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ROCKEFELLER  
INSTITUTE  
OF GOVERNMENT**

State University of New  
York  
411 State Street  
Albany, New York 12203  
(518) 443-5522  
[www.rockinst.org](http://www.rockinst.org)

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## PENSION SIMULATION PROJECT

# Public Pension Funding Practices

**How These Practices Can Lead to  
Significant Underfunding or  
Significant Contribution  
Increases When Plans Invest in  
Risky Assets**

**Donald J. Boyd**

[donald.boyd@rockinst.suny.edu](mailto:donald.boyd@rockinst.suny.edu)

**Yimeng Yin**

[Yimeng.Yin@rockinst.suny.edu](mailto:Yimeng.Yin@rockinst.suny.edu)

**The Rockefeller Institute of Government  
State University of New York**

## HIGHLIGHTS

- Public pension funds provide benefits to nearly ten million people, invest over \$3.6 trillion in assets, and are deeply underfunded. These funds invest in stocks and other potentially volatile assets in the hope of achieving investment returns of about 7.5 percent when secure investments are paying only 2 to 3 percent. Consequently, investment results in any year could be much worse than expected, or much better.
- This investment risk is borne by current and future taxpayers and beneficiaries of government services and infrastructure investments. It also may be borne by government workers and retirees. Risks cut in both directions, but shortfalls are most worrisome as they must be repaid through higher government contributions and require unplanned-for sacrifice.
- Governments and pension plans use funding policies that stretch out repayment of shortfalls, to make contributions smoother, more predictable, and less disruptive to budgets in the near term. Longer repayment methods push costs off to future taxpayers and create risks that pension funds will become more severely underfunded. Faster repayment methods shore up pension funds quickly but require current taxpayers to sacrifice more.
- About two-thirds of the unfunded liability of public pension funds is being repaid using methods that stretch payments out for thirty years or more.
- Based on results from our simulations, under funding methods currently used to repay the greatest unfunded liability, there is a one-in-six chance that a typical pension fund will fall below 40 percent funding sometime in the next thirty years – the crisis level faced by public plans in Kentucky and Illinois. Alternative funding methods, similar to those a few plans use, can reduce this risk to future taxpayers, but only by forcing current taxpayers to pay more and bear greater risk.
- Although pension funds are long-term investors, the risk of severe underfunding actually increases with longer investment horizons – the range for expected investment returns narrows with time, but smaller differences are compounded over more years.
- Once in this situation, there is no easy way out. Pension plans can de-risk their investments, reducing volatility, but that would require increasing government contributions by even more than they have been increased already. Or plans can continue to invest in assets that create substantial risks of severe shortfalls.

## Introduction

Public pension funds invest more than \$3.6 trillion in stocks, bonds, and other securities with the hope of achieving an assumed investment return. If investments do as well as the funds assume or better, state and local governments can fund pensions with much less tax money than risk-free investing would require. If investments do poorly, pension funding can become precarious and government contributions may have to rise dramatically, crowding out services and infrastructure investments or requiring tax increases, and leading to calls for benefit cuts. Taxpayers, citizens who benefit from government services and investments, and workers and retirees all have a stake in the investment decisions and risks that pension funds take. Tomorrow's taxpayers, citizens, workers, and retirees also have a stake.

This policy brief is about how the methods that public retirement systems and governments use to fund pensions interact with investment return volatility. We find that commonly used funding methods can exacerbate the risks of severe underfunding and of large increases in contributions by government employers. A companion report provides more background information and details about methodology, and examines additional scenarios. This brief and the associated report are the beginning of a series of reports from the Rockefeller Institute of Government's Pension Simulation Project. Later reports will examine other facets of these risks and how governments and plans may address them.

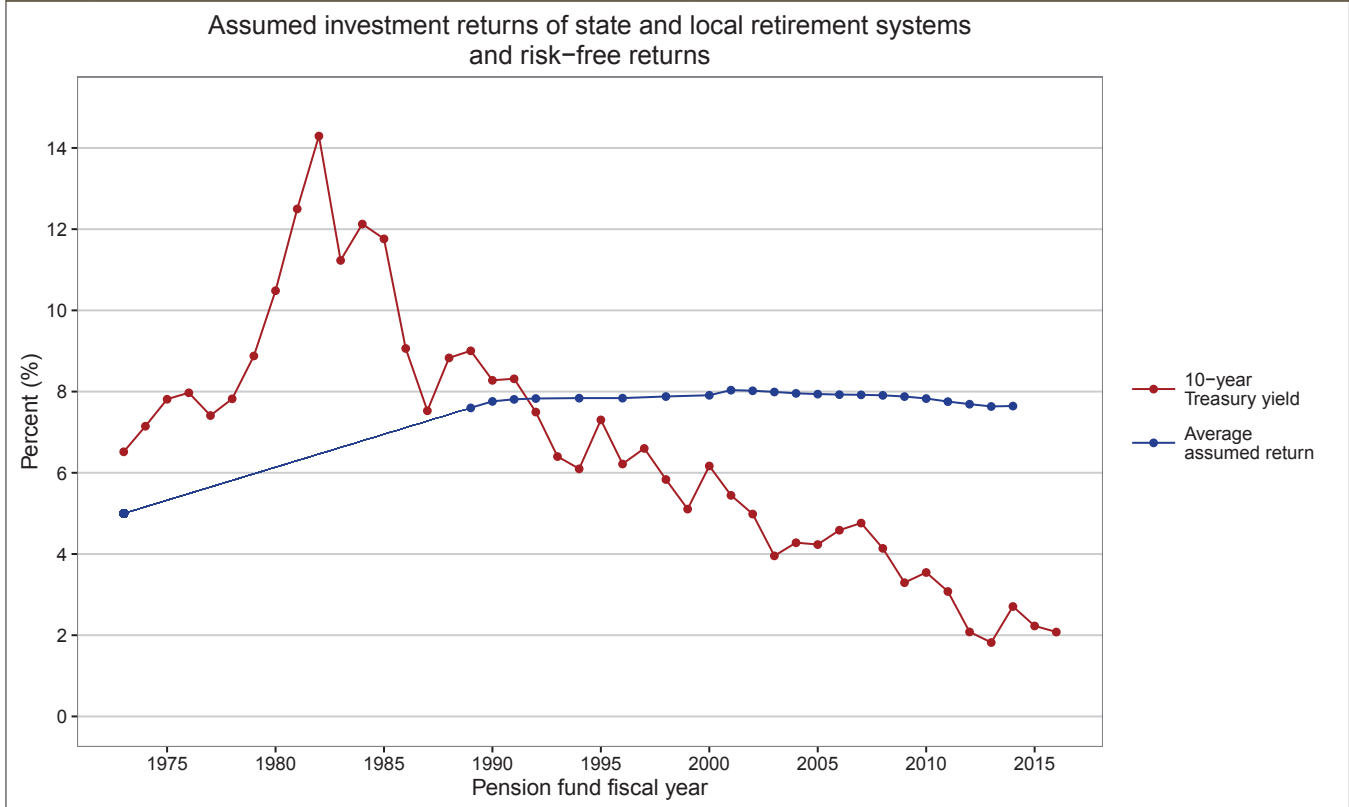
## Pension Funding Policies and Pension Fund Risks

Governments make contributions to pension plans with the goal of having enough money to pay future benefits when due. Governments and pension funds cannot predict the future with certainty, so they ordinarily adjust contributions as they go – paying more if things aren't working out as well as expected, or paying less if things are working out better than expected.

The biggest uncertainty is how well the pension plan's investments will do. From the 1970s through the mid-1990s, it was possible to earn 7 to 8 percent without taking much risk because U.S. Treasury securities, which are virtually risk-free, paid that much. Now, with Treasury rates much lower, public pension funds can only earn about 2 to 3 percent without taking risk. As a result, public plans must either invest in riskier assets or lower their assumed returns. For the most part they have chosen the former, continuing to assume they will earn 7 to 8 percent by investing in riskier assets, and assuming that things will work out over the long run. (See Figure 1.) Investment gains and losses can thus be much greater now than in earlier years.

If a pension fund's investments fall short in a given year, the government could shore up the fund by making a single large extra contribution. This contribution would have the advantage of restoring the fund immediately, protecting beneficiaries, and not pushing the costs for yesterday's services off to tomorrow's

Figure 1. Risk-Free Returns Have Declined Substantially But Assumed Returns of Public Pensions Have Not



taxpayers. But this practice could be devastating for governments if returns fall far short of assumptions, leading to sharp temporary cuts in budgets and public services or to tax increases. No large pension plan is funded this way. Instead, governments and pension plans use funding policies and practices designed to stretch out repayment of shortfalls over longer periods, in a smoother fashion, to make them easier to absorb in budgets. These practices work in the other direction, too, for positive investment surprises.

How long it takes to repay shortfalls or to reflect good news depends primarily on three elements: (1) the “discount rate” the plan uses to estimate the cost of future benefits in today’s dollars; (2) the method used to amortize shortfalls and overages (i.e., how the plan determines the amount to set aside each year); and (3) when and how the plan recognizes investment gains and losses, known as asset smoothing.

Funding policies and practices that take a long time to repay shortfalls protect current taxpayers and beneficiaries of government services from sharp and possibly unaffordable changes. But they create risk that the pension plan will become deeply underfunded and that future taxpayers who never benefited from past services will have to pay for them. This is particularly true if the plan suffers a series of shortfalls over several years. Funding policies and practices that repay shortfalls quickly shore up the fund and protect future taxpayers, but are risky for current taxpayers and government service beneficiaries.

Governments and plans commonly use methods that stretch repayments out over long periods — often for thirty years, or sometimes forever through use of “open” methods that constantly extend the period. About two-thirds of the unfunded liability of public pension funds is being repaid using methods that stretch repayments out for thirty years or more.

We have developed a model to evaluate pension risks under different funding policies and investment return scenarios. We find that while the most-common funding policies and practices reduce contribution volatility, they increase the likelihood of significant underfunding. Funding policies are unlikely to bring underfunded plans to full funding within thirty years, even if investment-return assumptions are met every single year and employers make full actuarially determined contributions. For example, a fairly typical plan — a 75-percent funded plan that spreads gains and losses as a fixed percentage of payroll over a constantly extended thirty-year “open” period, and that smooths assets over five years — would reach only 85 percent funding after thirty years even if it earned its assumed 7.5 percent every year.

However, plans rarely achieve their assumptions exactly in any given year. If investment returns vary from year to year — as they generally do — the situation is much more difficult, even if expected investment returns are correct on average. In this case, plans may become severely underfunded or possibly overfunded, and contributions may rise or fall, depending on investment results.

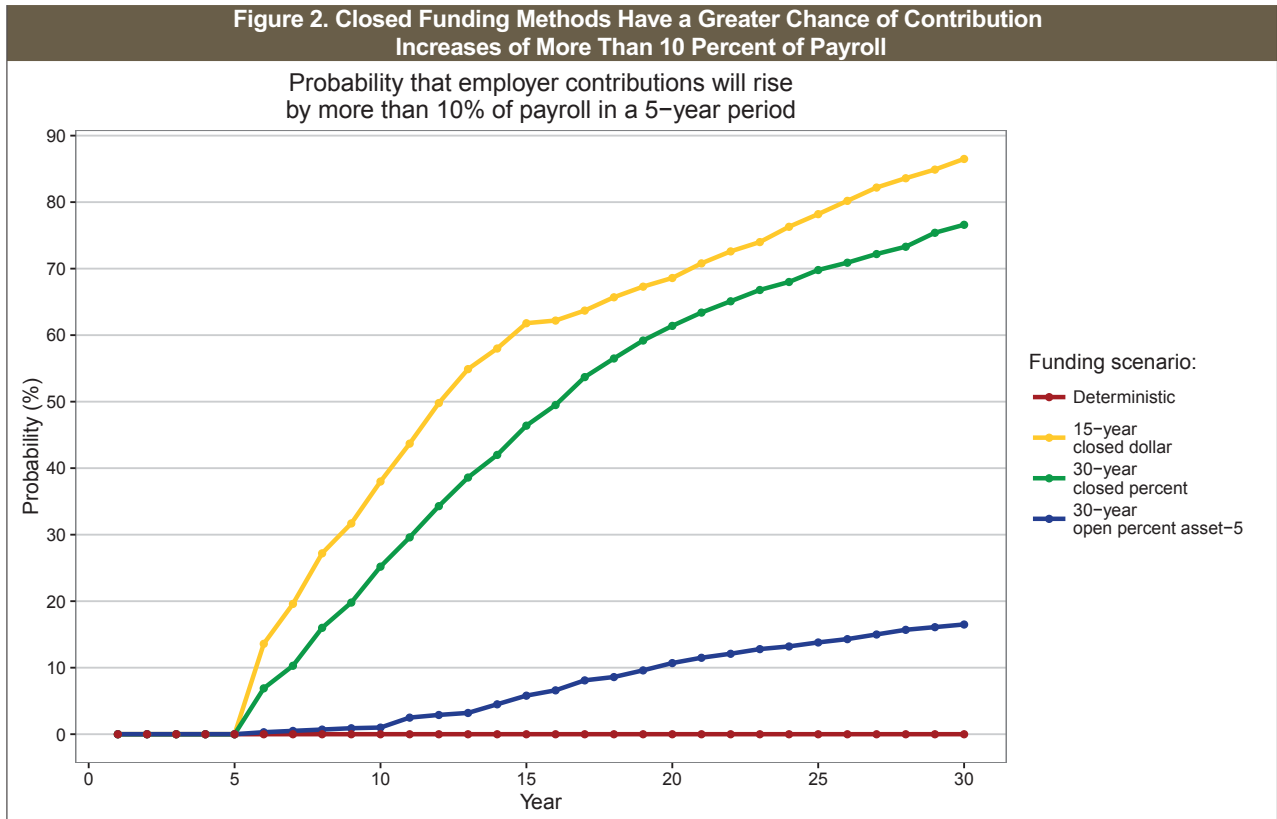
We evaluate the risk of a significant rise in employer contributions by calculating the probability that employer contributions will rise by more than 10 percent of payroll in any five-year period. We evaluate the risk of severe underfunding by calculating the probability that a plan’s funded ratio will fall below 40 percent — the crisis territory currently inhabited by major pension funds in Illinois and Kentucky.

Our model evaluates these risks for a typical 75-percent funded plan, assuming that its investment return assumption is correct on average, but that returns vary in plausible ways (measured with a 12 percent standard deviation). For each scenario, we run the model 1,000 times, as if the pension plan could live 1,000 different lives each with a different sequence of investment returns. On average, over 1,000 simulations, the compound investment return at the end of thirty years will be about 7.5 percent, but in any single simulation the thirty-year compound return could be very different. Over 1,000 simulations, about half of the thirty-year compound returns will fall between 6 and 9 percent, with the other half being greater than 9 percent or less than 6 percent.

We examine several funding scenarios designed to show the range of practice. We assume that governments make whatever contributions they are called upon to pay under a given scenario. We describe these policies below and provide their graph labels in parentheses:

- **Thirty-year level-percent open amortization with five-year asset smoothing:** Under this policy, investment gains and losses are recognized over five years, and once recognized are spread over a thirty-year open period that is extended with each new year. The annual payment starts out low and rises at the rate payroll is expected to grow (usually 3 to 4 percent). The unfunded liability is never fully repaid but can shrink considerably as a percentage of payroll. This is the slowest repayment method in common use. Although many smaller plans and CalPERS, the nation's largest plan, use faster repayment methods, this method is used to repay more total public pension plan unfunded liability than any other policy (*thirty-year open percent asset-5*).
- **Thirty-year level-percent closed amortization:** Investment gains and losses are recognized immediately and are spread over a thirty-year closed period. The annual payment starts out low and increases at the rate payroll is expected to grow. The liability is fully repaid at the end of thirty years (*thirty-year closed percent*).
- **Fifteen-year level-dollar closed amortization:** Investment gains and losses are recognized immediately and are spread over a fifteen-year closed period. The annual payment is the same each year. The liability is fully repaid at the end of thirty years. This is the fastest and most aggressive funding method examined below. No large plans fund gains and losses this aggressively, but a few plans use a variant that smooths assets over five years (*fifteen-year closed dollar*).
- **Deterministic:** We provide this alternative scenario for comparison. It is based on the first policy above. However, instead of earning returns that vary from year to year but are expected to be 7.5 percent on average, the plan earns exactly 7.5 percent every year, consistent with actuarial assumptions (*Deterministic*).

Figure 2 shows the probability that employer contributions will rise by more than 10 percent of payroll in any five-year period within the first thirty years. There is no chance of this when investment returns are deterministic — 7.5 percent each and every year. However, it is possible when investment returns vary, in which case investment shortfalls may trigger contribution increases. The quicker and more forcefully that a funding policy responds to investment shortfalls, the greater the probability that contributions will rise by more than 10 percent. Thus, this probability is greatest for the fifteen-year closed period level-dollar funding policy: it repays shortfalls over a fixed relatively short period, with constant-dollar payments that are higher than under level-percent funding policies.

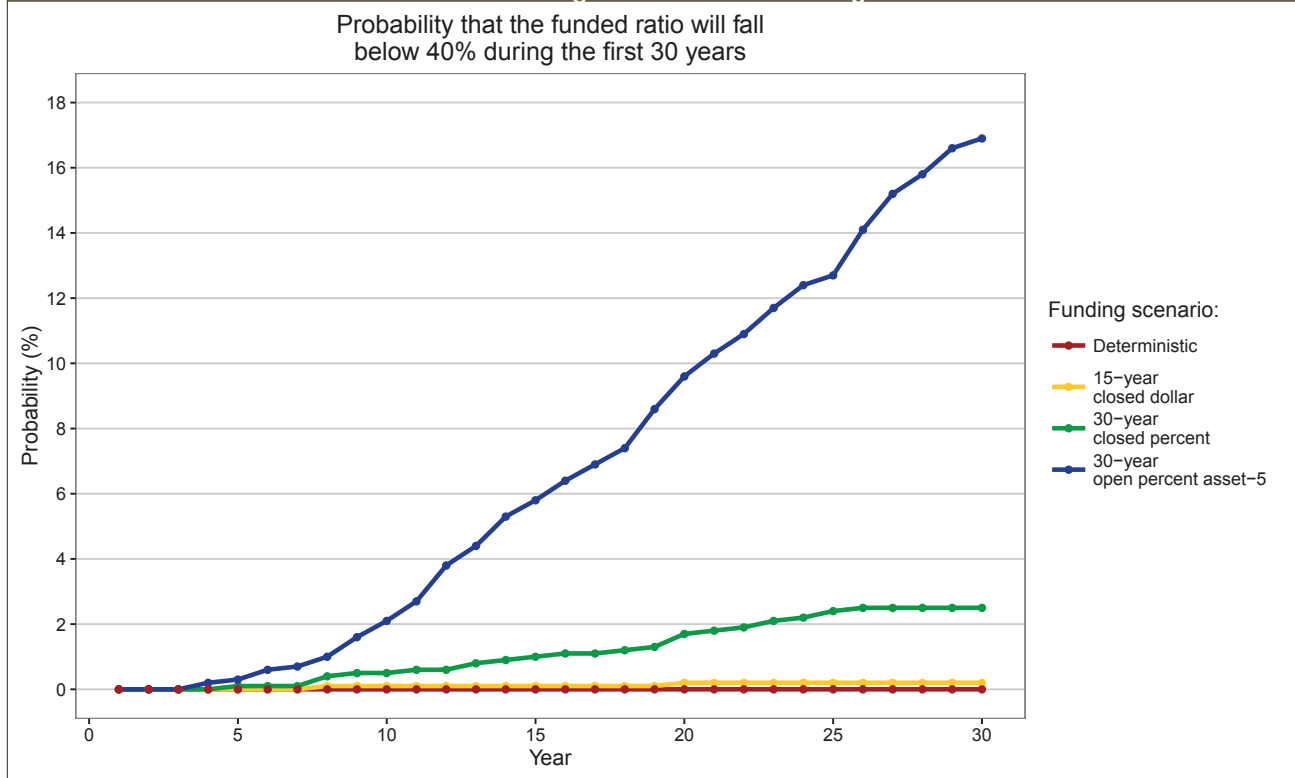


It is easy to see why the very stretched-out policy of thirty-year open funding as a level percentage of payroll is attractive to employers. Unlike other policies currently used by funds, it has a very low probability that contributions will rise by more than 10 percentage points in a five-year period. It provides stability to plan sponsors. That stability comes at a price, however: a risk of severe underfunding if investment returns vary from year to year.

As Figure 3 shows, there is zero chance that the typical plan using the most prevalent funding method (i.e., repaying the greatest unfunded liability) will become severely underfunded under the deterministic scenario (exactly 7.5 percent earned every year), which is the actuarial assumption. But once we introduce risk, so that investment returns vary from year to year, the plan would have a 17 percent chance of falling below 40 percent funding over the next thirty years (the rightmost point on the graph for thirty-year open percent asset-5). In other words, the plan would have a one in six chance over the next thirty years of falling into a severe crisis, even if expected-return assumptions are correct on average and governments pay full contributions.

This bears repeating: If investment returns vary from year to year, there can be a substantial risk of severe underfunding (a one in six chance in this case), even if expected returns are correct on average and even if governments pay full actuarial contributions. By “expected returns are correct on average” we mean that if our pension plan could relive its lifetime many times, on average its compound return at the end of thirty years would be about 7.5

**Figure 3. Thirty-Year Open Level-Percent Funding Runs Far Greater Risks of Severe Underfunding Than the Other Funding Policies**

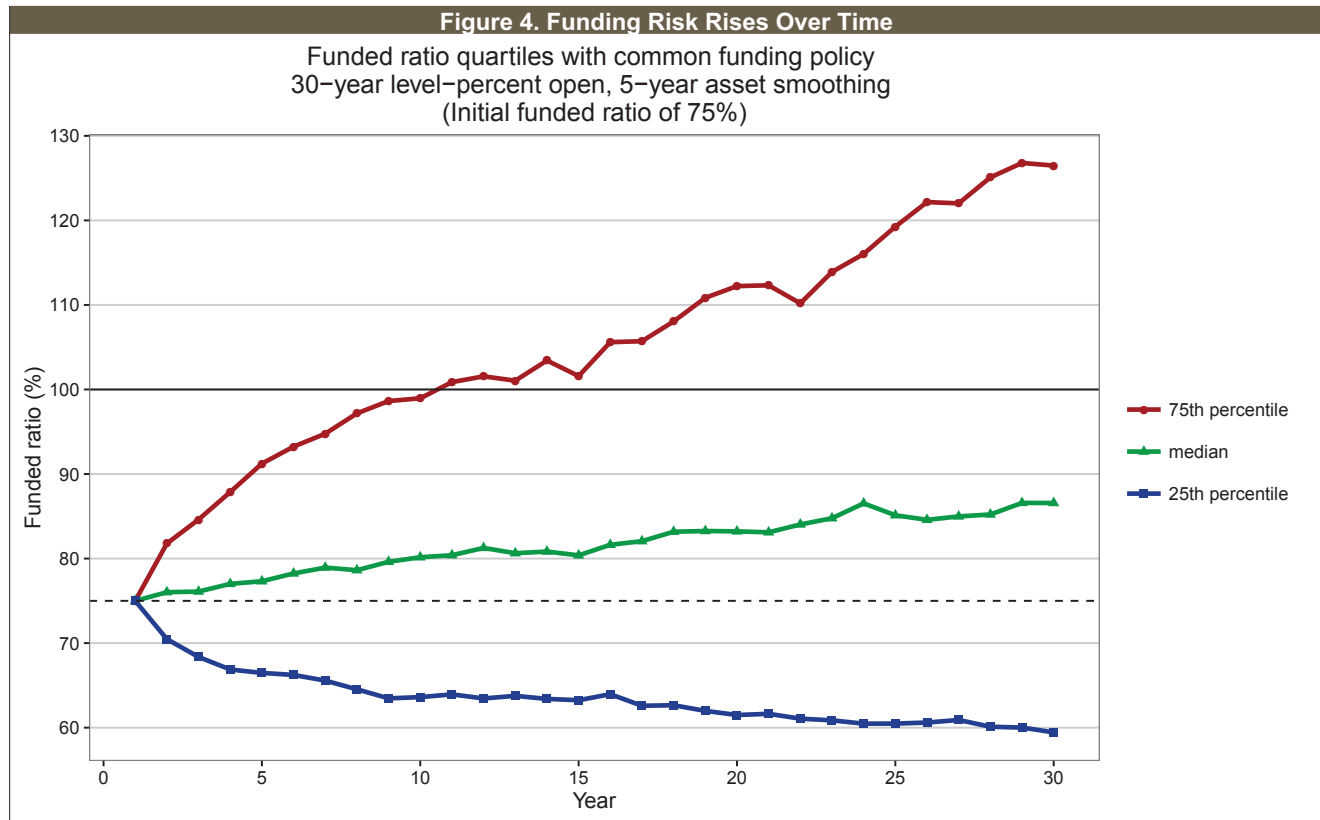


percent, but the return in any particular lifetime would be different, possibly significantly so. Of course, plans only get only one life. We don't know what the specific outcome will be, but we can estimate the risk that returns will be much better than expected or that they will be much worse.

If sponsors do not pay full actuarial contributions or if reasonable expectations for investment returns are less than 7.5 percent, the risk of severe underfunding would be even greater.

Finally, Figure 4 illustrates a conclusion that may be surprising to some people. It shows the 75th and 25th percentile for the pension plan funded ratio over time, under the most prevalent smoothing policy. The 75th percentile actually increases, and the 25th percentile decreases. Although the argument is sometimes made that the risks of investing diminish over time and that public pension funds, as long-term investors, can ride out the ups and downs, in fact the graph shows the opposite. At year ten, there is a 25 percent chance that the funded ratio will be about 100 percent or more and a 25 percent chance that the funded ratio will be below about 65 percent. But by year thirty, the magnitudes have increased: there is a 25 percent chance that the funded ratio will be more than 125 percent, and a 25 percent chance that the funded ratio will be less than 60 percent. While the variability in compound annual returns does indeed diminish over time, this is more than offset by compounding those returns over a longer time period.





## Conclusions and Policy Implications

The risk of severe underfunding varies dramatically with the choice of funding method. Public pension plans with the greatest aggregate unfunded liability are using methods that stretch payments out over a constantly extended time period that is thirty years on its face, but in effect is extended forever. In our model, a typical plan using this approach has a 17 percent chance of falling below 40 percent funding over the next thirty years. If, instead of amortizing over a thirty-year open period, the plan uses a closed period that ensures repayment after thirty years, the risk of severe underfunding falls to 10 percent. And if it shortens the period to fifteen years or pays a fixed dollar amount rather than amounts that start low and rise with payroll and does not use asset smoothing, the risk falls to 4 percent or less. In practice many governments do not always pay full actuarially determined contributions, which greatly exacerbates the risks of severe underfunding.

The risk of severe underfunding increases over time. It is often said that pension funds are very long-term investors and can achieve their financial goals by riding out market fluctuations. While differences from expected returns are likely to narrow over the long run, those differences are compounded over many more years so that fluctuations in assets available to pay pension benefits actually increase with time.

It is clear that current funding policy is inadequate, particularly in light of pension plans' investments in stocks and other

assets with volatile returns. The risks to governments and pension plans in the current environment are greater than commonly understood.

There is no easy way out. Pension plans can de-risk, reducing the volatility of their investment returns and reducing the volatility of contributions. However, reducing risk almost certainly will require lowering earnings assumptions, which will drive up contribution demands from governments and crowd out services or require tax increases.

## ACKNOWLEDGMENTS

This is the first policy brief of the Pension Simulation Project at the Rockefeller Institute of Government. In addition to the authors the project team includes Lucy Dadayan, senior researcher, and Kathleen Tempel, project manager. The project is supported by the Laura and John Arnold Foundation and The Pew Charitable Trusts. The authors solicited and received comments on an early draft from several public pension experts, and made revisions in response to many, but not all, comments. We appreciate this advice. The views and analysis in this report, as well as any errors, are the responsibility of the authors alone and do not necessarily reflect views of the sponsors or any reviewers.

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