%	4%	4%	4%	4%	4%
Liabilities	$19,011,861,315	$8,123,676,900	$6,013,331,223	$60,562,730,689	$6,251,797,203	$99,963,397,330
UAAL	$11,114,694,112	$3,849,236,555	$4,586,040,505	$31,175,244,260	$3,223,040,032	$53,948,255,464
Funding ratio	41.5%	52.6%	23.7%	48.5%	48.4%	46.0%

Source: Author's calculations from most recent plan CAFRs and actuarial valuations.

[T]he reported funding health of a plan is extremely sensitive to the discount rate chosen.

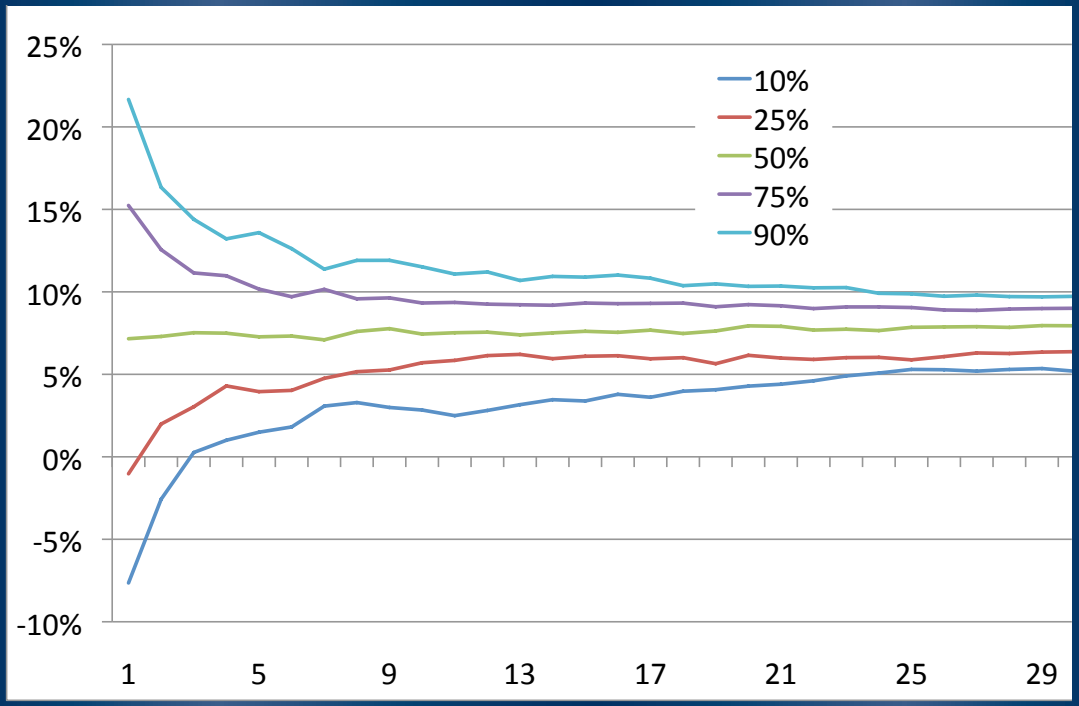
makes sense: it is not "the government" that bears the risk of pension funding. As the Congressional Budget Office points out, "The government does not have a capacity to bear risk on its own."[33] Rather, government *transfers* risk between different stakeholders, who include taxpayers, public employees, bondholders, and those who receive funds from the government. Thus, it makes sense to value that risk as these stakeholders do, using market prices that reflect how much individuals demand in order to bear risk and how much they are willing to pay to part with it.

In order to avoid such risk, taxpayers would be willing to pay a single constant pension contribution rate through good times and bad, even if that rate were significantly higher than the average of the varying rates paid using investment returns that were high but uncertain. How do we know this? Through the behavior of investors in financial markets every day. Millions of knowledgeable investors around the world hold safe investments such as long-term U.S. Treasury securities, with durations up to 30 years, instead of riskier but higher-yielding investments such as stocks. The low yields offered on such safe investments reflect the returns investors are willing to forgo in order to receive protection against the small — but *not* zero —chance of doing even worse. Thus, while some have mistakenly interpreted a riskless discount rate as a "worst-case scenario,"[34] a moment's reflection shows why this cannot be the case.

OBJECTION: LONG TIME HORIZONS

The behavior of investors belies that claim from public pensions that the "long-term" nature of their investing allows them to effectively ignore risk.

FIGURE 4: Distribution of Mean Returns Over Varying Holding Periods



This claim is based on the idea of "time diversification," which holds that the risk of investments, like stocks, declines over longer holding periods. If the government is perpetual, then it can focus on the long term and ignore shorter-term risk. The problem is that most financial economists believe that such ideas about "diversifying over time" are wrong. Indeed, a simple Internet search on that phrase "time diversification" will often pair it with the words "fallacy," "myth," and other such hints that caution should be used in applying the theory to multi-billion dollar investments. Even the investment firm Vanguard — well-known as an advocate of buy-and-hold investing — states that "there is little evidence to support the notion that time moderates the perceived volatility inherent in risky assets."[35]

Why is this the case? To illustrate, Figure 4 simulates the distribution of investment returns over different holding periods, assuming an 8 percent mean return and a standard deviation of returns of 10.4 percent. In the first year, returns vary significantly: 10 percent of returns are above 22 percent and another 10 percent are losses greater than -8 percent. But as the holding period increases, the distribution of average returns narrows. After 30 years, for instance, the 10th-90th percentile values have fallen to 10 percent and 5 percent, respectively. These figures appear to support the view that long-term investors need not worry about risk.

But now consider an alternate illustration based on the same underlying data. Instead of looking at rates of return, we look at actual dollar amounts. Using the same returns, we calculate the end value of $1 invested and held over varying lengths of time (Figure 5). While average returns appear to grow less risky over time, the opposite is the case for the actual dollar amounts invested. For instance, after a single year of investment, the median value is $1.06 and 80 percent of outcomes lie between 95 cents and $1.19, a gap difference of about 10 percent on the high and the low sides. After 10 years, however, the worst 10 percent of outcomes are worth 30 percent less than the typical outcome; after 20 years, the gap is 49 percent and after 30 years, 53 percent. A similar pattern holds for returns lying above the mean.

The simulation demonstrates an ever-widening distribution of investment outcomes and this distribution never narrows, no matter how long the investment is held. How are these two results consistent? It is because the effect of compounding over long time periods trumps the effects of a narrower distribution of average returns. And public pensions do not pay benefits with average rates of return; they pay them with dollars of investment income. The risk to that investment income does *not* shrink over time. This explains why guarantees against low market returns — which should be less expensive over long periods, if the time diversification argument is correct — actually grow *more* expensive over time.[36]

As Nobel Laureate Paul Samuelson put it:

> Invest for the long term, the theory goes, and the risk lessens. Is the dogma true as told? Alas, no. … Most of the time the buy-and-hold common stock investors do beat their more cautious

Under GASB's newly issued Rules 67 and 68, beginning in 2013, pensions will be required to publish actuarial figures using discount rates 1 percentage point above and 1 percentage point below the plan's chosen rate.

If public pension benefits are guaranteed — as they are intended to be, and as legal rulings and state constitutions have determined them to be — then they should be discounted using the interest rates that the markets pay on guaranteed investments, such as U.S. Treasury securities.

> neighbors; and, as the time horizon becomes larger, the odds do grow that the bold holders of stock will win the duel. But it is also true that a longer time horizon brings bigger losses when an inevitable loss does occur. … Ask yourself: Will stepping down toward a poverty level, when that rarely but inevitably does happen, outweigh for me the pleasures that occur in those likely outcomes when my equity nest egg does increase?[37]

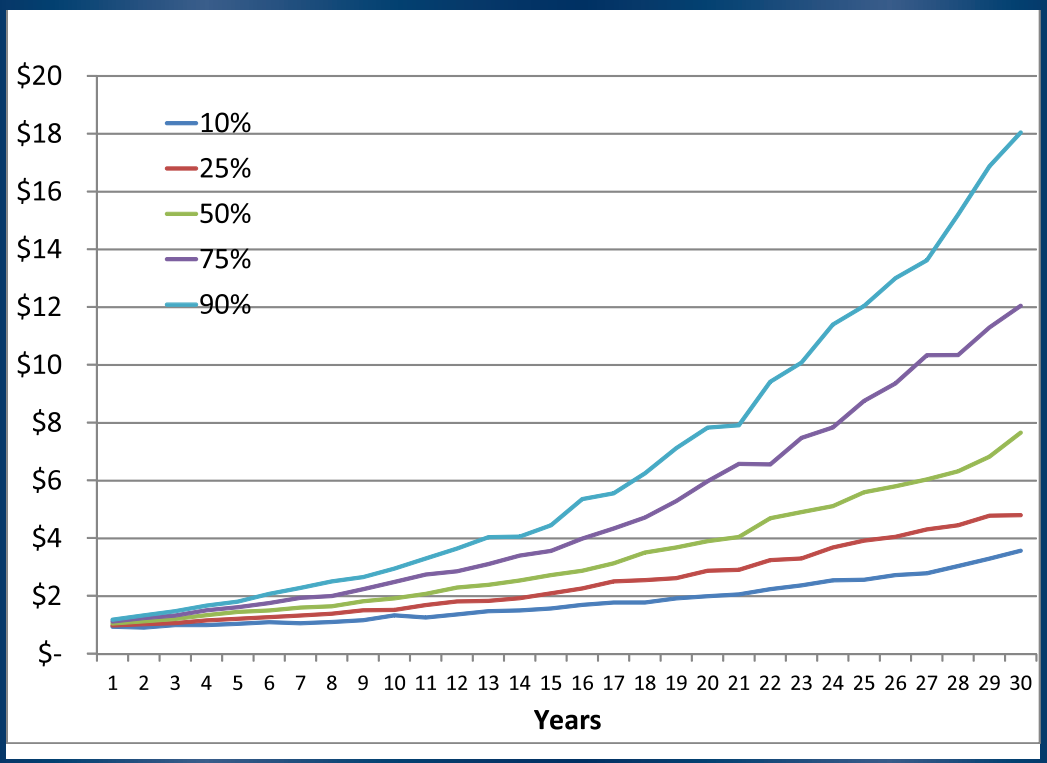
Thus, the claim that the long time horizons for public pension financing allow the plans to ignore market risk lacks support among experts in the field.

HOW DO OTHER PENSION PLANS MEASURE THEIR FINANCING?

It is worth noting that pension plans in other sectors value their liabilities differently than U.S. public plans. Private sector corporate DB pensions are required to value their liabilities using the yield on a portfolio of high quality corporate bonds. As of November 2012, the yield in the Citibank Liability Index was 3.9 percent.

Discounting corporate pension liabilities using a corporate bond rate makes sense: the yield on corporate bonds is based upon the low, but not zero, probability that the corporation will go bankrupt and default on its payments. In such a case, the corporation also would likely default on its pension benefits (in reality, the plan would be passed off to the Pension Benefit Guaranty Corporation, which, up to a limit, insures most benefits against loss. Employer contributions finance this coverage and thus the coverage is distinct from the discount rate to be applied to the plan's

FIGURE 5: Distribution of Values of $1 Initial Investment



liabilities.) In other words, the risk of the discount rate roughly matches the risk of the benefit liabilities. Public employee pensions are safer than corporate pensions in that their benefits generally are guaranteed in full by law and the plan sponsor — the government — has the power to tax. This indicates that the public pension discount rate should be *lower* than the corporate rate, not more than 4 percentage points higher.

The common response when discount rates for private DB plans are raised is that private plans should use low rates because, unlike public plans, there is the chance that a private pension could be discontinued. A public plan, it is said, is perpetual and therefore different rules should apply. In fact, because public plans are assumed not to go out of business, it also should be assumed they will continue to pay benefits in full. If so, a public plan's liabilities should be considered more binding than those of a private pension and thus a *lower*, not a higher, discount rate should be used.

If GASB-type accounting rules were the most appropriate for public employee plans, one would expect that public employee plans in other countries would follow similar accounting practices as U.S. public plans. In fact, most do not. In Canada, public employee pensions must follow similar rules to U.S private plans. In the Netherlands, public funds discount their liabilities using the riskless rate of return, such as from U.S. Treasury securities, which currently yield about 1.75 percent over 10 years and 2.5 percent over 20 years. In the United Kingdom, public plans discount their liabilities at 3 percent, the expected growth rate of gross domestic product.[38]

In addition, standards established by the International Public Sector Accounting Standards Board (IPSASB) — essentially the international version of GASB — dictate that the discount rate should not incorporate a risk premium. The standards also say that they should be based upon government bonds or high-quality corporate bonds, not, as is the case for U.S public pensions, on the expected return on stocks, private equity, or hedge funds.

Thus, the accounting rules for U.S. public pensions are at odds with how similar pensions are regulated both here and abroad. Finally, as pointed out earlier, almost no government agency other than GASB accepts the "government is special" argument. Beginning in 2013, the National Income and Product Accounts calculated by the federal Bureau of Economic Analysis will measure pension obligations using fair market valuation techniques. That is to say, pension liabilities that the plans report will now be inconsistent with those same liabilities as reported in the official ledger book of the United States economy.[39]

HOW DO PENSION ACCOUNTING RULES AFFECT RISK-TAKING?

The debate about pension accounting rules is not merely an argument about valuation of liabilities, important as that may be. Because investments with higher risk have higher expected returns, current actuarial standards incorrectly imply that a pension plan that takes more risk immediately becomes better funded as a result. For instance, if pension plans across the country shift from portfolios with an expected return of 8 percent

The way to calculate the full value of public pension liabilities is through a risk-adjusted discount rate; that is, an interest rate derived from investments that have approximately the same risk as the liability to which the discount rate is being applied.

Overall, the five Missouri pensions together are 46 percent funded using a risk-adjusted 4 percent discount rate. Unfunded liabilities total nearly $54 billion, far above the $11 billion figure calculated using GASB assumptions.

to riskier investments with expected returns of 8.5 percent, the value of their liabilities — under GASB accounting rules, at least — would immediately decline by about 10 percent, before a single penny of higher returns is earned.

The effect of discounting at the expected return on a risky investment portfolio is so powerful that a pension could improve its financial health — again, according to GASB rules — by literally *burning* any safe assets in its portfolio.[40] Destroying cash or Treasury bonds would reduce the plan's assets, but would shift the overall portfolio toward higher risk and higher expected returns, which allows for a higher discount rate to be applied to liabilities. The fact that it is better to assume high returns for the future than to actually have money today illustrates the absurdity of GASB's accounting rules. Robert Merton, winner of the Nobel Prize in economics, warns:

> Because a larger expected return on assets generally implies that the assets have greater risk, the pension fund that invests in riskier assets will have a lower actuarial valuation of its pension liabilities and thus a lower required contribution rate. This process not only distorts the economic valuation of pension liabilities, it creates incentives for more risk taking in the pension fund.[41]

Empirical research has borne out Merton's concerns that GASB accounting rules encourage excessive risk-taking. For instance, Biggs (2011) shows that, since the financial crisis, public plans are actually taking *more* investment risk than before.[42] This suggests that at least some pensions are "doubling down" on risk to restore their weakened finances.

Likewise, economists Aleksandar Andonov and Rob Bauer, of Maastricht University, and Martijn Cremers, of the University of Notre Dame, compared how public and private sector pensions in the U.S., Canada, and Europe manage their investments.[43] They point out that, according to economic theory, as a pension plan's population ages — meaning there are greater numbers of retirees relative to workers — and as interest rates on government bonds fall, a pension should take a more conservative investment approach and assume a lower discount rate for its liabilities. Private sector pensions and public plans outside the U.S. follow this logic, according to data the authors examined. U.S. public sector plans, by contrast, have taken on *greater* investment risk, because doing so allows them to lower the accounting value of their liabilities and put off difficult decisions such as raising contributions or lowering benefits. The problem with this strategy, of course, is that this investment risk is shifted onto future taxpayers. These accounting-driven choices by public sector pensions, the authors say, "have large economic effects and could have potentially severe future consequences."

MARKET VALUATION MYTHS

Fair-market valuation has a lot to say about public pensions, about how well-financed they are and what strategies would — and would not — help make them better funded going into the future. But it is important to note certain things the market valuation approach does not say – even though many public pension advocates claim it does.

For instance, some people assert that the market valuation critique claims that public pensions will earn no more than the riskless rate of return on their investments. Monique Morrissey of the Economic Policy Institute states that "… the critics contend that when pensions calculate the amount of money they need to set aside today to make promised payments to retirees in the future, they should assume that pension investments will earn rates equivalent to those of Treasury bonds and similarly low-risk to no-risk assets."[44] Similarly, columnist Gerard Miller writes, "Pension funds are not going to invest their entire portfolio in 3 percent Treasury bonds right now — or ever — so the risk-free model is not even descriptive of reality and has little normative value."[45]

In fact, economists say nothing of the sort. The issue is not whether pensions can achieve 8 percent returns "in expectation." In expectation, they can achieve almost any return they wish by taking sufficient risk. For instance, there are mutual funds that double the expected returns on the S&P 500 index — of course, by doubling the risk. Economists argue simply that pensions cannot achieve 8 percent returns without taking risk — something which is unquestionably true — and that this risk should not be interpreted as a benefit to taxpayers without any cost. As the examples here have shown, it is not necessary to assume that pensions earn the riskless return on their investments in order to justify market valuation. You need only show that (a) benefits are guaranteed, and (b) there is a cost to guaranteeing them. This cost is best reflected in the prices that participants are charged and pay in financial markets, where similar sorts of guarantees are traded every day.

The use of a risk-adjusted discount rate captures the value of taxpayers' obligation to make good on benefit promises even if pension investments do not achieve their assumed returns. This obligation has legal, political, and moral force alongside a significant monetary value. While GASB acknowledges that this obligation exists, current GASB pension accounting rules entirely ignore its value.[46]

RECENT EVENTS: REVISED GASB RULES

The issue of public pension valuation has been evolving quickly. On June 25, 2012, GASB released Statements 67 and 68, which revise earlier accounting guidelines for public sector pensions.[47] These revisions make two important changes to help pensions value their assets and their liabilities.

First, when pensions compare assets to liabilities, they must rely on the market value of assets, rather than an actuarial value that smoothes investment returns over five to 10 years. Smoothing means that investment losses or gains this year would not be fully incorporated into a plan's funding disclosures until at least 2016. Eliminating smoothing would reduce current funding ratios by about 10 percentage points. More importantly, eliminating smoothing would show the true volatility of plan funding and the degree to which even supposedly healthy plans depend upon risky investments.

Second, the discount rate used to value plan liabilities would change. Instead of

[U]ncertainty regarding pension financing poses significant costs for the taxpayer.

Contributions to pensions will need to rise at the same time that tax revenues are low, unemployment is high, and taxpayers have already seen their own 401(k) balance hit.

applying an 8 percent discount rate to all liabilities, under the new rules, this rate could be applied to benefits only through the period in which the plan's assets are expected to last. Following the exhaustion of plan assets, any remaining liabilities must be valued using a lower municipal bond rate. This split discount rate approach would reduce pension funding ratios further, by 10 percentage points or so.

Any step toward reality would seemingly be welcome. But GASB's new approach to discounting is, if anything, even less economically coherent than the current rules. To the degree there is any insecurity to public pension benefits, it is due to plan underfunding. Because benefits that are backed by assets are presumably more secure, they would be discounted using a lower interest rate. Likewise, if benefit liabilities that are not backed by assets are less secure, they might be valued using a higher discount rate. Even if you accept the idea of a bifurcated discount rate, the new GASB rules have economic logic precisely backward.[48]

But the dangers of GASB's discounting rules are far from merely academic. Like the current rules, the new regulations cement in place the flawed notion that boosting investment risk makes a pension better funded, before a dime of higher returns has been realized. Under the current rules, a pension that shifts to riskier investments can discount its liabilities using a higher interest rate. Under the new rules, a plan that takes greater investment risk can assume its trust funds will last longer and therefore fewer years of benefits would be discounted using lower municipal bond rates. The incentives to take greater investment risk, particularly at a time when state and local governments would be hard-pressed to increase pension funding, are obvious. And, as shown already, these incentives have real effects on the amount of risk public sector pensions choose to take.

GASB's revised pension accounting rules may have been designed to placate critics of their current approach without excessively angering public pension administrators, who are effectively GASB's "customers." However, these changes neither accurately measure the value of unfunded public pension liabilities nor eliminate incentives for pensions to take excessive investment risk.

OPTIONS FOR REFORM

This paper analyzed the accounting for DB pension liabilities, finding the plans to be significantly more expensive than is reported under current GASB accounting rules. Funding public employee pensions under current benefit structures implies taxpayer costs that far exceed private employer costs for 401(k)s and other DC pensions. This cost difference both stretches state and local government budgets and generates inequities in compensation between public and private employees.

DC and cash balance (CB) pension plans also offer advantages in the area of human resources, in terms of attracting and retaining desired employees. A cash balance plan is a form of defined benefit pensions in which benefits are based on a notional investment account rather than final salary and years of service. To an employee, the retirement benefits earned in a given year are an important part of

their overall compensation, along with salary, health coverage, and other fringe benefits. The advantages to DC and CB plans stem from the way in which pension benefits accumulate over time.

Under DB plans, benefit accruals follow an unusual pattern. An employee may accumulate very little pension benefits over the first two decades of employment. Costrell and Podgursky (2009) show that an employee with a DB pension would have accrued only about 15 percent of their total future benefits by the time he or she is in his or her mid-40s.[49] In the following decade, however, benefit accruals skyrocket. For a Missouri teacher, Costrell and Podgursky show, net pension accumulations of less than $100,000 as of age 45 rise to approximately $650,000 by age 55. But what happens after that? Net benefit accruals actually decline, meaning that the amount of additional benefits earned each year is less than the amount the employee must contribute to the program. From age 55 to 65, they show, a Missouri teacher's "pension wealth" falls by about $125,000.

What do these benefit accrual patterns mean for attracting and retaining employees? First, it means that the DB pensions carry very little value for employees who do not plan on remaining in government service over a full career. To such workers, a DB pension plan adds essentially nothing to their compensation, making public employment less attractive. Moreover, public employees who are not covered by Social Security — in Missouri, principally teachers — could leave government after 10 to 20 years of service with very little in the way of future retirement benefits. While DB pension may be very generous for full-career employees, they provide much less for the majority of workers who spend only a partial career in government service. A recent report from the Maine Unified Retirement Plan Taskforce highlighted issues regarding career length. The report pointed out that while a full-career employee does very well under traditional DB pension plans, the majority of public employees who fail to work a full career receive much lower benefits.[50]

To illustrate the effects of shorter job tenures, consider an employee who retires after 32 years in MOSERS, receiving a replacement rate of about 41 percent of final earnings. But an employee who began work at the same time but retired after half that job tenure — 16 years of service — would not receive half that replacement rate, 20 percent of earnings. Rather, his replacement rate would be about *10 percent* of earnings just prior to retirement, meaning that to avoid an inadequate income in retirement, he must save at extraordinary rates later in his career to meet the 70-80 percent replacement rate that financial advisors recommend. Assuming a DC pension account earned the same 8 percent return MOSERS projects for its own investments, a half-career employee with a DC plan would receive a replacement rate at retirement of about 30 percent. A government employer may wish to attract young, mobile employees who carry valuable skills but plan on staying in government for only a decade or so. For these employees, a DB pension does little to make government employment more attractive.

Now consider a mid-career employee who has become "burned out." He

[A]midst a recession, scarce government resources have been reallocated to pension funding, demanding either higher taxes or reduced expenditures on other government programs.

Public employee pensions are safer than corporate pensions in that their benefits generally are guaranteed in full by law and the plan sponsor — the government — has the power to tax. This indicates that the public pension discount rate should be lower than the corporate rate, not more than 4 percentage points higher.

might wish to change jobs and his employer might also wish him to do so. Yet a 45-year-old employee who exits government leaves literally hundreds of thousands of dollars of pension benefits on the table relative to staying through age 55, because he would be leaving at precisely the time in which pension accumulations are most rapid. Regardless of his own or his employer's desires, it would be extremely difficult for this employee to quit government service.

Finally, consider a 55-year-old employee who is a top performer, one who is good at his job, and would wish to remain in it. By doing so, however, he potentially sacrifices $100,000 or more in net pension benefits, because the annual contributions exceed the additional benefits he will earn. Not surprisingly, most employees will quit at this point, even if both they and their employers might wish them to stay.

In all three scenarios, the incentives embedded in DB pensions work contrary to reasonable human resources goals of state and local governments.

Under DC plans, by contrast, employees accumulate future pension benefits on a steady basis, with approximately the same amount (as a percentage of salary) earned each year. For instance, if an employer makes a DC contribution equal to 5 percent of salary, that amount is accumulated each year regardless of age. These smoother accrual patterns eliminate the "push and pull" incentives embedded in typical DB plan structures.

Costrell and McGee simulate a DC/CB-type reform in which benefit accumulation rates are constant by age/tenure.[51] They find that it raises employee retention among younger workers, increases voluntary turnover among mid-career workers, and lowers retirement rates for employees with long job tenure. That is, a DC- or CB-type pension reform could address some of the major human resources shortcomings of current DB pension systems.

The preferred type of reform depends upon the preferences of the sponsoring employer and the circumstances of the employees who would participate in the plan. For instance, Missouri teachers lack Social Security coverage, while most other Missouri public employees are covered by Social Security. This should not be seen as an overall disadvantage for teachers, as Social Security generally offers low benefits relative to contributions. However, without Social Security — which offers a DB benefit structure — teachers might prefer a hybrid DB/DC approach or, preferably, a CB plan. A CB plan offers the labor supply incentives of a DC plan, but with a guaranteed benefit similar to that of a DB pension. On the other hand, as other Missouri public employees already have a DB pension through Social Security, reforms for them might include a greater DC component.

However, it is important to remember that, in terms of financial accounting, CB plans are a subset of the DB pension universe and subscribe to the same accounting principles. One might think that because CB plans generally offer guaranteed returns of well less than 8 percent that they are not subject to the same accounting issues as conventional DB plans. However, the CB plan's accounting — which determines the level

of annual taxpayer contributions — is determined by the assumed return on the plan's investments, not the guaranteed return offered to participants on their virtual retirement accounts. For instance, the state of Nebraska runs a CB plan for its employees. The plan itself offers a guaranteed return of at least 5 percent on credits to employees' accounts, but assumes a 7.75 percent return on the plan's underlying investments and uses this return to calculate annual required contributions to the plan.

TRANSITION COSTS FOR DC PENSIONS

One essential difference between DB pensions and DC plans is that DC plans cannot generate unfunded liabilities. Under a DB plan, the employer promises employees a fixed retirement benefit regardless of how the plan's investments fare. In a DC plan, by contrast, employers promise employees a fixed contribution, say, 5 percent of salary. Once that contribution is made, the employer's obligation is fulfilled.

While DC plans cannot generate new unfunded liabilities, shifting to a DC pension plan does not alter unfunded liabilities from the existing DB plan. It does not eliminate them, as some DC reformers might wish to see. Those unfunded liabilities are effectively debts of the governments and must be honored. Nor, however, does shifting to DC plans increase costs, as some critics of DC plans contend. The idea that there are "transition costs" involved with shifting to DC pensions is widespread, but incorrect.

Pension advocates rely on financial disclosure rules that the Government Accounting Standards Board (GASB) generates regarding how quickly a DB plan must pay down — or "amortize" — its unfunded liabilities. A plan that is open to new employees may amortize its shortfalls over a longer period of about 30 years, while a closed plan must amortize its unfunded liabilities sooner.[52] This faster payoff means a temporary period of higher pension amortization costs, which is termed the "transition cost."

This creates a seemingly illogical conclusion: the bigger the plan's unfunded liabilities, the tougher it is to move to a DC plan that will not create more unfunded liabilities.

However, Costrell (2012) shows that these transition costs are largely a myth.[53] Pension advocates such as the National Institute for Retirement Security claim that "accounting rules can require pension costs to accelerate in the wake of a freeze." Costrell points out that GASB rules require nothing of the sort. GASB rules do not determine plan funding, they dictate only accounting figures that pensions must disclose. State and local governments set funding policy and regularly violate GASB rules, sometimes paying more than GASB requires and — too often — paying less. If a government wished to follow its current amortization schedule even as it shifts to a DC plan, nothing prevents the agency from doing so. And, as Costrell points out, some states that have moved to DC pensions have done exactly that.

Moreover, if a DC plan is made available as a new tier within the *existing* DB pension — as was done in Utah's pension reforms — then these amortization rules

[E]conomists and other policy analysts agree that the accounting rules that public pensions use significantly understate the funding shortfalls facing these plans.

do not apply. Because employee payroll under the overall plan is unchanged, GASB amortization payments also do not change.

More broadly, there is no strong policy reason that amortization payments should change even if the DC plan is set up separately. Total employee payroll has not changed. Plan sponsors, not participants, nearly always make amortization payments, so it makes little difference under which plan employee payroll is assigned. Finally, a pension's unfunded liability is a debt of the government that legally has to be paid off, regardless of how many or few new employees enter a DB pension plan. Having new employees participate in a new DC pension makes no difference to what the old DB plan owes. Costrell shows that pension plans and their actuaries will acknowledge all this, although it is often hidden in the footnotes of their reports headlining massive "transition costs."

Even after a DC reform, governments may continue to amortize unfunded liabilities as they previously have. There is no legal, economic, or policy reason to do otherwise, and states that have adopted DC pensions have not had to deal with transition costs.

CONCLUSION

Around the country, Americans in many capacities are concerned about the funding of public employee retirement plans. In recent years, plans have suffered from poor investment returns and insufficient funding, even as the Baby Boom wave of public employees begins to retire. Moreover, economists and other policy analysts agree that the accounting rules that public pensions use significantly understate the funding shortfalls facing these plans. These rules, which differ significantly from those that private plans and public employee pensions in other countries use, inappropriately use the expected return on a risky portfolio of investments to value future benefit liabilities that the law guarantees. Using a risk-adjusted discount rate, which is consistent with both economic theory and the way in which private markets value liabilities, shows public employee pensions nationwide suffer from multi-trillion dollar funding shortfalls.

The story in Missouri is no different. The five Missouri plans examined here have varying states of funding health under current GASB accounting rules. Using accurate accounting for plan liabilities, their measured financing suffers significantly. On average, the Missouri plans are only 46 percent funded and face unfunded liabilities topping $50 billion. Some plans, such as Missouri teachers, are very poorly funded. Current pension accounting standards also encourage pensions to take excessive investment risk, risk that is not disclosed or valued as part of pension accounting reports.

Reforms to public pensions must begin with better accounting. Accurate accounting will show the extent of public plan underfunding. It also will show, however, that taking more investment risk — that is, assuming a higher rate of return on plan investments — will do nothing to make unfunded liabilities smaller. A better

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understanding of how large pension funding problems are and what policies will — and will not — address these problems is more likely to lead to constructive policy solutions.

Changing plan structures, to either a defined contribution or cash balance approach, will not eliminate existing unfunded liabilities. But these alternate approaches may reduce or eliminate the accumulation of additional unfunded liabilities, giving state and local governments breathing room to determine how to fund shortfalls in existing DB plans. Moreover, DC and CB plans are likely superior to current DB pension structures in terms of attracting and retaining quality employees.

The appropriate reforms to enact may differ by plan and worker type. Missouri workers who have Social Security benefits may desire a different plan structure than Missouri teachers, who currently do not have Social Security coverage. In all cases, though, reforms can help make public employee plans more financially sustainable while eliminating large, contingent liabilities to the taxpayer.

ABOUT THE AUTHOR

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NOTES

[1] Munnell, Alicia H., Jean-Pierre Aubry, Josh Hurwitz, Madeline Medenica, and Laura Quinby. "The Funding Of State And Local Pensions: 2011-2015." Center for Retirement Research, Boston College. May 2012.

[2] Author's calculations from Public Plans Database.

[3] The database is available at: http://pubplans.bc.edu.

[4] Academic discussions of pension accounting include Novy-Marx, Robert, and Joshua Rauh, 2009. "The Liabilities and Risks of State-Sponsored Pension Plans." *Journal of Economic Perspectives* 23(4), 191-210; and Biggs, Andrew G. "An Options Pricing Method for Calculating the Market Price of Public Sector Pension Liabilities." *Public Budgeting and Finance*, Fall 2011.

[5] For individuals spending part of their careers in public employment not covered by Social Security and part under Social Security-covered employment, the Government Pension Offset and Windfall Elimination Provision may affect the Social Security benefits they or their spouses are eligible to receive.

[6] Actuarial fairness in claiming ages implies that individuals receive approximately the same total lifetime benefits regardless of the age at which they retire. Early retirees receive lower benefits but for a longer period, while later retirees receive higher benefits for fewer years. Social Security reduces benefits by almost 7 percent for each year of early claiming a rate that is close to actuarially fair. Most public plans, including MOSERS, reduce benefits by about 6 percent for each year the individual claims prior to the full retirement age. This implies that early retirees tend to receive higher lifetime benefits. As a result, employees may retire earlier under such rules.

[7] The average age of retirement in the Public Plans Database as of 2009 was 60, although only a small number of plans report ages of benefit claiming. The typical new retiree had almost 24 years of government service.

[8] Missouri State Employees Retirement System Annual Actuarial Valuation, June 30, 2012. Conducted by Gabriel, Roeder, Smith & Company, Actuarial Consultants.

[9] MOSERS's allocation to alternatives is high relative to other plans nationwide, where the average allocation reported in the Public Funds Survey is 11 percent. However, MOSERS has somewhat below-average allocations to stocks and above-average allocations to bonds, so the plan's overall risk cannot easily be compared to that of other programs. While historical risk can be compared using past returns, if asset allocations change, which is occurring throughout the pension world, historical risk may not represent risk going forward.

[10] These figures assume that the normal cost varies with the natural log of the discount rate, which in other instances has provided a good fit.

[11] See DuZebe, Robert S. "Study Reflecting Impact to the FRS of Changing the Investment Return Assumption to one of the following: 7.5 percent, 7.0 percent, 6.0 percent, 5.0 percent, 4.0 percent and 3.0 percent." Milliman. March 11, 2011. A similar analysis was conducted in Jones, Norman L., Brian B. Murphy, and Paul Zorn. "Actuarial Methods and Public Pension Funding Objectives: An Empirical Examination." Presented at Society of Actuaries Public Pension Finance Symposium. May 2009, and Office of the State Actuary. "Washington State 2009 Actuarial Valuation Report." October 2010; and Office of the State Actuary. "2010 Risk Assessment: Moving Beyond Expectations." August 31, 2010.

[12] This view derives from the Modigliani-Miller theorem of corporate finance, which holds that (under certain conditions) the value of an asset or liability is independent of how it is financed. See Modigliani, F.; Miller, M. (1958). "The Cost of Capital, Corporation Finance and the Theory of Investment." *American Economic Review*, 48 (3): 261–297.

[13] Brown and Wilcox discuss legal protections for accrued pension benefits in Brown, Jeffrey R., and David W. Wilcox. "Discounting State and Local Pension Liabilities," *American Economic Review*, vol. 99, May 2009.

[14] As of 2009, MOSERS's projected return assumed 1.4 percentage points of "alpha," meaning a return generated by active portfolio management that is in excess of that provided merely as compensation for the risk of the portfolio. In other words, the portfolio alone would have an expected return of 7.1 percent while active management would raise the return to 8.5 percent. However, there is little evidence that MOSERS or any other Missouri pensions have been capable of generating excess returns at this level. See Howe, John S. "A Comparison of Missouri Pension Plans." Show-Me Institute Policy Study No. 34, December 2012.

[15] The relevant case is Firemen's Retirement System v. City of St. Louis, 2006 WL 2403955 (Mo.App. E.D. Aug 22, 2006).

[16] Throughout the example, I calculate present values using continuous discounting. The present value equals the size of the future payment divided by the exponential of (r*n), where r is the annual discount rate and n is the number of years until the future payment will be made.

[17] The shaded blue area is stylized for illustrative purposes; in fact, outcomes either above or below the bounds of the blue shaded area are possible.

[18] The listed numbers contain a $1 discrepancy, reflecting rounding error.

[19] This result is based on a principal known as "put-call parity." See Stoll, H.R. 1969. "The Relationship Between Put and Call Option Prices." *The Journal of Finance* 24 (December): 801-824.

[20] Kohn, Donald L. "Statement at the National Conference on Public Employee Retirement Systems Annual Conference." New Orleans, La., May 20, 2008.

[21] Wilcox, David. Testimony before the Public Interest Committee Forum sponsored by the American Academy of Actuaries, September 4, 2008. Novy-Marx and Rauh present a similar argument; see Novy-Marx, Robert, and Joshua Rauh. "The Liabilities and Risks of State-Sponsored Pension Plans." *Journal of Economic Perspectives*, vol. 23, no. 4 (Fall 2009), pp. 191–210. In analyzing federal employee pensions, the CBO used a discount rate 1 percentage point above the Treasury rate. However, the CBO explicitly noted that this was because federal pensions lack the legal protections that state pension plans such as the WRS are entitled to.

[22] Reinsdorf, Marshall B., and David G. Lenze. "Defined Benefit Pensions and Household Income and Wealth." Bureau of Economic Analysis. *Research Spotlight*. August 2009. Also see Lenze, David G. "Accrual Measures of Pension-Related Compensation and Wealth of State and Local Government Workers." Bureau of Economic Analysis. April 2009.

[23] Reinsdorf, Marshall. "Actuarial Measures of Defined Benefit Pension Plans for the National Accounts." Presentation to BEA Advisory Committee Meeting, May 11, 2012.

[24] Congressional Budget Office. "The Underfunding of State and Local Pension Plans." May, 2011.

[25] For details, see: http://www.igmchicago.org/igm-economic-experts-panel/poll-results?SurveyID=SV_87dlrIXQvZkFB1r.

[26] Biggs, Andrew G. "Proposed GASB Rules Show Why Only Market Valuation Fully Captures Public Pension Liabilities." *Financial Analysts Journal*, March/April 2011, Vol. 67, No. 2: 18–22.

[27] "Report of the State Budget Crisis Task Force." July 2012. Available online at: http://www.statebudgetcrisis.org.

[28] View online at: http://missouri.municipalbonds.com/bonds/yield_curve/.

[29] Even this approach may result in too high a discount rate. State and local government debt carries a yield premium over federal debt, in part because of the higher perceived risk of default. Applying a discount rate that incorporates a default premium to a benefit that is intended to be riskless understates the cost of providing that riskless benefit.

[30] Brown, Jeffrey R., and David W. Wilcox. "Discounting State and Local Pension Liabilities," *American Economic Review* 99 (May 2009): 538-42.

[31] Even within Treasuries, however, disagreements loom. For instance, some economists point out that yields on U.S. Treasury securities — which are free from credit risk — are low in part because they are highly liquid and freely tradable, an attribute that pension liabilities neither share nor need. See Munnell, Alicia H., Richard W. Kopcke, Jean-Pierre Aubry, and Laura Quinby. 2010. "Valuing Liabilities in State and Local Plans." Issue in Brief SLP-11. Chestnut Hill, Mass.: Center for Retirement Research at Boston College. On the other hand, most public pension benefits are at least partially protected against inflation, which U.S. Treasury securities are not. Economists Joshua Rauh, of Northwestern University, and Robert Novy-Marx, of the University of Rochester, assume that these two effects are roughly offsetting and therefore use Treasury interest rates to value public pension liabilities. They discount pension liabilities at the yield on Treasury Inflation Protected Securities (TIPS) plus market expectations of inflation.

[32] Office of the State Actuary. "Washington State 2009 Actuarial Valuation Report." October 2010; and Office of the State Actuary. "2010 Risk Assessment: Moving Beyond Expectations." August 31, 2010.

[33] Congressional Budget Office, "Estimating the Value of Subsidies for Federal Loans and Loan Guarantees," August 2004.

[34] For instance, see California Legislative Analysts Office. "Summary of LAO Findings and Recommendations on the 2011-12 Budget." January 24, 2011. View online here: http://www.lao.ca.gov/laoapp/budgetlist/PublicSearch.aspx?Yr=2011&KeyCol=305.

[35] Vanguard Investment Counseling & Research. "Time Diversification and Horizon-Based Asset Allocations." 2008.

[36] For more detail on this argument, see Bodie, Zvi. "On the Risk of Stocks in the Long Run," *Financial Analysts Journal*, May-June 1995.

[37] Samuelson, Paul. "Dogma of the Day," *Bloomberg Personal Finance*, 1997.

[38] Andonov, Aleksandar, Rob Bauer, and Martijn Cremers. "Pension Fund Asset Allocation and Liability Discount Rates: Camouflage and Reckless Risk Taking by U.S. Public Plans?" (May 1, 2012).

[39] For background, see Reinsdorf, Marshall B., and David G. Lenze. "Defined Benefit Pensions and Household Income and Wealth." Bureau of Economic Analysis. Research Spotlight. August 2009. Also see Lenze, David G.. "Accrual Measures of Pension-Related Compensation and Wealth of State and Local Government Workers." Bureau of Economic Analysis. April 2009.

[40] Novy-Marx (2011): "Logical Implications of GASB's Methodology for Valuing Pension Liabilities," Working Paper, University of Rochester and NBER.

[41] Merton, Robert C. Introduction to Pension Finance, by M. Barton Waring. *Wiley Finance*. 2012.

[42] Biggs, Andrew G. "How Have Public Sector Pensions Responded to the Financial Crisis?" Pension Research Council. Working paper WP2011-18. 2011.

[43] Andonov, Aleksandar, Bauer, Rob, and Cremers, Martijn. "Pension Fund Asset Allocation and Liability Discount Rates: Camouflage and Reckless Risk Taking by U.S. Public Plans?" (May 1, 2012).

[44] Morrissey, Monique. "Discounting Public Pensions: Reports of trillions in shortfalls ignore expected returns on assets," Economic Policy Institute, April 14, 2011.

[45] Miller, Gerard. "Pension Puffery." *Governing Magazine*. January 5, 2012.

[46] Biggs, Andrew G. "Proposed GASB Rules Show Why Only Market Valuation Fully Captures Public Pension Liabilities." *Financial Analysts Journal*, March/April 2011.

[47] See Governmental Accounting Standards Board. "News Release: Adjustments to US State and Local Government Reported Pension Data." June 25, 2010.

[48] Biggs, Andrew G. "Proposed GASB Rules Show Why Only Market Valuation Fully Captures Public Pension Liabilities." *Financial Analysts Journal*, March/April 2011.

[49] Costrell, Robert M., and Michael Podgursky. 2009. "Peak, Cliffs, and Valleys: The Peculiar Incentives in Teacher Retirement Systems and Their Consequences for School Staffing." *Education Finance and Policy*. 4 (2): 175-211.

[50] State of Maine Unified Retirement Plan Task Force. 2010. Task Force Study and Report: Maine State Employee and Teacher Unified Retirement Plan. Augusta, Maine.

[51] Costrell, Robert M., and Joshua McGee. 2010. "Teacher Pension Incentives, Retirement Behavior, and Potential for Reform in Arkansas." *Education Finance and Policy*, Fall.

[52] Ongoing plans may amortize unfunded liabilities as a level percentage of employee payroll; because this tends to rise, initial amortization payments are lower. A closed plan, by contrast, has shrinking employee payroll. GASB reasons that amortizing as a level percentage of a shrinking payroll base would excessively backload amortization payments. Thus, closed pension plans should amortize unfunded liabilities more quickly, generally on a "level dollar" method that increases initial payments.

[53] Costrell, Robert M. "GASB Won't Let Me." Laura & John Arnold Foundation. May 2012.

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