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The Role of Employee Retirement Benefits in State & Local Financial Conditions

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I. INTRODUCTION

In 2009, economists Robert Novy-Marx and Joshua D. Rauh published their analyses of state government pension obligations. Using data as of the end of 2008, they reported very sobering findings. Specifically, they found:

- State-level pension obligations, when discounted by the U.S. treasury curve, were more than 2½ times the reported market value of the assets in the relevant pension funds;
- The unfunded part of the state-level pension obligations, when discounted by the U.S. treasury curve, was more than three times the total outstanding state public debt;
- The unfunded part of state-level pension obligations amounted to over $160,000 for each state employee or retiree participating in the plans;
- The unfunded part of state-level pension obligations also amounted to over $20,000 for each and every household in the U.S.[1]

The problem Novy-Marx and Rauh presented in 2009 has not disappeared, even though asset prices have rebounded strongly in the intervening years. If anything, it is now more prominent in the public awareness. The cover of the December 2014/January 2015 ***Institutional Investor*** blared, "The Options Are Lousy. The Politics Are Brutal. There's No Easy Way Out." The opening paragraph of the associated article highlighted the bleak picture.

> *Pension reform has staggered out of the closet and into a political dustup. The underfunding of many defined benefit plans has been evident for years, but when cities like Detroit and Stockton, California, went bust, the issues remained the bailiwick of experts. That ended with the 2014 elections. Public pensions were suddenly not just about calculating liabilities or debating investment strategies; they were driving higher taxes and reduced services, stirring charges of selling out to Wall Street or abandoning police officers and firefighters. The hope that a few bullish years and some investment prowess could repair a long-fraying retirement system was lost. Someone had to pay, whether it was taxpayers, beneficiaries or bondholders.*[2]

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[1] Robert Novy-Marx and Joshua D. Rauh, "The Liabilities and Risks of State-Sponsored Pension Plans," *Journal of Economic Perspectives*, Fall 2009, pp. 191-210 at pp. 192 and 196.

[2] Robert Teitelman, *et al*., "Pension 40: The Battle is On, Our ranking of the 40 most influential players in U.S. pensions highlights new names swept up in an intensifying political struggle," *Institutional Investor*, December 2014 / January 2015, p. 44.

As of March 2014, 92% of full time state and local government workers had access to a defined benefit pension program and 83% of those full time employees participated in those programs.[3] But pension obligations are not the only retirement liabilities assumed by states and localities. Most have also promised some level of health insurance benefits to their workers in retirement. Combined, these employee retirement obligations place severe financial strain on a number of states and municipalities.

This paper steps back from the current situation and associated political recriminations to examine some of the fundamental concepts and calculations – what we call here "pension analytics" – involved in determining the magnitude of retirement obligations. More importantly, this paper also outlines how errors, omissions, and a lack of discipline in following the prescriptions of the pension analytics have contributed to the current predicament. In the first part of the paper, we present a highly simplified but useful description of the major elements of pension analytics. We start with a single life of known length and then serially add important elements that determine the level of resources needed to fulfill pension obligations. This allows us to see where errors, omissions, and lack of discipline can result in underfunding of the obligations. The second part of the paper presents a listing of five general ways that public sector pension funds have either ignored or sidestepped the fundamental pension analytics as well as implications for the funding status of the government pensions. The third section briefly outlines some challenges presented by retirement health care benefits by highlighting the even higher levels of uncertainty and outright guessing prevalent here. The paper closes with some concluding observations on the challenges public sector retirement benefits pose for cities and states.

II. THE SIMPLE ANALYTICS OF PENSION OBLIGATIONS

Available accounts of how defined benefit pensions figure into state and local finances often jump very quickly to specifics – describing the financial conditions of Detroit, or Vallejo, or Stockton, or relating stories of the hardships that proposed remedies would pose to current and future retirees, taxpayers, and (occasionally) creditors. While not denying the validity or utility of these accounts, any clear and comprehensive understanding of the situation (and evaluation of possible solutions) needs to be based soundly on rigorous analysis. To that end, this section outlines some fundamental considerations of defined benefit pension programs in a very simplified form. In Section III, we will tie these fundamental considerations to some of the circumstances currently faced by state and local defined benefit pensions.

A. SINGLE LIFE MODEL – NO INTEREST RATE

Start first with a very simple situation: a single life entering the workforce after completing education and living for exactly 60 years after starting work. You might think of this as someone finishing high school at age 18 and living to the age of 78, or someone finishing college at the age of 22 and living to the age of 82, or someone finishing graduate school at the age of 25 and living to age 85. The point is that there are exactly 60 years for employment and retirement before death. Specifying exactly 60 years for working and retirement makes the arithmetic relatively simple as we vary the number of years employed and retired to quantify how the costs of retirement benefits change. In Section II.C we recognize that lifespans are uncertain, but by using the statistical properties of groupings of people we see that the observations we discern immediately below for a single, fixed-length life are largely applicable to the average length of multiple, uncertain-length lives.

Assume also for now that any savings accumulated during the working years do not increase through time with interest earnings or capital market returns. Consequently, the only assets

[3] U.S. Department of Labor, Bureau of Labor Statistics, *National Compensation Survey: Employee Benefits in the United States, March 2014*, Bulletin 2779, September 2014, State and Local Government Table 2, http://www.bls.gov/ncs/ebs/benefits/2014/ebbl0055.pdf.

available for use in retirement are from the accumulated (and non-interest-paying) savings that were set aside for our hypothetical person during his or her years employed.

Again keeping things as simple as possible, assume that our hypothetical person requires $50,000 per year to live during the working years and in retirement. The $50,000 amount is chosen for mathematical ease and is the amount that our hypothetical person consumes in each year. There is no inflation or significant change in consumption patterns experienced by our hypothetical person.

Under the assumptions outlined immediately above, if this person worked for 40 years and then enjoyed a retirement of exactly 20 years, how much would he or she have to save during the working years to maintain the specified level of lifetime consumption ($50,000 per year) in retirement?

Over the 40 years of employment our hypothetical worker would need $1,000,000 saved at the end of his or her period of employment to be used for consumption over the 20 years of retirement. (20 years times $50,000 is $1,000,000.) This, in turn, means that the worker has to save $25,000 in each of the 40 working years to accumulate the $1,000,000 needed for retirement. ($1,000,000 divided by 40 years is $25,000.) If consumption in the working years is also assumed to be $50,000 per year, the worker needs total compensation of at least $75,000 for each of the 40 working years where $25,000 of that amount is saved to be used to fund consumption in the 20 years of retirement.[4] The worker needs to save an amount equal to one-half of his or her annual consumption, or equivalently, needs to devote one-third of total compensation during the working years to fund retirement.

What happens if we change the number of years in retirement but maintain the fixed post-education lifespan of 60 years?

If we reduce the working period to 30 years (a “30 and out” situation) while maintaining $50,000 per year in consumption for the 30 years in retirement, our hypothetical worker now needs to accumulate $1,500,000 in savings at the end of his or her period of employment. This means that the worker has to save $50,000 per year in each year of working to accumulate the $1,500,000 needed to fund $50,000 per year of consumption in retirement. So the total compensation of the worker needs to be at least $100,000 per year (assuming $50,000 per year needed for consumption during the working years). The worker needs to save an amount equal to his or her annual consumption income, or devote one-half of total compensation during the working years to fund retirement.

If we increase the working period to 45 years (corresponding to retirement in the worker’s late 60s), the worker needs to accumulate $750,000 in savings to fund the remaining 15 years of life at $50,000 per year. Saving $16,667 per year for 45 years accumulates to $750,000. Total compensation during the working years would need to be at least $66,667, assuming $50,000 per year was needed for consumption during his or her lifetime. The worker needs to save an amount equal to one-third of his or her annual consumption income, or devote one-quarter of total compensation during the working years to fund retirement.

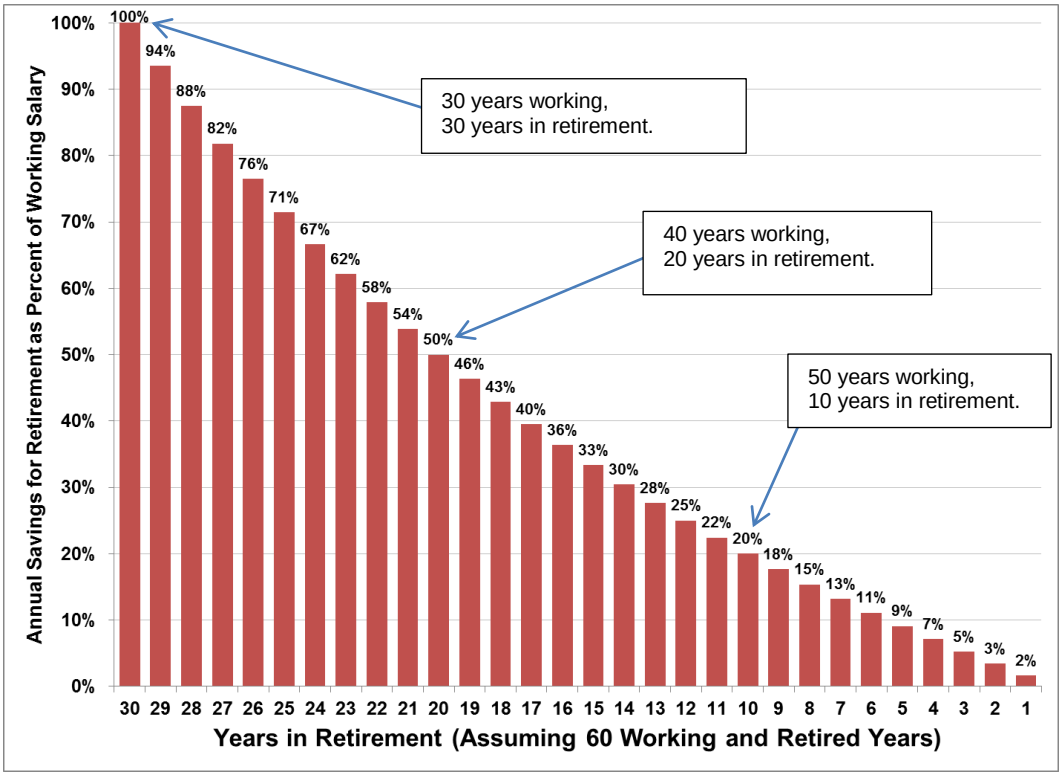
The explanation outlined above clarifies the mechanics of the time-in-work *versus* time-in-retirement trade-off, although the underlying motivation for the decision-making process does not comport with actual consumer decision making processes or more choice-theoretic economic models of work and retirement. It is more natural to think about a hypothetical worker receiving a certain amount of compensation and then determining how much of that total compensation is devoted to current consumption and how much is saved to be consumed in retirement. Once the decision between current and future consumption is made, the determination regarding the number of years working versus number of years in retirement is straightforward – the person

[4] Again, to keep things simple many other elements of compensation, particularly taxes and other benefits, are not treated here.

works for as many years as needed to accumulate the savings that will be consumed in the known number of years in retirement.[5]

Nevertheless, the pattern of interest to us for the purposes of this paper is clear and not at all controversial, at least under the simple assumptions used. The longer the period in retirement and the shorter the period working, the higher the portion of compensation during the working years one must devote to accumulate savings for retirement. Figure 1 depicts this relationship graphically.

Figure 1: Effect of Retirement Length on Annual Retirement Savings as Percent of Annual Consumption Income – No Interest



Source: Authors' calculations.

Note that the annual savings calculated above represents the minimum amount needed to be saved during each working year in order to accumulate enough savings to last through our hypothetical worker's expected lifetime, which is assumed to end exactly 60 years after entering the workforce. Any additional amount saved during the working years implies that our hypothetical worker reduced consumption during the working years either to obtain more consumption in the retirement years or to leave unused savings upon death. Under the assumptions adopted so far and basic economic thinking regarding the optimization of lifetime consumption, unused savings or higher consumption in retirement results in lower overall economic welfare for our hypothetical worker.

We now start to add a bit of complication and realism to the analysis.

[5] There are also more complicated models where the number of years in retirement can be included in the tradeoff between current and future consumption levels. We ignore those models in this exposition.

B. SINGLE LIFE MODEL – ADDING INTEREST

Employment and retirement happen through time. The availability of this time can be used to reduce the cost of funding retirement consumption if the value of assets saved can grow through time. In this section we demonstrate how earnings arising from an assumed interest rate reduce the cost of accumulating the savings needed to fund a fixed number of retirement years. This section again takes a very simple approach, examining only the implications of a constant rate of interest. For purposes of this paper, the constant interest rate represents capital market returns, albeit oversimplifying greatly. The goal here is to outline how capital market returns, as proxied by a constant interest rate, can work in pensions.[6]

Allowing for a constant, positive rate of interest increases the rate of growth in the accumulated savings balance during the employed phase and reduces the rate of decrease in the accumulated savings balance during the retirement phase. Since we are positing that we want the lowest savings amount during the working years that can fully fund a known retirement length with nothing left at death, we need to work backwards to figure out the effect of interest earnings on the annual savings amount during the working years. In other words, we first need to figure out the accumulated savings needed at the start of the retirement period, assuming that the savings will earn a specified constant rate of interest throughout retirement until death. Once we determine the minimum amount of accumulated savings needed at the start of retirement, we can then determine the minimum annual savings stream while working to accumulate that amount – again using a constant specified interest rate.

Table 1 below summarizes how interest during the retirement phase might work in the situation under consideration here. The measure presented is the accumulated savings amounts needed at the start of the retirement period under various interest rates and time spent in retirement divided by the total accumulated payments made in retirement. In other words, **Table 1** reports the amount of accumulated savings needed at the start of retirement as a percentage of the amount needed to fund all payments made in retirement. To construct **Table 1**, we first calculated the present value of the stream of annual payments in retirement for the number of years listed in the columns and the interest rate listed in the rows. We then divided this present value calculation by the cumulative undiscounted annual payments in retirement for the number of years listed in the columns. The cells in **Table 1** therefore show the size of the present value of the future payments to the cumulative undiscounted future payments. For a 30-year retirement term, interest earnings at 1% means that savings at the start of retirement only need to be 86.0% of the cumulative amount paid out in retirement. Increasing the interest earnings to 10% per year means that savings at the start of retirement only need to be 31.4% of the cumulative amount paid out in retirement. **Table 1** exhibits a clear and well-understood pattern – the higher the interest earnings during the retirement phase, the lower the amount of savings needed at the start of retirement. Also, the shorter the period of retirement, the higher the portion of the undiscounted cumulative amount that needs to be saved by the start of the retirement period. As expected, allowing interest earnings on the accumulated savings during retirement reduces the amount that must be saved from compensation during the working years.

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[6] The analysis presented in this paper ignores inflation and its effect on interest rates and everything else in the economy. The tables and figures below incorporate interest rates from 0% to 10%, a range that historically has been associated with inflation rates that have ranged from negative to double digits. While ignoring inflation reduces the realism and generality of the analysis, it allows for a useful level of analytical tractability. We focus here merely on how a various levels of constant interest rates reduce the annual savings stream required out of current compensation to fund future retirement consumption.

Another simplification embedded in this analysis is that our hypothetical worker/retiree has a zero percent time preference utility function. This means that our worker's time preference is identical to the assumed interest rate. In more general consumption/investment decision models for individuals, the cash flows are often discounted by market rates of interest and then the individual applies an additional factor to reflect his or her time preference beyond the interest rate effect. That level of complication and generality does not help us understand the role of retirement benefits for state and local government better than the simpler approach adopted here.

Table 1: Effect of Interest Earnings during Retirement Payout Period, Percent Required Compared to Situation with No Interest Earnings

Interest Rate	Time Spent in Retirement					
	30-years	25-years	20-years	15-years	10-years	5-years
0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
1%	86.0%	88.1%	90.2%	92.4%	94.7%	97.1%
2%	74.7%	78.1%	81.8%	85.7%	89.8%	94.3%
3%	65.3%	69.7%	74.4%	79.6%	85.3%	91.6%
4%	57.6%	62.5%	68.0%	74.1%	81.1%	89.0%
5%	51.2%	56.4%	62.3%	69.2%	77.2%	86.6%
6%	45.9%	51.1%	57.3%	64.7%	73.6%	84.2%
7%	41.4%	46.6%	53.0%	60.7%	70.2%	82.0%
8%	37.5%	42.7%	49.1%	57.1%	67.1%	79.9%
9%	34.2%	39.3%	45.6%	53.7%	64.2%	77.8%
10%	31.4%	36.3%	42.6%	50.7%	61.4%	75.8%

Source: Authors' calculations.

Earnings on the accumulation of savings during the working years also reduce the amount of savings needed in each year to fund retirement consumption. **Table 2** below summarizes this element. To construct **Table 2**, we took the amount of savings required at the start of retirement used in the **Table 1** calculations and then determined the level annual payments needed to be made for the working period associated with each column of years spent in retirement, all earning interest at the rates specified in the rows. In each case the years working are equal to 60 minus the years in retirement. So for a 30 year time in retirement, there are 30 working years during which savings are accumulating and earn at the rates specified in the left column. For a 20 year time in retirement, there are 40 working years of savings contributions earning interest at the rates specified. Those annual amounts are then divided by the annual salary amount – here posited as $50,000 per year. Although both **Table 1** and **Table 2** present percentages and show a similar pattern, the percentages presented refer to different concepts. In **Table 1** the percentages refer to the size of accumulated savings at the start of retirement needed to fund fully all consumption in retirement at the specified interest rates and years spent in retirement. The calculations embedded in **Table 1** are then used to determine the numbers presented in **Table 2**.

Table 2: Effect of Interest Earnings on Savings Required, Annual Savings Required as a Percent of Annual Working Salary

Interest Rate	Time Spent in Retirement					
	30-years	25-years	20-years	15-years	10-years	5-years
0%	100.0%	71.4%	50.0%	33.3%	20.0%	9.1%
1%	74.2%	52.9%	36.9%	24.5%	14.7%	6.7%
2%	55.2%	39.1%	27.1%	17.9%	10.6%	4.8%
3%	41.2%	28.8%	19.7%	12.9%	7.6%	3.4%
4%	30.8%	21.2%	14.3%	9.2%	5.3%	2.3%
5%	23.1%	15.6%	10.3%	6.5%	3.7%	1.6%
6%	17.4%	11.5%	7.4%	4.6%	2.5%	1.1%
7%	13.1%	8.4%	5.3%	3.2%	1.7%	0.7%
8%	9.9%	6.2%	3.8%	2.2%	1.2%	0.5%
9%	7.5%	4.6%	2.7%	1.5%	0.8%	0.3%
10%	5.7%	3.3%	1.9%	1.1%	0.5%	0.2%

Source: Authors' calculations.

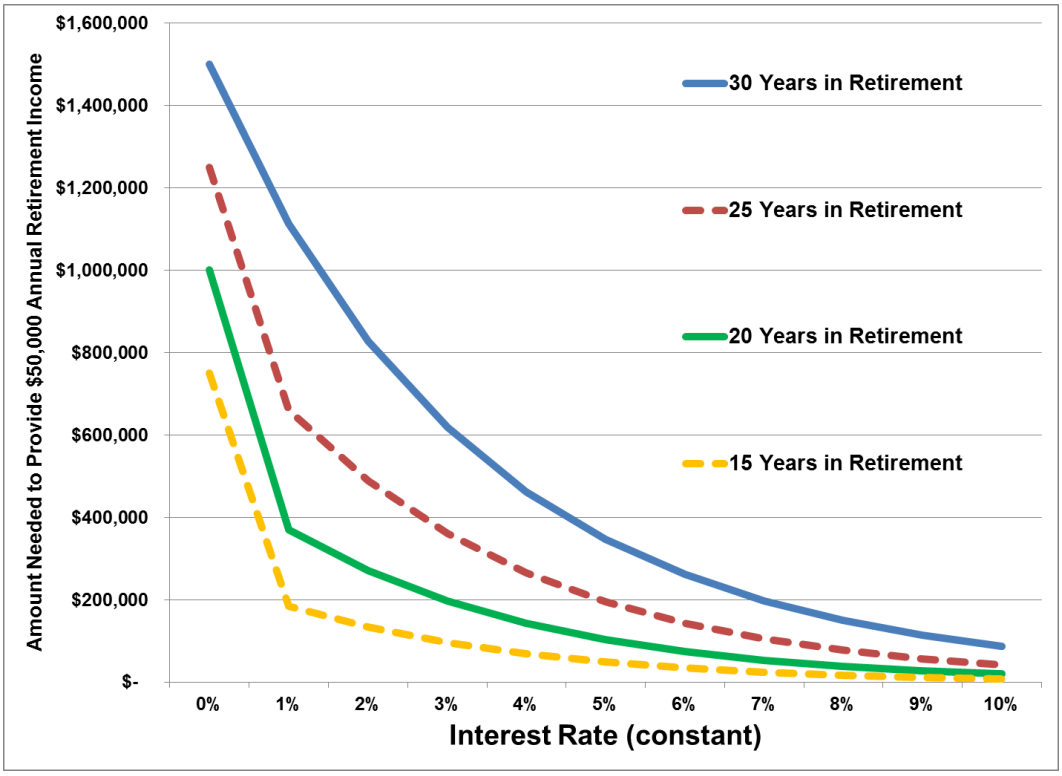
The interpretation of **Table 2** is as follows. The entry in each cell is the amount of annual savings going into a retirement savings account needed for each category of years spent in retirement listed in the columns at each of the interest rates specified in the rows, all as a percentage of the $50,000 per year spent on consumption. For a 30-year time spent in retirement and a 1% interest rate, annual savings equal to 74.2% of $50,000 per year (or $37,100) are needed to fund retirement savings that will yield $50,000 per year in retirement consumption payments. For 20-years spent in retirement and a 5% interest rate, annual savings equal to 10.3% of $50,000 per

year (or $5,150) are needed to fund retirement savings that will yield $50,000 per year in retirement consumption payments.

The overall pattern depicted in **Table 2** is as expected. The longer the number of working years compared to years in retirement, the lower the annual amount needed to be contributed for retirement savings. As interest rates rise, the annual amounts needed to be contributed for retirement savings declines.

This relationship is quantified and summarized for our simple example in **Figure 2** below. It takes over $1.1 million dollars in savings at the start of retirement to provide $50,000 per year in retirement income for 30 years if interest rates are a constant 1% over the entire 60 years. If interest rates are 5% over the entire period, just under $350,000 in savings at the start of retirement are required to provide $50,000 a year in retirement income for 30 years. If the time in retirement is reduced to 20 years, a balance of $370,000 in savings at the beginning of retirement will provide $50,000 per year in retirement income with a 1% interest rate. Raising the interest rate to 5% reduces the savings balance required at the start of retirement to fund 20 years of retirement to $103,000.

Figure 2: Savings Needed for Retirement by Time in Retirement and Interest Rate



Source: Authors' calculations.

The results summarized in **Table 2** and **Figure 2** are a consequence of the "miracle of compound interest." The fundamental point here is that a pattern of steady savings augmented by interest earnings at a single constant rate reduces the amount of savings out of current income needed for consumption in retirement. Interest earnings allow employees to maintain a higher level of both current consumption and future consumption than a situation with no interest earnings. In the parlance of microeconomic theory, interest earnings lower the current price for future consumption (benefit payments in retirement) leading to an overall improvement in welfare for the families of the covered employees with higher current and future consumption.

The benefits of interest earnings outlined in this paper depend crucially on several assumptions that are not met in practice. One assumption embedded in the analysis is that interest earnings

occur in a steady fashion over the entire working and retirement period. That assumption is clearly at odds with empirical interest rate behavior as well as the behavior of any other capital market instrument. Another key assumption is that funds are set aside and dedicated to retirement savings on a regular basis over the entire period the employee is working. That assumption is also often breached – employees with relatively short periods of employment with the entity sponsoring the pension fund receive substantial pension benefits. The implications of this will be discussed later in this paper.

C. Multiple Lives – Adding Mortality/Longevity

So far we have restricted attention to a single life of known length in order to highlight the effects of time in retirement (and its complement, time working) and interest earnings. The topic of this paper, however, presupposes a defined benefit pension plan for a group of current and retired employees. This means that an employer has promised to pay the pension obligations to multiple current and retired employees and it is the employer's responsibility to determine and then fund the total amount to be accumulated. Thus, both the payment obligations (the liabilities) and the funds available make the payments (the assets) are pooled. This section briefly introduces and explains some additional implications posed by a defined benefit pension fund covering multiple lives.

In the example discussed previously, the single life ended with certainty sixty years after entering the workforce. But a person's lifespan is not known with certainty. If our hypothetical single worker dies prematurely, some portion of the retirement savings is unused – at least for its intended use. This can be bequeathed to heirs, so a premature death does not pose a financial risk to our sole worker. The opposite situation – a life beyond our presumed date of death – poses the financial risk that the retirement savings are insufficient to support consumption in retirement. Our hypothetical worker may attempt to reduce this risk by extra savings so that consumption in retirement can be maintained.

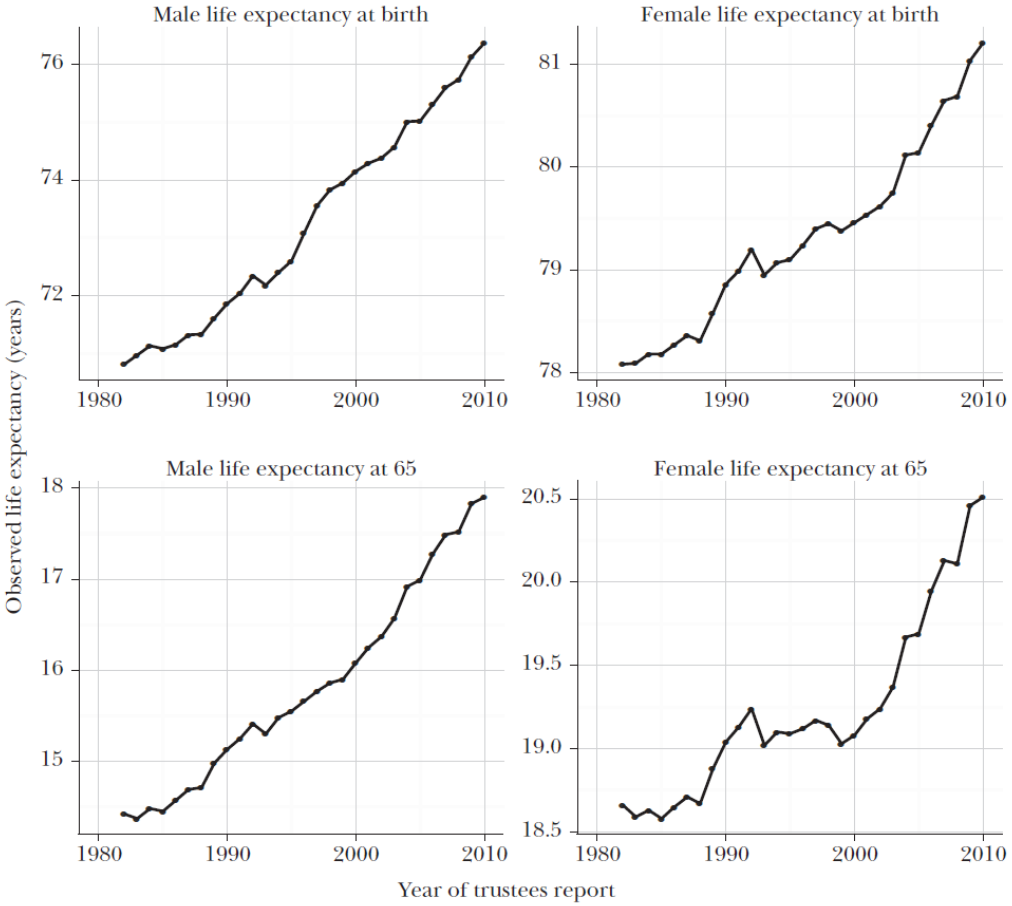
State and local defined benefit pension funds generally consist of relatively large numbers of active and retired employees – most state and local pension funds cover thousands of individuals. Some of these individuals will die relatively quickly upon retirement. They will not need the full 20 years of benefit payments that we have posited for the typical single worker above. Conversely, other individuals will live longer in retirement than the twenty years we have posited. They will need larger total benefit payments than we posited for the typical single worker. An employer promising retirement benefits to a group of plan participants can use funds set aside to pay retirement benefits for those that die shortly after retirement to pay the extra benefits for those who live longer. In other words, the employer sponsoring a defined benefit retirement plan can shift funds from paying benefits for some individuals to paying benefits for others – as long as the employer has a sufficiently accurate idea of the total amount of benefits that ultimately must be paid.

Actuarial methods can be used to project the mortality characteristics of the pool of pension participants. Employers, i.e., plan sponsors, and actuaries do not need to know the date of death of each participant, but they can use statistical methods to understand the mortality characteristics of the participant pool as a whole. If the methods are accurate and reliably applied, they can project the future benefit payment stream of the pool of participants quite closely, provided that the number of participating lives is sufficiently large.

Actuarial projections, however, can be wrong even if actuaries apply their expertise competently. If the actuarial methods are inaccurate or unreliably applied, or if the actuary is not adequately informed of all the ways that pension liabilities can accrue, the error can be significant. One of the major uncertainties in calculating future defined benefit pension payment streams is the effect of longer lives – longevity. Actuaries are well aware of the history of longevity improvements in the U.S., but even small deviations from the longevity/mortality assumptions used can yield significant changes in the total liabilities for pools of lives participating in the pension program.

Figure 3 depicts longevity experience in the U.S. over the past 35 years. As the top panels show, life expectancy at birth has been increasing – by about five years for males and three years for females. More importantly for defined benefit pension funds, life expectancy at age 65 has also been increasing. From the early 1980s up through 2010, the remaining life expectancy of a 65-year old male has increased from a bit over 14 years to nearly 18 years – a more than three year increase. A 65-year old female in 1980 was expected to live slightly more than 18½ more years. By 2010 a 65-year old female was expected to live an additional 20½ years. As the next section will document, increases in life expectancy can lead to significant increases defined benefit pension liabilities – especially if the increases are incompletely anticipated.

Figure 3: Observed Life Expectancy for Males and Females, 1980 through 2010



Source: Konstantin Kashin, Gary King, and Samir Soneji, "Systematic Bias and Nontransparency in US Social Security Administration Forecasts, *Journal of Economic Perspectives*, Vol. 29, No. 2 (Spring 2015), Figure 1, p. 242, http://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.29.2.239.

The shift from a single life of known length to multiple lives of varying lengths has two implications for our analytical purposes. First, the single life results outlined above are broadly applicable to participant pools if we substitute average retirement length and average interest rates for the single life of known length and a constant interest rate. A longer average time in retirement for a participant pool will require higher accumulated savings at (the average) retirement just as a longer single life of known length requires higher accumulated savings at (the known) retirement. Similarly, higher average interest rates for a participant pool will mean lower average annual savings streams just as a higher single interest rate results in a lower annual savings stream.

Second, however, moving to a pool of many participants with lives of uncertain length introduces variability regarding the actual ultimate value of needed accumulated savings compared to the calculated average values of accumulated savings for the participant pool. In other words, while

the calculated average savings value is the best single estimate of the ultimately realized savings value before the fact, the ultimately realized savings value could be higher or lower than the calculated average savings. The sponsor, therefore, implements the defined benefit pension plan in the face of uncertainty regarding both the future value of the payment obligations and the future realization of asset value and availability.

We now turn to an examination of some of the ways in which errors, omissions, and lack of discipline have led to public sector defined benefit plans that will not have enough assets to pay the retirement obligations.

III. ERRORS, OMISSIONS, AND LACK OF DISCIPLINE OBSERVED IN DETERMINING PUBLIC SECTOR DEFINED BENEFIT OBLIGATIONS

The underfunding of state and municipal defined benefit pensions arises from some combination of two general errors or omissions: (1) underestimating the amount of benefit payments needed from now until all benefits are paid and (2) insufficient funds available to make the benefit payments. Determining the value of all future benefit payments at any point in time (these are the liabilities of the pension fund) requires estimating the future expected payment streams and then discounting this expected payment stream to a present value. Underestimation of defined benefit pension fund liability is most often attributed to three types of error: (1) underestimating the life span of the pool (actuarial considerations), (2) using too high of a rate for discounting the future obligations, and (3) unforeseen payment obligations arising as participants or plan managers accrue or pay extra benefits. Insufficiency of funding arises from (1) inadequate contributions to the retirement savings pool and (2) low returns on the assets in the retirement savings pool. This section briefly describes each of these, outlines their possible effects, and finally discusses the relative magnitudes as disclosed by one state system.

A. LIFE EXPECTANCY/ACTUARIAL CONSIDERATIONS

The future pension benefit stream for each active and retired employee is determined by contract. In those states where government employees are represented by unions, collective bargaining agreements set forth the terms and conditions. Employees not covered by collective bargaining agreements obtain post-retirement benefits as part of their individual compensation arrangements. Since post-retirement benefits are paid until the death of the participant (or the participant's spouse if a survivorship option is available and elected), the total amount of the benefit stream depends on the when the last beneficiary dies.

In an effort to make actuarial calculations comparable across various products involving future payments (life insurance, annuities, pensions, etc.), the actuarial profession has developed and published tables summarizing past mortality experience. These tables are then used to forecast future mortality of the relevant pools. These tables require substantial amounts of mortality data and calculation. They are reviewed and vetted by the actuarial profession and certain regulatory bodies. Consequently, they are updated only periodically.

Medical progress, however, happens continuously – not periodically. Consequently, the standard actuarial tables can become out of date – their mortality projections do not reflect additional longevity arising from medical progress. Actuaries and others who use the mortality tables are aware of this phenomenon. They can (and do) incorporate adjustments in the tables in an attempt to reflect expected increasing longevity. Regulators and others, however, often put a premium on the comparability of pension obligations across time and across plans. Therefore, seemingly *ad hoc* adjustments, even if the intention is greater ultimate accuracy, are often discouraged. This leads to reluctance on the part of those presenting pension obligations to deviate from results derived from the published tables, even when the published tables do not reflect current experience. This can lead to problems for the sponsors of defined benefit pension plans if the longer *ex post* lives are not taken into account when calculating the amounts saved during employment. Going back to the discussion in Section II, the problem is that the number of

years in retirement is underestimated. This is not a hypothetical concern. Every forecast of male life expectancy at 65 made by the Social Security Administration from 1982 through 2010 was too low. Female life expectancy at 65, on the other hand, was overestimated by the Social Security Administration in the 1980s, but converged on the underestimation exhibited for males by 2003.[7]

In October 2014, the Society of Actuaries ("SOA") released a new mortality table projecting longevity, the RP-2014, applicable to pensions and annuities. The press release issued in October summarized the effects of the new mortality table succinctly.

> *The SOA's updated tables and mortality improvement scale show that people are living longer. For example, the updated reports show that among males age 65, overall longevity rose 2.0 years from age 84.6 in 2000 to age 86.6 in 2014. For women age 65, overall longevity rose 2.4 years from age 86.4 in 2000 to age 88.8 in 2014. Based on the data, the SOA estimates there could be a four to eight percent increase in private pension plan liability. This average cost impact will vary greatly according to the design and demographic profile of each plan.*[8]

The actuarial consulting firm of Milliman & Company tracks the conditions of the 100 largest corporate defined benefit pension plans. Recently they noted:

> *December 31 [2014] pension disclosures are expected to reflect adoption by many plan sponsors of new mortality assumptions that generally reflect increases in life expectancy, resulting in higher pension liabilities. The magnitude of these increases depends on the age, gender, and composition of annuitants and non-annuitants by individual pension plan. The March [2015] Milliman 100 PFI has not been adjusted to estimate the increase in PBO [pension benefit obligation] to reflect the mortality tables finalized by the Society of Actuaries last October. However, our preliminary analysis of the impact indicates an estimated increase of 6% to 8% in pension liabilities.*[9]

Towers Watson, another consulting firm working in pensions, estimated that the change in mortality table will result in an additional $72 billion in pension obligations for 400 large U.S. companies. General Motors reported a $2.2 billion and AT&T reported a $1.5 billion increase in pension obligations resulting from the new mortality figures.[10]

State and local pension fund obligations are also subject to longevity extension risk. They apparently have more flexibility than corporations regarding their use of mortality tables, and it is reported that at least some of them had already incorporated longer life expectancy into their pension obligation calculations.[11] The important point here is that uncertainty is ever present and miscalculation can creep into actuarial work.[12] This is a potential source for underestimating the

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[7] Konstantin Kashin, Gary King, and Samir Soneji, "Systematic Bias and Nontransparency in US Social Security Administration Forecasts, *Journal of Economic Perspectives*, Vol. 29, No. 2 (Spring 2015), Figure 2, p. 244, http://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.29.2.239.

[8] Society of Actuaries Press Release, "Society of Actuaries Releases New Mortality Tables and an Updated Mortality Improvement Scale to Improve Accuracy of Private Pension Plan Estimates," October 27, 2014 at https://www.soa.org/news-and-publications/newsroom/press-releases/society-of-actuaries-releases-new-mortality/.

[9] Milliman, "Pension Funding Index: Funded status improves in February due to a rise in corporate bond discount rates and investment gains," http://us.milliman.com/Solutions/Products/Pension-Funding-Index/.

[10] Michael Rapaport, "Longer Lives Hit Companies with Pension Plans Hard, Firms' Balance Sheets Will Have to Reflect Higher Costs," *Wall Street Journal*, February 23, 2015, http://www.wsj.com/articles/longer-lives-hit-firms-with-pension-plans-hard-1424742593.

[11] Michael Rapaport, "Public Pensions Not Expected to Take a Big Hit From New Data on Longer Lifespans," *Wall Street Journal Moneybeat* blog, February 25, 2015, http://blogs.wsj.com/moneybeat/2015/02/25/public-pensions-not-expected-to-take-a-big-hit-from-new-data-on-longer-lifespans/.

[12] The authors have worked on litigation where the actuary significantly underestimated the pension liabilities in private sector multi-employer pension plans: Connecticut Carpenters Pension Fund v. Watson-Wyatt (U.S.D.C. Connecticut, Case No. 99-CV-792) and Iron Workers Union v Watson-Wyatt (U.S.D.C. Eastern Michigan, Case No. 04-cv-40243 and 07-cv-12368).

payment obligations associated with state and local defined benefit pensions and, as discussed below in Section III.F, it has happened.

B. Discount Rate for Pension Obligations

A second way that the present value of pension obligations can be underestimated is by the use of a discount rate that is too high. To recap briefly, the present value calculation divides each future period's cash flow by one plus the discount rate structure, with this expression ($1+r_t$) being raised to a power reflecting the length of time from the present to the future period.[13] So the denominator for each period is a number greater than one (e.g., 1.1 if the discount rate for the first future period is 10%), and the value of the denominator increases the further in the future the future period is. This means that each cash flow is divided by a number greater than one, which further means that the resulting figure for the future period is less than its undiscounted cash value.

State pension systems use the expected rate of investment return on the assets in their portfolios as the discount rate for valuing the pension liabilities.[14] **Figure 4** reports on the investment return assumptions used by state pension plans as of October 2014. Over 95% of state pension plans were using discount rates of 7.0% per year or more. As a point of comparison, corporate pension funds in early 2015 were using discount rates of 4% or less to compute their pension obligations.[15]

Government and corporate defined benefit pension plans face the same capital market conditions. Why, then, are state and local pension funds using a substantially higher discount rate to value their pension obligations? Are the state and local pension funds obtaining substantially higher and more persistent investment returns than the corporate pension funds?

The answer to this apparent contradiction is simple – the use of expected investment returns as the discount rate for valuing pension liabilities is wrong and this error accounts for a substantial portion of the underestimation of the present value of state and local pension liabilities.[16] The prevailing state and local government practice of using expected investment returns as the

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13 Although government defined benefit pension funds generally use a single rate to discount the entire future payment stream to present value, modern financial theory and valuation practice argue for the use of a series of rates that reflects a discount rate term structure – a rate applied to each individual cash flow that applies specifically to each future period. The formula in this sentence reflects this approach. Using a single discount rate does not yield an accurate representation of the present value of the future cash flows except in the extremely unlikely case that the single rate represents the exact average of the discount rate term structure weighted by the relevant cash flows. Using a single discount rate to calculate the present value of the future benefit stream, therefore, can introduce a significant amount of error in the valuation exercise. This paper, however, focuses on the even larger source of discount rate error – the use of expected investment returns instead of a rate reflecting the low risk of nonpayment.

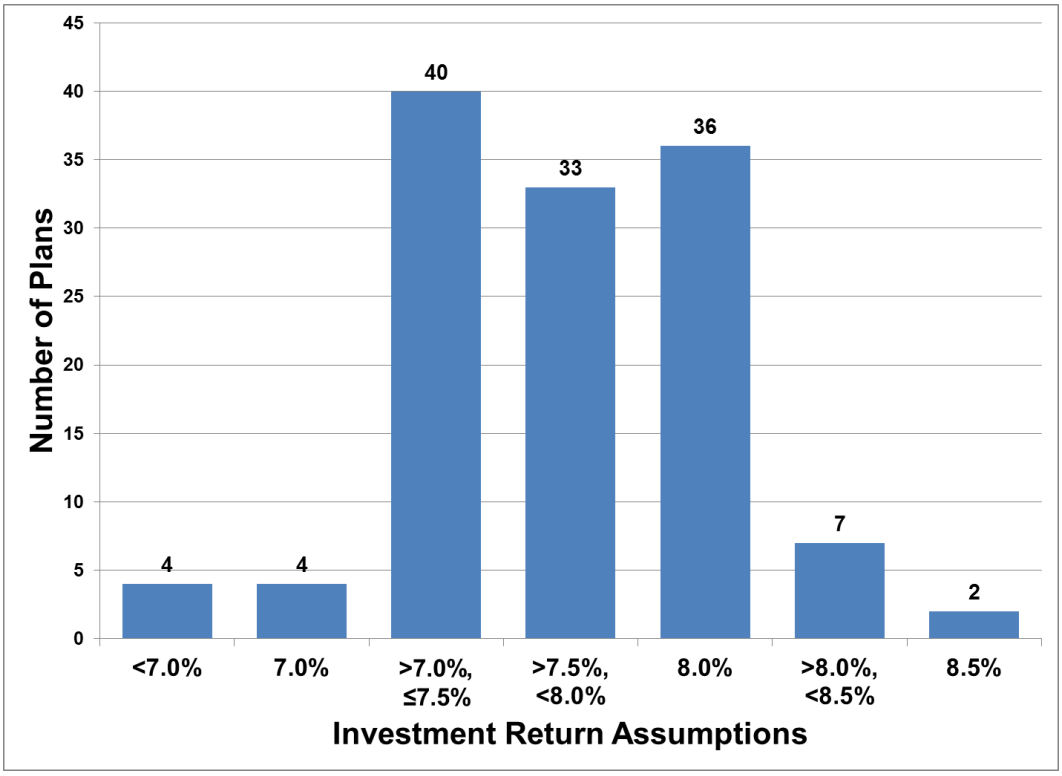
14 "Public retirement systems typically follow guidelines set forth by the Actuarial Standards Board to set and review their actuarial assumptions, including the expected rate of investment return." National Association of State Retirement Administrators, "NASRA Issue Brief: Public Pension Plan Investment Return Assumptions," Updated October 2014, p. 2, http://www.nasra.org/files/Issue%20Briefs/NASRAInvReturnAssumptBrief.pdf.

15 Milliman reported a 3.82% discount rate for April 2015, up from a 3.38% discount rate reported for January 2015. Milliman noted that "January's discount rate was the lowest ever in the history of the Milliman 100 PFI." Milliman, "Pension Funding Index: Funded status improves by $40 billion in April," http://us.milliman.com/Solutions/Products/Pension-Funding-Index/.
Mercer, another leading actuarial firm, reports pension discount rates along a modified duration curve reflecting the expected longevity of the pension plan population. Plans consisting of retirees have a lower discount rate, reflecting a shorter remaining life expectancy, than plans consisting of young, active workers. In April Mercer reported a 4.43% discount rate for "young" participants (currently working, modified duration of 21 years) and 3.34% for "retiree" participants (modified duration of 8 years). In December 2014, the figures were 4.13% and 3.42%, respectively. Mercer, "Mercer Pension Discount Yield Curve and Index Rates in US," http://www.mercer.com/content/mercer/global/all/en/insights/point/2014/mercer-pension-discount-yield-curve-an-index-rates-in-us.html.
Some analysts argue that the discount rate used by corporations to compute the present value of their pension liabilities embeds more risk than the benefit cash flows actually represent – i.e., the discount rates used by corporations are still too high.

16 Section III.F will show how relatively modest reductions in the discount rate used by one state's pension funds increased the present value of future pension obligations substantially.

discount rate for the pension liabilities ignores fundamental economic principles regarding the pricing of risk as well as the economic distinction between the source and use of funds.

Figure 4: Distribution of State Pension Fund Investment Return Assumptions in 2014



Source: National Association of State Retirement Administrators, "NASRA Issue Brief: Public Pension Plan Investment Return Assumptions," Updated October 2014, Table 5, p. 3, http://www.nasra.org/files/Issue%20Briefs/NASRAInvReturnAssumptBrief.pdf.

Pension obligations are contractual and, in the corporate world, rank higher in payment priority than dividends on equity and the interest and principal on much debt. In addition, private sector pension benefits are insured by the Pension Benefit Guaranty Corporation, an entity established by law to help protect private sector pension benefits.[17] Consequently, future pension payments from corporate plans are viewed as embodying relatively little risk of nonpayment.

Public sector pension benefits are also contractual and, in some cases, protected from default or diminishment by provisions written into state constitutions. On May 8, 2015, for example, the Supreme Court of the state of Illinois ruled that a pension reform law passed by the legislature in 2013 was invalid.[18] (As a consequence of this decision, the credit rating on Chicago's debt was cut to "junk" status by Moody's.[19]) There is also public pension litigation in other states. Although not insured by the Pension Benefit Guaranty Corporation, public sector pension payments appear to embody little risk for the recipients – they have a contractual and, in some cases, constitutional claim to receive benefit payments.

A fundamental principle of financial economics is that discount rates in a present value calculation reflect the riskiness embedded in the cash flows being discounted. If an investor is contemplating the purchase of a stream of future cash flows, an expected average cash flow stream with a

[17] Pension Benefit Guaranty Corporation, "Who We Are," http://www.pbgc.gov/about/who-we-are.html.

[18] *In re* Pension Reform Litigation (Doris Heaton *et al*., Appellees, v. Pat Quinn, Governor, State of Illinois, *et al*., Appellants), Supreme Court of the State of Illinois, 2015 IL 118585, http://www.illinoiscourts.gov/Opinions/SupremeCourt/2015/118585.pdf.

[19] Aaron Kuriloff, "Moody's Cuts Chicago Debt Rating to Junk," *Wall Street Journal*, May 13, 2015, p. C3, http://www.wsj.com/articles/moodys-cuts-chicagos-debt-to-junk-1431470944.

higher projected variability is worth less than expected average cash flow stream with a lower projected variability. The higher variability of expected cash flows implies higher overall risk of actually obtaining the projected cash flows for the investor. If the receipt of the cash flows is deemed risky, then the discount rate should be increased to compensate for that risk. Conversely, if the receipt of the cash flows is guaranteed or otherwise considered to entail little risk, then the discount rate should be low to reflect that lack of risk.

Applying these principles rigorously to the valuation of defined benefit pension obligations ultimately means that the present value of the benefit payment stream should not reflect any risk of default. Instead, this risk should be accounted for separately as an option to default, if there is such an option.[20] Valuing the pension obligations using a riskless rate and a possible option to default eliminates the baffling position of two cities owing the same pension benefits having different present values of those benefits, with the riskier credit city having a lower present value for the benefit obligations. It also eliminates the perverse incentive for a city or state to embed additional risk in its financial profile, at least in the pension dimension. The additional risk could take the form of a low credit rating or deliberating mismatching the financial characteristics of the pension assets and liabilities in a gamble that high (read risky) asset returns can be realized.

Public sector pension funds are discounting their obligations by their expected returns in the capital markets. Capital market returns are substantially riskier than either corporate or public sector pension payments. Why should contractually (and, in some cases, constitutionally) guaranteed cash flows be discounted at rates reflecting equity and debt market volatility and risk? "Discounting pension benefits using the expected yield on [the securities in the asset pool] implies that the entire yield is available to help pay future benefits, making no allowance for the cost of expected losses, which is represented by the risk premium."[21] The use of expected investment return as the discount rate for determining the present value of state and local pension obligations contradicts fundamental financial economic theory, as well as practice in the corporate world.

The National Association of State Retirement Administrators, the non-profit association serving the directors of state retirement systems,[22] disputes the applicability of standard financial economic theory in the valuation of state and local government pension obligations. They specifically contend that historical capital market returns support the use of discount rates as presented in **Figure 4**.[23] This, however, reveals a fundamental confusion – the cost of funds is determined by the use of funds, not the source of the funds.[24] The use of the fund – the projected cash flow stream – is the payment of pension benefits to retired state and local employees. The source of funds to pay state and local pensions is a combination of contributions (mostly from the employers) and capital market returns, with "investment earnings account[ing] for a majority of public pension financing."[25] So using expected investment returns from (a

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20 This would also apply to corporate defined benefit pension funds, which are backstopped by the Pension Benefit Guaranty Corporation. The current use of the yield on high quality corporate debt for discounting corporate pension liabilities (see footnote 15) constitutes, at best, an approximation of the riskless discount rate plus default option approach. It is also a compromise that eased the transition from a former regime of higher discount rates, facilitates comparisons across firms, and it is relatively easy to implement.

21 Alicia Munnell, Richard W. Kopcke, Jean-Pierre Aubry, and Laura Quinby, "Valuing Liabilities in State and Local Plans," Center for Retirement Research at Boston College Issue in Brief Paper Number 11, June 2010, p. 4, http://crr.bc.edu/wp-content/uploads/2010/06/slp_11-508.pdf.

22 National Association of State Retirement Administrators website, "About," http://www.nasra.org/about.

23 National Association of State Retirement Administrators, "NASRA Issue Brief: Public Pension Plan Investment Return Assumptions," Updated October 2014, p. 2, http://www.nasra.org/files/Issue%20Briefs/NASRAInvReturnAssumptBrief.pdf.
See also, National Association of State Retirement Administrators, "Faulty Analysis is Unhelpful to State and Local Sustainability Efforts," October 2010, http://www.nasra.org/files/Issue%20Briefs/Rauh-NovyMarxCritiquePART1.pdf and National Association of State Retirement Administrators, "More Faulty Pension Analysis Unhelpful to State and Local Recovery Efforts," July 2011, http://www.nasra.org/files/Issue%20Briefs/Rauh-Novy-MarxCritiquePART2.pdf.

24 David F. Babbel, "Evaluating Pension Insurance Pricing," *Journal of Pension Economics and Finance*, Cambridge University Press, April 2015.

25 National Association of State Retirement Administrators, "NASRA Issue Brief: Public Pension Plan Investment Return Assumptions," Updated October 2014, p. 1, http://www.nasra.org/files/Issue%20Briefs/NASRAInvReturnAssumptBrief.pdf.

portion of?) the source of funds to discount the projected pension cash flow stream is inappropriate.

Think about it this way: using expected investment returns as the discount factor in the calculation of pension liabilities means that the value of the pension liabilities can be changed with a change in expected investment returns. If, for example, a pension sponsor decides to reduce exposure to equity price volatility by reallocating some of the pension funds to high quality fixed income instruments, the expected investment return on the portfolio will likely decline. Fixed income instruments generally have lower (but also less volatile) investment returns than equities, which in theory offer the prospect of capital gains or losses along with dividends. So this means that reducing the risk in the asset portfolio (generally a benefit to both the recipients and the taxpayers) reduces the expected return and thereby increases the present value of the pension liabilities.

The converse situation is also possible – and more troublesome. A pension sponsor can implement a program to obtain higher expected investment returns. Given the characteristics of modern capital markets this means that the pension sponsor will increase the risk in the asset portfolio by investing in more volatile instruments, leveraging the portfolio, or some combination of the two. By accepting more asset risk (not necessarily desired by either the recipients or the taxpayers), the public pension sponsor increases the expected investment return (but not necessarily the realized investment return) and this decreases the present value of the pension liabilities. So, the use of expected investment return as the discount rate for computing the present value of pension obligations facilitates a perverse incentive – a riskier asset structure lowers the present value of the pension liabilities.[26] This contradicts fundamental financial economic theory and common sense.

There is an additional way of thinking about this. How much money would a pension sponsor have to transfer to another, unrelated party for the unrelated party to take over the pension obligations? Would the unrelated party accept the present value of the pension obligations discounted with the expected investment return, or anything close to that number, and then promise to keep paying the contractual benefits to the participants? Such pension transfer transactions have been few in the past, although some corporate pension funds have transferred portions of their pension liabilities to insurance companies in the past few years by purchasing an annuity.[27] To the extent the unrelated party would require more funds than the present value of the liability stream discounted by the expected investment return, the implied discount rate for the obligations is lower than the expected investment return. A bit of concentrated reflection on the issue will lead one to the conclusion that any non-coerced third party would require substantially more than the present value of the expected pension payment stream discounted by the sponsors' expected investment returns to accept the obligations. While not incorporating all the details of such a transaction, this thought experiment clarifies the fundamental logic of the valuation problem facing pension fund sponsors. Indications of the potential magnitude of this error will be discussed in Section III.F for a specific state and in the Conclusion (Section V) for all states.

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[26] "Using the return on the plan's assets [as the discount rate], as GASB recommends, produces misleading results. . . . It also suggests that a rise in the risk premium [in securities markets] improves a plan's funded status." Alicia Munnell, Richard W. Kopcke, Jean-Pierre Aubry, and Laura Quinby, "Valuing Liabilities in State and Local Plans," Center for Retirement Research at Boston College Issue in Brief Paper Number 11, June 2010, p. 4, http://crr.bc.edu/wp-content/uploads/2010/06/slp_11-508.pdf.

[27] In 2012, General Motors and Verizon transferred pension liabilities of $29 billion and $7.5 billion to Prudential Financial. In 2013, SPX Corp. transferred $625 million in pension obligations to MassMutual. In 2014, Motorola transfer $3.1 billion in pension liabilities to Prudential Financial. So far in 2015, Kimberly Clark transferred $2.5 billion in pension liabilities to a combination of Prudential Financial and MassMutual. Darla Mercado, "Prudential and MassMutual in $2.5 billion pension risk transfer deal with Kimberly-Clark," *Investment News*, February 24, 2015, http://www.investmentnews.com/article/20150224/FREE/150229958/prudential-and-massmutual-in-2-5-billion-pension-risk-transfer-deal.

C. UNFORESEEN OR INCOMPLETELY CALCULATED PENSION OBLIGATIONS

Another way that pension obligations can end up exceeding the funds available comes from obligations that are unforeseen or somehow not completely incorporated into the calculations for the liability stream. This is an area replete with anecdotes but short on comprehensive figures. This subsection will highlight just three ways that pension obligations can be higher than initially calculated.

One way that pension obligations can increase above what the designers anticipated is by the participants manipulating or "gaming" the system. For example, when retirement benefits are determined by a formula using the average salary of the last few years of work, an individual nearing retirement age can increase his or her pension benefit by increasing salary in the years just before retirement. This can occur if the individual receives promotions above those embedded in the actuarial calculations or simply by working a lot of overtime. This practice has been called "spiking" and can result in pension obligations that are higher than anticipated when contributions were being made. The analysis presented in Section II, particularly the narrative around **Table 2** and **Figure 2**, highlight the source of the problem here. To the extent that steady contributions over a long period of time are predicated on a particular pension payment stream, an unexpected upward deviation of that pension stream from that upon which the contributions are determined will result in inadequate assets being set aside, possibly for too short a period of time. This can lead to an insufficient amount of funds available to pay the pension obligations.

Another method for gaming the system is for part-time or contract employees to be covered under the pension plan or covered at levels commensurate with full-time employees. In 2012, the Comptroller of New Jersey released a report alleging "202 professionals enrolled in [the Public Employees Retirement System] after 2008 [the date of a new law prohibiting such enrollment] who are . . . 'unlikely,' as per IRS guidelines, to be properly considered a government employee due to their concurrent private professional practice." The report proceeded to note, "The continued PERS enrollment of ineligible professionals, despite the efforts to curb this abuse, has the potential to cost the state millions of dollars in inappropriate future pension benefits."[28]

A third way that pension obligations can increase over the anticipated amount is the practice of the "13th check." These consist of an additional benefit payment, or 13th check, to participating retirees from some defined benefit pension plans. Some of these were negotiated substitutes for previous cost-of-living adjustment provisions, and some are paid only when the investment return on the pension fund assets exceeds the assumed return.[29] A recent investigation found:

- "The Philadelphia school system, with less than half the assets it needs to meet its future obligations, is set to hand out $62 million in bonuses;"
- Wayne County in Michigan, whose pension is only 45% funded, provides $16,000,000 a year in 13th checks;
- The fire and police funds in Hollywood, Florida are less than half funded, but in 2013 retired firefighters received an average 13th check of $19,000 and retired police received an average check of $6,400;
- The Illinois Municipal Retirement Fund, one of the better funded pensions in Illinois, sent bonus checks amounting to $41 million in 2013.[30]

The practices outlined above do not inevitably result in underfunding (or additional underfunding) of state and local pension funds. The plan sponsors may specifically incorporate the above

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[28] State of New Jersey Office of the State Comptroller, *Investigative Report: Improper Participation by Professional Service Providers in the State Pension System*, July 17, 2012, p. 9, http://www.nj.gov/comptroller/news/docs/pensions_report.pdf.

[29] PensionDialog.com post, "The 13th Check," March 25, 2014, https://pensiondialog.wordpress.com/2014/03/25/the-13th-check/.

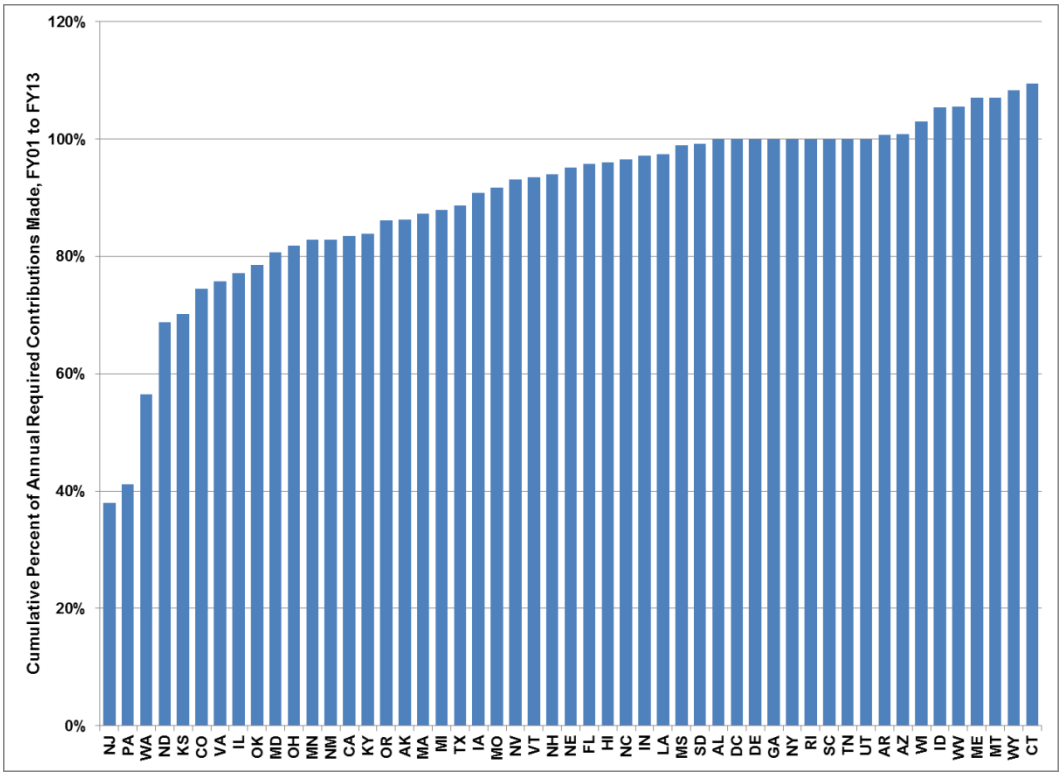
[30] Steven Malanga, "No Bonus for Taxpayers: Deeply Indebted Pension Systems Continue to Dole Out Bonuses," *City Journal Soundings*, Spring 2015, http://www.city-journal.org/2015/25_2_snd-bonuses.html. Last three bullet points are paraphrases.

practices into their actuarial calculations of liabilities. At a minimum, however, these and other practices increase the variability and the scope for underestimating the ultimate amount of pension liabilities to be paid. More troublesome, such practices may not be fully incorporated into the calculations underlying the benefit payments.

D. Insufficient Contribution Payments

The simplest and most straightforward way for pension funds to end up with insufficient funds to pay their pension benefits is for the sponsor (be it a corporation or a government entity) not to provide assets to the pension fund trust. Since the passage of the Employee Retirement Income Security Act of 1974 and the adoption of a number of accounting standards and practices in the past forty years, corporations have been required, and faced strong financial incentives, to fund the bulk of their pension obligations or terminate the pension funds. Public pension funds, however, are not subject to ERISA and operate under a different set of accounting standards and practices. As an unfortunate consequence, a number of public pension funds have not contributed sufficient moneys to fund their pension obligations.

Figure 5: Weighted Average of Annual Required Contribution Paid by State, Cumulative FY2001–FY2013



Source: National Association of State Retirement Administrators, "The Annual Required Contribution Experience of State Retirement Plans, FY 01 to FY 13," March 2015, Figure C1, p. 5 and Appendix B, p. 14, http://www.nasra.org/files/JointPublications/NASRA_ARC_Spotlight.pdf.

Figure 5 summarizes the percentage of the "annual required contribution" ("ARC") that each of the 50 states and the District of Columbia have made over the FY2001 through FY2013 period. The ARC is a calculation that represents an amount reflecting pension obligations accrued by non-retired plan participants for their work in that year plus an amount designed to close the gap (if any) between the amount of promised benefit payments and the assets available to pay those benefits. ARC data are collected and reported by the National Association of State Retirement Administrators ("NASRA"). As NASRA states, "A government that has paid the ARC in full has

made an appropriation to the pension trust to cover the benefits accrued that year and to pay down a portion of any liabilities that were not pre-funded in previous years."[31]

Figure 5 is ordered from the state that appropriated the lowest percentage of ARC, cumulated over the FY2001 through FY2013 period, on the left to the state that appropriated the highest percentage of ARC on the right. As reported by NASRA and depicted in **Figure 5**, the state of New Jersey appropriated only 38% of the ARC over FY2001 to FY2013. New Jersey was followed by Pennsylvania (41.2%), Washington (56.5%), and North Dakota (68.8%). Eighteen states appropriated 100% (or more) of their ARC over FY2001 through FY2013 – headed by Connecticut at 109.5%.

NASRA summarized the results of their calculations as follows:

- *The median ARC experience is 95.1 percent, meaning that one-half of the plans received at least 95.1 percent of their required contributions.*
- *All but two states paid at least one-half of their ARC.*
- *All but six states paid at least 75 percent of their ARC.*
- *The average plan received 89.3 percent of its ARC.*
- *The weighted average ARC received was 84.4%: of $779 billion of combined ARC, plans received $657 billion.*[32]

Figure 6 presents a closer look at New Jersey's experience – how it got into the predicament of funding only 38% (at best) of its state pension obligations. According to this source (Pension360.org), over the period from 1995 through 2015 (projected) New Jersey has contributed only $6.3 billion out of a "statutory annual required contribution" of $33.9 billion – a shortfall of $27.6 billion. There are two particularly notable aspects of **Figure 6**. First, the annual required contributions have now reached a level where they have a nearly exponential growth pattern even with actual payments larger than had ever been made previously. Second, the inability or unwillingness to make actual payments to the pension funds approximating the annual required contributions has been a bi-partisan phenomenon.

Figure 7 shows a similar story for Chicago. From 2003 through 2013 Chicago made pension contributions of less than $500 million per year. Over that time, the "annual pension cost" has been higher than the annual contributions and has grown each year. In 2013,

> *The unpaid portion of the city's pension contribution exceeded $1.2 billion, a figure representing an astonishing 43% of the city's general fund budget. A decade ago the contribution gap represented a manageable 9% of the city's budget, but the compounding effects of underfunding have caused this gap to mushroom.*[33]

One analysis contends that Chicago property taxes would have to have been 50% higher to generate sufficient funds to pay the full pension contribution in 2013.[34]

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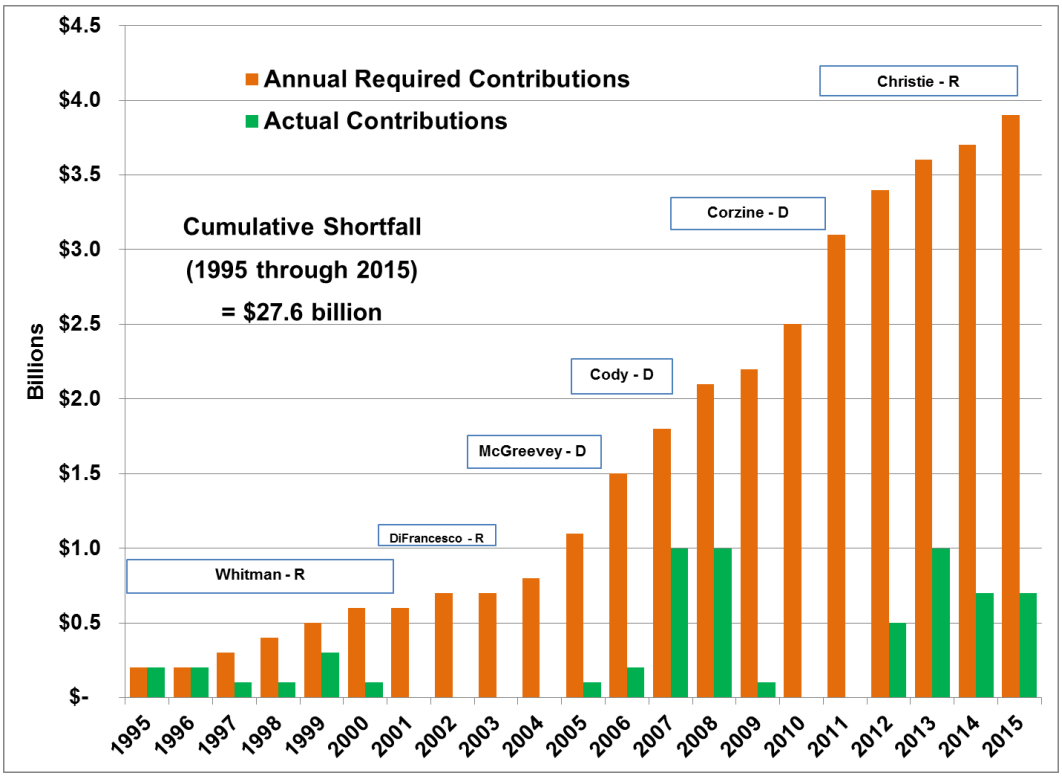
31 National Association of State Retirement Administrators, "The Annual Required Contribution Experience of State Retirement Plans, FY 01 to FY 13," March 2015, p. 1, http://www.nasra.org/files/JointPublications/NASRA_ARC_Spotlight.pdf.

32 National Association of State Retirement Administrators, "The Annual Required Contribution Experience of State Retirement Plans, FY 01 to FY 13," March 2015, p. 4, http://www.nasra.org/files/JointPublications/NASRA_ARC_Spotlight.pdf.

33 Kristen DeJong, CFA, "Chicago's Fiscal Stress: New Term, Same Problems," Nuveen Asset Management, April 2015, http://www.nuveen.com/Home/Documents/Default.aspx?fileId=65715.

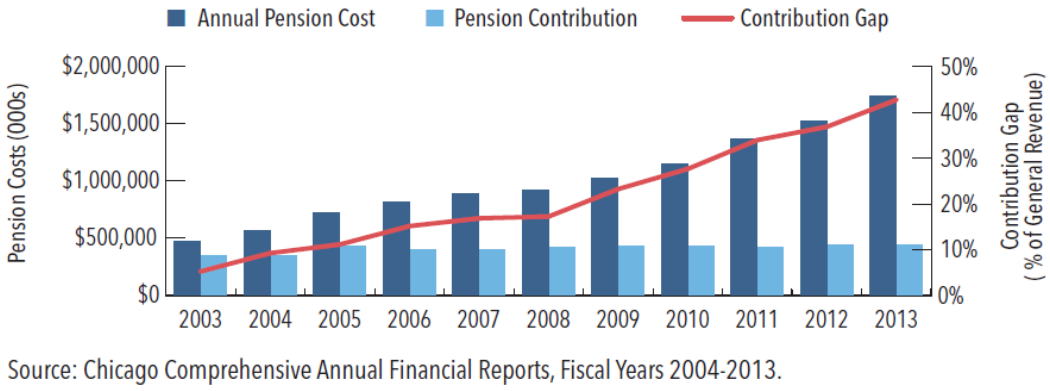
34 Kristen DeJong, CFA, "Chicago's Fiscal Stress: New Term, Same Problems," Nuveen Asset Management, April 2015, http://www.nuveen.com/Home/Documents/Default.aspx?fileId=65715.

Figure 6: Comparison of New Jersey's ARC and Actual Pension Payments, 1995 through 2015 (projected)



Source: Ted Ballentine, "Chart: A History of New Jersey's Pension Payments," *Pension360* website, http://pension360.org/chart-a-history-of-new-jerseys-pension-payments/.

Figure 7: Chicago's Pension Payment Gap, 2003 through 2013



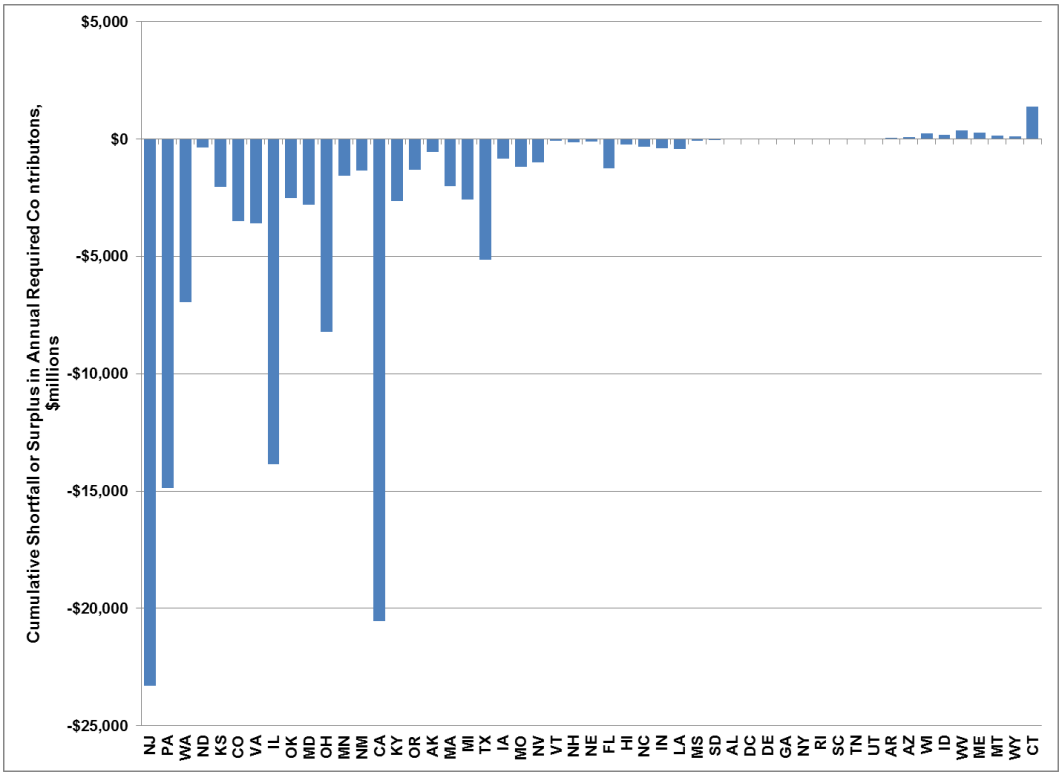
Source: Kristen DeJong, CFA, "Chicago's Fiscal Stress: New Term, Same Problems," Nuveen Asset Management, April 2015, http://www.nuveen.com/Home/Documents/Default.aspx?fileId=65715.

Figure 8 below presents a different way to view the cumulative underfunding of state pension funds based on calculations from NASRA. Instead of presenting the percentage of ARC appropriated, **Figure 8** shows the dollar amount of the cumulative shortfall in pension appropriations. **Figure 8** has the same ordering as **Figure 5** – New Jersey with a cumulative shortfall of $23.3 billion as calculated by NASRA on the left and Connecticut with a cumulative surplus of $1.4 billion on the right. **Figure 8** shows that even if the accumulated percentage shortfall of pension appropriations appears modest in some states, for the larger states this still

amounts to significant sums – $20.6 billion for California, $14.9 billion for Pennsylvania, $13.8 billion for Illinois, $8.2 billion for Ohio, etc.

This NASRA study documents that over the FY2001 through FY 2013 period, the cumulative shortfall in state appropriations needed to fund their pension obligations exceeded $120 billion. It is important to recall that the present value of the pension obligations in this NASRA study is determined using the expected investment return as the discount rate. This practice, as described above, leads to an artificially low value for the pension obligations. The reality, therefore, is that no state has likely appropriated enough to fund fully their pension obligations. The ranking by state exhibited in **Figure 5** may be approximately correct, but the 100% of funding line should be well above where the 100% line lies in **Figure 5**.

Figure 8: Cumulative Shortfall or Surplus of Annual Required Contribution by State, FY01–FY13



Source: National Association of State Retirement Administrators, "The Annual Required Contribution Experience of State Retirement Plans, FY 01 to FY 13," March 2015, Appendix B, p. 14, http://www.nasra.org/files/JointPublications/NASRA_ARC_Spotlight.pdf.

E. Low Investment Returns on Asset Pool

As explained above, the financial burden of pensions can be reduced if the funds set aside to pay the benefits can earn investment returns in the capital markets. The higher the investment returns, the easier it is for a sponsoring entity (be it a corporation or a government) to fund a pension obligation. Conversely, if the investment returns are low, the funds needed from the sponsoring organization (or the employees) increase.

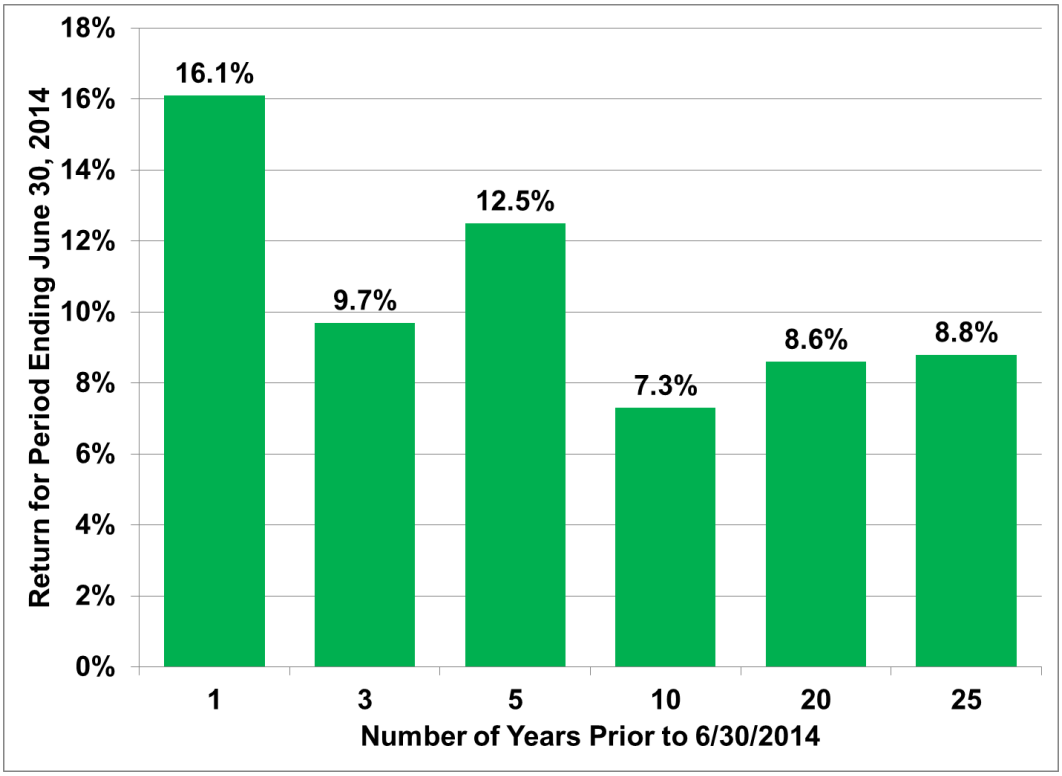
According to NASRA,

> *Public pension fund assets are invested in diversified portfolios that include public equities; bonds issued by the U.S. and foreign governments and corporations; real estate; alternatives, such as private equities, hedge funds, and infrastructure; and other asset classes. Over time, earnings on*

> *investments constitute the largest portion of public pension fund revenues, which also include contributions from employers and employees.*[35]

NASRA reports that public equity investments constitute 50% of the pension assets pool, followed by fixed income (24%), real estate (7%), alternative investments (15%), and cash & other (4%). They also report that, "Since 1982, on a national basis, investment earnings have accounted for approximately 60 percent of all public pension revenues. Investment earnings take the form chiefly of income from fixed income securities (bonds), and capital appreciation of equities."[36] **Figure 9** presents the median public pension investment returns as of 6/30/2014 as reported by NASRA over 1, 3, 5, 10, 20, and 25 year periods.

Figure 9: Median Public Pension Annualized Investment Returns, for period ending 6/30/2014



Source: National Association of State Retirement Administrators, "NASRA Issue Brief: Public Pension Plan Investment Return Assumptions," Updated October 2014, Figure 1, p. 1, http://www.nasra.org/files/Issue%20Briefs/NASRAInvReturnAssumptBrief.pdf.

Public and private sector pension funds hire third-party (external) investment managers and employ internal investment managers. They both have access to a large pool of investment talent. Given the overall informational efficiency of capital markets, over time any differences in investment returns will be a function of different focuses, different attitudes toward risk, and randomness. These differences, however, will be overwhelmed by the similarities and correlations inherent in capital markets.

Moreover, even a pension plan that has experienced good investment results and looks to be sufficiently funded can experience substantial setbacks. If interest rates rise and the investments are of the wrong duration, the assets could lose value relative to the liabilities quite substantially. If credit or equity risk exists in the asset portfolio, there is even more risk of ultimate pension failure.

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35 National Association of State Retirement Administrators website, "Investment," http://www.nasra.org/investment.

36 National Association of State Retirement Administrators website, "Investment," http://www.nasra.org/investment.

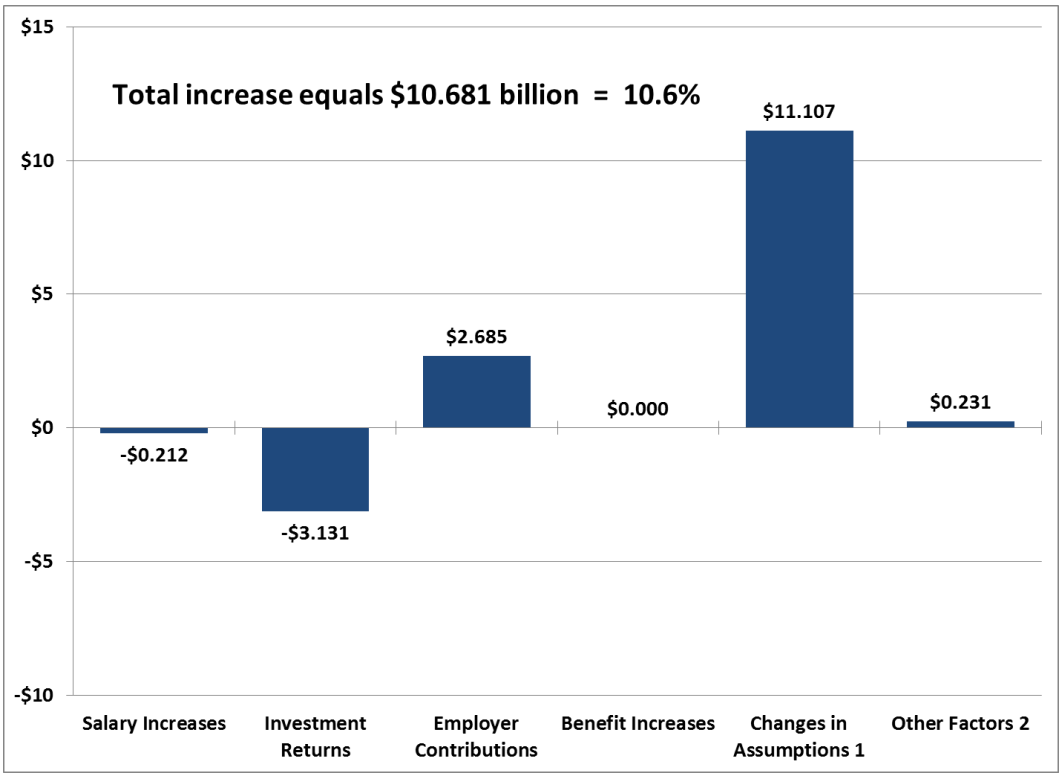
Much more can be said about how capital market performance affects pension funding status, but that is the topic of a different paper.

F. Apportioning the Shortfall – the Example of Illinois

Having outlined five different ways that pension obligations can exceed pension assets, what do we know about how each of those possible errors affects pension funding status?

Figure 10 presents figures compiled for the Illinois state funded retirement systems for fiscal year 2014. This analysis includes the five sources discussed above plus an additional source for changes in Illinois unfunded liabilities – salary increases. As portrayed in the far left bar, salary increases did not cause any increase in unfunded liabilities for the Illinois state retirement systems in fiscal 2014. In fact, salary increases were lower than anticipated, and therefore actually reduced unfunded liabilities by about $212 million dollars in fiscal 2014.

Figure 10: Change in Unfunded Liabilities, FY 2014, Illinois State Funded Retirement Systems ($ in Billions)



Source: Commission on Government Forecasting and Accountability, Illinois State Retirement Systems, Financial Condition as of June 30, 2014, February 2015, Chart 2, p. 29, http://cgfa.ilga.gov/Upload/FinConditionILStateRetirementSysFeb2015.pdf.

Notes: This chart is based upon asset actuarial values, i.e., WITH asset smoothing.
[1] Reflects lowering of investment rate of return assumptions by funds (see p. 28 of Source).
[2] Other Factors include losses from retirements, terminations, and rates of mortality.

Moving right to the next column in **Figure 10** we see that investment returns in fiscal year 2014 also reduced the unfunded liability by over $3 billion. Investment returns in fiscal year 2014, therefore, substantially exceeded expectations.

A shortfall in employer contributions increased the unfunded pension liabilities for Illinois state retirement funds by nearly $2.7 billion in fiscal 2014. Unexpected benefit increases had no effect on the funded status.

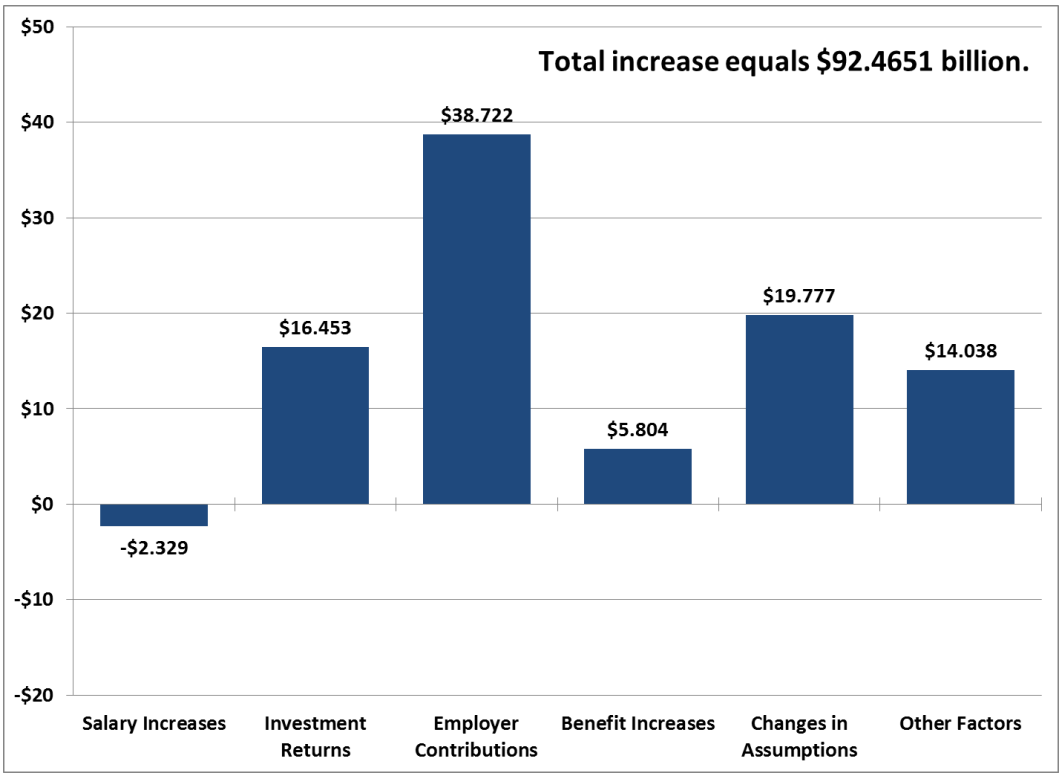
Unfunded liabilities for the Illinois state funded retirement system increased by $11.1 billion in 2014 because of changes in the rate of investment return assumptions by the three largest constituent funds. The Teachers' Retirement System (56.6% of system liabilities and 44.2% funded) reduced its assumed rate of investment return from 8.0% to 7.5%. Also, the State Employees' Retirement System (21.4% of system liabilities and 36.9% funded) and the State University Retirement System (20.4% of system liabilities and 46.5% funded) reduced their assumed rate of investment return from 7.75% to 7.25%. Therefore, a one-half percent (50 basis point) reduction in the assumed rate of investment return increased liabilities by over $11 billion. If the discount rates in Illinois were reduced in 2014 by 300 or 400 basis points to somewhere in the 3% to 4% range, a rate that is still arguably too high in today's interest rate environment, the increase in unfunded liabilities would be more like $65 to $90 billion on top of the existing unfunded liability in excess of $100 billion.

Other factors, which include changes due to actuarial calculations, increased the unfunded liabilities for the Illinois state retirement system by $231 million in fiscal 2014.

Figure 11 presents the same analysis for the Illinois state funded retirement system but for a longer period of time – fiscal year 1996 through fiscal year 2014.

Interestingly, salary increases over this entire period were lower than anticipated, leading to a $2.3 billion reduction in the unfunded status of the Illinois state retirement programs. But that is the only good news, if lower-than-anticipated salaries can be considered good news.

Figure 11: Change in Unfunded Liabilities, FY 1996 – FY 2014, Illinois State Funded Retirement Systems ($ in Billions)



Source: Commission on Government Forecasting and Accountability, Illinois State Retirement Systems, Financial Condition as of June 30, 2014, February 2015, Chart 3, p. 31, http://cgfa.ilga.gov/Upload/FinConditionILStateRetirementSysFeb2015.pdf.

Note: This chart is based upon asset actuarial values, i.e., WITH asset smoothing.

While in fiscal year 2014 the investment returns for the funds exceeded expectations and lowered the unfunded status by $3.1 billion, over a longer period of time the Illinois state retirement fund

investment performance has been lower than anticipated. This has contributed to nearly a $16.5 billion increase in unfunded liabilities.

The lack of discipline in funding the pensions on the part of the employers constitutes the largest portion of the increase in unfunded pension liability for the Illinois state system. Employer contributions have been over $38.7 billion lower than required.

Over the fiscal 1996 through fiscal 2014, originally unanticipated benefit increases have contributed a $5.8 billion increase in unfunded liabilities.

Changes in assumptions, most prominently reductions in the assumed rate of investment return, have increased unfunded liabilities by nearly $19.8 billion over the fiscal 1996 through 2014 period.

Finally, other factors, including change due to actuarial refinements, have increased the unfunded liabilities for state funded defined benefit pension funds in the state of Illinois by $14 billion over the fiscal 1999 through fiscal 2014 period.

While this information is only for one state, and a state whose poorly functioning pension fund is in the news, the apportionment of the source of unfunded pension liabilities is enlightening. The official report attributes over 40% of the increase in unfunded liabilities to the lack of discipline on the part of the state as it did not contribute funds to the asset portfolio. Reductions in discount rates contributed over 20% to the increase in unfunded liabilities, at least according to the way the Illinois Commission on Government Forecasting and Accountability views it. A correct valuation of the pension liability stream based on more appropriate (and lower) discount rates would likely increase the unfunded liabilities by at least another $100 billion. In other words, the properly valued unfunded pension liability would be more than double that reported by the Illinois Commission on Government Forecasting and Accountability. Lower than anticipated investment returns and longer than anticipated lives accounted for 17.8% and 15.2%, respectively, of the officially recorded increase in unfunded liabilities. Unforeseen or incompletely calculated pension benefits ("Benefit Increases" in **Figure 11**) comprise only 6.3% of the increase in unfunded pension liabilities.

We will return to a consideration of the error arising from discount rates that are too high in the concluding section.

IV. RETIREMENT HEALTH CARE BENEFITS

In addition to pension benefits, a number of state and local governments provide health care benefits to retired employees. In March 2014, 89% of full time state and local government employees participated in health care as an employer-provided benefit.[37] NASRA reported that, in 2012, "43 percent of state and local governments offered [health] insurance to employees under the age of 65 and 30 percent offered coverage to those 65 and older." The same publication also reported that, "as of March 2014, 86 percent of state government employees and 66 percent of local government employees had access to retiree health care under the age of 65. Eighty-four percent of state workers and 59 percent of local employees had access to these benefits at age 65 and above."[38]

These can also be a source of financial stress for state and local finances. This section will briefly outline the additional complications that these retirement health care obligations pose in understanding state and local financial conditions, primarily by contrasting what we can know about retirement health care obligations with pension obligations. To summarize, retirement

[37] U.S. Department of Labor, Bureau of Labor Statistics, *National Compensation Survey: Employee Benefits in the United States, March 2014*, Bulletin 2779, September 2014, State and Local Government Table 9, http://www.bls.gov/ncs/ebs/benefits/2014/ebbl0055.pdf. 83% received medical care benefits, 56% received dental care benefits, 36% received vision care benefits, and 81% had outpatient prescription drug coverage.

[38] National Association of State Retirement Administrators, "Retiree Health Care Benefits for State and Local Employees in 2014," December 2014, p. 1, http://www.nasra.org/files/Spotlight/OPEB%202014%20Spotlight.pdf.

health care obligations are even more uncertain and less funded than defined benefit pension obligations.

When calculating future pension obligations, the dollar amount per person per period of time is known. It is set by contract or agreement. As explained above, the major uncertainty regarding the future pension benefit payment stream is how long participants will live.

Health care is very different from pensions in terms of the underlying economic drivers. The need for health care for any one person in any period of time is quite variable and, more important, unknowable. A retiree may be in excellent health and not need any significant health care until the day he or she dies. On the other hand, many retirees, especially near the end of their lives, require extensive and expensive medical attention. "More than 25 percent of Medicare spending goes to the five percent of beneficiaries who die each year. This results in spending for decedents (persons who are in their last year of life) that is six times greater than the cost for a survivor."[39] So there is inherently more uncertainty in projecting future medical expenditures than future pension benefit payments.

This uncertainty is reduced when a number of individuals, such as a group of employees or retirees, are covered under a health insurance policy. In a large enough population, knowledge of average tendencies can be calculated. More importantly, the obligations of the pool can be projected with less uncertainty than the obligations associated with any individual. This pooling is the reason that health care obligations over (a fairly short) period of time can be projected quite accurately.

Over longer periods of time, however, health care expenditures have proven to be hard to project accurately. As medical technology has advanced, more conditions have responded to newer treatments and more people what to take advantage of the medical progress. This process has proven to be extremely difficult to project. Indeed, most (if not all) medical insurance contracts have fairly short durations – one year or maybe longer if the insurer can limit its risk with provisions in the contract.

Some may remember a time when employee unions in the private sector first negotiated and obtained retirement health care benefits. When they started during World War II, the cost of the benefits was quite low. Frankly, for many health conditions medicine could do little other than perhaps ease the pain. Health care benefits, for current and retired employees, became quite popular through the 1960s and even into the 1980s. Eventually, however, the costs for providing health care, especially to the retirees, started to rise quickly. Under ERISA corporations had to pre-fund their retiree benefits, including retirement health care. The corporations called upon the actuaries to project the benefits in order to arrive at a funding figure. The problem was that every few years, the actuaries would increase the funding requirements for retirement health care substantially. (The funding requirement for pensions might also increase, but it was generally a small amount compared to the retirement health care benefits.) Eventually, the retirement health care funding burden on corporations became so large that they looked for ways to drop it. A number of corporations eliminated retirement health care benefits for retirees eligible for Medicare, as long as a contract did not preclude this action. Often, the non-union salaried retirees felt the brunt of this. General Motors eliminated its retirement health care benefits for its salaried retirees as it slid into bankruptcy.[40] It also restructured retirement health care benefits for its unionized employees as part of the bankruptcy in 2009. In return for this, the union

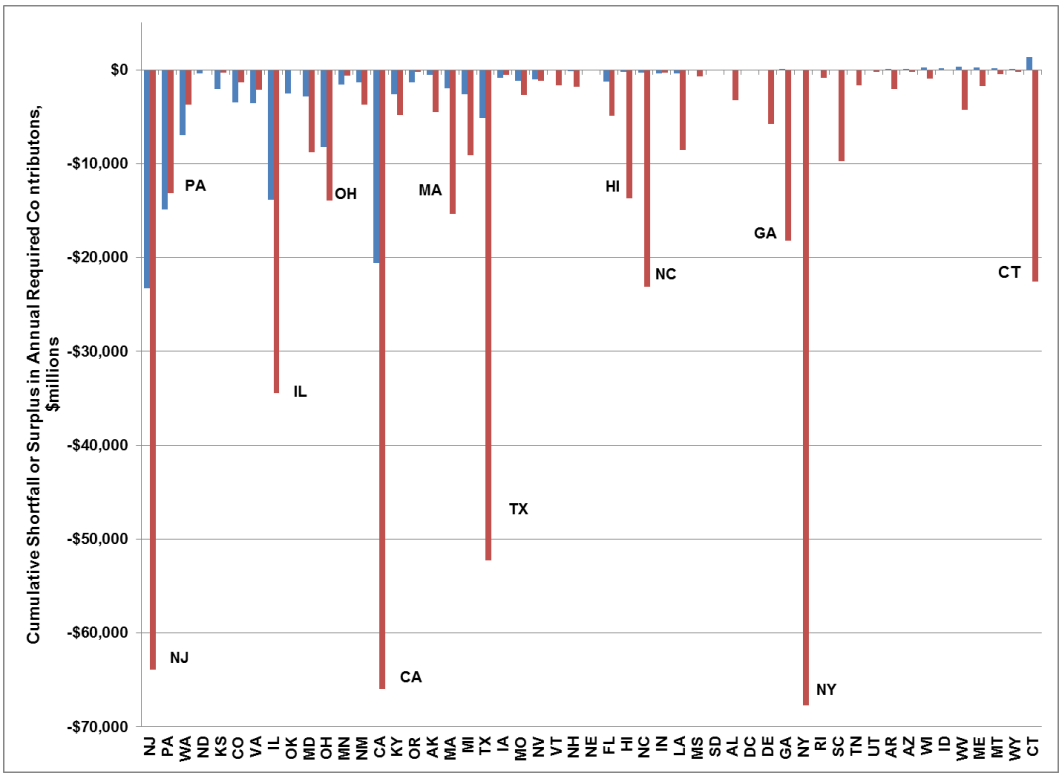
[39] Helen Adamopoulos, "The Cost and Quality Conundrum of American End-of-Life Care," *The Medicare New Group*, June 3, 2013, http://www.medicarenewsgroup.com/context/understanding-medicare-blog/understanding-medicare-blog/2013/06/03/the-cost-and-quality-conundrum-of-american-end-of-life-care.

[40] Vanessa Fuhrmans and Theo Francis, "Retiree Benefits Take Another Hit, GM's Plan to End Medical Coverage for Many 65 and Over Signals a New Era; Pensions to Increase by $300 a Month," *Wall Street Journal*, July 16, 2008, http://www.wsj.com/articles/SB121617237912356653 (accessed March 2015).

received approximately 308 million shares (about 20 percent) of the company's new equity as it emerged from bankruptcy.[41]

A final added complication here is the Affordable Care Act – Obamacare. This will undoubtedly change how medical care is supplied to the nation in ways that we cannot yet even start to understand. If, as some observers predict, medical care will become more expensive as a consequence of the ACA, then the effect on state and local retirement health care benefit obligations will be negative. The ACA, however, was passed by Congress on a premise that it would "bend the cost curve downward." If that comes to pass, then all patients will benefit and the benefit could also extend to the states and localities providing retirement health care benefits. Another option is that states and localities scrap their existing retirement health care benefits and transfer the covered individuals to some element of Obamacare. It took a bankruptcy, however, for the UAW to agree to restructure its retirement health care benefits from General Motors.

Figure 12: Unfunded Actuarial Accrued Liabilities for Other Postemployment Benefits by State, FY 2013



Source: National Association of State Retirement Administrators, "Retiree Health Care Benefits for State and Local Employees in 2014," December 2014, Appendix: State OPEB UAAL, FY 13, http://www.nasra.org/files/Spotlight/OPEB%202014%20Spotlight.pdf and National Association of State Retirement Administrators, "The Annual Required Contribution Experience of State Retirement Plans, FY 01 to FY 13," March 2015, Appendix B, p. 14, http://www.nasra.org/files/JointPublications/NASRA_ARC_Spotlight.pdf (both accessed March 2015).

Figure 12 summarizes NASRA's calculations regarding the retirement health care benefits for state and local employees. The red columns in **Figure 12** depict the unfunded actuarial accrued liabilities for each state's "other post-employment benefits" in FY2013. Retiree health care benefits constitute the bulk of "other post-employment benefits." These figures are compiled by NASRA from annual reports filed by the states. The ordering of the states in **Figure 12** is the

[41] Lee Spears and Craig Trudell, "GM IPO Raises $20 Billion Selling Common, Preferred," *Bloomberg Business*, November 17, 2010. http://www.bloomberg.com/news/articles/2010-11-16/gm-ipo-said-to-be-raised-to-478-million-shares-as-u-s-sells-bigger-stake (accessed March 2015).

same as in **Figure 5** and **Figure 8** – the states with the largest shortfalls in appropriating their "annual required contributions" for pensions over FY2001 through FY 2013 are on the left and the states with surplus ARC's for pensions are on the right. In addition, the blue columns repeat the exact figures presented **Figure 5** – each state's ARC shortfall for pensions over FY2001 through FY2013.

The conclusion from **Figure 12** is apparent. Unfunded obligations for retiree health benefits are large in a number of states – even states where the pension obligations are thought to be well managed. Connecticut, for example, reports an ARC surplus for its state pensions, but it also reports a $22.6 billion unfunded obligation for retiree health benefits. New York, Georgia, North Carolina, Hawaii, Texas, Massachusetts, California, Ohio, Illinois, Pennsylvania, and New Jersey all report unfunded actuarial accrued liabilities for "other post-employment benefits" in excess of $10 billion. Using figures reported by NASRA, the potential size of the problem is significant.

A recent opinion column in the *Wall Street Journal* suggested some optimism or danger regarding state and local retiree health care benefits, depending on your outlook.[42] The column first noted, "Unlike public pension plans, retiree health benefits aren't funded in advance; they are typically paid out of current tax revenues, so they compete with other budget priorities like schools and police." The column noted that the U.S. Supreme Court in January 2015 unanimously decided retiree health care benefits are not vested for life unless the contract specifically so states. This case involved a private sector collective bargaining agreement, but the column's authors argued the principle would apply to public sector.

V. CONCLUSION

Robert Novy-Marx and Joshua Rauh recalculated the pension obligations for 116 major pension plans sponsored by the fifty states as of the end of 2008. These 116 pension plans reported liabilities of nearly $3 trillion and held nearly $2 trillion in assets at the end of 2008.[43] When Novy-Marx and Rauh recalculated the pension obligations using the U.S. Treasury curve for discount rate, thereby reflecting a low risk of nonpayment, they determined that the pension obligations were well over $5 trillion. By this measure, Novy-Marx and Rauh reported that every state had unfunded pension liabilities exceeding 1½ years of state tax revenues. **Table 3** below presents some detail from Novy-Marx and Rauh.

Table 3: State Underfunding of Pension Obligations

State (# of plans)	Pension Assets (as of December 2008, $bn)	PV of Pension Liabilities ($bn, using Treasury curve)	Unfunded Liabilities as percent of tax revenue
Ohio (5)	115.6	332.5	874%
Colorado (1)	29.3	105.4	827%
Rhode Island (1)	6.0	27.1	765%
Illinois (4)	65.7	284.8	717%
Alabama (3)	22.3	78.8	637%
Wisconsin (1)	62.2	153.3	629%
South Dakota (1)	6.0	13.6	603%
Missouri (3)	27.0	88.6	575%
Mississippi (3)	15.1	51.8	573%
Oregon (1)	46.1	90.4	573%
New Mexico (2)	16.2	45.0	554%
South Carolina (2)	21.8	68.4	537%
Kentucky (3)	21.6	74.5	535%
Oklahoma (4)	12.0	54.7	516%
New Jersey (4)	60.5	204.8	496%
Arizona (3)	25.0	85.1	485%
Connecticut (3)	20.4	80.7	469%

[42] Robert C. Pozen and Ronald F. Gilson, "Debt-Saddled Municipal Budgets Get a Lifeline," *Wall Street Journal*, March 2, 2015, p. A13, http://www.wsj.com/articles/robert-pozen-and-ronald-gilson-debt-saddled-municipal-budgets-get-a-lifeline-1425249172.

[43] Robert Novy-Marx and Joshua D. Rauh, "The Liabilities and Risks of State-Sponsored Pension Plans," *Journal of Economic Perspectives*, Fall 2009, pp.194 and 191, respectively.

State (# of plans)	Pension Assets (as of December 2008, $bn)	PV of Pension Liabilities ($bn, using Treasury curve)	Unfunded Liabilities as percent of tax revenue
Texas (4)	125.3	313.5	467%
Georgia (2)	53.7	137.3	460%
New Hampshire (1)	4.4	14.2	450%
Maine (1)	8.3	24.0	438%
Nevada (1)	17.8	24.0	417%
Minnesota (4)	36.2	109.9	415%
California (3)	330.0	805.7	415%
Montana (2)	5.9	15.4	412%
Arkansas (3)	8.1	38.3	408%
Louisiana (2)	17.7	61.4	403%
Maryland (1)	27.8	88.2	400%
Hawaii (1)	8.3	28.1	389%
Pennsylvania (2)	70.9	190.5	388%
Iowa (1)	18.1	42.3	373%
Kansas (1)	10.3	36.0	372%
Wyoming (4)	4.8	12.3	370%
Alaska (2)	11.7	24.3	366%
Idaho (1)	8.1	21.0	363%
Utah (3)	18.6	38.5	338%
Indiana (2)	15.5	62.4	335%
Florida (1)	97.2	213.7	326%
Washington (7)	44.3	101.1	321%
Virginia (1)	41.3	100.1	317%
Michigan (4)	43.4	118.4	314%
Massachusetts (2)	37.8	96.7	285%
Tennessee (1)	25.8	58.1	284%
West Virginia (2)	6.6	19.1	270%
New York (3)	189.8	356.2	263%
North Carolina (2)	59.1	117.0	256%
Nebraska (2)	5.4	14.1	214%
North Dakota (2)	2.9	6.7	212%
Delaware (1)	6.2	12.0	201%
Vermont (3)	2.4	6.7	171%
Total (116)	**1,936.7**	**5,167.1**	**431%**

Source: Robert Novy-Marx and Joshua D. Rauh, "The Liabilities and Risks of State-Sponsored Pension Plans," *Journal of Economic Perspectives*, Fall 2009, pp.191-210, Table 1, pp. 198-199.

NASRA has taken strong exception to the analysis presented in Novy-Marx and Rauh,[44] and it is true that capital market values have rebounded substantially since December 2008. Nevertheless, as argued above, Novy-Marx and Rauh are at least directionally correct as they discounted the pension obligations by the U.S. Treasury yield curve instead of using the economically indefensible expected investment return on the pension assets. And even the information presented by NASRA indicates severe conditions in a number of states.

The use of inappropriately high discount rates that lower the present value of future retirement benefits may prompt another deleterious effect on state and local financial conditions. A fundamental tenet of economics is that a lower price engenders higher demand. By definition, present discounted value is the current price of supplying benefits in the future. If the discount rates are too high, then the present discounted value is too low and the perceived current price for future benefits is lower than the ultimately experienced price – the future is underpriced.

The artificially low current price for retirement benefits increases the demand for retirement benefits relative to the other elements of compensation (salary, vacation, working conditions, current benefits, etc.). The artificially low current price of future retirement benefits prompts employers to offer more future retirement benefits in compensation packages than they would if the price of future retirement benefits was correct. In other words, the inappropriately high discount rate used by state and local governments as they compute present value of retirement

[44] National Association of State Retirement Administrators, "Faulty Analysis is Unhelpful to State and Local Sustainability Efforts," October 2010, http://www.nasra.org/files/Issue%20Briefs/Rauh-NovyMarxCritiquePART1.pdf and National Association of State Retirement Administrators, "More Faulty Pension Analysis Unhelpful to State and Local Recovery Efforts," July 2011, http://www.nasra.org/files/Issue%20Briefs/Rauh-Novy-MarxCritiquePART2.pdf.

benefits not only currently underestimates the present value of the retirement benefits, but is an underpricing of the future that results in more retirement benefits being provided than would be the case if the future was priced correctly. It is not only an issue of underestimating the current value of retirement liabilities, economic decisions about the level of benefits to provide are being made with incorrect (read, too low) prices. As time passes, the actual higher price of retirement benefits is revealed and must be addressed. Then, either money must be transferred from other state and local government activities to fund the actual higher prices for retirement benefits or the level of benefits must be reduced. If state and local governments lack the discipline to fund fully their obligations to retirees during some years, the passage of time will only exacerbate the problem.

Is it too cynical to observe that it is hard to discern any party with an uncompromised motivation to protect the interests of the taxpayer or bondholder when determining or negotiating retirement benefits for state and local employees? To the extent that the retirement benefits of the management or politicians are correlated with the benefits received by the government employees, management or politicians can benefit their retirement situations directly by providing higher retirement benefits to employees. And, of course, to the extent that government employees are a political force, offering benefits – especially if the benefits are thought (incorrectly) to be inexpensive – can work to engender support for the politicians.

Pension and health care retirement benefits are substantial obligations for state and local governments. Their magnitudes are large – often times larger than outstanding public debt – and growing. Their projected payment streams are uncertain. The present discounted values of the promised obligations are incorrectly calculated.

Given the situation outlined in this paper, how will the state and local retirement benefit situation be resolved? The authors of this paper are pessimistic. The situation is untenable and at some point substantial financial pain will be evident. There is sure to be extensive and expensive litigation and political wrangling. Right now, no one can say which group or groups will suffer the most, but recent events (e.g., the Detroit bankruptcy, the Illinois Supreme Court decision, etc.) strongly suggests that creditors of states and localities are in for a rough ride.

Bibliography

Adamopoulos, Helen ,"The Cost and Quality Conundrum of American End-of-Life Care," *The Medicare New Group*, June 3, 2013, http://www.medicarenewsgroup.com/context/understanding-medicare-blog/understanding-medicare-blog/2013/06/03/the-cost-and-quality-conundrum-of-american-end-of-life-care (accessed May 2015).

Babbel, David F., "Evaluating Pension Insurance Pricing," *Journal of Pension Economics and Finance*, Cambridge University Press, April 2015.

Ballentine, Ted, "Chart: A History of New Jersey's Pension Payments," *Pension360* website, http://pension360.org/chart-a-history-of-new-jerseys-pension-payments/ (accessed March 2015).

Commission on Government Forecasting and Accountability, *Illinois State Retirement Systems, Financial Condition as of June 30, 2014*, February 2015, http://cgfa.ilga.gov/Upload/FinConditionILStateRetirementSysFeb2015.pdf (accessed May 2015).

DeJong, Kristen, "Chicago's Fiscal Stress: New Term, Same Problems," Nuveen Asset Management, April 2015, http://www.nuveen.com/Home/Documents/Default.aspx?fileId=65715 (accessed May 2015).

Fuhrmans, Vanessa and Theo Francis, "Retiree Benefits Take Another Hit, GM's Plan to End Medical Coverage for Many 65 and Over Signals a New Era; Pensions to Increase by $300 a Month," *Wall Street Journal*, July 16, 2008, http://www.wsj.com/articles/SB121617237912356653 (accessed May 2015).

In re Pension Reform Litigation (Doris Heaton *et al*., Appellees, v. Pat Quinn, Governor, State of Illinois, *et al*., Appellants), Supreme Court of the State of Illinois, 2015 IL 118585, http://www.illinoiscourts.gov/Opinions/SupremeCourt/2015/118585.pdf (accessed May 2015).

Kashin, Konstantin, Gary King, and Samir Soneji, "Systematic Bias and Nontransparency in US Social Security Administration Forecasts, *Journal of Economic Perspectives*, Vol. 29, No. 2 (Spring 2015) pp. 239-258, http://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.29.2.239 (accessed May 2015).

Malanga, Steven, "No Bonus for Taxpayers: Deeply Indebted Pension Systems Continue to Dole Out Bonuses," *City Journal Soundings*, Spring 2015, http://www.city-journal.org/2015/25_2_snd-bonuses.html (accessed May 2015).

Mercado, Darla, "Prudential and MassMutual in $2.5 billion pension risk transfer deal with Kimberly-Clark," *Investment News*, February 24, 2015, http://www.investmentnews.com/article/20150224/FREE/150229958/prudential-and-massmutual-in-2-5-billion-pension-risk-transfer-deal (accessed May 2015).

Mercer, "Mercer Pension Discount Yield Curve and Index Rates in US," http://www.mercer.com/content/mercer/global/all/en/insights/point/2014/mercer-pension-discount-yield-curve-an-index-rates-in-us.html (accessed May 2015).

Milliman, "Pension Funding Index: Funded status improves in February due to a rise in corporate bond discount rates and investment gains," http://us.milliman.com/Solutions/Products/Pension-Funding-Index/ (accessed May 2015).

Munnell, Alicia, Richard W. Kopcke, Jean-Pierre Aubry, and Laura Quinby, "Valuing Liabilities in State and Local Plans," Center for Retirement Research at Boston College Issue in Brief Paper Number 11, June 2010, http://crr.bc.edu/wp-content/uploads/2010/06/slp_11-508.pdf (accessed May 2015).

National Association of State Retirement Administrators, "Faulty Analysis is Unhelpful to State and Local Sustainability Efforts," October 2010, http://www.nasra.org/files/Issue%20Briefs/Rauh-NovyMarxCritiquePART1.pdf (accessed May 2015).

National Association of State Retirement Administrators, "More Faulty Pension Analysis Unhelpful to State and Local Recovery Efforts," July 2011, http://www.nasra.org/files/Issue%20Briefs/Rauh-Novy-MarxCritiquePART2.pdf (accessed May 2015).

National Association of State Retirement Administrators, "NASRA Issue Brief: Public Pension Plan Investment Return Assumptions," Updated October 2014, http://www.nasra.org/files/Issue%20Briefs/NASRAInvReturnAssumptBrief.pdf (accessed May 2015).

National Association of State Retirement Administrators, "Retiree Health Care Benefits for State and Local Employees in 2014," December 2014, http://www.nasra.org/files/Spotlight/OPEB%202014%20Spotlight.pdf (accessed May 2015).

National Association of State Retirement Administrators, "The Annual Required Contribution Experience of State Retirement Plans, FY 01 to FY 13," March 2015, http://www.nasra.org/files/JointPublications/NASRA_ARC_Spotlight.pdf (accessed May 2015).

National Association of State Retirement Administrators website, "Investment," http://www.nasra.org/investment (accessed May 2015).

New Jersey (State of) Office of the State Comptroller, *Investigative Report: Improper Participation by Professional Service Providers in the State Pension System*, July 17, 2012, http://www.nj.gov/comptroller/news/docs/pensions_report.pdf (accessed May 2015).

Novy-Marx, Robert and Joshua D. Rauh, "The Liabilities and Risks of State-Sponsored Pension Plans," *Journal of Economic Perspectives*, Fall 2009.

Pension Benefit Guaranty Corporation, "Who We Are," http://www.pbgc.gov/about/who-we-are.html (accessed May 2015).

PensionDialog.com post, "The 13th Check," March 25, 2014, https://pensiondialog.wordpress.com/2014/03/25/the-13th-check/ (accessed May 2015).

Pozen, Robert C. and Ronald F. Gilson, "Debt-Saddled Municipal Budgets Get a Lifeline," *Wall Street Journal*, March 2, 2015, p. A13, http://www.wsj.com/articles/robert-pozen-and-ronald-gilson-debt-saddled-municipal-budgets-get-a-lifeline-1425249172 (accessed May 2015).

Rapaport, Michael, "Longer Lives Hit Companies with Pension Plans Hard, Firms' Balance Sheets Will Have to Reflect Higher Costs," *Wall Street Journal*, February 23, 2015, http://www.wsj.com/articles/longer-lives-hit-firms-with-pension-plans-hard-1424742593 (accessed May 2015).

Rapaport, Michael "Public Pensions Not Expected to Take a Big Hit From New Data on Longer Lifespans," *Wall Street Journal Moneybeat* blog, February 25, 2015, http://blogs.wsj.com/moneybeat/2015/02/25/public-pensions-not-expected-to-take-a-big-hit-from-new-data-on-longer-lifespans/ (accessed May 2015).

Society of Actuaries Press Release, "Society of Actuaries Releases New Mortality Tables and an Updated Mortality Improvement Scale to Improve Accuracy of Private Pension Plan Estimates," October 27, 2014 at https://www.soa.org/news-and-publications/newsroom/press-releases/society-of-actuaries-releases-new-mortality/ (accessed May 2015).

Spears, Lee and Craig Trudell, "GM IPO Raises $20 Billion Selling Common, Preferred," *Bloomberg Business*, November 17, 2010. http://www.bloomberg.com/news/articles/2010-11-16/gm-ipo-said-to-be-raised-to-478-million-shares-as-u-s-sells-bigger-stake (accessed May 2015).

Teitelman, *et al*., "Pension 40: The Battle is On, Our ranking of the 40 most influential players in U.S. pensions highlights new names swept up in an intensifying political struggle," *Institutional Investor*, December 2014 / January 2015.

U.S. Department of Labor, Bureau of Labor Statistics, *National Compensation Survey: Employee Benefits in the United States, March 2014*, Bulletin 2770, September 2014, State and Local Government Table 2, http://www.bls.gov/ncs/ebs/benefits/2014/ebbl0055.pdf (accessed May 2015).