Rating the State Government Public Pension Plans in the US

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Abstract
The government-sponsored pension plans in the US, mostly defined benefit (DB) pension plans, are severely underfunded. In this study we examine the current state of the public pension plans, and rate them based on their actuarial funding ratio, risky asset allocation, and other multiple variables using both a simple ranking and a principal component analysis method. We aim to help public employees/retirees understand the financial health of their pension plans, and to raise the public awareness of the pension Tsunami.

Keywords: Public pension, Funding ratio, Asset allocation risk

JEL Codes: G18, G11, G28

1. Introduction
The 50 states across the U.S. are currently facing a big issue with their government-sponsored pension plans. These plans, mostly defined benefit (DB) pension plans, are severely underfunded; that is, their assets are not sufficient to meet future liabilities (i.e., employees’ retirement payment and benefit). The total funding gap, or the difference between pension assets and liabilities, is estimated to be $843 billion as of March 2013 for 99 pension systems. (Note 1)

Using a more conservative method to estimate pension liabilities, some economists (i.e., Novy-Marx and Rauh, 2010, 2011; Rauh, 2011) estimate the funding gap to be $4.4 trillion. (Note 2) As a reference point, these unfunded pension liabilities of $4.4 trillion accounts for 33% of the 2011 U.S. real gross domestic product (GDP) of $13.3 trillion (Healey, Hess, and Nicholson, 2012).

Table 1. Five states in the U.S. with the largest pension funding shortfall
Panel A: If using actuarial rate to discount future pension liabilities

<table>
<thead>
<tr>
<th>State</th>
<th>Pension funding shortfall ($ bil.)</th>
<th>Shortfall as a % of total pension liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>154.2</td>
<td>32%</td>
</tr>
<tr>
<td>Illinois</td>
<td>85.4</td>
<td>57%</td>
</tr>
<tr>
<td>Ohio</td>
<td>75.3</td>
<td>39%</td>
</tr>
<tr>
<td>New Jersey</td>
<td>62.9</td>
<td>51%</td>
</tr>
<tr>
<td>Texas</td>
<td>53.7</td>
<td>30%</td>
</tr>
</tbody>
</table>

Panel B: If using a conservative estimation method, as suggested by Novy-Marx and Rauh (2009)

<table>
<thead>
<tr>
<th>State</th>
<th>Pension funding shortfall ($ bil.)</th>
<th>Shortfall as a % of total pension liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>475.7</td>
<td>59%</td>
</tr>
<tr>
<td>Illinois</td>
<td>219.1</td>
<td>77%</td>
</tr>
<tr>
<td>Ohio</td>
<td>216.9</td>
<td>65%</td>
</tr>
<tr>
<td>Texas</td>
<td>188.2</td>
<td>60%</td>
</tr>
<tr>
<td>New York</td>
<td>166.4</td>
<td>47%</td>
</tr>
</tbody>
</table>

Table 1 lists top (worst) five states with the largest pension funding shortfall as of fiscal year of 2009, based on a study conducted by Novy-Marx and Rauh (2009). When using actuarial rate to discount future pension liabilities, California suffers the largest pension funding gap of $154.2 billion, followed by Illinois ($85.4 billion), Ohio ($75.3 billion), New
Jersey ($62.9 billion), and Texas ($53.7 billion). However, when using Treasury yield as a beach market to discount future pension liabilities, the funding gap for California widens to $475.7 billion. When considering funding gap as a percentage of total pension liabilities, Illinois is the worst state with an underfunding ratio of 57% (when using actuarial rate as a discount rate) or 77% (when using Treasury yield as a bench mark).

The severe underfunding of public pension plans has threatened the retirement security of a large population, as public pension plans cover pension benefits for about 12.8 million active public employees and 5.9 million retirees and other annuitants. (Note 3) Rauh (2010) estimates that at an aggregate level, the pension payment would exhaust pension assets by 2028, and that several pension plans would run out much sooner – Illinois would run out of pension assets in 2018, and New Jersey, Connecticut and Indiana follow suit during the next year.

More severely, the 50 state governments continue to face major fiscal challenges and budget deficits. The combined budget gaps were $350 billion for 2010 and 2011, making most state governments unable to make pension contributions and to narrow funding gap. Facing various fiscal constraints and budget difficulties, some states have to cut spending, withdraw from reserves, or reduce investments in public services. In fact, according to the Center on Budget and Policy Priorities (2012), the budget difficulties have led at least 30 states to raise taxes, in some cases quite substantially. For example, lawmakers of Illinois, one of the states with the largest pension funding gap (as shown in Table 1), passed a big income-tax increase in January 2011, with the individual income-tax rate jumping to 5% from 3% and the corporate tax jumping to 7% from 4.8%. Illinois lawmakers hope that the tax increase will help to close the pension funding shortfall and reduce the budget deficit (Bellandi, 2011). (Note 4) According to Novy-Marx and Rauh’s (2009) calculation, if the governments elect to raise the tax to close the funding gap between $1.27 to $3.26 trillion, each household would need to contribute an additional tax payment of $21,500. The effect of underfunded pension plans therefore touches a large percentage (if not all) of the population in the country, including those at risk and the taxpayers who may be ultimately called upon to close the funding gap (Mohan and Zhang, 2014).

The primary objective of this paper is to provide the first comprehensive study on the current state of public pension plans in the US. In particular, we rate each state pension plan based on a thorough evaluation of plan financial health (from A, A–, to D, F). Our rating framework will consider pension funding levels, investment risks, state fiscal constraints, and workforce/retirees demographics, as well as other important factors. We aim to help public employees/retirees understand the financial health of their pension plans, and to raise the public awareness of the pension Tsunami.

The remainder of this paper is organized as follows. Section 2 discusses the magnitude of pension funding gap. Section 3 describes the data, variables and methodology. Section 4 shows the empirical results. Section 5 concludes.

2. The Magnitude of Pension Funding Gap

Compared to the studies on the private pension plans, the studies concerning state government public pension plans have been sparse for a fairly long time. The lack of the related studies could be due to the different orientation of issues as well the data availability (Mohan and Zhang, 2012). In particular, firms or sponsors of private pension plans, including those firms listed on the stock exchanges, are required to file financial statements and other reports (i.e., Form 5500) to their shareholders and regulatory and government agencies (i.e., the Securities Exchange Commissions, Department of Labor, Pension Benefit Guaranty Corporation, and Internal Revenue Service). But the pertinent law and regulations on public pension plans are generally nonexistent. (Note 5) Although state governments are required to make their Comprehensive Annual Financial Report (CAFR) and budget report publicly available online, the information and discussions on the public pension plans in these reports is very limited. Indeed, the lack of information transparency for state and local governments has become a severe concern for the general public, municipal bond investors, and lawmakers. It has been reported that one third of the governments that issued debt to the public failed to disclose their financial information from 2005 to 2007. (Note 6)

This paper is mainly related with previous studies on public pension underfunding magnitude/scope. Novy-Marx and Rauh have been active researchers in public pension plans and they have conducted a series of the studies on the size and scope of public pension obligations. Using data of the 116 largest public pension plans in 2008, Novy-Marx and Rauh (2009) estimate the total pension liabilities to be $2.97 trillion for the 50 states in 2008. For the first time, this article has cautioned the general public of the staggering magnitude of public pension shortfall. In another article, Novy-Marx and Rauh (2010) conservatively estimate “already-promised” benefits between $3.21 and $5.2 trillion, depending on the discount assumption to be used. The latest estimation of total pension liabilities by Rauh (2011) is as high as $7.03 trillion. The growth of pension obligations is largely due to continuous decrease of Treasury yields, which is used to discount future pension payments. Regarding the effect of unfunded pension liabilities on the social welfare, Novy-Marx and Rauh (2009) report that in order to close funding gap, which is between $1.27 and $3.26
trillion, each household would need to make an additional tax payment of $21,500. Furthermore, assuming that newly created pension benefit debt is funded, Rauh (2010) estimates that the existing pension payment would exhaust pension assets, in aggregate, by 2028.

Several large consulting firms and research institutions have recently focused on public pension issues as well. Using data in fiscal year 2009, the Pew Center on the States (2011) estimates the total pension liabilities to be $2.94 trillion. The Pew Center uses the actuarial assumption, rather than Treasury yields as a discount rate to estimate pension liabilities, so its estimation of pension liabilities is smaller than that made by Novy-Marx and Rauh. The total pension liabilities would jump to $4.6 trillion if the Treasury rate is used to discount the same liabilities by the Pew Center. The total size of pension liabilities for the 126 largest public plans in 2010 estimated by Wilshire (2012) is $3.23 trillion. According to Public Fund Survey (2013), the aggregate pension liabilities are $3.49 trillion and pension assets exceed $2.65 trillion, with a funding deficit of $843 billion. The severe underfunding of public pension plans has threatened the retirement security of a large population. Moreover, taxpayers may be ultimately called upon to close the funding gap, as the state governments continue to face major fiscal challenges and budget deficits.

3. Data, Variables, and Methodology

The data on public pension funds are obtained from the Public Plans Database (PPD), maintained by the Center for Retirement Research at Boston College. The sample period extends from fiscal years 2001 through 2011, covering 126 pension systems for 50 states and the District of Columbia. These pension systems together held $2.28 trillion pension assets at the end of fiscal year 2011. In addition, the public employee union membership and coverage data are obtained from the Union Membership and Coverage Database. (Note 7)

The key variables in this study are pension funding ratio and risky asset allocation. Pension funding ratio \( (FUNDING\_RATIO) \) is defined as the ratio of pension actuarial assets over pension actuarial liabilities.

\[
FUNDING\_RATIO = \frac{PENSION\_ACTUARIAL\_ASSETS}{PENSION\_ACTUARIAL\_LIABILITIES}
\]

Risky asset allocation is the percentage of a pension plan assets invested in equity market and alternatives (i.e., private equity and venture capital). Other variables including (1) % of annual required contribution paid, (2) 1-year actual return of pension assets, (3) actuarial discount rate, (4) projected total annual required Contribution as a % of payroll, (5) total normal cost as a % of payroll, (6) inflation rate assumption, (7) active to retired employee ratio, and (8) % of unionized employees.

Table 2. Anticipated rating structure of public pension plans

<table>
<thead>
<tr>
<th>Rating Classification</th>
<th>Cardinal Value</th>
<th>Letter Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safe pension plans</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highest Grade</td>
<td>1</td>
<td>A</td>
</tr>
<tr>
<td>High Grade</td>
<td>2, 3</td>
<td>A-, B+</td>
</tr>
<tr>
<td>Medium Grade</td>
<td>4, 5</td>
<td>B, B-</td>
</tr>
<tr>
<td>At-risk pension plans</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Grade</td>
<td>6, 7, 8</td>
<td>C+, C, C-</td>
</tr>
<tr>
<td>Poor Standing</td>
<td>9, 10</td>
<td>D, F</td>
</tr>
</tbody>
</table>

This table is created based on Jorion, Liu and Shi (2005). We rate all pension plans from fiscal year 2001 to 2011 using (1) actuarial funding ratio, (2) risky asset allocation, and (3) a combination of 10 variables as ranking variables. When ranking pension plans based on multivariate variables, we use a simple ranking and a principal component analysis (PCA) method. The pension plan rating structure is similar to bond credit ratings performed by S&P. The rating structure is shown in Table 2. We classify all pension plans into two categories: safe pension plans and at-risk pension plans. Safe pension plans refer to those with a rating between B- to A and at-risk plans refer to those with a rating between F to C+.

4. Empirical Results

In this section we first describe summary statistics for all pension plans during the fiscal years of 2001 to 2011. We then proceed to rate all pension funds based on various criteria.
### 4.1 Summary Statistics

Table 3. Summary Statistics

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Mean</th>
<th>MIN</th>
<th>Q1</th>
<th>Median</th>
<th>Q3</th>
<th>MAX</th>
<th>STD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actuarial Funding Ratio</td>
<td>83.3386</td>
<td>19.0786</td>
<td>72.6153</td>
<td>84.2485</td>
<td>96.3889</td>
<td>147.7331</td>
<td>17.2269</td>
</tr>
<tr>
<td>Risky Asset Allocation %</td>
<td>58.9846</td>
<td>0.0000</td>
<td>54.0000</td>
<td>60.5000</td>
<td>66.0000</td>
<td>88.0000</td>
<td>11.0079</td>
</tr>
<tr>
<td>% of Annual Required Contribution Paid</td>
<td>92.3146</td>
<td>0.0000</td>
<td>79.5900</td>
<td>100.0000</td>
<td>100.0000</td>
<td>1727.7000</td>
<td>59.0401</td>
</tr>
<tr>
<td>1-Year Actual Return of Pension Assets</td>
<td>5.6359</td>
<td>-29.6300</td>
<td>-4.4750</td>
<td>9.3000</td>
<td>15.0100</td>
<td>36.2400</td>
<td>12.3640</td>
</tr>
<tr>
<td>Actuarial Rate (Pension Liab. Discount Rate)</td>
<td>0.0798</td>
<td>0.0450</td>
<td>0.0775</td>
<td>0.0800</td>
<td>0.0825</td>
<td>0.0900</td>
<td>0.0039</td>
</tr>
<tr>
<td>Projected Total Annual Required Contribution as a % of Payroll</td>
<td>19.3656</td>
<td>0.0000</td>
<td>13.5900</td>
<td>17.7500</td>
<td>24.3600</td>
<td>100.1100</td>
<td>9.0284</td>
</tr>
<tr>
<td>Inflation Rate Assumption</td>
<td>0.0358</td>
<td>0.0050</td>
<td>0.0300</td>
<td>0.0350</td>
<td>0.0400</td>
<td>0.3000</td>
<td>0.0103</td>
</tr>
<tr>
<td>Active to Retired Employee Ratio</td>
<td>3.3255</td>
<td>0.0376</td>
<td>1.8689</td>
<td>2.2712</td>
<td>2.8239</td>
<td>179.7286</td>
<td>7.7921</td>
</tr>
<tr>
<td>% of Employees w/Collective Bargaining Contract</td>
<td>0.3962</td>
<td>0.1038</td>
<td>0.2297</td>
<td>0.3679</td>
<td>0.5587</td>
<td>0.7533</td>
<td>0.1766</td>
</tr>
</tbody>
</table>

Table 3 shows that public pension plans, on average, are underfunded during our sample period. A historical evolution of pension funding status is illustrated in Figure 1. The mean (median) actuarial funding ratio is 83.34% (84.25%), and half of the pension plans have a funding ratio between 72.62% and 96.39%. The minimum and maximum funding ratios are 19.08% and 147.73%, with a standard deviation of 17.23%, indicating a high variability of pension funding status. Pension funds tend to invest a majority of their assets in risky assets, including equity and alternatives. Table 3 shows that 75% of the plans in the sample have allocated more than 54% of their pension funds into risky assets. The average (median) risky asset allocation is 58.98% (60.5%), with a range of 0 to 88% and a standard deviation of 11.01%. Note that about half of the pension plans did not report their actuarial assets and liabilities in 2011 when we obtain the data. In Figure 2, we provide average and median risky asset allocation for the pension funds from 2001 to 2011. The average risky asset allocation peaked in 2004 – 2006 at about 62% and then declined to 56% in 2009. Risky asset allocation is about 57% at the end of fiscal year 2011. Note that about half of the pension plans did not report their asset allocation in 2011 when we obtain the data.

![Figure 1. Average and Median Pension Actuarial Funding Ratios for US Public Funds from 2001 to 2011](image-url)
Figure 2. Average and Median Risky Asset Allocation for US Public Funds from 2001 to 2011

These two figures are created based on the authors’ own calculations. And they are consistent with the figures reported by Mohan and Zhang (2012, 2014). As shown in Table 3, the mean actuarial rate is 7.98%, with a standard deviation of 0.39%. Actuarial rate is based on pension fund long-term expected investment returns. Such a relatively low variation probably indicates that plans do not often change their pension discount rate. In contrast to the actuarial rate, the actual investment returns are lower. The average 1-year investment return is 5.64%, employing that pension plans generally underperform their expectations by 2.34%. Table 3 shows there are relatively few working employees (3.33) for each retiree, an indication of an aging workforce. Finally, on average 39.62% of all public employees are unionized.

4.2 Rating Pension Plans

We use (1) actuarial funding ratio, (2) risky asset allocation percentage, and (3) a combination of 10 variables as ranking variables to rate all pension plans.

4.2.1 Ranking Pension Plans by Actuarial Funding Ratios

Table 4. Ranking Pension Plans by Actuarial Ratio

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Pension Name</th>
<th>Actuarial Funding Ratio (%)</th>
<th>Ranking</th>
<th>Letter Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>Washington LEOFF P</td>
<td>126.5768</td>
<td>1</td>
<td>A</td>
</tr>
<tr>
<td>2010</td>
<td>New York State Tea</td>
<td>100</td>
<td>2</td>
<td>A</td>
</tr>
<tr>
<td>2010</td>
<td>NY State &amp; Local E</td>
<td>100</td>
<td>2</td>
<td>A</td>
</tr>
<tr>
<td>2010</td>
<td>NY State &amp; Local P</td>
<td>100</td>
<td>2</td>
<td>A</td>
</tr>
<tr>
<td>2010</td>
<td>Washington LEOFF P</td>
<td>100</td>
<td>2</td>
<td>A</td>
</tr>
<tr>
<td>2010</td>
<td>Washington PERS 2/</td>
<td>100</td>
<td>2</td>
<td>A</td>
</tr>
<tr>
<td>2010</td>
<td>Washington School</td>
<td>100</td>
<td>2</td>
<td>A</td>
</tr>
<tr>
<td>2010</td>
<td>Washington Teacher</td>
<td>100</td>
<td>2</td>
<td>A</td>
</tr>
<tr>
<td>2010</td>
<td>Wisconsin Retireme</td>
<td>99.83667</td>
<td>9</td>
<td>A</td>
</tr>
<tr>
<td>2010</td>
<td>North Carolina Loc</td>
<td>99.59287</td>
<td>10</td>
<td>A</td>
</tr>
<tr>
<td>2010</td>
<td>Maine Local</td>
<td>96.34939</td>
<td>11</td>
<td>A-</td>
</tr>
<tr>
<td>2010</td>
<td>South Dakota PERS</td>
<td>96.30235</td>
<td>12</td>
<td>A-</td>
</tr>
<tr>
<td>2010</td>
<td>Delaware State Emp</td>
<td>95.95045</td>
<td>13</td>
<td>A-</td>
</tr>
<tr>
<td>2010</td>
<td>North Carolina Tea</td>
<td>95.36732</td>
<td>14</td>
<td>A-</td>
</tr>
<tr>
<td>2010</td>
<td>Texas County &amp; Dis</td>
<td>89.35037</td>
<td>15</td>
<td>A-</td>
</tr>
<tr>
<td>2010</td>
<td>Minnesota State Em</td>
<td>87.29861</td>
<td>16</td>
<td>A-</td>
</tr>
<tr>
<td>2010</td>
<td>Oregon PERS</td>
<td>86.94427</td>
<td>17</td>
<td>A-</td>
</tr>
<tr>
<td>Year</td>
<td>Plan Type</td>
<td>Score</td>
<td>Rank</td>
<td>Grade</td>
</tr>
<tr>
<td>------</td>
<td>----------------</td>
<td>---------</td>
<td>------</td>
<td>-------</td>
</tr>
<tr>
<td>2010</td>
<td>University of Cali</td>
<td>86.71912</td>
<td>18</td>
<td>A-</td>
</tr>
<tr>
<td>2010</td>
<td>Florida RS</td>
<td>86.59335</td>
<td>19</td>
<td>A-</td>
</tr>
<tr>
<td>2010</td>
<td>Texas LECOS</td>
<td>86.26372</td>
<td>20</td>
<td>A-</td>
</tr>
<tr>
<td>2010</td>
<td>Georgia Teachers</td>
<td>85.74881</td>
<td>21</td>
<td>A-</td>
</tr>
<tr>
<td>2010</td>
<td>Texas ERS</td>
<td>85.39764</td>
<td>22</td>
<td>B+</td>
</tr>
<tr>
<td>2010</td>
<td>Indiana PERF</td>
<td>85.18651</td>
<td>23</td>
<td>B+</td>
</tr>
<tr>
<td>2010</td>
<td>Washington Teacher</td>
<td>84.67608</td>
<td>24</td>
<td>B+</td>
</tr>
<tr>
<td>2010</td>
<td>Wyoming Public Emp</td>
<td>84.595</td>
<td>25</td>
<td>B+</td>
</tr>
<tr>
<td>2010</td>
<td>California PERF</td>
<td>83.37144</td>
<td>26</td>
<td>B+</td>
</tr>
<tr>
<td>2010</td>
<td>Illinois Municipal</td>
<td>83.25362</td>
<td>27</td>
<td>B+</td>
</tr>
<tr>
<td>2010</td>
<td>Texas Teachers</td>
<td>82.93626</td>
<td>28</td>
<td>B+</td>
</tr>
<tr>
<td>2010</td>
<td>Texas Municipal</td>
<td>82.93338</td>
<td>29</td>
<td>B+</td>
</tr>
<tr>
<td>2010</td>
<td>Nebraska Schools</td>
<td>82.42578</td>
<td>30</td>
<td>B+</td>
</tr>
<tr>
<td>2010</td>
<td>Utah Noncontributo</td>
<td>82.235</td>
<td>31</td>
<td>B+</td>
</tr>
<tr>
<td>2010</td>
<td>Iowa PERS</td>
<td>81.3704</td>
<td>32</td>
<td>B</td>
</tr>
<tr>
<td>2010</td>
<td>Vermont State Empl</td>
<td>81.15081</td>
<td>33</td>
<td>B</td>
</tr>
<tr>
<td>2010</td>
<td>Missouri Local</td>
<td>81.04596</td>
<td>34</td>
<td>B</td>
</tr>
<tr>
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<td>Massachusetts SERS</td>
<td>80.95523</td>
<td>35</td>
<td>B</td>
</tr>
<tr>
<td>2010</td>
<td>Missouri State Emp</td>
<td>80.41462</td>
<td>36</td>
<td>B</td>
</tr>
<tr>
<td>2010</td>
<td>Georgia ERS</td>
<td>80.06082</td>
<td>37</td>
<td>B</td>
</tr>
<tr>
<td>2010</td>
<td>Missouri PEERS</td>
<td>79.05542</td>
<td>38</td>
<td>B</td>
</tr>
<tr>
<td>2010</td>
<td>Idaho PERS</td>
<td>79.03002</td>
<td>39</td>
<td>B</td>
</tr>
<tr>
<td>2010</td>
<td>New Mexico PERF</td>
<td>78.47799</td>
<td>40</td>
<td>B</td>
</tr>
<tr>
<td>2010</td>
<td>Minnesota Teachers</td>
<td>78.45047</td>
<td>41</td>
<td>B</td>
</tr>
<tr>
<td>2010</td>
<td>Missouri Teachers</td>
<td>77.70221</td>
<td>42</td>
<td>B</td>
</tr>
<tr>
<td>2010</td>
<td>New Jersey Police</td>
<td>77.05897</td>
<td>43</td>
<td>B-</td>
</tr>
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A snapshot of the complete rank of all pension plans from fiscal year 2001 to 2011, Table 4 shows the ranking and rating for pension plans in 2010 and 2011 only. Actuarial funding ratio in column (3) is calculated as in Eq. (1). “Ranking” in column (4) is a simple rank (descending) of actuarial funding ratio. In column (5) We assign each pension plan a letter rating based on rating structure denoted in Table 2, with A denoting the healthiest pension plans and F the worst plans.

Six pension plans have the highest A ratings in fiscal year 2011: (1) NY State & Local Employee, (2) NY State & Local Police and Firefighters, (3) South Dakota PERS, (4) Delaware State Employees, (5) Maine Local Employees, and (6) TN State and Teachers. Six pension plans have the lowest F ratings in fiscal year 2011: (1) Illinois Teachers, (2) Illinois Universities, (3) Indiana Teachers, (4) Missouri DOT and Highway, (5) Kentucky ERS, and (6) Illinois SERS.

4.2.2 Ranking Pension Plans by Risky Asset Allocation (Equities + Alternatives)

Table 5. Ranking Pension Plans by Risky Asset Allocation

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Table 5 shows the ranking and rating for pension plans in fiscal year 2010 and 2011 based on the risky asset allocation percentage. “Ranking” in column (4) is a simple rank (ascending) of risky asset allocation. In column (5) we assign each pension plan a letter rating based on rating structure denoted in Table 2, with A denoting the safest pension plans and F the riskiest plans.

Pension plans have the highest A ratings (or safest pension plans) in fiscal year 2011 are as follows: (1) Nebraska Schools, (2) Missouri DOT and Highway, (3) Arizona Public Safety, and (4) several Washington state pension plans. The following pension plans are rated as “riskiest”: (1) Mississippi PERS, (2) Georgia Teachers, (3) Delaware State Employees, (4) Georgia ERS, (5) Louisiana Teachers, (6) Minnesota Teachers, (7) Minnesota PERF, and (8) Missouri Local Employees.

4.2.3 Ranking Pension Plans by a Combination of Variables

We now use a combination of 10 variables to rate pension plans, including (1) Actuarial Funding Ratio, (2) Risky Asset Allocation %, (3) % of Annual Required Contribution Paid, (4) 1-Year Actual Return of Pension Assets, (5) Actuarial rate (Pension Liab. Discount Rate), (6) Projected Total Annual Required Contribution as a % of Payroll, (7) Total Normal Cost as a % of Payroll, (8) Inflation Rate Assumption, (9) Active to Retired Employee Ratio, and (10) % of Unionized Employees. We here use both a simple ranking and a PCA method.

A. A Simple Ranking Method

With a simple ranking method, We rank each of the 10 variables (mentioned in the above section) into 10 groups from the best to the worst, and then We sum all the ranks for these 10 variables –this is called “Aggregate Rank”, which ranges from 1 to 100 (10 variables × 10 ranks = 100). We sort this “Aggregate Rank” into 10 groups and assign the letter rating (as shown in the rating structure of Table 2), with A denoting the best pension plans and F the worst plans.

Table 6. Ranking Pension Plans based on Multivariable Variables: A Simple Ranking Method

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Table 6 shows the “Aggregate Rank” and rating for pension plans in fiscal year 2010 and 2011 based on these 10 variables. Five pension plans have the highest A or A- ratings in fiscal year 2011: (1) Texas Teachers, (2) Virginia Retirement, (3) Missouri PEERS, (4) New Mexico PERF, and (5) Delaware State Employees. Five pension plans have the lowest F or D ratings in fiscal year 2011: (1) Pennsylvania School, (2) Louisiana Teachers, (3) Texas ERS, (4) Kentucky ERS, and (5) Illinois Teachers. This rating framework is more comprehensive and accurate than previous method which only uses one single rating variable. It paints a colorful picture of the US public pension funds status.

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The rationale is that pension plans have a number of important dimensions while only using pension actuarial ratio or risky asset allocation to rank them might not be an optimal way.

B. PCA Method

Table 7. The Result of PCA Method

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Panel B: Eigenvectors

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<th>Prin3</th>
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Panel C: Eigenvectors

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Table 7 shows the result of PCA method. It shows the first principal component explains 62.60% of total variance and the first 7 principal components (each with an Eigenvalue > 1) explain all variance. As the first principal component explains a fairly large proportion of total variance, we use the first principal component in my analysis.
Table 8. Ranking Pension Plans based on Multivariable Variables: PCA Method

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</tr>
<tr>
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<tr>
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<tr>
<td>2010</td>
<td>Kentucky County</td>
<td>A</td>
</tr>
<tr>
<td>2010</td>
<td>North Carolina Tea</td>
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</tr>
<tr>
<td>2010</td>
<td>Oregon PERS</td>
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<tr>
<td>2010</td>
<td>Washington LEOFF P</td>
<td>A</td>
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<tr>
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<td>Nevada Regular Emp</td>
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<tr>
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<td>New Hampshire Reti</td>
<td>B</td>
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<td>Rhode Island ERS</td>
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</table>
Table 8 shows the letter ranking of all pension plans (during 2010 and 2011) using PCA method. Seven pension plans have the highest A or A- ratings in fiscal year 2011: (1) Kentucky Teachers, (2) Kentucky County, (3) Minnesota PER, (4) Arizona Public Safety, (5) Delaware State Employee, (6) Missouri PEERS, and (7) Missouri State Employee. Six pension plans have the lowest F or D ratings in fiscal year 2011: (1) Kentucky ERS, (2) Montana PERS, (3) Texas ERS, (4) North Dakota PERS, (5) Pennsylvania School, and (6) Virginia Retirement. The rating results are consistent with previous results.

5. Conclusions

The 50 states across the US are currently facing a big issue with their government-sponsored pension plans. As the first comprehensive study on the current state of public pension plans, this study has important impact on the American people’s retirement security. It provides the first rating of all the government pension plans after incorporating a number of important dimensions, including pension funding levels, financial health, investment risk, state fiscal constraints, and workforce/retirees demographics. We use (1) actuarial funding ratio, (2) risky asset allocation percentage, and (3) a combination of 10 variables as ranking variables to rate all pension plans. These variables include funding ratio, risky asset allocation, % of annual required contribution paid, 1-year actual return of pension assets, actuarial discount rate, projected total annual required Contribution as a % of payroll, total normal cost as a % of payroll, inflation rate assumption, active to retired employee ratio, and % of unionized employees. When considering a combination of 10 variables, we use both a simple “aggregate” ranking method and a principal component analysis method.

Our study complements previous studies on the significant issue of the US public pension funds. It has been estimated that the total pension liabilities for the 50 states to be $2.97 trillion in 2008 (Novy-Marx and Rauh, 2009) and the “already-promised” benefits between $3.21 and $5.2 trillion (Novy-Marx and Rauh, 2010). Rauh (2011) estimates that the latest total pension liabilities to be $7.03 trillion, mainly due to the decreased Treasury yields, which is used to discount future pension payments. The pension funding gap has been estimated to be between $1.27 and $3.26 trillion (Novy-Marx and Rauh, 2009). Similar findings have been reported by several large consulting firms and research institutions that have focus on public pension issues for a long time. Our study helps public employees/retirees to understand their pension plans, and to raise the public awareness of the pension issues.

One limitation of this study is that when we use risky asset allocation to rate pension funds, risky asset allocation is the percentage of a pension plan assets invested in equity market and alternatives (i.e., private equity and venture capital). Jin et al. (2006) propose an innovative measure of pension risk, pension asset beta, which is estimated as the weighted average beta of all asset classes in a pension fund. Future research can use this alternative measure of pension investment risk. In addition, the effects of pension underfunding and investment risk on a state government fiscal policy, tax rate, or municipal bond yield can be other interesting research questions.

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References


Notes

Note 1. See the Public Fund Survey (http://www.publicfundsurvey.org/publicfundsurvey/scorecard.asp), jointly sponsored by the National Association of State Retirement Administrators and the National Council on Teacher Retirement.

Note 2. The difference of estimated pension shortfall between different methods is mainly due to the discount rate (or the denominator) used to calculate the present value of projected total future pension benefits. State governments and the Public Fund Survey use actuarial rate (based on pension asset long-term expected investment return), which is generally 8%, as a discount rate, while economists prefer to use Treasury yield, which is much less than the actuarial rate, as a discount rate. High (low) discount rate translates to low (high) pension liabilities. Also see Congressional Testimony by Joshua Rauh, Feb. 24, 2011 for the hearing on “The Role of Public Employee Pensions in Contributing to State Insolvency and the Possibility of a State Bankruptcy Chapter” (http://judiciary.house.gov/hearings/pdf/Rauh02142011.pdf).


Note 4. As another example, a $650 million shortfall of Pittsburg’s pension system dried up “funds for the sustained investments that remade Pittsburgh after the 1980s collapse of the steel industry” (Green, 2011, p1). In order to deal with this situation, Mayor Luke Ravenstahl created a 1% fair-share tax for the privilege of attending colleges in the city of Pittsburgh (Maher, 2009).

Note 5. Note that although there are no formal laws regulating state government financial information disclosure, both Securities Exchange Commissions and Government Accounting Standard Board have specific requirements on filing state government financial report.
