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*Public Pension Funding Risk:  
Pennsylvania in the  
National Context*

**Pennsylvania Independent Fiscal Office  
Annual Presentation  
Harrisburg, PA**

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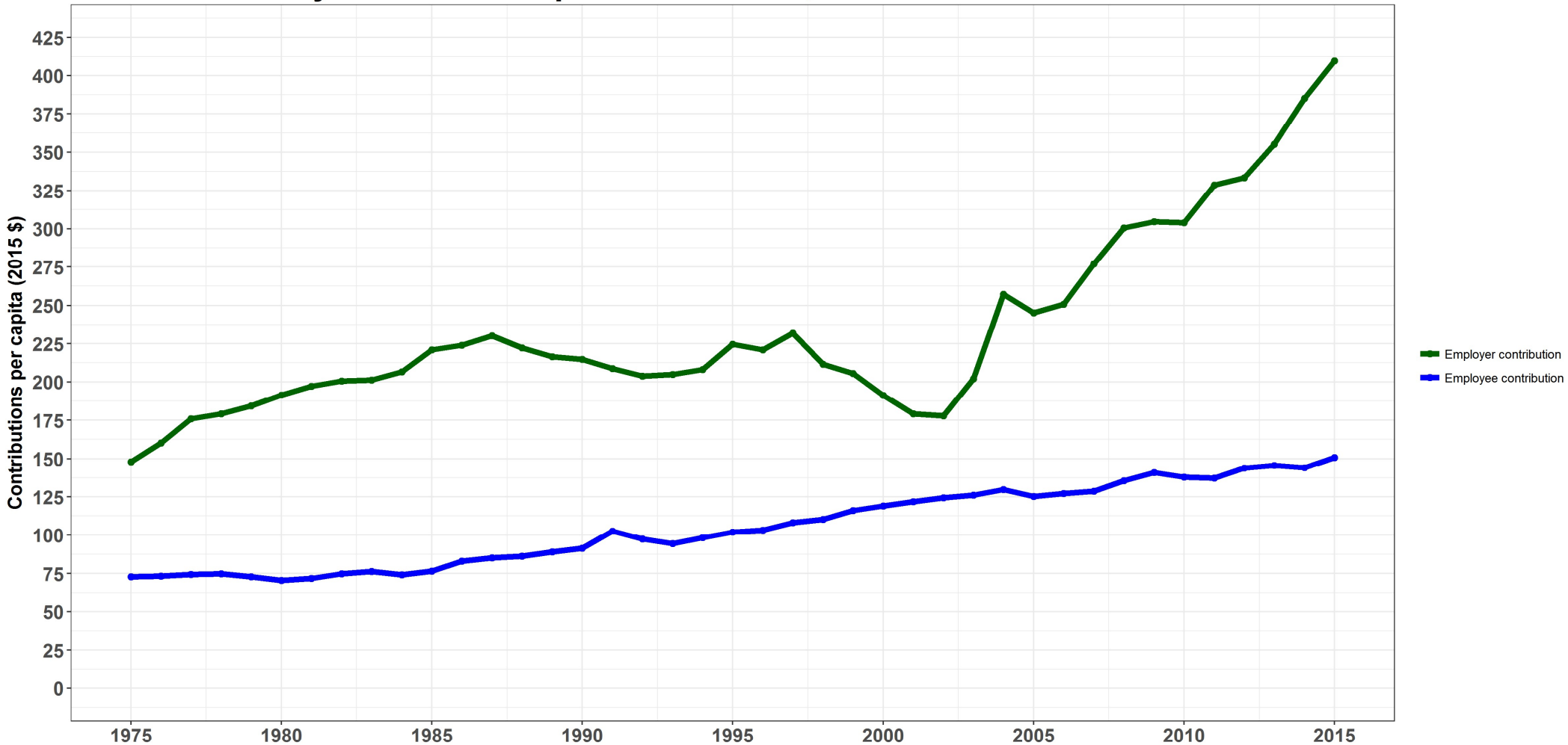
**November 15, 2016**

# Main points

- Despite large contribution increases (> avg in PA) and benefit cuts (primarily for new workers), U.S. public pension underfunding remains near record, almost as severe as at end of recession
- Underfunding varies greatly. PA pensions significantly underfunded.
- As interest rates fell and investing environment became more difficult, public pension plans maintained earnings assumptions and increased investment risk. Private plans and plans in other countries reduced earnings assumptions.
- Incentives & institutions encourage risk taking. Lowering earnings assumptions would require large contribution increases.
- Risk to taxpayers & stakeholders in govt is 3-4x greater than in 1990s. Creates roller coaster rides and difficult political choices even if earnings assumptions achieved in the long run.
- Smoothing contributions cannot make risk go away. Mature plans (e.g., PA) tend to have greater risk. Shared-risk provisions might slightly dampen incentives that favor risk taking.
- PA and most other states need risk-taking to work out well or else contributions will rise significantly. Already public pension plans generally have bad news in the bank for FY 2015 and 2016 that will drive contributions up. Plans and govts should evaluate risk carefully, with an eye toward reducing risk.

# Real per-capita employer and employee pension contributions

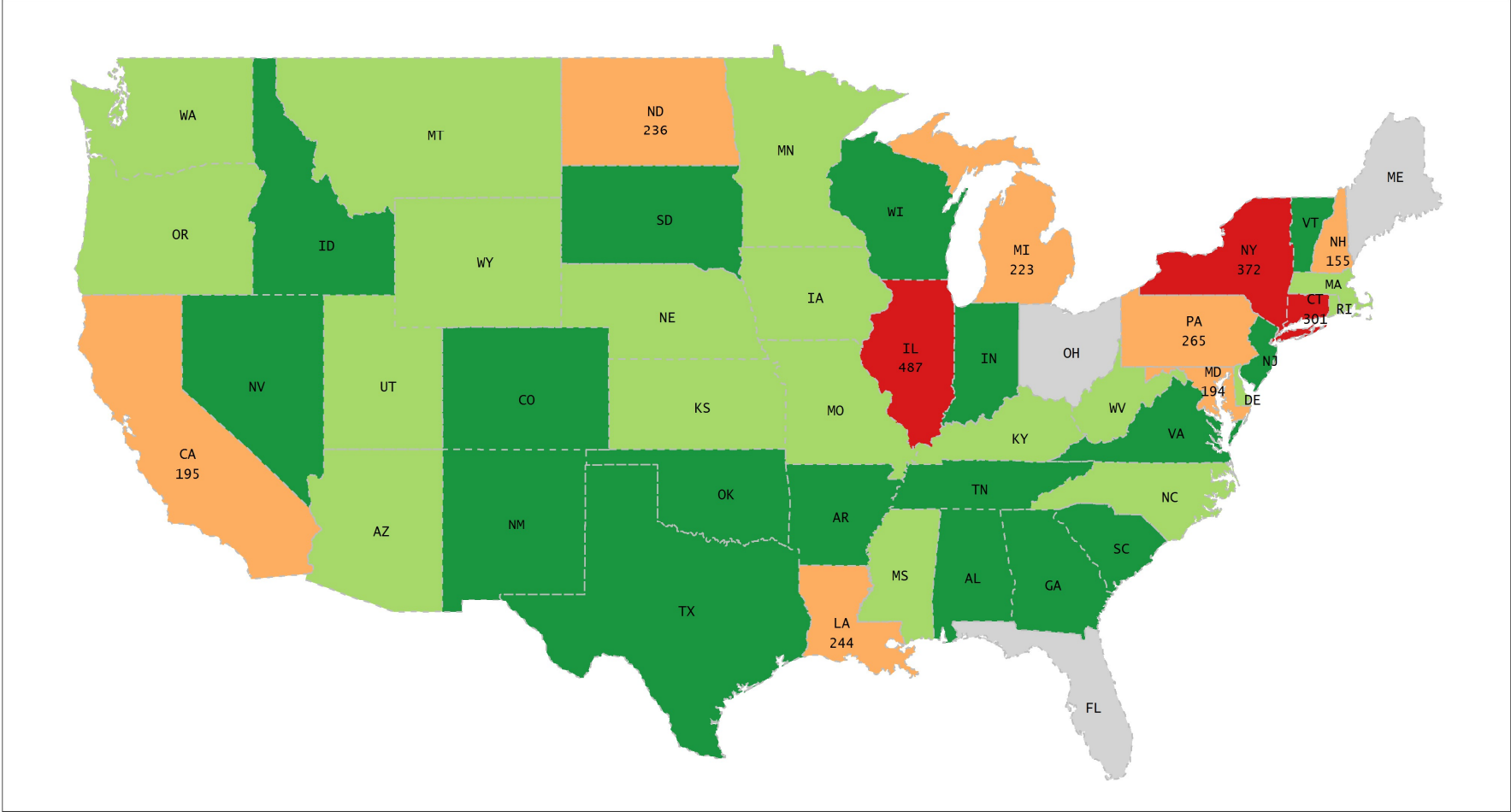
## State and locally administered plans combined, U.S. as a whole



Contributions from U.S. Bureau of the Census Annual Retirement Systems Survey  
Adjusted for inflation with GDP price index (BEA)

# Change in state & local government pension contributions

Inflation-adjusted dollars per capita, 2007 to 2015



change in 2015 dollars per capita

- Decrease
- >\$0 - \$75
- >\$75 - \$150
- >\$150 - \$300
- >\$300

Source: Rockefeller Institute analysis of Annual Survey of Public Pensions, U.S. Bureau of the Census  
 Note: Due to extraordinary contributions in West Virginia in 2007 and Alaska in 2015, contributions for 2008 and 2014 were used for these states and years, respectively

# Unfunded public pension liability as percent of GDP

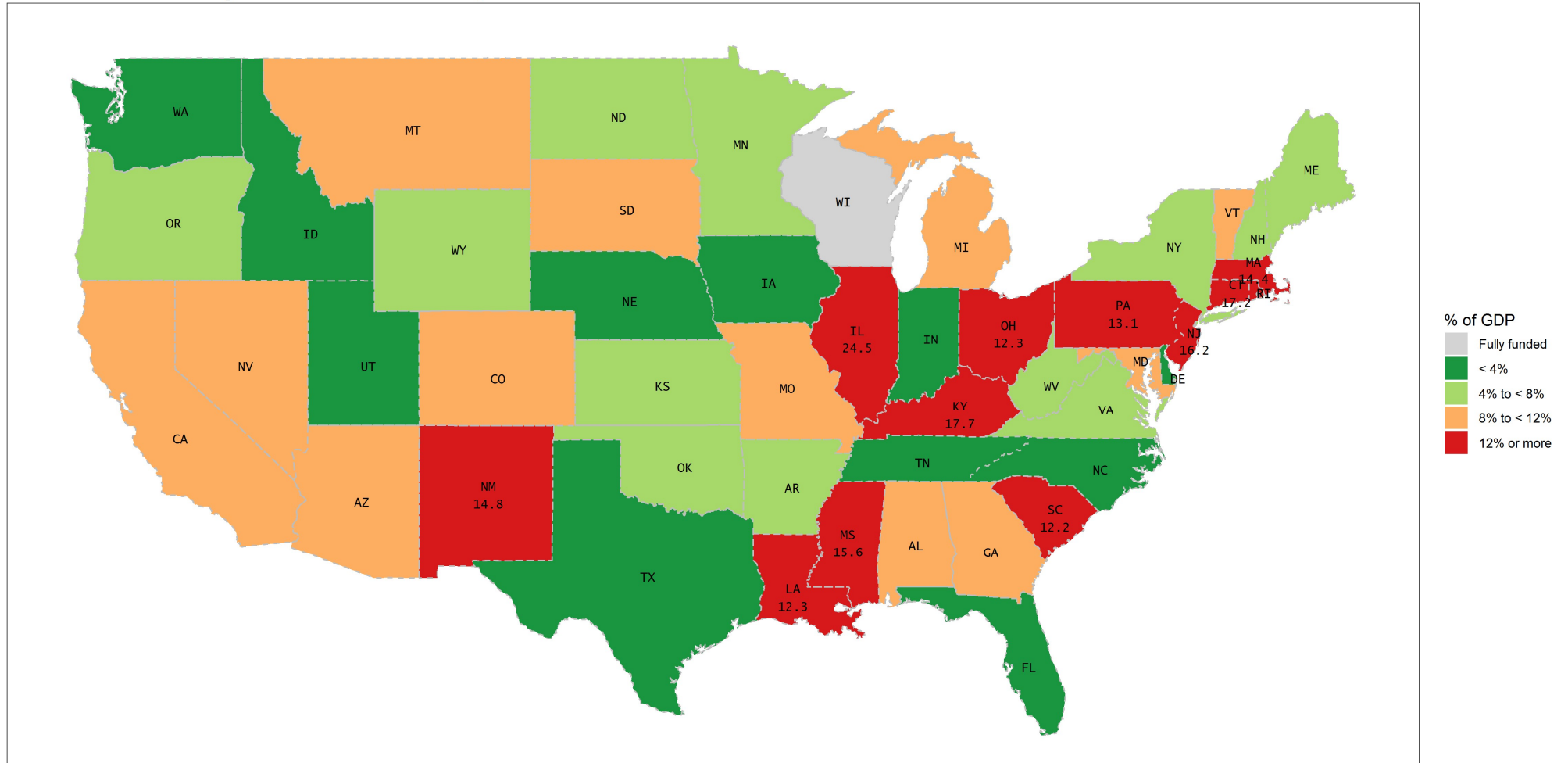
## State and local government defined benefit pension plans



Source: Federal Reserve Board, Financial Accounts of the United States, Table L.120.b  
These numbers differ from actuaries' estimates, and for recent years reflect discounting at 5%.

# Unfunded liability as % of state gross domestic product, 2013

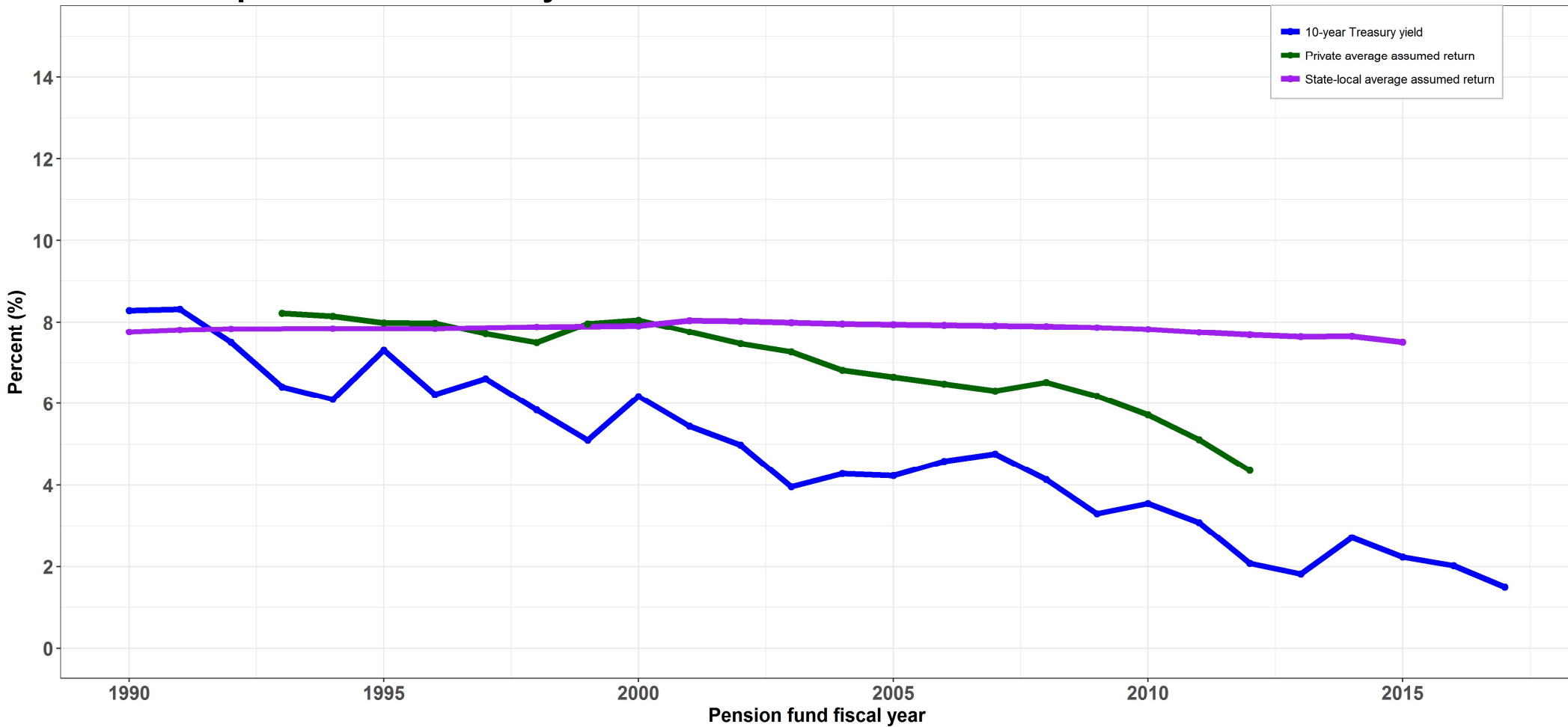
## State & locally administered plans combined



Source: Federal Reserve Board Enhanced Financial Accounts  
<https://www.federalreserve.gov/apps/fof/efa/efa-project-state-local-government-defined-benefit-pension-plans.htm>

# Assumed investment returns and risk-free returns

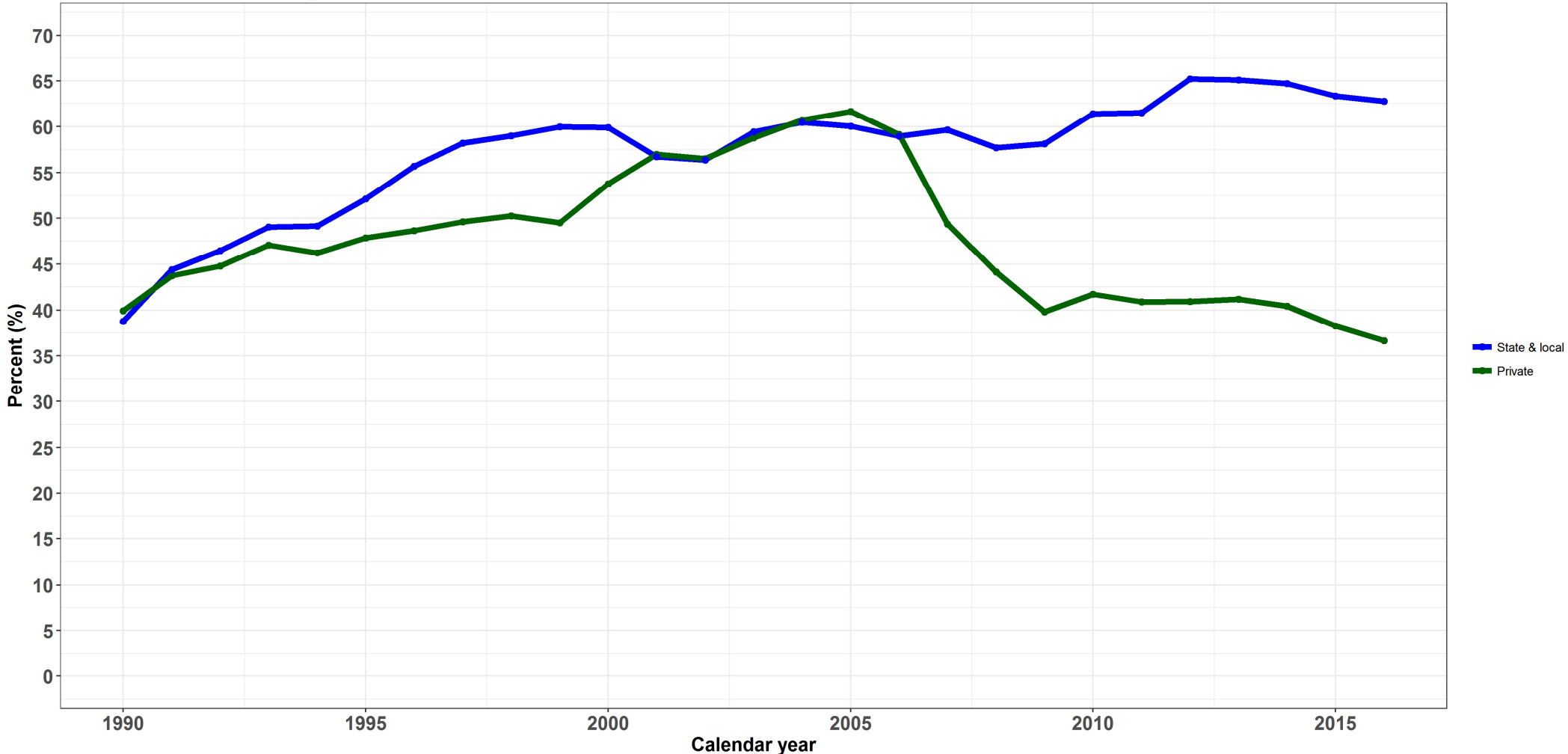
## Public and private retirement systems



Public plan assumptions from Public Plans Database, Center for Retirement Research  
Private plan assumptions provided by Andonov, Bauer, Cremers  
10-Year Treasury yield from Federal Reserve Bank of St. Louis (FRED)

# Equity-like investments as percentage of invested assets

State and local government and private sector defined benefit pension plans



Source: Authors' analysis of Financial Accounts of the United States, Federal Reserve Board



“...gradually, U.S. public funds have become the biggest risk-takers among pension funds internationally.”

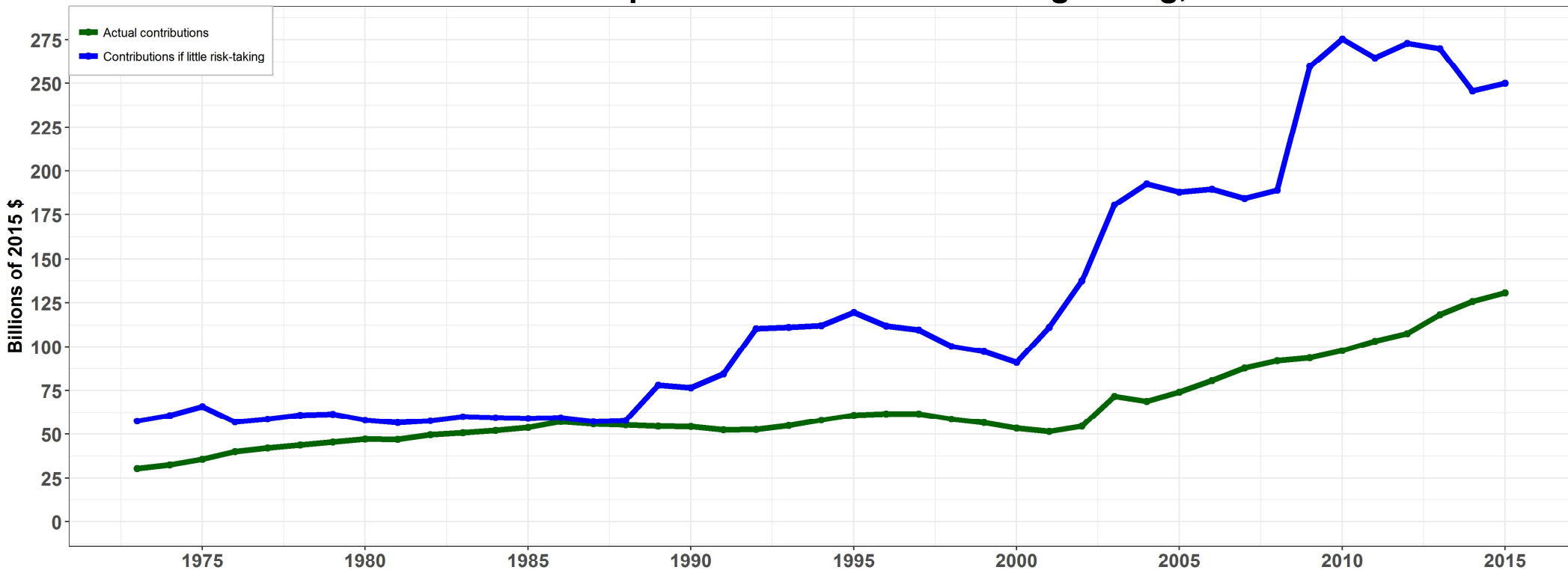
Aleksandar Andonov, Rob Bauer, and Martijn Cremers, “Pension Fund Asset Allocation and Liability Discount Rates,” *Available at SSRN 2070054*, March 2016,  
[http://papers.ssrn.com/sol3/Papers.cfm?abstract\\_id=2070054](http://papers.ssrn.com/sol3/Papers.cfm?abstract_id=2070054).

# Institutions and incentives encourage risk taking

- U.S. public plans calculate liabilities and contributions using earnings assumption based on plan portfolio rather than market rates (unlike U.S. private plans, generally unlike other countries). Higher earnings assumption:
  - Keeps contributions lower in the short run, attractive of course
  - Keeps reported liabilities lower, also attractive
  - Riskier assets needed to support higher assumptions
- Investment risk is taken by pension plans but borne by stakeholders in govt (moral hazard).
- Investment risk is taken now but largely borne in the future, often by different people: Asset smoothing and long, open amortization periods protect officials from risk in the short run, but cannot avoid risk over longer run, and potentially encourage it.
- Govts often have ability to underpay actuarial contributions, at least for a while, which can encourage risk taking.

# Governments hope that successful (but risky) investing will keep contributions low

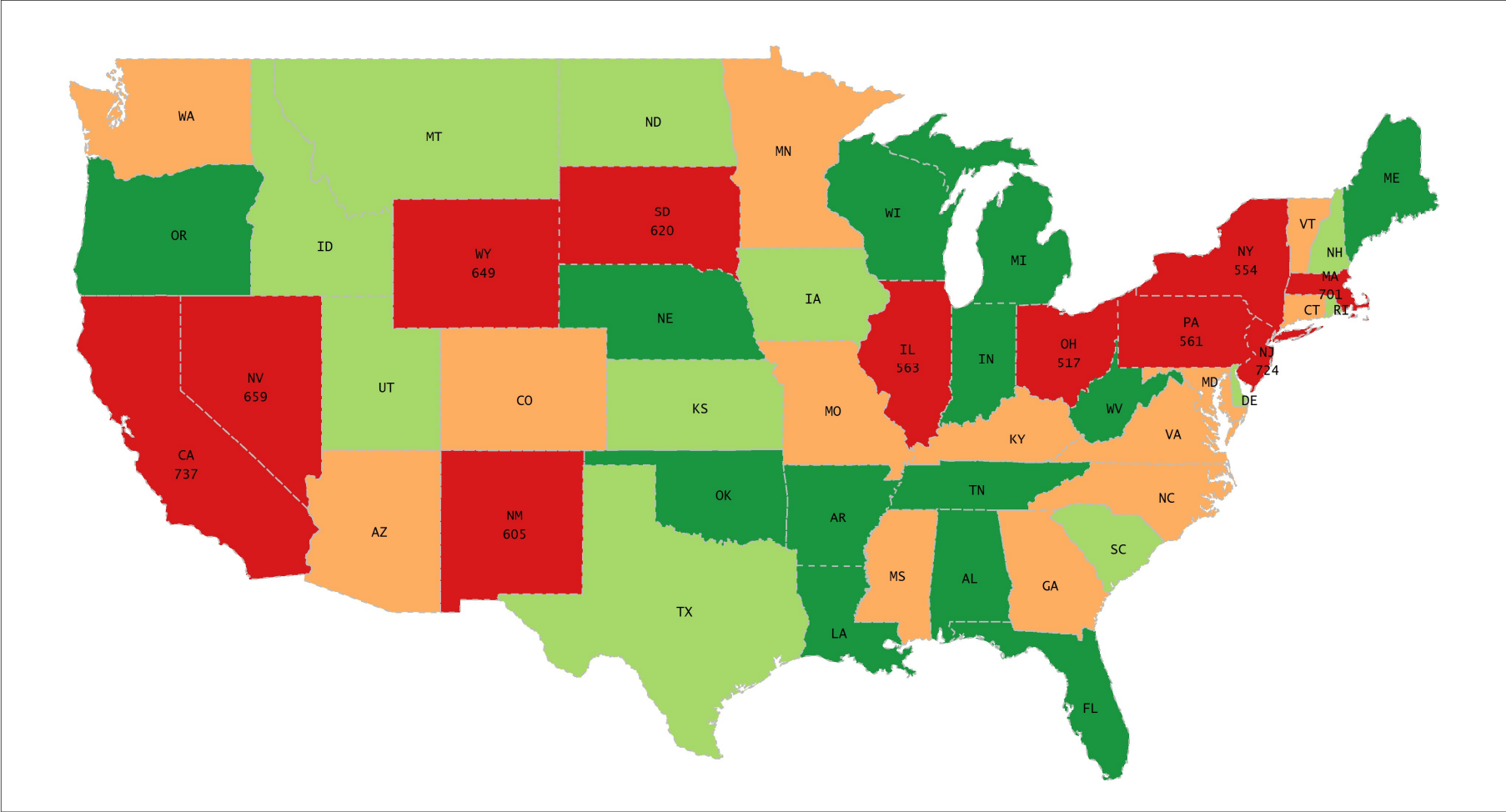
## State and local government inflation-adjusted pension contributions Versus contributions needed to keep unfunded liabilities from growing, if little risk taken



'Little-risk' contributions based on U.S. Bureau of Economic Analysis NIPA Table 7.24: Normal cost + interest on unfunded liability  
Actual contributions from U.S. Bureau of the Census Annual Retirement Systems Survey

# Employer contributions shortfall relative to normal cost plus interest, 2014

## Per capita, state & locally administered plans combined



Author's analysis and estimates based upon employer contributions from Census Bureau Annual Retirement System Survey (<https://www.census.gov/govs/retire>) normal costs from Bureau of Economic Analysis (<http://www.bea.gov/regional/xls/PensionEstimatesByState.xlsx>) and unfunded liabilities from Federal Reserve Board (<https://www.federalreserve.gov/apps/fof/efa/efa-project-state-local-government-defined-benefit-pension-plans.htm>) These numbers differ from actuaries' estimates, and reflect discounting at 5%.

# Consequences of a one standard deviation shortfall are 3-4x as great as in 1995, 10x vs 1985

- Typical plan has about a 1 in 6 chance of a single-year shortfall of at least 1 “standard deviation”
- For U.S. as a whole, today, that’s about \$425 billion. About 27% of all state-local taxes, up from 7.6% in 1995, 2.7% in 1985
- Even if amortized slowly\* it is a lot:
  - increased contributions of about \$23 billion now, rising 3% annually for 30 years (after which it is paid off)
  - **roughly equivalent to a 24 percent cut in all U.S. state-local highway capital spending, for 30 years**
  - *the result of a single year of moderately bad investment returns*
- Risks borne by current and future taxpayers and stakeholders in govt services, infrastructure. Also potentially borne by workers, retirees.
- Why the increase?
  1. Greater investment in risky assets
  2. Plans much larger now relative to economy and state-local budgets than 10-20 years ago
- Details are in the appendix

\* 30-year closed-period level percentage of pay, 7.5% interest, 3% growth

## Even if plans hit compound-return targets over 30 years, it will be a roller coaster ride. How will govts respond?

Three simulations, from our model, that hit 7.5% compound average return by year 30:

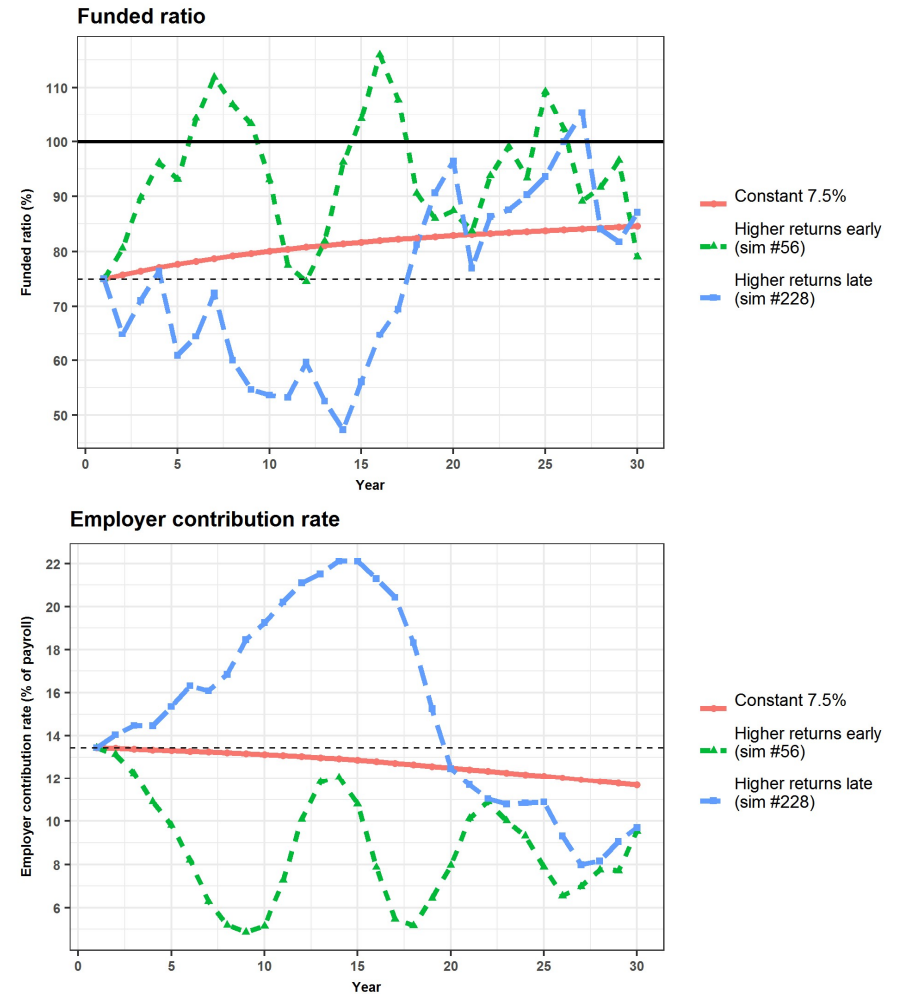
- 7.5% every year – (Red line)
- Higher returns in early years, lower later (Green)
- Lower returns in early years, higher later (Blue)

Plan is 75% funded in year 1

Will officials avoid “harvesting” gains when plan is overfunded? Will they pay full contributions when underfunded?

Volatility often will be much greater than this, as there is no guarantee that return targets will be hit even at 30 years.

Three simulations that achieve compound annual return of 7.5% at 30 years  
(Initial funded ratio of 75%)



# Observations from our modeling & analysis

- Contribution smoothing (e.g, asset smoothing, long amortization periods, caps, collars) cannot make investment risk go away. Pushes risk to the future, creates potential stress for pension plans.
- Mature pension plans (e.g., low # of active workers relative to # of retirees, and high cash outflows) are more affected by investment risk and timing of investment returns than less-mature plans. PA plans are very mature.
- Shared-risk provisions shift some risk from govts to workers and retirees. Might also slightly dampen incentives that favor risk taking. We plan to revise our models to allow risk-sharing provisions.

# Concluding comments

- PA and most other states need risk-taking to work out well or else contributions will rise significantly.
- The problem with risk is that it cuts in two directions: it could work out poorly if can't-happen-again events like the Great Recession, the dot-com bust, or the 1973-1974 bear market continue to happen or if there is a sustained period of low returns.
- Already public pension plans generally have bad news in the bank for FY 2015 and 2016 that will drive contributions up.
- Given that plans take risk but current and future stakeholders in govt bear risk, it is crucial to analyze risk carefully and disclose it to the right audiences.
- Plans and govts should evaluate risk and risk tolerance carefully, with an eye toward possibly reducing risk.



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# Consequences of a one standard deviation shortfall are 3-4x as great as in 1995, 10x vs 1985

Potential magnitude of public pension fund investment risk  
as % of taxes

| Pension fund fiscal year | Invested assets, (billions of 2016 \$)<br>(A) | Volatility (risk) for a portfolio with 8% expected return (Standard Deviation)<br>(B) | One standard-deviation risk, (billions of 2016 \$)<br>(C = A x B) | State & local government taxes, (billions of 2016 \$)<br>(D) | One standard-deviation risk, as % of taxes<br>(E = C ÷ D) |
|--------------------------|---|---|---|--|---|
| 1975                     | \$ 335  | 3.7%  | \$ 12.4   | \$ 516.6   | 2.4%  |
| 1985                     | 698   | 2.7%  | 18.8  | 685.3  | 2.7%  |
| 1995                     | 1,719   | 4.3%  | 73.9  | 978.3  | 7.6%  |
| 2016                     | 3,554   | 12.0%   | 426.5   | 1,576.8  | 27.0%   |
| 2016 / 1985              | 5.1   | 4.4   | 22.6  | 2.3  | 9.8   |
| 2016 / 1995              | 2.1   | 2.8   | 5.8   | 1.6  | 3.6   |

## Sources and notes:

- Volatility estimates for 1975, 1985, 1995 are from Biggs (2013); 2016 is authors' assumption. There is about a 1 in 6 chance of a shortfall of 1 standard deviation or larger in a single year, under plausible assumptions.
- Invested assets from Federal Reserve Board, Financial Accounts of the United States.
- Taxes from Bureau of Economic Analysis, NIPA Table 3.3.
- Taxes and assets are in fiscal year 2016 dollars, adjusted using GDP price index.
- Risk measure is for a single year. Longer-term investment risks are larger.