Public Pension Plan Volatility
What Can We do?

NCPERS 2019 Public Pension Funding Forum
September 11 – 13
New York, NY

Gene Kalwarski, FSA
Topics for Discussion

- Volatility From an Actuary’s Viewpoint
- Consequences of Volatility
- Negative Cash Flows
- Your Options to Manage the Impact of Volatility
- How to Anticipate for Volatility
Pension Plan Volatility – Investment Perspective
Actuary’s Perspective – No Volatility

Valuation as of June 30, 2018 to 2038

- Actuarial Liability
- Actuarial Value of Assets
- Market Value of Assets

Member Contribution, Employer Contribution, Baseline

Fiscal Year Ending June 30, 2018 to 2038
Actuary’s Perspective – With Volatility

-49.67% 119.79% -0.38% # 37.99% 6.91% ### 0.71% # #

67% 35% 45% 60% 73% 76% 76% 88% 106% 115% 116%

$0.0 $2.0 $4.0 $6.0 $8.0 $10.0 $12.0 $14.0 $16.0

2018 2020 2022 2024 2026 2028 2030 2032 2034 2036 2038

Valuation as of June 30,

Actuarial Liability
Actuarial Value of Assets
Market Value of Assets

Member Contribution
Employer Contribution
Baseline
Is Volatility Really a Problem?

- Pension plans have long-term horizons
- Over the long term equities have met assumptions
Yes! Because of Negative Cash Flows
Negative Cash Flows

• Greatest misunderstood risk facing DB plans

• As plan’s mature while active workforce declines, the risk spirals

• The greater the negative cash flow,
  – the more vulnerable a plan is to market volatility
  – the greater the difference between “reported” and actual returns
Without Negative Cash Flows
Market Volatility Can be Managed

<table>
<thead>
<tr>
<th>Year</th>
<th>New Cash Flow</th>
<th>Level Returns</th>
<th>Volatile Returns</th>
<th>ASSETS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>8.0%</td>
<td>-2.0%</td>
<td>$1,080</td>
</tr>
<tr>
<td>1</td>
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<td>15.0%</td>
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<tr>
<td>7</td>
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<td>18.0%</td>
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<td>8.0%</td>
<td>21.0%</td>
<td>$1,999</td>
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<tr>
<td>9</td>
<td>$ -</td>
<td>8.0%</td>
<td>24.0%</td>
<td>$2,159</td>
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<tr>
<td>10</td>
<td>$ -</td>
<td>8.0%</td>
<td>8.0%</td>
<td>$2,159</td>
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</tbody>
</table>

Reported return = 8.0%
Actual return = 8.0%
Asset Loss/(Gain) = $0
% of Level Assets = 100%
Add in Negative Cash Flows

<table>
<thead>
<tr>
<th>Year</th>
<th>New Cash Flow</th>
<th>Level Returns</th>
<th>Volatile Returns</th>
<th>ASSETS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>8.0%</td>
<td>-2.0%</td>
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<tr>
<td>1</td>
<td>$ (60.0)</td>
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<td></td>
<td>$1,018</td>
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<td>8.0%</td>
<td>8.0%</td>
<td>$1,104</td>
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<td>11.0%</td>
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<tr>
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<td>$ (60.0)</td>
<td>8.0%</td>
<td>15.0%</td>
<td>$1,157</td>
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<tr>
<td>8</td>
<td>$ (60.0)</td>
<td>8.0%</td>
<td>18.0%</td>
<td>$1,188</td>
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<td>9</td>
<td>$ (60.0)</td>
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<td>21.0%</td>
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<tr>
<td>10</td>
<td>$ (60.0)</td>
<td>8.0%</td>
<td>24.0%</td>
<td>$1,256</td>
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</tbody>
</table>

Reported return = 8.0%  
Actual return = 8.0%  
Asset Loss/(Gain) = $292  
% of Level Assets = 77%

Starting Assets: $1,000  
Net Cash Flow: -6.0%  
Net Cash Flow Growth: 0.0%  
Market Cycle: du

![Graph showing Level and Volatile Returns over 10 years](image-url)
# Growing Negative Cash Flows

<table>
<thead>
<tr>
<th>Year</th>
<th>New Cash Flow</th>
<th>Level Returns</th>
<th>Volatile Returns</th>
<th>ASSETS level</th>
<th>ASSETS volatile</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>$ (60.0)</td>
<td>8.0%</td>
<td>-2.0%</td>
<td>$1,018</td>
<td>$921</td>
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<td>-6.0%</td>
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<td>8.0%</td>
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<td>11.0%</td>
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<tr>
<td>7</td>
<td>$ (106.3)</td>
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<td>15.0%</td>
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<td>$ (116.9)</td>
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<td>18.0%</td>
<td>$939</td>
<td>$462</td>
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<tr>
<td>9</td>
<td>$ (128.6)</td>
<td>8.0%</td>
<td>21.0%</td>
<td>$880</td>
<td>$418</td>
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<tr>
<td>10</td>
<td>$ (141.5)</td>
<td>8.0%</td>
<td>24.0%</td>
<td>$803</td>
<td>$361</td>
</tr>
</tbody>
</table>

*Reported return:* 8.0%  
*Actual return:* 8.0%  
*Asset Loss/(Gain):* $443  
*% of Level Assets:* 45%
Devastating Impact of Pension Volatility – 2000’s

- Higher level of assets than ever before
- Higher allocation to risky assets than ever before
- Higher level of retiree liability than ever before
- Never have actuarial assumptions been as aggressive
- Higher benefit levels than ever before
- More competition for the pension contribution
- Dot Com and the Great Recession
- All the above combined led to the “Perfect Storm”
Net Cash Flow

- 5th to 25th Percentile
- 25th to 50th Percentile
- 50th to 75th Percentile
- 75th to 95th Percentile

Years: 2001 to 2019
Impact of the 2008 Market Downturn
Given the Situation in the 1970’s

- Fixed income return: 5%
- Equity return: -26%

- Equity Exposure: 30%
- Plan Funding Ratio: 60%
- % Retired Liability: 20%
- Discount Assumption: 6.5%
- Asset Smoothing: 5
- Amortization of Loss: 40

Recognized Loss as a % of Payroll: 3.9%
Amortization of Loss as a % of Payroll: 0.3%
Impact of Increasing Equity Exposure

- Fixed income return: 5%
- Equity return: -26%
- Equity Exposure: 65%
- Plan Funding Ratio: 60%
- % Retired Liability: 20%
- Discount Assumption: 6.5%
- Asset Smoothing: 5
- Amortization of Loss: 40

- Recognized Loss as a % of Payroll: 8.1%
- Amortization of Loss as a % of Payroll: 0.5%

Payroll
Recognized Loss
Amortization of Loss
Impact of Increased Funded Status

- Fixed income return: 5%
- Equity return: -26%
- Equity Exposure: 65%
- Plan Funding Ratio: 100%
- % Retired Liability: 20%
- Discount Assumption: 6.5%
- Asset Smoothing: 5
- Amortization of Loss: 40

Recognized Loss as a % of Payroll: 13.4%
Amortization of Loss as a % of Payroll: 0.9%
Impact of Increased Plan Maturity

- Fixed income return: 5%
- Equity return: -26%

- Equity Exposure: 65%
- Plan Funding Ratio: 100%
- % Retired Liability: 65%
- Discount Assumption: 6.5%
- Asset Smoothing: 5
- Amortization of Loss: 40

Recognized Loss as a % of Payroll: 30.7%
Amortization of Loss as a % of Payroll: 2.0%
Impact of Increased Earnings Expectations

- Fixed income return: 5%
- Equity return: -26%

- Equity Exposure: 65%
- Plan Funding Ratio: 100%
- % Retired Liability: 65%
- Discount Assumption: 8.0%
- Asset Smoothing: 5
- Amortization of Loss: 40

- Recognized Loss as a % of Payroll: 32.9%
- Amortization of Loss as a % of Payroll: 2.6%

Bar chart showing:
- Payroll
- Recognized Loss
- Amortization of Loss
Impact of Shorter Smoothing Period

- **Fixed Income Return**: 5%
- **Equity Return**: -26%

- **Equity Exposure**: 65%
- **Plan Funding Ratio**: 100%
- **% Retired Liability**: 65%
- **Discount Assumption**: 8.0%
- **Asset Smoothing**: 3
- **Amortization of Loss**: 40

- **Recognized Loss as a % of Payroll**: 54.8%
- **Amortization of Loss as a % of Payroll**: 4.3%
Impact of Shorter Amortization Period

- Fixed income return: 5%
- Equity return: -26%

- Equity Exposure: 65%
- Plan Funding Ratio: 100%
- % Retired Liability: 65%
- Discount Assumption: 8.0%
- Asset Smoothing: 3
- Amortization of Loss: 15

- Recognized Loss as a % of Payroll: 54.8%
- Amortization of Loss as a % of Payroll: 5.9%
Consequences of Volatility
Consequences of Volatility

- Governmental Budget Strains
- Decline of DB Plans
- Inadequate Pensions
- Loss of Tax Revenue
- Decline in Economic Spending
Poster Children

ILLINOIS PENSION REFORM HAS MADE FOR SOME STRANGE POLITICS

America's Pension Crisis

Welcome to Rhode Island
The Ocean State
Donald L. Carcieri, Governor

Welcome to Vallejo

Central States Pension Fund
Rescue Plan

Detroit's Bankruptcy Plan

Chicago's Underfunded Pensions

Pension Crisis!
Ways to Manage the Impact of Volatility

• Less Risky Investments
• Actuarial Smoothing Techniques
• Contribution Smoothing
• Risk Sharing Plans
• PayGo
• Anticipate Volatility
## Traditional Approach Actuarial Disclosure

### Summary of Principal Results

<table>
<thead>
<tr>
<th>Participant Counts</th>
<th>7/1/2015</th>
<th>7/1/2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actives</td>
<td>295</td>
<td>268</td>
</tr>
<tr>
<td>Participants with Deferred Benefits</td>
<td>348</td>
<td>342</td>
</tr>
<tr>
<td>Retirees and Disabled</td>
<td>955</td>
<td>969</td>
</tr>
<tr>
<td>Beneficiaries</td>
<td>223</td>
<td>222</td>
</tr>
<tr>
<td>Total</td>
<td>1,821</td>
<td>1,801</td>
</tr>
</tbody>
</table>

| Annual Salaries of Active Members | $23,265,360 | $21,492,384 |
| Annual Retirement Allowances      | $39,365,610 | $40,392,906 |

### Assets and Liabilities

<table>
<thead>
<tr>
<th></th>
<th>7/1/2015</th>
<th>7/1/2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actuarial Accrued Liability</td>
<td>$525,930,801</td>
<td>$522,542,498</td>
</tr>
<tr>
<td>Actuarial Value of Assets</td>
<td>376,332,776</td>
<td>375,071,975</td>
</tr>
<tr>
<td>Unfunded Actuarial Liability / (Surplus)</td>
<td>$149,598,025</td>
<td>$147,470,523</td>
</tr>
<tr>
<td>Funding Ratio (Actuarial Value of Assets)</td>
<td>71.56%</td>
<td>71.78%</td>
</tr>
<tr>
<td>Funding Ratio (Market Value of Assets)</td>
<td>70.02%</td>
<td>67.09%</td>
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<tr>
<td>Present Value of Accrued Liability</td>
<td>$509,442,056</td>
<td>$508,437,615</td>
</tr>
<tr>
<td>Market Value of Assets</td>
<td>368,266,074</td>
<td>350,581,323</td>
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<tr>
<td>Unfunded FASB Accrued Liability</td>
<td>$141,175,982</td>
<td>$157,856,292</td>
</tr>
<tr>
<td>Accrued Benefit Funding Ratio</td>
<td>72.29%</td>
<td>68.95%</td>
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### Actuarial gain/(loss)

<table>
<thead>
<tr>
<th></th>
<th>7/1/2015</th>
<th>7/1/2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liability gain/(loss)</td>
<td>$5,093,044</td>
<td>$1,608,028</td>
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<tr>
<td>Actuarial asset gain/(loss)</td>
<td>(2,016,676)</td>
<td>(6,626,834)</td>
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<tr>
<td>Net Transfer gain/(loss)</td>
<td>24,173</td>
<td>(297,812)</td>
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<tr>
<td>Total actuarial gain/(loss)</td>
<td>$3,100,541</td>
<td>($5,316,618)</td>
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### Annual Contribution Requirement at End of Year

<table>
<thead>
<tr>
<th></th>
<th>FYE 2016</th>
<th>FYE 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Cost (with interest and expense load)</td>
<td>$1,960,945</td>
<td>$1,825,059</td>
</tr>
<tr>
<td>UAL Amortization (with interest)</td>
<td>17,915,982</td>
<td>18,523,911</td>
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<tr>
<td>Annual Contribution Requirement</td>
<td>$19,876,927</td>
<td>$20,348,970</td>
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Anticipate Volatility
Stochastic Stress Testing

Contribution Rate Projection
How to Think About Stress Testing