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DELAWARE'S PUBLIC EMPLOYEES' RETIREMENT SYSTEM
A Complete and Transparent Accounting

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Abstract

Current government accounting standards result in US public pension plans understating the size of pensions promised to workers. The result is that state plans are more deeply underfunded than is recognized. Delaware reports an overall funding ratio of 81 percent, but on a market-valuation basis average funding of its plans is 40 percent. Accounting reforms contained in GASB 67 meant to correct the measurement problem are likely to only increase the amount of risk plans take with pension assets.

JEL Codes

H75, H72, J26, G11

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Delaware Public Employees' Retirement System, public sector pensions, discount rate, DPERS, pension assets, Delaware pension system, liability matching portfolio, alternative investments

Delaware's Public Employees' Retirement System:

A Complete and Transparent Accounting

Eileen Norcross

I. Introduction

The sustainability of public sector pension plans is an issue of great fiscal concern for state and local governments in the United States. According to government reports, state public sector pension plans confront a total unfunded liability of $842 billion.[1] Underfunding of this magnitude presents a serious fiscal problem for individual governments and will require a growing amount of budgetary resources to fund benefit promises to retired workers.

As large as this figure is, it understates the true magnitude of plan underfunding. Current government accounting conventions do not recognize the full value of public pension promises. When valuing plans on a fair-market basis—the method that economists recommend and that most countries use—the unfunded liability of US state pensions is actually $4.6 trillion.[2]

Two states, Illinois and New Jersey, stand out as especially weak performers, lacking the assets necessary to fully fund plan liabilities. Absent continued reform, by some estimates both Illinois and New Jersey are on track to run out of assets to pay benefits for current retirees by the end of the decade.[3]

Delaware is on the other end of the plan funding performance spectrum. It is cited as a state that operates a well-funded, well-managed defined benefit retirement system. According to

[1] Public Funds Survey, National Association of State Retirement Officers and the National Council on Teacher Retirement, http://www.publicfundsurvey.org/publicfundsurvey/scorecard.asp and http://www.publicfundsurvey.org/publicfundsurvey/aboutus.htm.
[2] Andrew Biggs, "Public Sector Pensions: How Well Funded Are They, Really?," State Budget Solutions, July 2012, 1.
[3] Joshua Rauh, "Are State Public Pensions Sustainable? Why the Federal Government Should Worry About State Pension Liabilities," *National Tax Journal* 63, no. 3 (September 2010): 585–602.

the state's pension valuation reports, Delaware's nine plans are, on average, funded at 81.4 percent, with an unfunded liability of $1.03 billion. This estimate is based on the assumption that Delaware's pension investments, on average, will return 7.5 percent annually.[4]

However, when valuing Delaware's pension plans on a fair-market basis—that is, as a government-guaranteed benefit based on a 2.03 percent US Treasury bond yield—the average funding ratio for Delaware's plans drops to 40 percent and the unfunded liability rises to $11 billion.[5] This amount is several times larger than Delaware's total outstanding general obligation debt, reported at $1.62 billion in FY 2013, and the state's current budget of $3.58 billion.

Delaware confronts a significant funding gap in its pension system. However, unlike other states, Delaware is also well-placed to reinforce its current defined benefit system and to pursue reforms that ensure the state does not end up with insurmountable obligations.

The good news is that Delaware has a long history of making full annual contributions to its pension system. Unfortunately, since these contributions are calculated based on the expected rate of return on plan assets, the annual payments fall short of the amount needed to truly fully fund the plan. To be fully funded, Delaware must increase its annual contribution to the pension system based on a market valuation of plan liabilities.

This paper analyzes Delaware's pension system on a fair-market or government-guaranteed basis, with reference to the average US Treasury rate on 10- and 20-year bonds in June 2012. A discussion of the discrepancy between current government accounting conventions and the fair-market value approach and the implications for plan management follows.

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[4] Delaware Public Employees' Retirement System (DPERS), *Forty-First Comprehensive Annual Financial Report* (Dover, DE: DPERS Board of Pension Trustees, 2012), http://auditor.delaware.gov/Audits/FY2013/Audits/DPERS%20FY12.pdf.

[5] This rate reflects the yield on 10- to 20-year Treasury bonds as of June 2012 when the valuation of Delaware's pension system was performed.

This paper also considers how the new guidance from the Government Accounting Standards Board (GASB) for valuing plan liabilities, known as GASB 67, affects the plan's investment strategy. One outcome of GASB 67 is that public sector pension plans may be encouraged to take on more investment risk in order to realize higher expected asset returns and to give the plan the appearance of full funding.

Since 2002, Delaware's asset portfolio is increasingly made up of alternative investments such as venture capital funds, hedge funds, and real estate. While investing in alternatives is not necessarily problematic, unless the pension portfolio is balanced to hedge the risk inherent in the liability, this asset strategy may introduce more risk into Delaware's pension system.

The paper concludes with recommendations for how Delaware can stabilize its current defined benefit plan through accounting reform.

II. Delaware's Defined Benefit Pension Plans

Delaware's current pension system was established in 1970. Currently, the state operates nine plans for public employees:

- State Employees' Pension Plan
- Special Fund
- New State Police Pension Plan
- Judiciary Pension Plans
- County & Municipal Police and Firefighters' Plans
- County & Municipal Other Employees' Pension Plan
- Closed State Police Pension Plan

- Diamond State Port Corporation Pension Fund
- Delaware Volunteer Firemen's Fund

In total, the system has 42,832 active and vested employees. In 2012, there were 25,356 retirees collecting benefits. In addition 3,031 employees terminated their employment or were on long-term disability and entitled to receive retirement benefits. There are 137 participating state and local government employers in the system.[6]

Basic Policies

Like most state and local governments in the United States, Delaware's government offers its employees a defined benefit pension plan that promises to pay an employee, once vested, a fixed amount over the course of retirement. That amount is based on a formula that accounts for the employee's years of service, age, and a measure of the employee's final salary. Defined benefit pension plans are funded with a combination of employee and employer contributions and the return on those contributions when invested in a mix of stocks, bonds, fixed income, and alternative investments. The amount that the employee contributes to this pension plan varies by fund.[7]

The defined benefit plan is the most common type of retirement plan in the public sector. In 2011, 73 percent of public sector workers participated in an employment-based retirement plan.[8] Of those, 80 percent were enrolled in a defined benefit plan.[9] By contrast, in the private

[6] DPERS, *Forty-First Comprehensive Annual Financial Report*, 31.
[7] Ibid., 108–9.
[8] Craig Copeland, "Employment-Based Retirement Plan Participation: Geographic Differences and Trends, 2011," Employee Benefit Research Institute Issue Brief no. 378, November 2012, http://www.ebri.org/pdf/briefspdf/EBRI_IB_11-2012_No378_RetParticip.pdf.
[9] Ibid.

sector, 49 percent of workers participate in an employment-based retirement plan,[10] with 30 percent enrolled in a defined benefit plan, 54 percent enrolled in a defined contribution plan, and the remainder in a hybrid plan.

In a defined contribution plan, the employer and employee make a contribution to the employee's retirement savings that is typically invested in a mix and stock and bonds. The final payment to the retiree is unknown and depends on the contributions and investment performance of the plan's portfolio.

The core difference between the defined benefit and the defined contribution plan is the assignment of risk of payment. In a defined benefit plan, the employer bears the risk of making a guaranteed pension payment to the worker. In the public sector, this risk is ultimately borne by the taxpayer. In a defined contribution plan, the amount available to the employee upon retirement depends on the performance of the employee's investments. Thus, the employee bears the risk of securing adequate retirement savings.

The third kind of plan that has become more common in the public sector is the hybrid plan. The hybrid plan provides the worker with a small defined benefit plan alongside a larger defined contribution plan and, in some cases, Social Security. The federal government instituted this "three-legged stool" approach to retirement for federal workers in 1983. In the past decade, nearly one dozen states have instituted a hybrid plan to lessen the fiscal risk to taxpayers that accompanies the defined benefit plan.[11]

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[10] Ibid. Copeland notes that there is a discrepancy between the Bureau of Labor Statistics (BLS) and the Current Population Survey (CPS) of the US Census Bureau on how to measure the participation rate of private sector workers in an employer-sponsored retirement plan. In March 2011, the BLS reported in its National Compensation Survey that 49 percent of private sector workers participate in a retirement plan. The CPS reports this figure as 34.4 percent. The difference is due to the BLS's exclusion of certain categories of workers, including the self-employed, agricultural workers, and household workers. Also, the BLS only considers monthly data. See Copeland, "Employment-Based Retirement Plan Participation," 8.

[11] Ronald K. Snell, "State Defined Contribution and Hybrid Retirement Plans," National Conference of State Legislatures, July 2012, http://www.ncsl.org/issues-research/labor/state-defined-contribution-hybrid-retirement-plans.aspx.

Appendix 1 provides the formulas used to determine benefits for each of Delaware's pension plans. Delaware's pensions also provide a cost of living adjustment (COLA) for retirees, granted by the legislature on an ad hoc basis and funded separately in one of two funds, the County & Municipal Police and Firefighters' COLA Fund and the Post-Retirement Increase Fund.[12]

Recently, Delaware and other states have sought to improve the solvency of their pension systems by increasing vesting and service requirements for retirement. In 2012, Delaware created a new tier in the State Employees' Pension Plan. For those hired after December 31, 2011, the vesting period was increased from 5 to 10 years of service and the retirement age was raised from 62 to 65. In addition, Delaware increased member contributions from 3 percent to 5 percent of earnings over $6,000.[13]

Retirees have also received some basic enhancements. In 2012, Senate Bill 279 granted a 1 percent increase for retired state employees, retired judges, retired state police (under the New State Police Pension Plan), and retired county police and firefighters.[14]

Calculating Measures of Financial Health for Delaware's Defined Benefit Plans

To assess the financial health and funding status of Delaware's pension plan requires comparing plan assets with plan liabilities. These measures determine whether the plan's assets are

[12] In 1990, the legislature established the County & Municipal Police and Firefighters' COLA Fund. Supported by a 0.25 percent tax on the value of insurance premiums written within the state, these revenues are allocated to participating governments on a per-member basis when COLAs are granted by the legislature. In 1994, the New State Police Pension Plan also began participating in the fund. In 1994, the Post-Retirement Increase Fund (PRI) was established to grant ad hoc post-retirement increases by the Delaware legislature. In June 2012, the PRI had outstanding liabilities of $132.7 million.

[13] Chapter 14, Formerly House Bill No. 81, as amended by House Amendment No. 1, http://delcode.delaware.gov /sessionlaws/ga146/chp014.pdf.

[14] Chapter 289, Formerly Senate Bill No. 79, http://delcode.delaware.gov/sessionlaws/ga146/chp289a.pdf.

sufficient to cover the liability (i.e., the benefits) promised to employees upon their retirement at a future date.

Since the plan's promised benefit to the employee is premised upon interest earned on the money set aside over the worker's employment until he or she reaches retirement (the time value of money), it is necessary to "back out" the interest earned on that benefit each year. This process of backing out those interest payments is known as "discounting" the liability. Discounting a future stream of payments is the reverse of calculating compound interest on given cash flow. The end result of discounting is to translate the future value of the liability into a present value. Discounting allows for a comparison of the present value of the plan's liability to the plan's current assets.

To discount a pension liability, one begins with the pension benefit amount determined by the plan's formula. A rate of interest or "discount rate" is assumed. The controversy in public sector pensions involves deciding what interest rate to use.

The selection of a discount rate to value a stream of future financial payments is a straightforward matter for economists.[15] It begins with the principle that the value of a liability is independent from the value of the assets used to finance or pay for that liability.[16] To value the

[15] The widespread agreement on how to select a discount rate can be found in several recent remarks by economists. For example, Donald Kohn, a former vice chairman of the Federal Reserve, notes, "While economists are famous for disagreeing with each other on virtually every other conceivable issue, when it comes to this one there is no professional disagreement: The only appropriate way to calculate the value of a very low-risk liability is to use a very low-risk discount rate." Donald L. Kohn, "Statement at the National Conference on Public Employee Retirement Systems Annual Conference," New Orleans, LA, May 20, 2008.

[16] The subject of how to value pension plan liabilities on an economic basis flows from the Modigliani-Miller theorem. For a layman's summary, see Anne P. Villamil, "Modigliani-Miller theorem," *The New Palgrave Dictionary of Economics*, 2nd ed., 2008, http://www.econ.uiuc.edu/~avillami/course-files/PalgraveRev_Modigliani Miller_Villamil.pdf. Further discussion of this principle of corporate finance can be found in the following sources: M. Barton Waring, *Pension Finance: Putting the Risks and Costs of Defined Benefit Plans Back Under Your Control* (Hoboken, NJ: Wiley, 2012); Robert Novy-Marx and Joshua Rauh, "The Liabilities and Risks of State-Sponsored Pension Plans," *Journal of Economic Perspectives* 23, no. 4 (Fall 2009): 191–210; Frank Russek, "The Underfunding of State and Local Pension Plans," Economic and Budget Issue Brief, Congressional Budget Office, May 4, 2011.

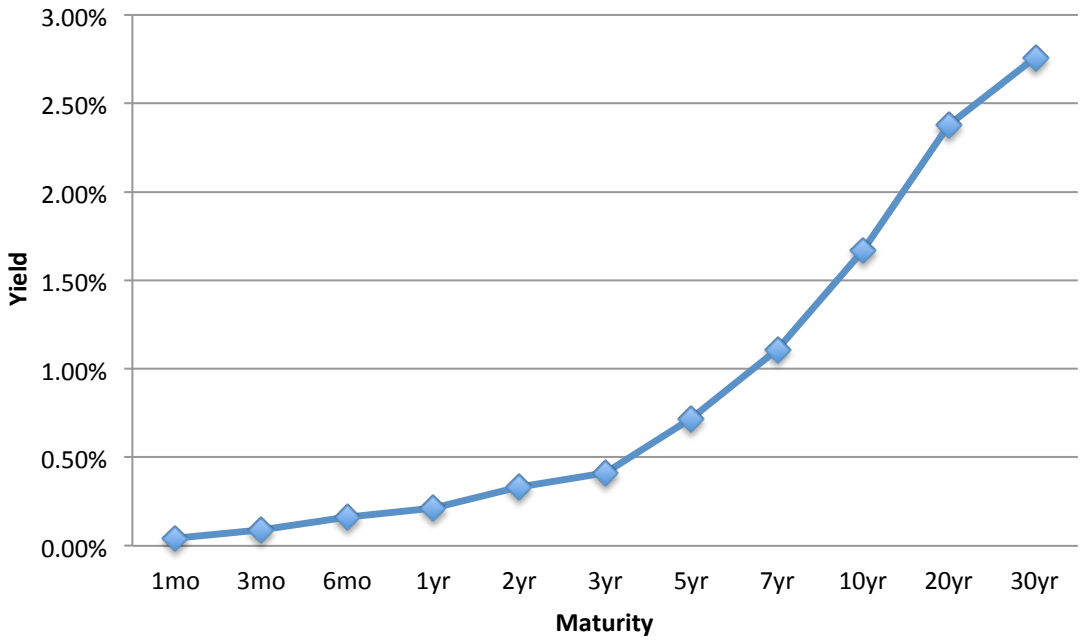
liability, the discount rate should match the risk and timing of those liability payments.[17] Since government pension plans (a liability to the government) represent guaranteed payments to workers that are certain (or intended to be certain) to be paid over a particular time horizon and that in many cases are protected by state statute or constitution, the discount rate chosen should reflect this certainty and legal guarantee.

A public pension is not unlike general obligation debt.[18] It is risk-free from the worker's vantage point. The level of legal protection pension benefits are afforded varies by state. Delaware is one of 27 states to offer protections for employees' past and future benefit accruals.[19] This level of protection indicates that the pension benefit may be safer (and have a higher recovery rate of payment) than a state's general obligation debt. A countervailing consideration is the possibility of a federal bailout of state pensions, which could weaken the state protection afforded to pension plans.[20] If Delaware's plan is valued as "default-free," then a good rate to choose to value the pension liability is the notional yield on 15-year Treasury bonds.[21] This rate is selected from the yield curve of nominal Treasury bonds as shown in figure 1. The reason for using the 15-year point is that it represents the midpoint of a public pension plan's stream of future benefit payments to employees. In other words, a lump-sum payment 15 years from today can be treated as an approximation of the total benefit liability owed by the

[17] In terms of the timing of payments, 15 years is typically selected. This period reflects the median or average duration of a plan with a mix of active and retired members. See Ronald J. Ryan and Frank J. Fabozzi, "Rethinking Pension Liabilities and Asset Allocation," *Journal of Portfolio Management* 28, no. 4 (Summer 2002); and Mercer LLC, "Mercer Pension Discount Yield Curve and Index Rates in the U.S.," 2010, http://www.mercer.com/articles/1213490.
[18] General Obligation Debt is debt that is backed by the full taxing authority of the issuing government.
[19] See Moira Kearney-Marks, "Navigating the Legal Landscape for Public Pension Reform: Travel at Your Own Risk," *Forefront* 3, no. 1 (April 2012), http://www.clevelandfed.org/forefront/2012/winter/ff_2012_winter_10.cfm.
[20] Robert Novy-Marx and Joshua Rauh, "Pension Promises: How Big Are They and What Are They Worth?," *Journal of Finance* 66, no. 4 (August 2011).
[21] The yield on 15-year Treasury bonds is a notional value: that is, it exists as a spot on the curve and is not a traded instrument.

plan over time.[22] As figure 1 shows, in June 2012, when Delaware's latest pension valuation was performed, the yield on a notional 15-year Treasury bond was 2.03 percent.

Figure 1. Treasury Bonds, Nominal Yield Curve, June 29, 2012



Source: US Department of the Treasury, Interest Rate Statistics, Daily Treasury Yield Curve Rates, http://www.treasury.gov/resource-center/data-chart-center/interest-rates/pages/TextView.aspx?data=yieldYear&year=2012.

Lowering the discount rate increases the liability's present value. The persistence of low Treasury rates has led some plan sponsors and actuaries to conclude that applying the risk-free rate to value plan liabilities amounts to "cherry-picking" a low number simply to make plans look more poorly funded than they actually are.

However, the opposite is true. Economists make the case that the liability should be valued not based on cherry-picking numbers, but with reference to that liability's nearest risk-

[22] See M. Barton Waring, "Liability-Relative Investing," *Journal of Portfolio Management* 30, no. 4 (2008).

free match in the market.[23] It is not likely that the US government will default on Treasury bonds, just as it is not likely that a state or local government will default on its promises to pay a pension to its workers.[24] It should also be noted that while interest rates are low today, if interest rates rise, plan liabilities and contribution levels will fall and funding levels will improve.

In contrast to the economic approach to valuing pension liabilities, GASB Statement No. 25 offers guidance to government actuaries. According to GASB 25, public plan actuaries may select a discount rate to value a pension plan liability based on the *expected annual return on plan assets*, or what fund managers anticipate the plan portfolio is likely to return when invested in mix of stocks, bonds, and other financial instruments.

Once a discount rate has been selected, the matter of calculating the present value of the plan liability is basic reverse compounding. Text box 1 shows how to compute the present value of the plan liability using the risk-free rate of return on notional 15-year Treasury bonds.

[23] Economists are nearly unanimous in the view that public sector plans are using discount rates that are too high in assessing plan liabilities. A recent survey conducted by the University of Chicago's IGM Economic Experts panel finds that 98 percent of economists surveyed agree that by discounting pension liabilities at high discount rates, US state and local governments understate their pension liabilities and the cost of providing pensions to public sector workers. See IGM Forum, "U.S. State Budgets," October 1, 2012, http://www.igmchicago.org/igm-economic-experts-panel/poll-results?SurveyID=SV_87dlrlXQvZkFB1r.

[24] The discount rate is not so much "picked" as it is "observed" based on the market values of low-risk financial instruments that are matched in risk and timing to the payment of the pension benefit. Contrary to what critics of the economic approach suggest, the discount rate is not intentionally selected from a menu of numbers to try to make pensions "look bad." This reasoning could be applied to critique the current actuarial approach that can be seen as "cherry-picking" higher rates of return on assets in order to make plans "look good" and meet the budgetary objectives of the sponsor government. In other words, the cherry-picking of discount rates is an unfortunate hazard in the current actuarial guidance provided by the GASB, which allows plans to use an expected return on pension assets to value plan liabilities. It is the expected return on assets figure that can be varied and manipulated by plan sponsors. The more important point is that the performance of plan assets is irrelevant to the true value of the liability. This point is easily lost in arguments that focus on the possibility of manipulating the assumed rate of return on assets to inflate or deflate the measurement of the liability. As the Modigliani-Miller theorem states, how a liability is valued is independent from how it is financed.

Text box 1. Calculating the Market Value of the Liability for the Delaware State Employees' Plan

As reported in the Comprehensive Annual Financial Report, FY 2012:

actuarial value of assets (AVA): $7,270,430,000

actuarial accrued liabilities (AAL): $7,949,855,000

unfunded accrued liability = (AVA - AAL) = $679,425,000

funding ratio = (AVA ÷ AAL) = 91.5%

actuarial assumption: interest rate = 7.5%

To arrive at the market value of the liability based on the information provided, first calculate the future value of the liability by compounding the AAL 15 years forward based on the plan's assumed interest rate (r = 7.5%). Fifteen years represents the approximate midpoint of the pension plan's future benefit obligations. Then discount this future value back to the present value based on the risk-free rate (r = 2.03%). We choose the yield on notional 15-year Treasury bonds.

formula to find the future value: $FV = AAL \times (1 + r)^{15}$

$= \$7,949,855,000 \times (1 + 0.075)^{15} = \$23,522,654,918$

The formula to discount the future value of the reported liability back to the present value is based on the risk-free discount rate.

formula to find the present value of the market value liability (MVL):

$MVL = FV \div (1 + r)^{15}$

$MVL = \$23,522,654,918 \div (1 + 0.0203)^{15} = \$\ 17,400,\ 746,154$

market value unfunded liability = AVA − MVL

= $7,270,430,000 − $17,400,746,154

market value unfunded liability = $ 10,130,316,154

funded ratio based on market value = AVA ÷ MVL = 41.8%

A shortcut conversion factor may be calculated using the following formula:

$(1+ r1)^{15}/(1 + r2)^{15}$

where:

r1 = expected rate of return on assets

r2 = risk-adjusted discount rate

Source: State of Delaware, *2012 Annual Financial Report.*

As the text box shows, once the liabilities are transformed into a present value, two important funding measures may be calculated: the funding ratio (assets divided by liabilities) and the unfunded liability (assets minus liabilities).

In addition, plan actuaries use present value figures to calculate the annual required contribution (ARC) needed to fund the plan. The ARC consists of contributions made by employees and employers each year to fund the benefit and ensure the payment of future obligations. It is calculated based on both demographic and economic assumptions such as estimated age of retirement, mortality, salary growth, years of service, and inflation.

The text box illustrates the dramatic difference that the selection of the discount rate makes on the value of the plan liability. Under the current assumed discount rate of 7.5 percent, the State Employees' Pension Plan has an unfunded liability of $679 million and is funded at 91.5 percent. Using the risk-free rate of 2.03 percent produces an unfunded liability of $10.1 billion and a funding ratio of 41.8 percent.

Under GASB 25's guidance and a 7.5 percent discount rate, Delaware's plans appear well-funded, as shown in figure 2. It should be noted that the Closed State Police Pension Plan covers police hired before 1980 and operates on a pay-as-you-go basis. As a plan that has been closed to new hires for over 30 years, the Closed State Police Pension Plan represents a very small portion (1 percent) of the total number of employees covered, but it requires the second largest annual contribution of all nine plans at $26 million annually.

Figure 2. Delaware's Pension Plans and Basic Measures of Funding Health, As Reported (Thousands of Dollars)

Plan	Actuarial Value of Assets	Actuarial Accrued Liability	Unfunded AAL	Funded Ratio
State Employees'	$7,270,430	$7,949,855	$679,525	91.5%
Special Fund	$366	$264	$(102)	138.6%
New State Police	$292,262	$324,898	$32,636	90.0%
Judiciary	$59,279	$65,946	$6,667	89.9%
County & Municipal Police and Firefighters	$179,816	$186,901	$7,085	96.2%
County & Municipal Other Employees'	$23,851	$25,189	$1,338	94.7%
Delaware Volunteer Firemen's	$14,972	$30,149	$15,177	49.7%
Diamond State Port Corporation	$18,930	$23,039	$4,109	82.2%
Closed State Police	$2,748	$293,808	$291,060	0.90%

Source: Delaware Public Employees' Retirement System (DPERS), *Forty-First Comprehensive Annual Financial Report* (Dover, DE: DPERS Board of Pension Trustees, 2012), 46–48, http://auditor.delaware.gov/Audits/FY2013/Audits/DPERS%20FY12.pdf.

The most robust plan is the Special Fund, which reports a funding ratio of 138.6 percent. That is, 138.6 percent of the plan liability is backed by the plan's current assets. The least well-funded open plan is the Delaware Volunteer Firemen's Fund, with a funding ratio at 49 percent. The total unfunded liability for all nine plans is $1.03 billion, and the average funding ratio is 81.4 percent. Based on Delaware's actuarial valuations, the state's nine pension plans appear relatively well-funded.

However, on a market-valuation basis, these funding levels are far less robust. Mathematically, the measurement of the liability is very sensitive to changes in the discount rate assumption used to value it. A one percentage point difference in the discount rate causes the liability to change by 15 to 20 percent. The effect of lowering Delaware's assumed discount rate of 7.5 percent to 2.03 percent, a drop of roughly 5.5 percentage points, causes the unfunded

liability of the State Employees' Pension Plan to increase from $679 million to $10 billion.[25] Market valuation reveals that the State Employees' Pension Plan funding is only 42 percent, necessitating larger annual contributions in the present to ensure full funding.

Figure 3 contrasts current government reporting under the assumed 7.5 percent return on assets for each plan against the fair-market value, using a risk-free discount rate of 2.03 percent.

Figure 3. Delaware's Pension Plans and Basic Funding Measures Based on the Risk-Free Rate of Return (Thousands of Dollars)

Plan	Reported Unfunded Liability (7.5% assumed discount rate)	Funded Ratio	Market Value Unfunded Liability (June 2012 riskless rate, 2.03%)	Funded Ratio
State Employees'	$679,425	91.5%	$10,130,316	42%
Special Fund	$(102)	138.6%	$211	63%
New State Police	$32,636	90.0%	$418,878	41%
Judiciary	$6,667	89.9%	$85,064	44%
County & Municipal Police and Firefighters'	$7,085	96.2%	$229,275	44%
County & Municipal Other Employees'	$1,338	94.7%	$31,238	43%
Delaware Volunteer Firemen's	$15,177	49.7%	$51,018	23%
Diamond State Port Corporation	$4,109	82.2%	$31,498	38%
Closed State Police	$291,060	0.90%	$640,342	0.43%
Total	**$1,037,200**	**81.4%**	**$11,617,094**	**40%**

Source: DPERS, *Forty-First Comprehensive Annual Financial Report*, 38; author's calculations.

[25] Thus, for every 1 percent change in the discount rate, there is an 18 percent change in the liability.

III. Why Market Valuation Matters

The crux of the market-valuation argument is that public plans are making a serious measurement error in valuing their liabilities by linking the value of plan liabilities to expected asset returns. There are several reasons for this error. The core flaw is that under GASB 25, plan liabilities, which are a safe and government-guaranteed payment for the employee, are valued based on *risky and uncertain* asset returns.

While there is a chance that the assets will perform as expected, there is also a chance that the portfolio will underperform, leaving the plans deeply underfunded. Specifically, there is a less than 50 percent chance that the plan will achieve the "average" return. The reason is that stock market returns are skewed. There are a smaller number of returns that are high and a larger number of returns that are low.[26] The practical result of failing to recognize that the assets may fail to perform as expected (known as the contingent liability) is to shift the resulting underfunding burden onto workers in the form of higher employee contributions and onto taxpayers in the form of future tax increases, increased debt, or cuts to public services.

The debate over how to value public pension liabilities is not only a theoretical matter. It is a principle that is grounded in the behavior of financial markets and is the practice of public pensions worldwide.

The International Public Sector Accounting Standards Board advises that public pensions should be valued based on government bonds or high-quality corporate bonds.[27] With the exception of Australia, public pension plans worldwide use the fair-market value approach to selecting a discount rate. Figure 4 reports the discount rates in use in 2008 for several international plans as surveyed by the Organisation for Economic Co-operation and Development (OECD).

[26] Biggs, "Public Sector Pensions," 6.
[27] Ibid., 10.

Figure 4. Discount Rates Selected to Value Public Employee Defined Benefit Pension Plans as of 2008

Country	Public Employee Defined Benefit Plan	Discount Rate Guidance	Discount Rate (December 2008)
Canada	Public Service		6.00%
Canada	OTTPF		4.00%
France	Public Service Additional Pension Scheme		1.80%
Netherlands	ABP (government and education)	nominal swap rate curve	3.57%
Netherlands	PfZW (health care sector)	nominal swap rate curve	3.55%
Sweden	Federal	market-based discount rate, net of future indexation	1.90%
Norway	Federal	market-based discount rate	5.80%
United Kingdom	West Yorkshire	sum of long-term gilt return plus assumed outperformance of assets over the gilt return	6.00%
United Kingdom	approximately all local plans	sum of long-term gilt return plus assumed outperformance of assets over the gilt return	6.00%
United States		estimated long-term yield for the plan with consideration given to the mix of current and planned investments (GASB 25)	8.00%
Australia	CSS Super	actuarial method based on assets	7.54%
Australia	ESS Super	actuarial method based on assets	8.00%

Source: Eduard Ponds, Clara Severinson, and Juan Yermo, "Funding in Public Sector Pension Plans: International Evidence" (OECD Working Papers on Finance, Insurance and Private Pensions, No. 8, OECD Publishing, May 1, 2011), 23–25, http://dx.doi.org/10.1787/5kgcfnm8rgmp-en.

In the United States, this fundamental financial principle—discounting public pension plans based on low-risk financial instruments to reflect the guaranteed nature of the promise to workers—is the practice of corporate defined benefit plans. The fair-market approach is used or advocated by the national income and product accounts of the Bureau of Economic Analysis, by the Congressional Budget Office, and by Moody's Investors Service (a leading provider of credit ratings), which will begin valuing pension plans based on high-quality corporate bonds in assessing the fiscal health of credit-issuing state and local governments.

GASB's Proposed Reforms: GASB 67

In response to the ongoing criticism of GASB 25, the GASB has issued new guidance in GASB 67 to inform governments in selecting a discount rate to use when valuing pension plan liabilities.[28] Effective June 2013, plans may continue to use the expected rate of return on plan assets when valuing the portion of the plan liability that is backed by assets.[29] The unfunded portion of the liability is to be valued based on a lower-risk, high-quality municipal bond yield. This guidance may seem like a happy compromise between current US practice and the economic approach. Yet, upon further inspection, several problems become apparent.

First, this calculation of plan liabilities is only required for reporting purposes and is not to be used in calculating annual plan contributions or to inform funding policy. Plans may continue to use the expected rate of return on plan assets to calculate the plan's funding level.

[28] GASB, "Financial Reporting for Pension Plans: An Amendment of GASB Statement No. 25," Statement No. 67 of the Government Accounting Standards Board, Governmental Accounting Standards Series No. 327-B, June 2012, http://www.gasb.org/cs/BlobServer?blobkey=id&blobwhere=1175824320579&blobheader=application%2Fpdf&blobcol=urldata&blobtable=MungoBlobs.

[29] Ibid., 19. Specifically, If the current and projected plan assets (with respect to current employees) would not be expected to meet all future plan benefits then the benefits not covered by projected plan assets would be discounted by a yield or index rate for 20-year tax-exempt general obligation bonds with an average rating of AA/Aa or higher.

Second, the practical result of GASB 67 is that plans that are poorly funded will show greater funding gaps in their annual financial reports. The reason is simple arithmetic. The larger the portion of the liability that is not backed by assets, the larger the portion of the liability that is valued using the lower, risk-free discount rates. Plans that appear well-funded under current discount rate assumptions, like Delaware's, will still report relatively robust funding levels.

GASB gives an example of how the new guidance will affect the measurement of plan liabilities that is relevant to the Delaware case. A plan with an assumed interest rate of 7.5 percent in a market with a tax-exempt bond rate of 3.5 percent and a 35-year period before the tax-exempt rate is used (that is, the plan has 35 years to exhaust current assets to cover plan liabilities under a 7.5 percent discount rate) may see an increase in the total plan liability of 20 to 25 percent.[30]

Unfortunately, this compromise rule rests on unsound logic as the guidance continues to apply a higher-risk discount rate to value benefits that have assets backing them. Asset-backed liabilities will continue to be undervalued based on high-risk discount rates, producing artificially inflated funding levels. GASB 67 will continue to give fund managers the incentive to take on greater investment risk to give plans the appearance of robust funding levels, without recognizing the risk that the assets may underperform.

If valued strictly on a market-valuation basis, Delaware's State Employees' Pension Plan has a current funding level of only 42 percent. Market valuation reveals that while not the most deeply underfunded plan in the nation, Delaware's pension system is not as secure as current accounting methods suggest and will require higher present contributions.

[30] Cheiron, "GASB Approves New Accounting Standard for Pension Plans," https://www.cheiron.us/cheironHome /viewArtAction.do?artID=94. See also Alicia Munnell et al., "How Would GASB Proposals Affect State and Local Pension Reporting?" (Chestnut Hill, MA: Center for Retirement Research at Boston College, September 2012), http://crr.bc.edu/wp-content/uploads/2012/06/wp_2012-17.pdf.

By relying on GASB 67, US public sector pension plans continue to value their liabilities based on riskier asset returns and continue to rationalize the continuance of the practice.[31] In the meantime, Moody's will base its pension plan analysis on a lower-risk corporate bond index. While corporate bonds are not risk-free, matching liabilities to a debt instrument will reveal the true worth of public plans more fully than current GASB guidance.

Economists' case for a risk-free rate in valuing public pensions is not immediately intuitive. The notion of the independence of assets and liabilities for the purpose of valuation is perhaps best explained by way of an analogy.[32]

A borrower's home mortgage—the value of the debt that is owed by the mortgage-holder to the bank—is independent from the performance of that mortgage-holder's 401(k) plan. The borrower's monthly mortgage payment to the bank does not change in value based on the performance of the borrower's investments. While the borrower may do better than expected in his or her 401(k) and have a large amount of savings to pay down the mortgage, these facts do not allow the borrower to recalculate and reduce the amount owed to the bank on that mortgage. Yet, tying the expected annual return on pension plan assets to the valuation of the plan's liability implies that such a recalculation is possible.

How the Discount Rate May Subtly Affect the Plan's Investment Strategy

In addition to artificially reducing the plan's liability, linking expected asset performance to the valuation of plan liabilities produces distortions in how pension plans are funded and managed. These distortions include enhancing benefits based on artificially overinflated funding ratios and

[31] Andrew Biggs defines and responds to several common arguments against fair-market valuation, including the notion that the government can ignore risk because it never goes out of business and that over any long period of time assets typically perform close to current expected market returns. See Biggs, "Public Sector Pensions," 5–12.
[32] Douglas Elliot, "State and Local Pension Funding Deficits: A Primer" (Washington, DC: Brookings Institution, December 6, 2010), http://www.brookings.edu/research/reports/2010/12/06-state-local-funding-elliott.

shifting plan assets into higher-risk investments to make up for market losses or to give plans the appearance of more robust funding levels.

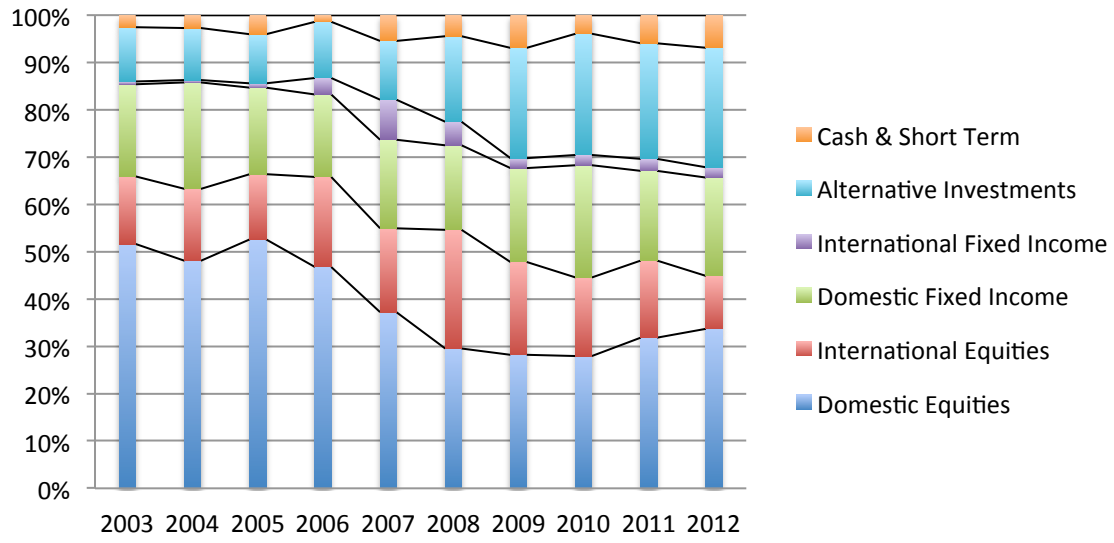
Unfortunately, this last behavior—the shifting of plan investments into higher-risk assets—introduces more uncertainty onto plan balance sheets and increases the likelihood that plans will fall short of the amount needed to pay out benefits. One result of GASB 25 is the incentive to "double down" on risky investments after a market downturn in order to make up for funding gaps. This strategy is a result of the conflating of assets and liabilities for valuation purposes.

It may be that such risk-taking is at work in Delaware. Since 2002, the state has shifted more of the pension system's asset portfolio into alternative investments. This strategy became more pronounced after the market crashed in 2007.

Figure 5 shows this trend. In 2002, Delaware's pension system held 9 percent of its portfolio in alternative investments: high-risk, high-return instruments such as venture capital funds, hedge funds, real estate, and distressed debt.[33] In 2012, one-quarter of Delaware's portfolio was comprised of alternative investments, a larger share than that of the average US public pension fund.[34]

[33] DPERS, *Forty-First Comprehensive Annual Financial Report*, 72.
[34] Public pension plans have largely shifted toward alternative investments since 2007. In 2012 it is estimated that alternatives constitute 20 percent of the average public plan portfolio, based on a sample of 96 state plans. See Cliffwater LLC, "Trends in State Pension Asset Allocation and Performance," June 26, 2012, http://www.cliffwater.com/research/Cliffwater%20Research%20-%20Trends%20in%20State%20Pension%20Asset%20Allocation%20and%20Performance%20June%202012.pdf.

Figure 5. Investment Composition of Delaware's Pension Assets, 2003–2012



Source: FY 2003–FY 2012 Comprehensive Annual Financial Reports, Delaware Public Employees' Retirement System, http://www.delawarepensions.com/information/actuarial_valuation_reports.shtml.

According to the Public Fund Survey, on average, alternatives consitute 11 percent of public plan portfolios. Data gathered by the Center for Retirement Research at Boston College for 112 state pension plans show that in 2009, Delaware was ranked fifth in terms of the portion of the asset portfolio that is invested in alternatives.[35]

In general, the allocation of public pension fund assets has shifted markedly over the last several decades. In the 1950s, public pensions were primarily invested in cash and fixed income securities (i.e., bonds). In recent years, the strategy of public funds has been to invert this mix and invest the bulk of assets in equities and a smaller amount in fixed income. Since the boom markets of the 1990s, a growing portion of public plan assets has been dedicated to alternative

[35] Author's calculations based on data from the Center for Retirement Research at Boston College, *Public Plans Database*, http://crr.bc.edu/data/public-plans-database/.

investments such as hedge funds, real estate, and other investments.[36] Delaware's strategy also includes investing a minimum of 20 percent of its portfolio in fixed income securities.

This large exposure to alternative investments is not necessarily harmful to the long-term health of Delaware's pension plans. By shifting more of the plan's assets into higher-risk, higher-return alternatives, plan managers may be hoping to capture investment gains by taking on more risk to ensure the pension system is well-funded. Holding derivatives and alternatives can be part of a hedging strategy to "immunize" the risk of the liabilities. But in order to be properly hedged, the plan sponsor must first accurately value the liability, which, as discussed in the previous section, is not currently the case in public plans. Properly valuing the liability means that it should be valued based on its risk-free characteristics and based on Treasury bond yields.

To adopt a hedging strategy, the plan sponsor must hedge against the risk that the liability will fluctuate in value based on either real or nominal interest rate changes and on changes in the wages paid to workers. The concern is *not* that Delaware's pension plan is invested heavily in alternatives, but that the assets are not properly hedged since the strategy is based on an artificial and overinflated valuation of the liability. The sponsor's asset investment strategy may be influenced by the erroneous linkage of the value of the plan's liabilities to the expected performance of the plan's assets.

Put another way: Do GASB accounting standards create an incentive (perhaps even unintentionally) for plan managers to invest in higher-risk assets to justify higher discount rates and thus reduce the size of plan liabilities reported on the books?

Current discount rate methods imply that plans that embrace more investment risk can achieve higher levels of funding health. By investing in higher-return assets, the plan is also

[36] George Pennacchi and Mahdi Rastad, "Portfolio Allocation for Public Pension Funds," *Journal of Pension Economics and Finance* 10, no. 2 (April 2011), 221–45.

increasing the portfolio's exposure to risk. The plan may achieve these returns. But there is a less than 50 percent chance that the plan will achieve the average return. If the plan fails to meet the targeted discount rate, the resulting investment losses are a cost that is passed on to taxpayers. It is this investment risk, and potential cost to the system, that current accounting methods do not recognize.

George Pennacchi and Mahdi Rastad test these possibilities in a recent empirical study of state pension plan investment portfolios. They find a positive relationship between the rate the fund chooses to discount its liabilities by and the pension fund's investment volatility. It is unclear if fund managers are pursuing higher-risk investments to justify a higher discount rate or if they are selecting the discount rate to justify a higher-risk investment strategy.[37]

The authors also consider what assets a public plan portfolio might consist of if the plan manager is trying to hedge against risk, or "immunize" the plan from the consequences of market underperformance. Market underperformance could result in higher taxes and budgetary instability for the sponsor government.

The literature has suggested several approaches to public plan investment. Pennacchi and Rastad note these findings. Earlier literature suggests that a public plan's investment objectives may be irrelevant if taxpayers adjust their own savings decisions in anticipation of pension surpluses or deficits. However, in practice, individuals are unlikely to monitor their government's pension plan with a view toward adjusting their own private savings decisions. It is more likely that public pension policies affect citizens' individual tax burdens in the form of unexpected tax hikes or rebates. Where a pension fund does not meet its expected returns or

[37] Ibid., 27.

otherwise fails to fund the liability fully, future generations become responsible for the shortfall. This possibility gives rise to another pension fund objective: intergenerational equity.[38]

Intergenerational equity is the idea that it is important to balance the investment risk in a pension fund to ensure that future generations do not pay for current pension underfunding. Since municipal and state governments operate under budget constraints and cannot print money to "inflate away" their pension debts, municipalities may pursue intergenerational equity to ensure budgetary stability.

A related idea is the goal of *intra*generational equity. The pension fund manager may also want to reduce the risk that the plan is underfunded for the current generation of taxpayers. The strategy here is to have a fully funded plan at all times. This strategy is based on an asset mix that immunizes a change in the value of the plan's liability due to fluctuations in wages or a change in the value (real or nominal) of the bonds used to value the liability.[39] The policy outcome is a fully funded pension that minimizes uncertainty for governments, employees, and taxpayers.

Pennacchi and Rastad model what a public pension plan portfolio might consist of if the goal is to hedge the risk of the plan's liabilities, or the value of the retirement annuities the government is obliged to pay to its employees. When pension fund liabilities are indexed to inflation, Pennacchi and Rastad find several scenarios that meet the criteria of hedging the plan's liabilities to ensure their guarantee to pay employees and minimize uncertainty for taxpayers. Their results are in figure 6, which shows the pension asset portfolio weights (percentages) that minimize the pension fund's tracking error volatility (TEV). TEV is the difference between the portfolio's actual performance and that of the benchmark portfolio.

[38] Ibid., 5–6.
[39] Ibid., 6.

For example, where the pension fund's liabilities are nominal and no COLAs are provided, the allocation that minimizes liability risk calls for a 9 percent short position in equities, a 160 percent allocation to fixed income, 24 percent in private equity, and a 67 percent short position in hedge funds.[40] The authors explain that the huge allocation to fixed income is due to the assumption that investments in fixed income are less sensitive to interest rates than the pension liability. This assumption implies that the fund should borrow via short positions in other categories to increase its investment in US fixed income securities.[41] A short position allows the investor the option to sell the assets with the intention of buying them back at a lower price, thus realizing a profit.[42]

[40] Ibid., 237.
[41] Ibid., 236.
[42] Pennacchi and Rastad note that previous research suggests that pension funds invest in equities to hedge wage uncertainty. See Fisher Black, "Should You Use Stocks to Hedge Your Pension Liability?," *Financial Analysts Journal* 45, no. 1 (January/February 1989), 10–12; Mirko Cardinale, "Cointegration and the Relationship Between Pension Liabilities and Asset Prices" (Watson Wyatt Technical Paper Series No. 2003-TR-06, 2003); Deborah Lucas and Stephen Zeldes, "Valuing and Hedging Defined Benefit Pension Obligations—The Role of Stocks Revisited" (working paper, Northwestern and Columbia Universities, 2006); and Deborah Lucas and Stephen Zeldes, "How Should Public Pension Plans Invest?" *American Economic Review* 99, no. 2 (2009): 527–32. This recommendation is based on evidence of a positive correlation between equities and wages. However, Pennacchi and Rastad find a negative correlation between growth in US state and local wages and US equities. They check the negative correlation by testing it over longer periods (from one year to up to nine years) and find that as the period grows longer, the negative correlation between equities and wages increases. They note that this pattern is consistent with the findings of Urban J. Jermann, who estimates wage–stock correlations over the period 1926 to 1996 and finds negative correlations for periods between 7 and 17 years, before turning positive. Pennacchi and Rastad conclude that since the typical duration of a pension fund's liabilities is 15 years, stocks may not be the best hedge of wage risk. See Pennacchi and Rastad, "Portfolio Allocation for Public Pension Funds," 233–34; Urban J. Jermann, "Social Security and Institutions for Intergenerational, Intragenerational, and International Risk Sharing: A Comment," *Carnegie-Rochester Series on Public Policy* 50 (June 1999): 205–12, http://ideas.repec.org/a/eee/crcspp/v50y1999ip205-212.html.

Figure 6. Pension Portfolio Allocations That Minimize the Liability's Risks

	Variance Minimizing Portfolio			Alternative Portfolio
Asset Type	**No Constraints**	**No Private Equity & Hedge Funds**	**No Short Sales**	**No Constraints**
US Equities	−0.0886 (short)	−0.1259 (short)	0	0.0553
Non-US Equities	−0.0109 (short)	−0.0285 (short)	0	−0.6140 (short)
US Fixed Income	1.5991	1.3586	1	−1.5304 (short)
Non-US Fixed Income	−0.0103 (short)	−0.1719 (short)	0	0.5756
US Real Estate	−0.0662 (short)	−0.0322 (short)	0	0.1052
Private Equity	0.2442	-	0	0.5087
Hedge Fund	−0.6673 (short)	-	0	1.8996
TIPS	-	-	-	-
Tracking Error	0.04054	0.05004	0.06444	-
Return	0.04706	0.04806	0.05200	0.1547

Source: George Pennacchi and Mahdi Rastad, "Portfolio Allocation for Public Pension Funds," *Journal of Pension Economics and Finance* 10, no. 2 (April 2011): 237.

Is Delaware's investment strategy problematic over the long run? According to the plan's investment report, the Investment Committee's philosophy is to strike a balance between risk-taking and ensuring the plan's long-term health and affordability, indicating a fiduciary responsibility to ensure the plan is well-funded. Delaware's Investment Committee bases its policies on the analysis of the plan's cash flow and the system's liabilities, as well as a comparison of the plan's performance to that of similar funds. It may be that Delaware's investment strategy goals will be met. The most recent investment report highlights that the portfolio has achieved a 7.3 percent rate of return annualized over 15 years.[43]

[43] DPERS, *Forty-First Comprehensive Annual Financial Report*, 67.

Regardless of past performance or the current mix of assets, there is a significant chance going forward that the plan will fail to meet expectations. The question is, to what extent are these investment decisions driven by flawed GASB guidance that encourages plan managers to ensure that plan liabilities appear well-funded based on higher discount rates?

This hazard can be lessened by introducing market valuation and using a risk-free rate of return to value plan liabilities. Moving to market valuation of the pension liability benefits taxpayers, pension beneficiaries, and plan managers. Breaking the link between the liability's value and the assumed rate of return on assets removes the potential for signal noise in investment decision-making. Market valuation reduces the incentive implicit in GASB 67 that encourages plans to embrace more investment risk to give pension accounts a healthier appearance. As Robert Novy-Marx notes, the problem with valuing the liability based on expected returns on risky assets is that it implies that the pension fund could improve its financial health "by burning any safe assets in its portfolio."[44]

Unfortunately, GASB 67 has the potential to worsen the distorted decision-making contained in the original guidance of GASB 25. GASB 67 implies that liabilities backed by assets are more secure and can be valued using riskier discount rates. But this logic exposes the funded portion of the plan to an increased risk of plan underfunding. GASB's new guidance allows plans to report their liabilities in a way that makes them appear well-funded before any actual funding returns are realized.

It should be noted that valuing plan liabilities on a risk-free basis does not mean that the plan must invest exclusively in bonds, as Pennacchi and Rastad demonstrate. Figure 4 shows that in a scenario where liabilities are hedged against the risk of plan underfunding, the portfolio may

[44] Robert Novy-Marx, "Logical Implications of GASB's Methodology for Valuing Pension Liabilities" (working paper, University of Rochester and NBER, 2011), quoted in Biggs, "Public Sector Pensions," 17.

take on several different compositions. The switch to market valuation has the benefit of focusing portfolio decisions exclusively on what portfolio managers should consider when investing: hedging the risk that liabilities will be underfunded due to fluctuations in bond rates or wages, thus protecting the plan against market volatility and uncertainty.

IV. Conclusion

The controversy over how to value public plan liabilities has resulted in some changes to public sector accounting guidance in recent years. The result is that plans that appear well-funded under current guidance, such as that of Delaware, will show slightly deeper funding gaps. However, the new guidance still fails to correctly capture the true size and value of pension liabilities, thus ensuring that funding gaps and volatile swings in funding levels emerge during market downturns.

One concern for Delaware is the possibility that government accounting guidance has influenced how plan managers consider Delaware's pension asset investment strategy. Even if the fund managers have a well-crafted investment strategy and philosophy and meet their investment objectives, the plan should not use the expected asset return assumptions to value the plan's liabilities. This principle violates economic theory and is contrary to the practice of pension plans throughout the world. GASB 67 will encourage plans to potentially embrace more investment risk to give them a healthier appearance for reporting purposes. However, government accounting guidance contained in GASB 67 continues to allow actuaries and accountants to underestimate the amount needed to fund the plan by valuing the promised benefits based on the performance of risky asset returns.

To remain a top performer, Delaware should consider introducing market valuation in measuring plan liabilities. Delaware has a good track record in terms of its contribution policy. Policy makers have been disciplined and have made the full contribution on an annual basis.

The effects of transparently accounting for plan liabilities using market valuation and a risk-free rate of return will only assist the plan. They will allow Delaware to remain disciplined in its contribution policy and focus plan managers on ensuring that the asset portfolio hedges the liability from market volatility and uncertainty.

Market valuation enables policy makers to guarantee a specific payment to workers and to plan for budgets based on the true value of these promises. Avoiding market valuation ensures that plans are structured as uncertain payments and subject to volatile and uncertain returns, turning what is supposed to be a safe retirement for public workers into a fiscal gamble.

Appendix 1. Benefit Policies Guiding Delaware's Nine Defined Benefit Pension Plans

	Eligibility	Benefits Formula	Vesting Period	Retirement	Employee Contribution
State Employees' Pension Plan	cost-sharing, single-employer plan covering all full-time and part-time state employees	(pre-1997 final average monthly salary × 2% × years of credited service) + (post-1996 final average compensation × 1.85% × years of credited service)	5 years of credited service for those hired before January 2011; for those hired after January 2011, 10 years of credited service are required to be vested in the benefit	pre-2012 hires: age 62 with 5 years of credited service, age 60 with 15 years of credited service, or after 30 years of credited service at any age; post-2011 hires: age 65 with 10 consecutive years of service, age 60 with 20 years of service, or 30 years of credited service at any age	pre-2012 date of hire: 3% of earnings in excess of $6,000; post-2011 date of hire: 5% of earnings in excess of $6,000
Special Fund	certain benefits granted to individuals identified through legislation passed by the General Assembly	defined by special legislation	defined by special legislation	defined by special legislation	not applicable
New State Police Pension Plan	single-employer, defined benefit plan covering all state police post-1980	2.5% of final average monthly compensation × years of credited service up to 20 years, plus 3.5% of final average monthly compensation × years of service in excess of 20 years	10 years of credited service at age 62	age 62 with 10 years of credited service, age plus credited service (no fewer than 10 years) equals 75, or 20 years of credited service	7% of compensation

Judiciary Pension Plans	plan has a closed and a revised portion	for revised plan: 1/24 of final average monthly compensation × years of service up to 12 years, plus 1/48 of final average monthly compensation multiplied by years of service from 13 to 24 years, subject to maximum limitations	12 years of credited service	age 62 with 12 years of credited service, or any age with 24 years of credited service	3% of earnings that exceed $6,000 per year, plus 2% of earnings that exceed the Social Security Wage Base for the first 24 years of service
County & Municipal Police and Firefighters' Plans	cost-sharing, multiple-employer plans for county and municipal police and firefighters	2.5% of final average monthly compensation multiplied by years of credited service up to 20 years, plus 3.5% of final average monthly compensation multiplied by years of service in excess of 20 years	5 years of credited service	age 62 with 5 years of credited service; age plus credited service (but not less than 10 years) equals 75; or 20 years of credited service	7% of compensation
County & Municipal Other Employees' Pension Plan	cost-sharing, multiple-employer defined benefit plan that covers employees of counties or municipalities that have become part of the plan	1/60 of final average monthly compensation multiplied by years of credited service, subject to maximum limitations; final average monthly compensation is the monthly average of the highest five years of compensation	5 years of credited service	age 62 with 5 years of credited service, age 60 with 15 years of credited service, or after 30 years of credited service	3% of earnings in excess of $6,000

Delaware Volunteer Firemen's Fund	cost-sharing length of service award covering active volunteers of fire departments, ladies auxiliaries, or ambulance organizations	$5 multiplied by years of credited service, not to exceed 25 years, per month	10 years of credited service	age 60 with 10 years of credited service	$60 per member per year
Diamond State Port Corporation Pension Fund	single-employer plan covering employees of the Diamond State Port Corporation	1.75% of final average monthly compensation multiplied by years of credited service (not to exceed 30 years)	5 years of credited service	age 65 with 5 years of credited service, or age (not less than 55) plus credited service equals 90	2% of compensation
Closed State Police Pension Plan	single-employer plan covering state police officers pre-1980	50% of monthly salary	20 years of credited service or age 55	not applicable	5% of salary with 20 or fewer years of credited service; 2% of salary with over 20 years of credited service

Source: DPERS, *Forty-First Comprehensive Annual Financial Report*, 30–33.