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PENSION SIMULATION PROJECT

INVESTMENT RETURN VOLATILITY AND THE LOS ANGELES FIRE AND POLICE PENSION PLAN

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INVESTMENT RETURN VOLATILITY AND THE LOS ANGELES FIRE AND POLICE PENSION PLAN

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Executive Summary

Introduction

Public pension funds invest in stocks, bonds, and other assets with the goal of accumulating sufficient funds, in combination with employer and employee contributions, to pay benefits when due. Investments can entail risk, and contributions may have to be adjusted to ensure that assets are sufficient to pay benefits. State and local governments generally backstop public pension funds, paying higher contributions when investment returns are below expectations, or lower contributions when investment returns are above expectations. Thus, taxpayers and those who benefit from government services and investments bear the consequences of this investment risk. The Rockefeller Institute of Government's Pension Simulation Project is examining the potential consequences of investment-return risk for public pension plans, governments, and stakeholders in government.

In this report, we examine the potential implications of investment return volatility for the Los Angeles Fire and Police Pension Plan (LAFPP). We selected LAFPP as one of five plans to analyze in detail. LAFPP is one of the nation's largest public safety plans and has many characteristics common to these plans, including relatively young retirement ages, and relatively high benefits and costs of funding those benefits. The other plans, which we examine in separate analyses, include a deeply underfunded plan, a very well-funded plan, a closed plan, and an average plan. Our analysis is independent of LAFPP, and is neither sponsored nor approved by LAFPP, although we have communicated with their staff. The LAFPP pension system also includes a retiree health benefits plan, which we exclude from our analysis — references to LAFPP below pertain only to the pension plan.

Several characteristics of LAFPP play an important role in our results. First, LAFPP is much better funded than most public pension plans, with a funded ratio of 91 percent in 2016 (the market value of LAFPP assets was 91 percent of its reported liabilities). Second, like many public safety plans, in comparison to plans for other government workers, LAFPP pension benefits are high relative to its payroll, and assets available to fund those benefits also are high relative to payroll. Thus, unexpected investment gains or losses will be large relative to payroll, as will be corresponding changes in employer contributions — in other words, upside and downside risk to employers is greater in plans that are more expensive. Third, the plan spreads investment gains and losses over a fixed twenty-year period as a constant percentage of payroll. This is a shorter period and a more conservative approach than many plans use; as a result, the City of Los Angeles repays investment losses and reaps benefits from investment gains more quickly than it would under other common methods. Finally, the City of Los Angeles has a very good track record of paying, in full, the contributions determined by LAFPP actuaries, in contrast to

many other governments and plans. Another important feature of LAFPP, its Deferred Retirement Option Program (DROP), did not have an important effect on our analysis of investment risk.

Our Analytic Approach

We model the finances of LAFPP and contributions from the City of Los Angeles under six different investment-return scenarios falling into the three broad categories shown below:

Investment return assumption achieved

1. *Assumption Achieved: Deterministic:* The plan achieves its investment return assumption of 7.5 percent each year.
2. *Assumption Achieved: Stochastic Base Case:* The 7.5 percent return assumption is correct on average but varies from year to year, with a standard deviation — a measure of how much returns vary — of 12 percent. This is our base-case stochastic scenario against which we usually compare other scenarios.

A period of low returns

3. *Five Years of Low Returns:* Expected investment returns fluctuate around an average that rises from 5 percent to 7 percent during the first five years, then fluctuate around the plan's long-run assumption of 7.5 percent. In this scenario the current low-interest-rate environment reverses relatively quickly.
4. *Fifteen Years of Low Returns:* Expected investment returns rise much more slowly, fluctuating around an average that rises from 5 percent to 6.5 percent during the first fifteen years. After that, returns fluctuate around the plan's long-run assumption of 7.5 percent. In this scenario the current low-interest-rate environment lingers for a long time.

Greater investment-return volatility or lower expected return

5. *High Volatility:* The expected investment return is 7.5 percent, but investment-return volatility is higher than in the first four scenarios, with a standard deviation of 17.2 percent rather than 12 percent, consistent with some current market forecasts.
6. *Target Asset Allocation:* Expected investment returns and volatility reflect the target asset allocation proposed to LAFPP by a consulting firm in its asset-liability study, with an expected return of 6.1 percent and a standard deviation of 13.4 percent.

We examine the six investment-return scenarios under the current funding policy. We also examine their impact under hypothetical policies that would arise if California voters were to approve statewide pension initiatives similar to previously

proposed initiatives. Among other things, those initiatives would limit employer contributions for new hires to one-half of the total cost of retirement benefits, including unfunded liability costs. Implicitly, the initiatives would require new employees to share in investment-return risks by picking up costs above 50 percent.

We use two main measures of risk: (1) the probability that at some point in the next thirty years LAFPP's market-value funded ratio will fall below 40 percent, which we consider to be a crisis level, (2) the probability that the employer contribution will rise sharply in a short time period, increasing by more than 10 percent of payroll in any consecutive five-year period over the next thirty years. We also analyze changes in employer contributions relative to the Los Angeles city budget. For the scenarios that assume employer contribution caps are imposed by a statewide initiative and employees would share in investment risk, we also examine what could happen to employee contributions as a percentage of payroll.

Results

If assumed investment returns are achieved each year, LAFPP will move toward full funding with contribution amounts as expected. The fiscal pressure on the Los Angeles city budget from LAFPP pension contributions will ease, falling from nearly 8 percent of general fund revenue to slightly more than 5 percent over the next ten years as unfunded liabilities are paid down.

Realistically, even if assumed returns are achieved on average, investment returns will vary significantly from year to year, potentially leading to years of substantial underfunding even in simulations in which, after thirty years, investment returns exceed assumed returns. In simulations in which the assumed return is not achieved over thirty years, volatility can be greater and outcomes worse.

If assumed returns are **correct on average** over the long run, but have a 12 percent annual standard deviation (a moderate degree of volatility in the current investing environment), then under current funding policy:

- There is very little chance that the *funded ratio* will fall below 40 percent — what we consider to be crisis territory — between now and year thirty.
- Employer contribution risks abound: There is a nearly two-in-three chance that the City of Los Angeles's *employer contribution* will rise sharply, increasing by more than 10 percent of payroll in at least one consecutive five-year period over the next thirty years. In one-quarter of our simulations, the city's contribution rose to 13 percent or more of its general fund revenue by year thirty, compared to slightly less than 8 percent now and to slightly less than 5 percent in year thirty if the plan's investment return assumptions are met every year.

If expected returns are **lower than the plan's assumed returns**, or investment return **volatility is greater than we assume**, then under current funding policy:

- The risk of severe underfunding is still quite low. The chance that the *funded ratio* will fall below 40 percent in the next thirty years ranges from 3.4 percent to 15 percent depending on the return scenario. The risk of severe underfunding is low, in part, because LAFPP's policy for determining contributions requires investment shortfalls to be repaid relatively quickly and because we assume that the City of Los Angeles will continue to pay actuarially determined contributions no matter how high they go.
- The probability that the *employer contribution* will rise sharply is much higher under lower-return and higher-volatility scenarios. For example, in the *Target Asset Allocation* scenario (# 6), which is based on the plan's asset-liability study, the probability that employer contributions will rise by more than 10 percent of payroll in at least one five-year period over the next thirty years is about 83 percent, compared to a probability of 64 percent in our base-case scenario that has expected compound returns of 7.5 percent and a standard deviation of 12 percent. In Scenario 6, employer contributions would rise to at least 19 percent of the city's general fund revenue by year twenty and beyond in one quarter of our simulations.

If California voters approve an initiative that caps employer contributions for new hires as described above:

- The impact on total *employer contributions* would grow over time but be relatively small over the next thirty years. As is generally the case, reforms that only affect new hires take a long time to have substantial impact.
- New employees would face considerable uncertainty in *employee contributions*. In our base-case scenario where the assumed investment return of 7.5 percent is met and the standard deviation is 12 percent, there would be a 25 percent chance that employee contributions of new hires rise to 16 percent of their pay or more by year thirty.

If the initiative had been in effect long enough to affect all employees, so that all would bear investment risk:

- The probability of sharp increases of *employer contributions* will be reduced substantially.
- The *employee contribution* would be about 35 percent of payroll in year one, with a substantial chance of staying at a very high level over the next thirty years. Under a return scenario with the expected compound return 1.4 percentage points below the earnings assumption of 7.5 percent, employees would have to contribute 53 percent or more of their payroll in year thirty in 25 percent of the simulations.

When fully effective, employer contribution caps would result in a dramatic transfer of risk to employees.

Conclusion

Our analysis suggests that if LAFPP's investment-return assumption is approximately correct over the long run, the plan has very little risk of becoming severely underfunded in the next thirty years, even if investment returns vary significantly from year to year. The main reasons for this are LAFPP's good current funded status, its relatively conservative method of determining contributions, and our assumption that the City of Los Angeles will continue its good track record of fully paying actuarially determined contributions. However, this means that even if the long-run expected return is reasonable, the city bears the full risk of year-to-year variation in returns and could face large contribution increases relative to payroll and to its general fund revenue. Under plausible alternative investment-return assumptions, the risks of severe underfunding remain small but the city's contribution risks are greater.

If California voters approve an initiative that caps employer contributions for new hires and requires the new employees to bear investment risk above the cap, there will be very little impact on employer contributions over the next thirty years, although impacts could be large for individual new employees. In the very long-run, after such a policy is fully in effect, there would be a large transfer of risk from the city to its employees, with a substantial chance that the employee contribution risk will become prohibitively high. Should voters adopt such an initiative, it would be important for the plan and the city to communicate these risks clearly to the public and potential future employees of the City of Los Angeles.

The broader lessons from this analysis are that if a plan has a relatively good funded status and a conservative contribution policy, and if participating governments pay full actuarially determined contributions in all years, the plan has minimal chance of facing a funding crisis even if investment returns are quite volatile. However, the participating governments face a risk of substantial contribution increases, and those contributions can be large relative to a government's budget, particularly if the plan benefits are relatively expensive.



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Introduction

Public pension funds invest in stocks, bonds, and other assets with the goal of accumulating sufficient funds, in combination with employer and employee contributions, to pay benefits when due. Investments can entail risk, and contributions may have to be increased, or may be decreased, to ensure that assets are sufficient to pay benefits.

When a pension fund invests in a portfolio of assets that entail higher risk, expected investment returns generally will be higher than for investments in lower-risk assets. And if these higher expected returns are achieved, contributions will be lower than they otherwise would be. The disadvantage is that expected returns are not guaranteed returns, neither over short time periods nor even over the long run.

Depending on how volatile investment returns are, funded ratios — the ratio of pension fund assets to pension fund liabilities — may rise or fall significantly, and required contributions may fall or rise considerably. The extent and timing of these changes will depend in part upon methods used to determine contributions. If adverse movements in investment returns are too large, funded ratios could become so low that they create political crises. In some states, this may lead to pressure to cut benefits. (Benefit cuts are unlikely in California due to the legal protections afforded pensions.) Adverse movements could cause requested contributions to increase so much that they create

fiscal stress for employers, leading to pressure for substantial increases in taxes or other revenue, cuts in spending, or other undesirable outcomes. Alternatively, investment returns above expectations could lead to very high funded ratios and very low required contributions.

How much risk is too much risk? There is no magic rule. Plans, employers, and other stakeholders need to weigh the potential risks and rewards. The key to making these decisions is to understand risks, evaluate risks, and communicate that analysis to those affected.

In this report, we examine the potential implications of investment return volatility for the Los Angeles Fire and Police Pension Plan (LAFPP). We selected LAFPP as one of five plans to analyze in detail in our Public Pension Simulation Project. The five plans have a broad range of characteristics. LAFPP has many characteristics common to public safety plans, including relatively young retirement ages and high normal costs. In addition, with a market-value funded ratio of 91 percent as of June 30, 2016, LAFPP is well funded by public pension plan standards. The other plans, which we examine in separate analyses, include a deeply underfunded plan, a very well-funded plan, a closed plan, and an average plan.

Our analysis is independent of LAFPP, and is neither sponsored nor approved by LAFPP, although we have communicated with their staff.

Risks can be positive or negative, and we examine both in this report. However, we pay particular attention to the consequences of investment return shortfalls because shortfalls can be extremely problematic for pension plans, beneficiaries, policymakers, and government stakeholders.

To evaluate risks, we focus primarily on the market-value funded ratio and on employer contributions (ERC) as a percentage of payroll, and the probability that either may change considerably over time or enter into dangerous territory. We examine LAFPP finances under the current funding policy and practice and several alternatives, and we examine different investment return scenarios.

Our Pension Plan Simulation Model

We have developed a simulation model that can be used to evaluate the implications of investment risk. The model calculates the annual cash flows and fiscal position of a public pension plan for future years. Typically, we run a simulation for fifty years or more, but focus our analysis on the earlier years (the first thirty). Each year the model starts with beginning asset values and computes ending assets by subtracting benefits paid, adding employee and employer contributions (including any amortization), and calculating investment income.

The model keeps track of these values and other variables of interest, such as the funded ratio and employer contributions as a

percentage of payroll. It saves all results so that they can be analyzed after a simulation run in any way desired.

The model is quite flexible:

- Benefits can be calculated within the model using rules of the plan (e.g., benefit factors and retirement ages), plan demographics, chosen mortality tables, and other actuarial assumptions. Multiple tiers can be modeled. Alternatively, the model can import projections of annual benefit payments that have been prepared by an actuary or the model user.
- Contributions can be determined actuarially under commonly used funding policies. The user can decide the length of the amortization period and whether it is open or closed, as well as whether the amortization payment is a level percentage of payroll or a level dollar amount. Asset smoothing can be allowed, or not. Actuarially determined contributions can be constrained by caps and floors, or overridden completely and set as a fixed percentage of payroll. We do not allow contributions to be negative (employers cannot withdraw assets from the fund).
- Accrued actuarial liabilities can be calculated under several common cost methods.
- The plan can be modeled as closed, or new employees can be brought in each year to achieve a target for annual growth in the number of active members.

Investment returns are determined flexibly as well, and can be:

- **Fixed (i.e., deterministic):** for example, 7.25 percent every year
- **Stochastic:** for example, 7.25 percent expected return in every year, with a 12 percent standard deviation, drawn from a normal distribution. (“Stochastic” means that returns are random and follow a specific distribution.)
- **Time-varying:** returns can be set to a fixed value each year, but that value may vary from year to year — for example 5 percent annually for the first five years, then 6 percent annually for the next five years, then 8 percent for the next forty years.
- **Time-varying and stochastic:** for example, expected return of 5 percent in the first five years with a standard deviation of 8 percent, followed by expected return of 6 percent for the next five years with a standard deviation of 10 percent, followed by expected return of 8 percent with a standard deviation of 12 percent for the next forty years.

When investment returns for a scenario have a stochastic component we run 2,000 simulations, each with a different set of annual investment returns (drawn from the same assumed probability distribution), so that we can examine the distribution

of results. Each simulation results in different investment earnings, leading to different funded ratios and contribution requirements. By examining the 2,000 different sets of results we can gain insight into the probability of alternative outcomes. For example, we examine the probability that the funded ratio will fall below 40 percent anytime during the first thirty years – a level that has been associated with crisis in other states.

Table 1 illustrates possible investment returns for a scenario with a 7.25 percent expected return and a 12 percent standard deviation.¹ Returns vary randomly from year to year and from simulation to simulation, even though the expected return is the same. Some simulations may produce much better outcomes for a pension plan than others. For example, simulation #3 clearly has much lower returns in the first two years than simulation #1; as a result, in our model assets and the funded ratio would be lower at the end of year two in simulation #3 than in #1.

Table 1. Investment Returns in the Model Can Vary Greatly From Year to Year and From Simulation to Simulation

Illustration of investment returns used to calculate pension fund finances

2,000 simulations of a given scenario, returns drawn from a normal distribution with mean 7.25%, standard deviation 12%

Simulation number	Simulation year					
	1	2	3	...	49	50
1	24.7%	17.1%	2.7%	...	10.8%	36.0%
2	5.5%	15.1%	-1.8%	...	39.4%	-0.7%
3	-15.3%	-11.4%	-0.9%	...	2.1%	-4.2%
...
1,999	7.9%	8.5%	18.2%	...	-20.2%	17.0%
2,000	15.6%	-1.4%	-8.9%	...	23.5%	-6.5%

Source: Authors' generation of random investment returns

About the Los Angeles Fire and Police Pension Plan²

Key Features of LAFPP

The Los Angeles Fire and Police Pension Plan (LAFPP) is a defined-benefit pension plan within the Los Angeles Fire and Police Pension System. The LAFPP pension system also includes a retiree health benefits plan, which we exclude from our analysis – references to LAFPP in this report pertain only to the pension plan.³ LAFPP covers all full-time active sworn firefighters, police officers, and certain Harbor Port Police officers of the City of Los Angeles. As of 2016, it had 13,050 active members, 128 vested terminated members, and 12,819 retirees and other beneficiaries.

In 2015, LAFPP had more than \$17 billion of assets and paid \$990 million in benefits. Its market-value-of-assets funded ratio

was approximately 91 percent — above the 90th percentile among large plans.⁴ Its unfunded liability was \$1.7 billion.

LAFPP is composed of six tiers. The largest one is “Tier 5,” which covers employees hired between 2002 and 2011 and employees transferred from older tiers, and accounts for about 78 percent of actives. A new tier, “Tier 6,” was added on July 1, 2011, which accounts for about 13.7 percent of actives. Benefits generally are calculated based on the highest monthly average salary actually received during any twelve consecutive months (non-Tier 6 members) or twenty-four consecutive months (Tier 6 members) of service. The initial service retirement benefit can range from 20 percent to 90 percent of final average salary, depending upon years of service and tier. The overall LAFPP normal cost is 28.2 percent of payroll.

Funding Approach

LAFPP currently uses the following approach to funding. First, the independent actuary determines a recommended employer contribution. This is an actuarially determined amount calculated using the following actuarial method and funding policies:

- LAFPP uses the Entry Age Normal Actuarial Cost Method, a widely used method.
- Actuarial gains and losses are amortized using 20-year level-percent closed amortization. Asset values are smoothed over 7 years. The actuarial value of assets is limited to be within 40 percent of the market value of assets.

Although the actuarially determined contribution is only a recommended amount and the contribution actually paid could differ from it, the City of Los Angeles has been making the full actuarially determined contributions for at least ten years. In addition to the employer contribution, employees are required to contribute 6 percent to 11 percent of their salaries to the pension fund, depending on which tier they are in.⁵ Employee contributions are not required if the employees’ continuous service exceeds thirty years for Tier 1 through 4, and thirty-three years for Tier 5 and 6.

Deferred Retirement Option Program (DROP)

The DROP program was introduced in 2002 as an enhancement to the regular pension benefits and aims to retain experienced and skilled employees in the workforce. DROP is an optional voluntary program that allows participants to work and receive pay as active employees while accumulating service pension payments in a DROP account, which enjoys a guaranteed interest rate of 5 percent per year. The eligible employees can participate in DROP for a maximum of five years, and during that period they must generally continue to make employee contributions to LAFPP. When they leave the DROP program, the participants will receive the accumulated DROP account balance and then begin to receive the regular pension benefits.

Risk-Sharing Policies Proposed in Public Pension Initiatives

There were two recent statewide public pension initiatives in California that proposed to limit government contributions to public pension plans and require employees to share the contribution responsibility. The “Voter Empowerment Act” would require voter approval for new government employees hired on or after January 1, 2019, to participate in defined benefit pension plans like LAFPP, and limit government employers from paying more than half of the total cost of retirement benefits for new employees, unless voters approve a higher proportion. The “Government Pension Cap Act” would require the same limit proposed in the “Voter Empowerment Act,” and would also limit government employer contributions for new public safety employees’ retirement benefits to 13 percent of their salary. California public pension initiative proponents aim to place at least one pension initiative on the November 2018 ballot.

Investment Return Assumption

LAFPP currently uses a 7.50 percent earnings assumption. As of June 30, 2016, approximately 51.3 percent of assets were in equity, 23 percent in fixed income, and the remainder in other asset classes including real estate and private equity. Total investment return was 1.18 percent in 2016, 4.15 percent in 2015, 17.86 percent in 2014, and 13.01 percent in 2013.

How We Modeled the Finances of LAFPP

We model LAFPP as an open plan where new employees are hired annually to keep the number of active members constant from year to year. We use our pension simulation model to generate a projection of annual benefit payments that reflects this constant number of active members. Annual benefits vary from year to year, generally increasing, but do not vary across simulations in a single scenario, or across scenarios. We also generate a projection of payroll that is consistent with the benefit payments. These projections are made based on the demographic data, decrement tables, benefit provisions, and actuarial assumptions provided in the LAFPP actuarial valuation report of 2015.

We model the finances of LAFPP under six investment-return scenarios. We examine all of these scenarios under the current funding policy. In addition, we examine two investment return scenarios under policies that would result from voter initiatives that could cap employer contributions, shifting risk to employees.

Investment Return Scenarios

Investment-return volatility can cause great uncertainty in pension fund finances and government finances. (See the appendix, *Variability in Investment Returns*, for a discussion of investment return volatility.) We model the finances of LAFPP and contributions from the City of Los Angeles under six different

investment-return scenarios falling into the three broad categories shown below:

Investment return assumption achieved

1. *Assumption Achieved: Deterministic:* The plan achieves its investment return assumption of 7.5 percent each year. We call this a deterministic scenario because there is no uncertainty.
2. *Assumption Achieved: Stochastic Base Case:* We model a stochastic version of the plan's assumption, in which the expected long-term compound return is 7.5 percent — that is, the 7.5 percent return assumption is expected to be correct on average but varies from year to year.⁶ The standard deviation — a measure of how much returns vary — is 12 percent.^{7,8} This is our base-case stochastic scenario against which we compare other stochastic scenarios.

A period of low returns

3. *Five Years of Low Returns:* Expected investment returns fluctuate around an average that rises from 5 percent to 7 percent during the first five years, then fluctuate around the plan's long-run assumption of 7.5 percent. This recognizes that in the current low inflation and low interest rate environment, it may be plausible for expected returns to be quite low for the next several years, and then gradually rise, perhaps as the Federal Reserve Board raises short-term interest rates. This makes it extremely difficult to achieve assumed returns in the short run, even if they may be achievable in later years. In this scenario, the current low-interest rate environment reverses relatively quickly.
4. *Fifteen Years of Low Returns:* Expected investment returns rise much more slowly, fluctuating around an average that rises from 5 percent to 6.5 percent during the first fifteen years. After that, returns fluctuate around the plan's long-run assumption of 7.5 percent. In this scenario the current low-interest-rate environment lingers for a long time.

Greater investment-return volatility or lower expected return

5. *High Volatility:* The expected investment return is 7.5 percent, but investment-return volatility is higher than in the first four scenarios, with a standard deviation of 17.2 percent rather than 12 percent, consistent with some current market forecasts.⁹
6. *Target Asset Allocation:* Expected investment returns and volatility reflect the target asset allocation proposed to LAFPP by a consulting firm in its asset-liability study,

with an expected return of 6.1 percent and a standard deviation of 13.4 percent.¹⁰

Table 2 shows these six investment-return scenarios. The first two columns label and describe the simulation. The next two columns show the expected compound return during sub periods of the first thirty years. The next column shows the expected compound return over the full thirty years and the final column shows the standard deviation.

Table 2. Investment Return Scenarios

Return scenario	Description	Year	Expected compound annual return for the period in question	Expected compound annual return over entire simulation period	Standard Deviation
1 Assumption Achieved: Deterministic	Return assumption is met each and every year	1-30	7.50%	7.50%	0%
2 Assumption Achieved: Stochastic Base Case	Constant expected return over 30 years that meets the actuarial assumption	1-30	7.50%	7.50%	12%
3 5 Years of Low Returns	Starting with a relatively short period of low expected return (year 1-5)	1	5.00%	about 7.1%	12%
		2	5.50%		
		3	6.00%		
		4	6.50%		
		5	7.00%		
		7-30	7.50%		
4 15 Years of Low Returns	Starting with a relatively long period of low expected return (year 1-15)	1-10	5.00%	about 6.6%	12%
		11-15	6.50%		
		16-30	7.50%		
5 High Volatility	High volatility reflecting current market forecasts based on market assumptions from private consulting firms	1-30	7.50%	7.50%	17.2%
6 Target Asset Allocation	Low expected return based on target asset allocation proposed by a private consulting firm	1-30	6.1%	6.1%	13.4%

Notes: When expected returns are not constant over the entire simulation period (scenario 3 and 4), the approximate formula for calculating expected compound annual return is not readily available and the expected compound annual return is obtained by simulation approach (close to the mean of 50,000 simulations).

How We Modeled LAFPP Funding Policy

Current Practice

We model current funding practice as follows:

- *Employee* contributions are fixed. (Depending on the employee's tier, the contribution rate can be between 6 percent and 9 percent of payroll.)
- *Employer* contributions are determined as follows:
 - The model calculates the actuarially determined contribution using the current LAFPP policy: new investment gains and losses occurring in the

simulation period are amortized over a closed twenty-year period using level percent repayment. Asset values are smoothed over seven years,¹¹ but the actuarial value of assets cannot deviate from the market value of assets by more than 40 percent.

- When the total actuarially determined contribution is greater than the employee contribution, the employer contribution is equal to the difference between them.
- When the total actuarially determined contribution is smaller than the employee contribution, the employer contribution is zero. No negative employer contribution (withdrawal from the fund) is allowed.

The DROP program is modeled in a simplified way such that the simplification does not have a significant impact on the overall cash flow of LAFPP. (Please see the appendix, *Modeling DROP*, for a more detailed description.)

The Potential Implications of a Voter Initiative That Caps Employer Contributions

We compare the current LAFPP policy, under which the government pays the full actuarially determined contribution, to a policy in which the employer contribution is capped as proposed in several pension initiatives. The cap would apply only to new employees. In the far future, all employees would be covered by the cap, and so we also examine a variant in which the cap applies to all employees in our model.¹²

Our goal in our analysis of the pension-initiative employer contribution cap is to illustrate the potential impact of this policy change on plan finances rather than provide accurate projections. For this purpose, we let the employer contribution cap become effective from the initial simulation year 2016, instead of year 2019 specified in the pension initiatives, so that it is easier to compare results from different policies.

The employer contribution cap is modeled as 13 percent of the payroll or 50 percent of the total cost of the employees affected by the policy, whichever is lower. When the employer contribution cap is reached, employees make additional contributions to ensure that the full actuarially determined contribution is made.

Measures We Use to Evaluate Results

We are primarily concerned about two kinds of risks:

- Extremely low funded ratios, which create a risk to pension plans and their beneficiaries, and create political risks that could lead to benefit cuts in states in which cuts are legally permissible, and
- Extremely high contributions, or large increases in contributions in short periods of time, which pose direct risks to plan sponsors and their stakeholders, and in turn could pose risks to pension plans and their beneficiaries.

There usually are trade-offs between these two kinds of risks and how the trade-offs operate is a function of a plan's contribution policy. If a pension plan has a contribution policy designed to pay down unfunded liabilities very quickly, it is unlikely to have low funded ratios but it may have high contributions. If a pension plan has a contribution policy designed to keep contributions stable and low, there is greater risk that funded ratios may become very low because contributions may not increase rapidly in response to adverse experience.¹³

Probability That the Funded Ratio Will Fall Below 40 Percent During the First Thirty Years

When returns are stochastic, many outcomes are possible, including very extreme outcomes, so it does not make sense to focus on the worst outcomes or the best outcomes. We are particularly concerned about the risk of bad outcomes, and one useful measure is the probability that the funded ratio, using the market value of assets, will fall below 40 percent in a given time period.

We choose 40 percent because it is a good indicator of a deeply troubled pension fund. In 2013, only four plans out of 150 in the Public Plans Database¹⁴ had a funded ratio below 40 percent – the Chicago Municipal Employees and Chicago Police plans, the Illinois State Employees Retirement System, and the Kentucky Employees Retirement System. Each plan is widely recognized as being in deep trouble, with the likelihood of either substantial tax increases, service cuts, or benefit cuts yet to come.

Given LAFPP's current level of funding, falling to 40 percent funded would require an investment shortfall of well over 50 percent, which is not likely in a single year. But as the time period extends, there is a chance of an extended period of low returns, leading to severe underfunding. This measure evaluates the likelihood of this occurring.

Probability that Employer Contributions Will Rise By More Than 10 Percent of Payroll in a Five-Year Period

Making contributions stable and predictable is one of the most important goals of funding policies from the perspective of the employer. Sharp increases in employer contributions, even if not large enough to threaten affordability, can cause trouble in budget planning. We use the probability that the employer contribution will rise by more than 10 percentage points of payroll in a five-year period to measure this possibility. Extremely low returns in a very short time period as may occur in a severe financial crisis may push up the required contribution considerably even after being dampened by asset smoothing and amortization policies.

In the analysis below the normal cost rate in the first year is 28.2 percent and the employer contribution in the first year, including amortization of unfunded liability, is about 31.5 percent. Thus, an employer contribution of 50 percent is a substantial increase from the initial contribution level for LAFPP.

Results

Although we extend our model for fifty years, we generally focus on the first thirty years, in the belief that this is a meaningful period for policymakers.¹⁵ We organize our discussion of results as follows:

- We begin by discussing results for the six investment-return scenarios under current funding policy. We compare results of alternative stochastic scenarios to our *Assumption Achieved: Stochastic Base Case* (Scenario 2).
- Next we discuss the potential implications of a cap on employer contributions, which entails a shift of risk to employees.
- Finally, we discuss how LAFPP investment risk could affect the Los Angeles City budget.

Results Under Current Funding Policy

Investment Return Assumption Achieved (Scenarios 1 and 2)

Scenario 1: Assumption Achieved: Deterministic

In the deterministic scenario, the investment return is 7.5 percent each year so there are never any unanticipated gains or losses, and a single simulation is all that is needed. It embodies LAFPP's key assumptions in important respects and is the scenario against which we compare stochastic alternatives.

Table 3 shows results for key variables in selected years, generally spaced five years apart. The plan starts out with about a 91 percent funded ratio in the initial year but the unfunded liability is gradually eliminated so that at the end of thirty years the funded ratio is approximately 100 percent. The employer contribution is 30.8 percent of payroll in the initial year, which is higher than about 80 percent of public plans in the Public Plans Database, and then falls by more than half over the thirty years as the amortization payments ensure that the initial unfunded liability is paid off.¹⁶

Table 3. Results from Deterministic Simulation

Year	Actuarial Liability	Market value of assets	Benefit	Total Contribution	Employer contribution	Employee contribution	Net external cash flow (contribution minus benefit)	Funded ratio (market value of assets)	Employer contribution as % of payroll	Normal cost as % of payroll	Net external cash flow as % of assets	Asset to payroll ratio
2016	\$18,808	\$17,116	\$942	\$565	\$431	\$135	-\$376	91.0	30.8	28.0	-2.2	12.2
2020	22,146	20,765	1,175	598	422	176	-578	93.8	22.9	24.1	-2.8	11.3
2025	27,299	26,313	1,383	612	403	209	-771	96.4	18.0	23.2	-2.9	11.8
2030	33,115	32,148	1,774	700	449	251	-1,073	97.1	16.9	23.0	-3.3	12.1
2035	39,567	38,671	2,192	908	606	301	-1,285	97.7	19.3	23.0	-3.3	12.3
2040	46,968	46,865	2,627	983	623	361	-1,644	99.8	16.6	23.1	-3.5	12.5
2045	55,738	55,791	3,103	1,041	608	433	-2,062	100.1	13.5	23.1	-3.7	12.4

Note: All dollar values are in millions.

The high normal costs shown in Table 3 indicate that LAFPP is a very expensive plan. The normal cost of LAFPP in 2015 is about 28 percent of payroll, which is higher than 90 percent of plans in the Public Plans Database. The high costs are primarily a result of relatively expensive benefit provisions that are quite common in public safety pension plans, such as a low retirement-eligibility age and a high benefit factor.

LAFPP holds a large amount of assets relative to its covered payroll: the asset-to-payroll ratio in 2016 is about 12, which is higher than 90 percent of plans in the Public Plans Database, and stays at about the same level during the thirty years. A high asset-to-payroll ratio can make the employer contribution rate very volatile when investment returns vary from year to year, because the amortization payments for investment losses or gains will be large relative to the payroll.¹⁷ This point will be demonstrated in the following sections where investment returns are stochastic.

Scenario 2: Assumption Achieved: Stochastic

In the base-case stochastic scenario, everything is the same as in the deterministic scenario, except that although the expected long-run compound return is 7.5 percent, returns vary from year to year with a standard deviation of 12 percent.

Impact on Plan Funding

We first show the likely range of funded ratios resulting from the 2,000 simulations under the stochastic scenario. Figure 1 shows the median funded ratio and the 25th percentile and the 75th percentile, along with the funded ratio in the deterministic scenario. In the deterministic scenario, where investment returns are exactly 7.5 percent in every year, the initial funded ratio is 91 percent and, because there are never any investment shortfalls or overages, the plan marches closer to full funding every year.

In the stochastic scenario, investment returns in any single year will be better than assumed or worse than assumed. In some simulations, investment returns may be worse than assumed for many years in a row. Although contribution policy is intended to put the plan back onto a path toward full funding after investment shortfalls, the combination of asset smoothing, long amortization period, and a series of bad investment returns can lead to circumstances where plan funding becomes dangerously low. By the same token, the plan can become considerably overfunded after experiencing a series of good investment returns. Figure 1 shows that if the expected long-term compound return is equal to the assumed return of 7.5 percent during the next thirty years, in 25 percent of the simulations the funded ratio will drop to about 80 percent or lower by 2045, while in another 25 percent of simulations, the funded ratio will rise to 167 percent or higher. In the other 50 percent of simulations, the 2045 funded ratio will fall between these values.

The distribution of funded ratios is asymmetric around the median and skewed upward: the distance between the 75th

percentile funded ratio and the median is much larger than the distance between the 25th percentile and the median. This skewness is partly caused by the fact that the employer is not allowed to withdraw from the fund when the fund is overfunded. Thus, the lower bound for employer contributions is zero but the upper bound is infinite (in the model). Although the funded ratio can become very high in simulations with good returns, the probability of the funded ratio being above the median and the probability of the funded ratio being below the median are both 50 percent.

Figure 1. Once We Allow Investment Returns to Vary, the Likely Range of the Funded Ratios Is Large Even If Expected Return Assumptions Are Correct

Distribution of funded ratios across simulations
 Current LAFPP funding policy; expected compound return = 7.5%

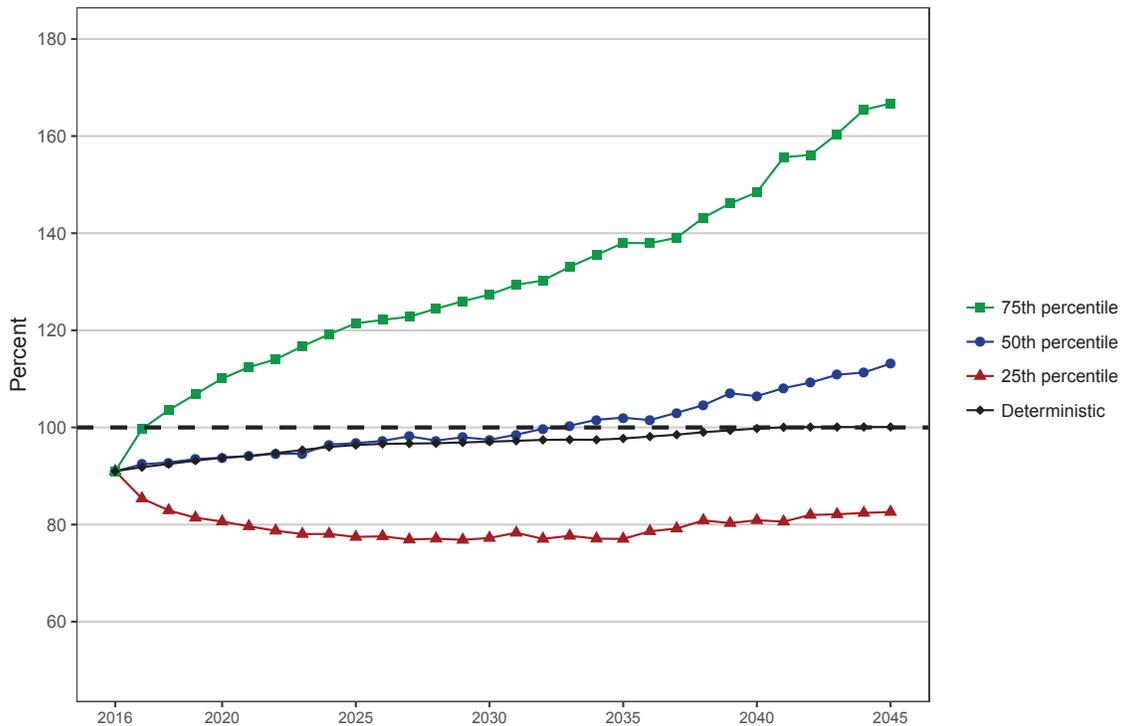
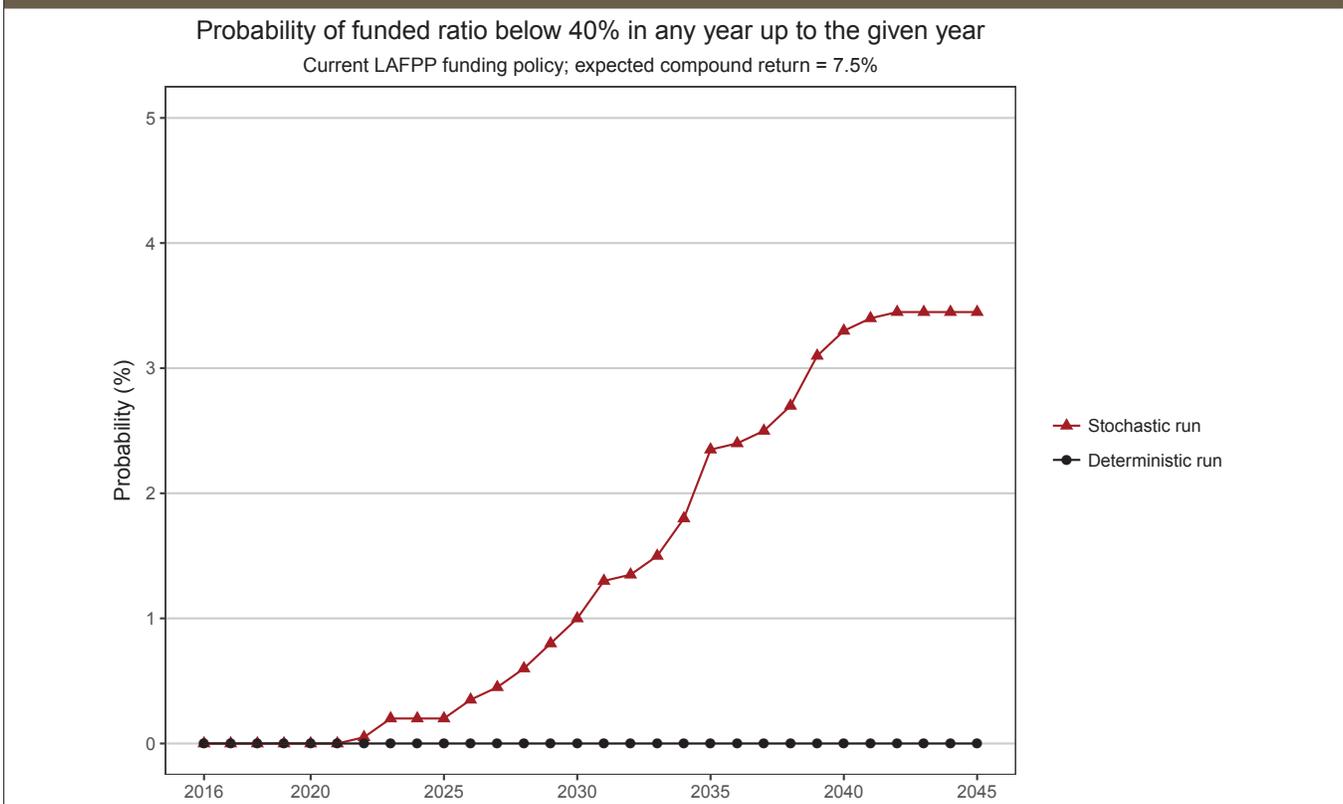


Figure 2 shows the risk of a dangerously low funded ratio under the deterministic scenario and the stochastic scenario. At each year, the graph shows the probability that the funded ratio, based on the market value of assets, will have fallen below 40 percent in any year up to that point. In the deterministic scenario, the probability of the funded ratio falling below 40 percent is always zero because the funded ratio starts off at 91 percent and then rises toward full funding. In the stochastic scenarios, thirty years into the simulation (2045), there is only about a 3.4 percent chance that the funded ratio will have fallen below 40 percent at some point in the period.

LAFPP’s low risk of becoming severely underfunded is primarily a result of the good initial funded status of LAFPP. We ran a separate simulation in which LAFPP starts off only 75 percent funded, which is about the median funded level in the Public

Plans Database in 2015, and at this lower funding there was a 35 percent chance that the funded ratio would fall below 40 percent, and that the median funded ratio would decline to 61 percent by year thirty rather than rising toward full funding. The better initial funded status leads to a lower risk of severe underfunding not only because the plan has a higher funded ratio to start with, but also because the larger initial assets allow the plan to earn more investment income. With deterministic investment returns of 7.5 percent in each year, the plan starting off 91 percent funded earns about 48 percent more investment income over the thirty-year period than the plan starting off at 75 percent funded.¹⁸

Figure 2. The Risk of Severe Underfunding Is Quite Low When Expected Return Assumptions Are Correct

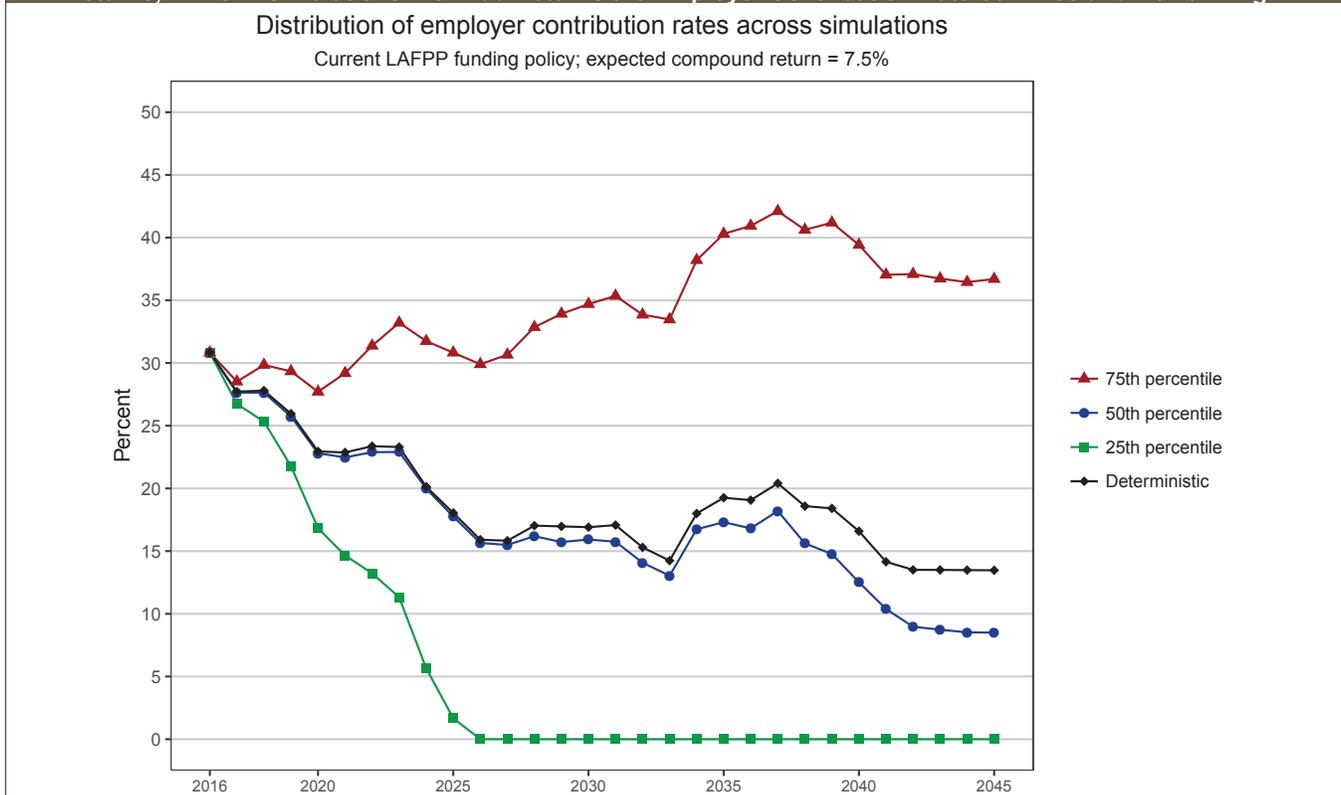


Impact on Employer Contributions

Although LAFPP has little exposure to the risk of becoming severely underfunded, the City of Los Angeles faces substantial uncertainty in employer contributions. Figure 3 shows the median employer contribution as a percentage of payroll under the stochastic scenario, along with the 25th percentile and 75th percentile, and the employer contribution rates under the deterministic scenario. The median and the 25th percentile employer contribution rates both decrease over time. The median employer contribution rate, starting at 30.8 percent in year one, gradually falls to less than 10 percent by year thirty, consistent with decreasing amortization payments for the initial unfunded liability and

improving funded status. The 25th percentile for employer contribution rates, which represents simulations with relatively good investment returns, even drops to zero after 2026. However, in a quarter of the simulations that have relatively bad investment returns, represented by the 75th percentile line, the employer contribution will stay high and reach about 37 percent of payroll or higher by year thirty.

Figure 3. The Employer Contribution Rates Tend to Decrease in Simulations with Average or Good Investment Returns, While in Simulations with Bad Returns the Employer Contribution Rate Can Rise and Remain High

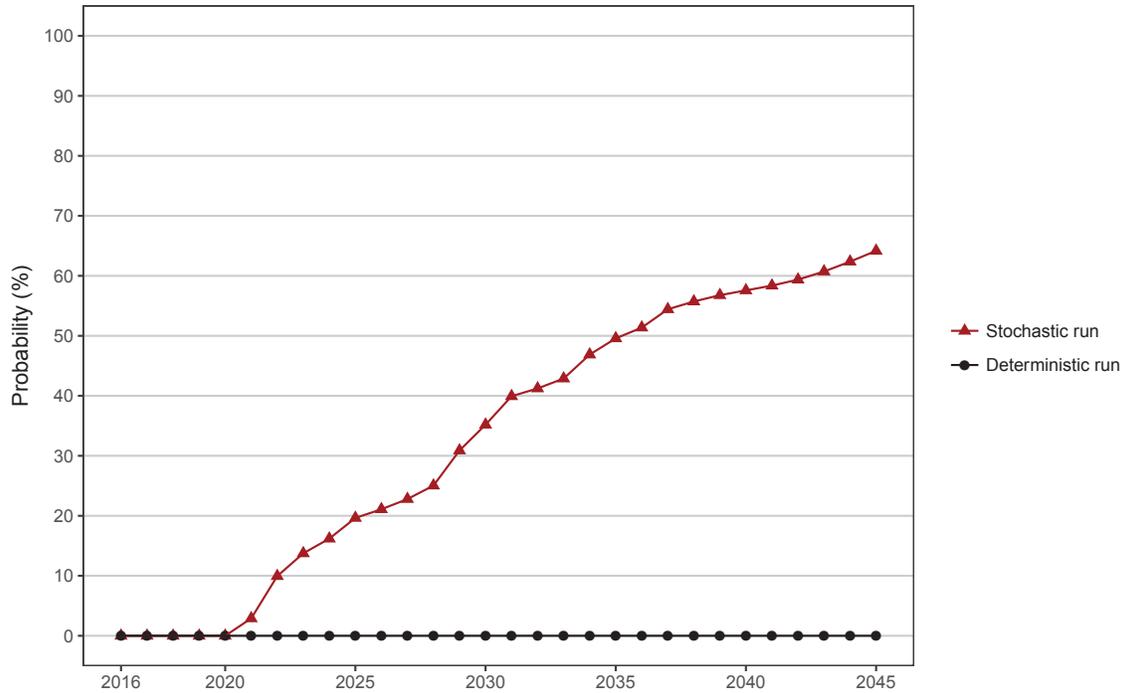


The uncertainty in the employer contribution rate is demonstrated more clearly in Figure 4, which shows the risk of large increases of employer contributions in a short time. Each point shows the probability that the employer contribution rose by more than 10 percent of payroll in any previous consecutive five-year period. For example, the probability at 2025 is about 20 percent. This means that there is about a 20 percent chance that employer contributions will have increased by more than 10 points in any five previous consecutive years, such as periods from 2015 to 2020, 2016 to 2021, and so on, through 2021 to 2025. By the end of the thirty-year period, there is about a 64 percent chance that contributions will have increased by more than 10 points in at least one of those five-year periods.

Figure 4. The Risk That Contributions May Rise by More Than 10 Percent of Payroll in a Short Period of Time is Substantial Under the Current LAFPP Funding Policy

Probability of employer contribution rising more than 10% of payroll in a 5-year period at any time prior to and including the given year

Current LAFPP funding policy; expected compound return = 7.5%



A Period of Low Returns (Scenarios 3 and 4)

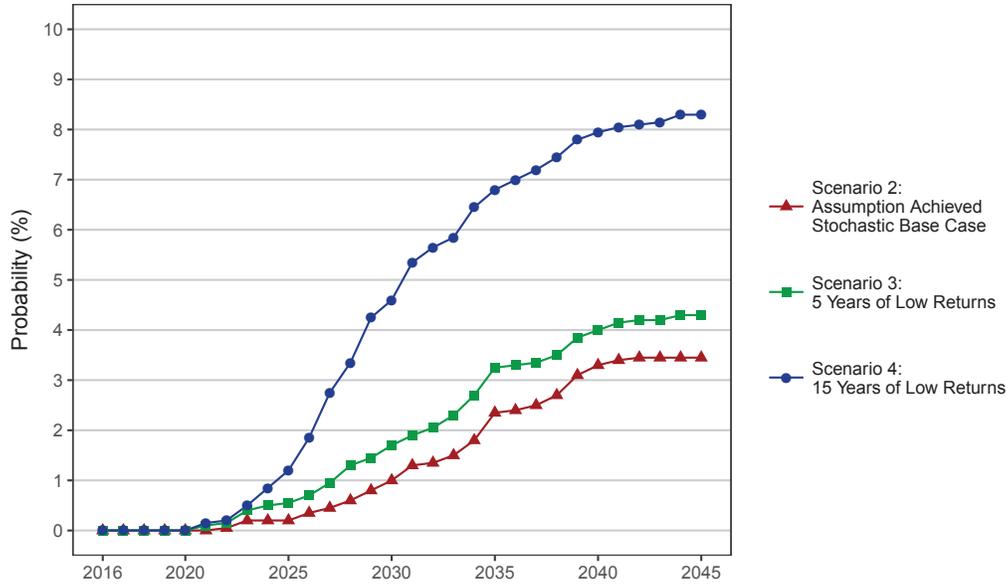
In this section we compare a short period of low returns (*Scenario 3: 5 Years of Low Returns*) and a longer period of low returns (*Scenario 4: 15 Years of Low Returns*) to our base-case stochastic scenario in which the expected return is 7.5 percent and the standard deviation is 12 percent (*Scenario 2: Assumption Achieved: Stochastic Base Case*). Refer back to Table 2 for details of investment return scenarios.

Impact on Plan Funding

The simulation results show that even if the true expected compound return is lower than the assumed return of 7.5 percent in early years, the risk of severe underfunding remains quite low for LAFPP. Figure 5 shows the probability of the funded ratio falling below 40 percent under the three return scenarios; even with fifteen years of low returns, the probability of dangerously low funded ratio is 8.2 percent, which is still relatively low although it is already more than double the risk compared to when the 7.5 percent earnings assumption is met.

Figure 5. The Risk of Severe Underfunding Is Still Low Even If the Expected Investment Returns Are Low in Early Years

Probability of funded ratio below 40% at any time prior to and including the given year under different return scenarios
Current LAFPP funding policy



Notes:

Scenario 2: Expected compound return is 7.5%, standard deviation is 12%
 Scenario 3: Expected compound return is 7.1%, standard deviation is 12%
 Scenario 4: Expected compound return is 6.6%, standard deviation is 12%

Impact on Employer Contributions

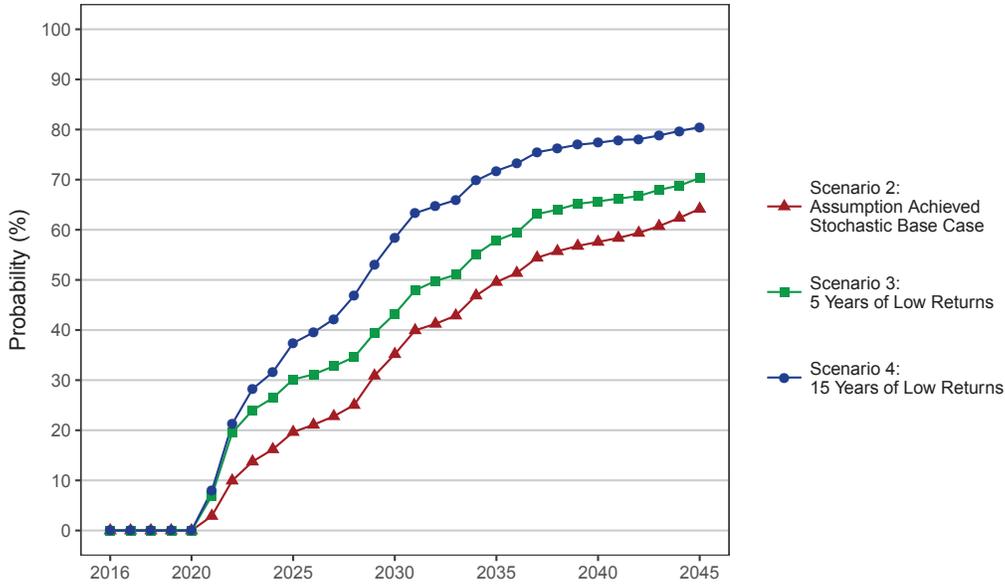
Under the current LAFPP funding policy that has no employer contribution cap, low expected returns in early years would increase substantially the risk of sharp increases in employer contributions. Figure 6 shows the probability of employer contributions rising by more than 10 percent of payroll in a five-year period during thirty years. This probability increases from about 64.2 percent in *Scenario 2: Assumption Achieved: Stochastic Base Case* to 70 percent in the scenario with five years of low returns, and to about 80.5 percent in the scenario with fifteen years of low returns.

Greater Investment-Return Volatility (Scenarios 5 and 6)

In this section we examine (1) *Scenario 5: High Volatility*, which has an expected compound return of 7.5 percent and a standard deviation of 17.2 percent, consistent with some publicly available capital market assumptions, and (2) *Scenario 6: Target Asset Allocation*, which has an expected compound return of 6.1 percent and a standard deviation of 13.4 percent, consistent with an asset-liability study conducted for LAFPP. We compare these scenarios to our base-case stochastic scenario in which the expected return is 7.5 percent and the standard deviation is 12 percent (*Scenario 2: Assumption Achieved: Stochastic Base Case*). Refer back to Table 2 for details of investment return scenarios.

Figure 6. Low Expected Returns in Early Years Lead to Higher Risk of Large Increases in Employer Contributions in a Short Time Period

Probability of ERC rising by more than 10% of payroll in any 5-year period up to the given year under different return scenarios
Current LAFPP funding policy



Notes:
 Scenario 2: Expected compound return is 7.5%, standard deviation is 12%
 Scenario 3: Expected compound return is 7.1%, standard deviation is 12%
 Scenario 4: Expected compound return is 6.6%, standard deviation is 12%

Impact on plan funding

In *Scenario 6: Target Asset Allocation*, in which the expected return is 1.4 percentage points lower than the earnings assumption, it is more difficult for the plan to achieve full funding than in the base case or the other scenario, and the plan faces the greatest risk of severe underfunding at some point during the thirty years. In *Scenario 5: High Volatility*, although the median funded ratio rises well above 100 percent by year thirty, the plan still has substantially higher risk of severe underfunding than in the base-case scenario because of the greater chance of extremely low returns.

Figure 7 shows the median funded ratio under the three scenarios. In Scenarios 2 and 5 where the expected compound returns equal the earnings assumption of 7.5 percent, the median funded ratio will rise dramatically and reach overfunding well before year thirty. In *Scenario 6: Target Asset Allocation*, with a 6.1 percent expected compound return, the median funded ratio declines for about twenty years and then rises slowly toward 100 percent but still fails to reach full funding by the end of year thirty, despite full payment of actuarially determined contributions in all years.

Figure 7. Median Funded Ratio is Lowest for the Low-Return Scenario

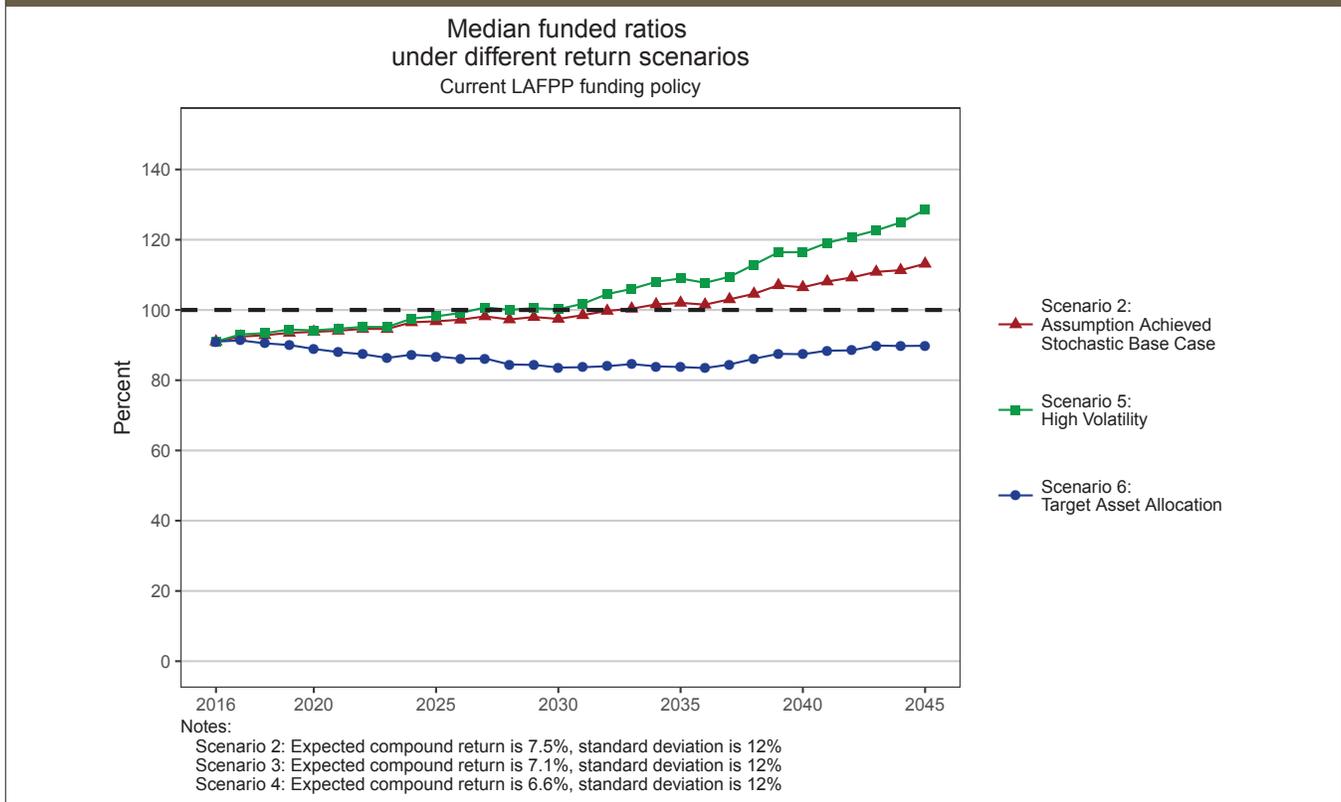


Figure 8 shows the probability of the funded ratio becoming dangerously low (falling below 40 percent). *Scenario 5: High Volatility* has greater risk of severe underfunding than *Scenario 6: Target Asset Allocation*, which has a lower expected return but also lower volatility. Investment-return volatility poses a severe risk to plan funding.

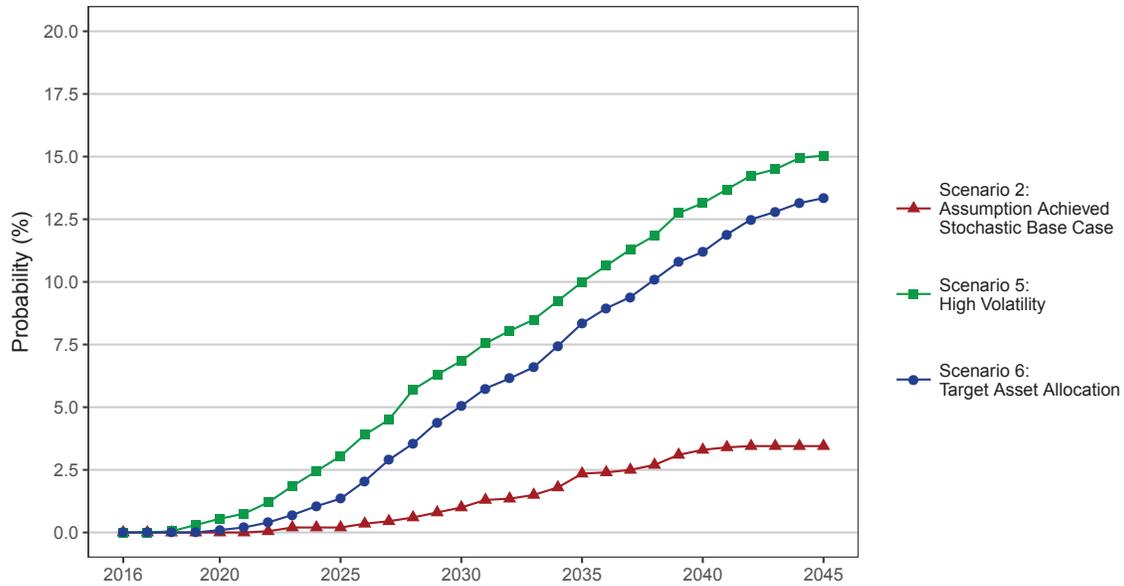
Impact on Employer Contributions

Both *Scenario 5: High Volatility* and the lower-return *Scenario 6: Target Asset Allocation* will lead to higher risk of large contribution increases in short time periods compared to the base-case *Scenario 2: Assumption Achieved: Stochastic*. The median employer contributions are much higher in the lower-return Scenario 6 than in the other two scenarios.

Figure 9 presents the median employer contribution of the three investment return scenarios under the current LAFPP contribution policy. In the low-investment-return *Scenario 6: Target Asset Allocation*, the median employer contribution rates are much higher than in the higher-return, higher-volatility investment Scenario 5 and the base-case Scenario 2. In Scenario 6, the expected compound return of 6.1 percent falls far short of the assumed return of 7.5 percent, and a higher employer contribution on average is required to make up the shortfall.

Figure 8. Probability of Severe Underfunding Is Generally Greatest When Investment-Return Volatility Is High

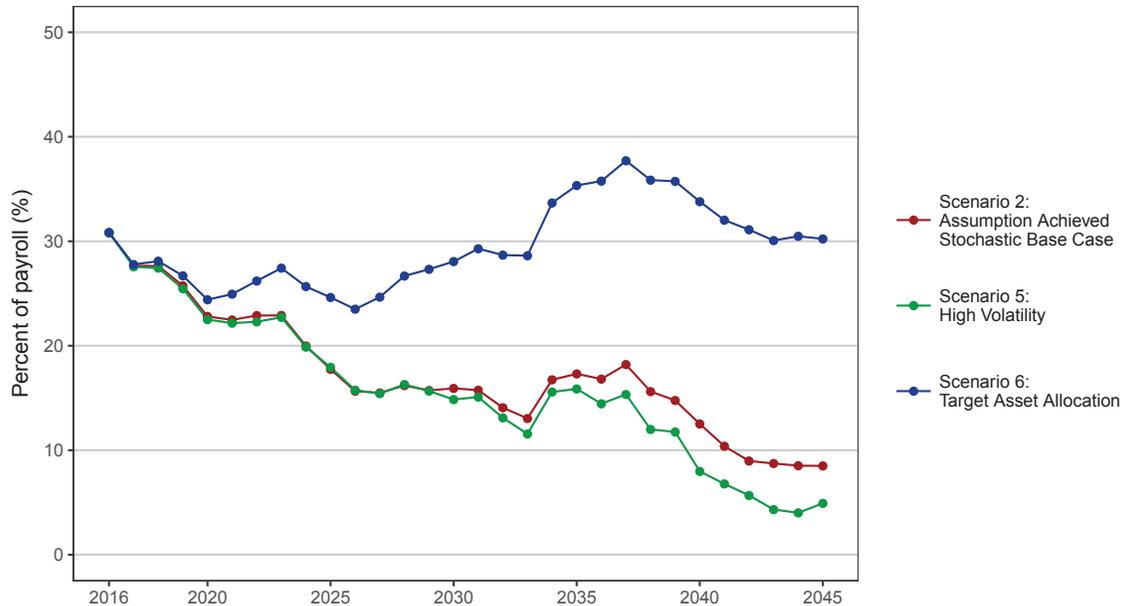
Probability of funded ratio below 40%
at any time prior to and including the given year
under different return scenarios
Current LAFPP funding policy



Notes:
Scenario 2: Expected compound return is 7.5%, standard deviation is 12%
Scenario 5: Expected compound return is 7.5%, standard deviation is 17.2%
Scenario 6: Expected compound return is 6.1%, standard deviation is 13.4%

Figure 9. Median Employer Contribution as a Percentage of Payroll Is Highest in the Lower-Return Lower-Volatility Scenario

Median employer contribution rates
under different return scenarios and funding approaches
Current LAFPP funding policy

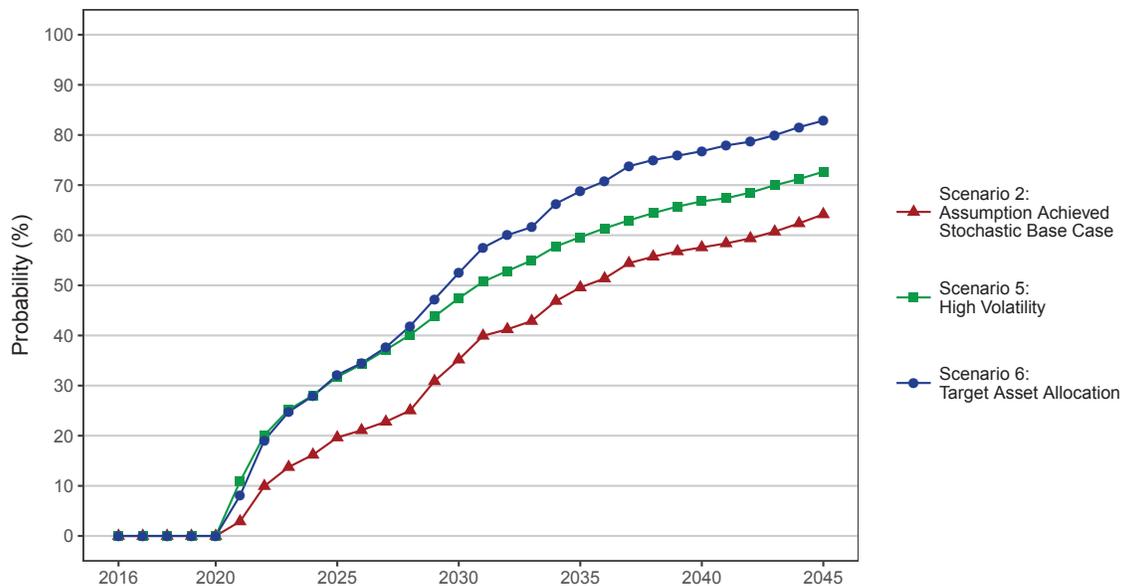


Notes:
Scenario 2: Expected compound return is 7.5%, standard deviation is 12%
Scenario 5: Expected compound return is 7.5%, standard deviation is 17.2%
Scenario 6: Expected compound return is 6.1%, standard deviation is 13.4%

Figure 10 shows the probability of the employer contribution rising by 10 percent of payroll in any consecutive five-year period over the next thirty years. Under the current funding policy with no employer contribution cap, the plan will face the greatest contribution risks in low-return *Scenario 6: Target Asset Allocation*: the probability of sharp increases in employer contributions is 83 percent, which is almost 20 percentage points higher than that in the base-case *Scenario 2*. The high-volatility *Scenario 5* also results in higher contribution risks: the probability of sharp increases in employer contribution is 73 percent. If either of these return scenarios, which are based on publicly available capital markets analyses, reflect likely market conditions, there is considerable risk that employer contributions will rise substantially in short time periods.

Figure 10. The Risk of Large Contribution Increases in a Short Time Period Is Higher in the High-Volatility Scenario and the Low-Return Scenario

Probability of ERC rising by more than 10% of payroll in any 5-year period up to the given year under different return scenarios
Current LAFPP funding policy



Notes:
 Scenario 2: Expected compound return is 7.5%, standard deviation is 12%
 Scenario 5: Expected compound return is 7.5%, standard deviation is 17.2%
 Scenario 6: Expected compound return is 6.1%, standard deviation is 13.4%

How Would Initiatives That Cap Employer Contributions Affect Risks Borne by the City and by City Employees?

We compare the current LAFPP policy, under which the government pays the full actuarially determined contribution, to a policy in which the employer contribution is capped as proposed in several pension initiatives. The cap would apply only to new employees, and we model it as a cap on contributions for employees hired after the first year of our model (2016). In the far future, all employees would be covered by the cap, and so we also examine a variant in which the cap applies to all employees in our

model. We examine all three approaches under *Scenario 2: Assumption Achieved: Stochastic*, which has an expected compound return of 7.5 percent and a standard deviation of 12 percent.

In the graphs that follow, these three approaches are labeled as:

- **Without ERC cap:** current policy without the employer contribution cap
- **ERC cap for new hires:** current policy with the proposed employer contribution cap applied to new hires after 2016.
- **ERC cap for all tiers:** current policy with the proposed employer contribution cap applied to all plan members.

Since the employer contribution cap would only affect how the total actuarially determined contribution is allocated between employer and employees, and not the total contribution, the three policy scenarios always have exactly the same aggregate cash flow and funded status. In this section, therefore, we only discuss how employer and employee contributions are affected.

How Employer Contributions Would be Affected by the Cap

Applying the employer contribution cap to new employees will only slightly reduce the contribution risks for the employer, in aggregate, because for many years, the new hires will be a small proportion of participants in the plan. However, the impact on individual new employees could be very large, creating considerable risk of substantial increases in employee contributions. If the employer contribution cap is applied to all employees, contribution risk will become considerably lower for the employer, but employee contributions will be tripled in early years, and there is a substantial chance that the contribution will remain high through the thirty-year period.

Each panel of Figure 11 shows the median employer contribution rate, as well as the 25th percentile and 75th percentile for one of the three funding approaches, under *Scenario 2: Assumption Achieved: Stochastic Base Case*. The leftmost panel shows the funding policy without the employer contribution cap. The middle panel is for the employer contribution cap applied to new hires. Comparing the leftmost panel and the middle panel shows that applying the employer contribution cap to new hires only slightly reduces the total employer contribution in early years when new hires account for a very small share of the workforce. The impact grows over time as the share of new hires after 2016 increases, but is still only moderate by the end of the thirty-year period — the median employer contribution rate in 2045 is 2.3 percentage points lower than that under the current policy (6.2 percent vs. 8.5 percent), and the 75th percentile employer contribution rate in 2045 is 4.4 percentage points lower than that under the current policy (32.3 percent vs. 36.7 percent).

The rightmost panel of Figure 11 shows the employer contribution cap applied to all plan members. In the median simulation and all higher percentiles (including the 75th percentile) the employer contribution will be at the cap of 13 percent of payroll in most years. In 25 percent of the simulations with relatively good investment returns, the employer contribution rate will drop to zero after 2026.

Figure 11. Applying The Employer Contribution Cap to New Employees Will Reduce Employer Contributions Only Moderately Over the Next Thirty Years, While If the ERC Cap Is Applied to All Active Employees the Employer Contribution Will Be Capped at About 13 Percent of Payroll

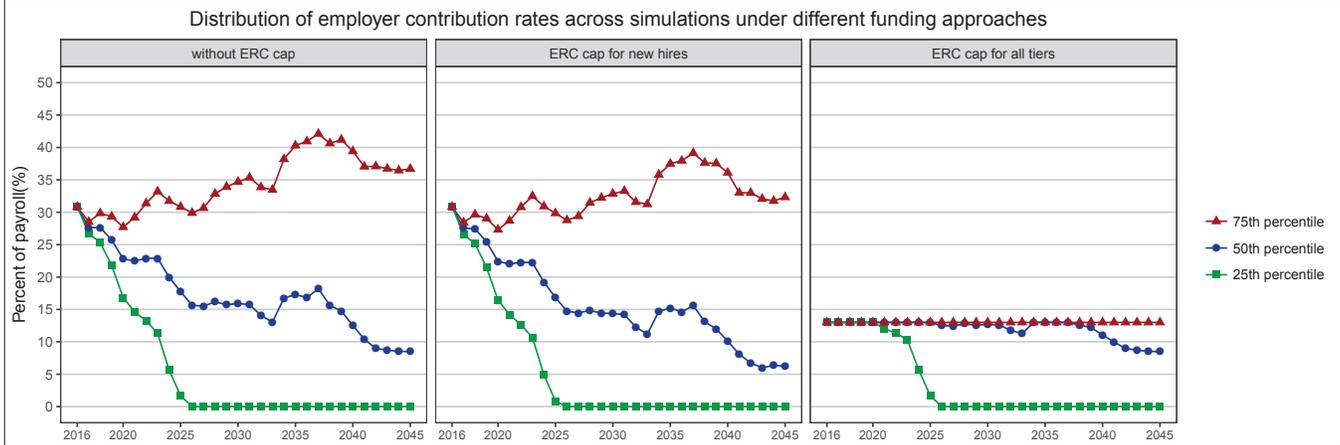


Figure 12 shows how the employer contribution cap will affect the risk of large increases in employer contributions in short time periods. Applying the employer contribution cap to new hires after 2016 will affect the contribution risk only moderately, reducing the probability that the employer contribution will rise by more than 10 percent of payroll in any five-year period in the first thirty years from 64.2 percent to 61 percent. However, when fully effective (modeled by applying the employer contribution cap to all current and future employees) the impact is much larger, reducing the risk of sharp increases in the employer contribution to only 19.1 percent.

How Employee Contributions Would be Affected

We next examine how much contribution risk will be imposed on employees if an employer contribution cap is implemented. Figure 13 shows the likely range of total employee contribution made by new hires after 2016 as a percentage of their total payroll. There is a 25 percent chance that by year thirty the total employee contribution will be higher than 15.4 percent of payroll for new hires (the 75th percentile line), and a 10 percent chance that it will rise to 19.5 percent of payroll or higher (90th percentile).

Figure 12. Applying the Employer Contribution Cap to New Employees Will Slightly Reduce the Risk of Sharp Increases in Employer Contributions; Applying the ERC Cap to all Active Employees Will Significantly Reduce the Risk

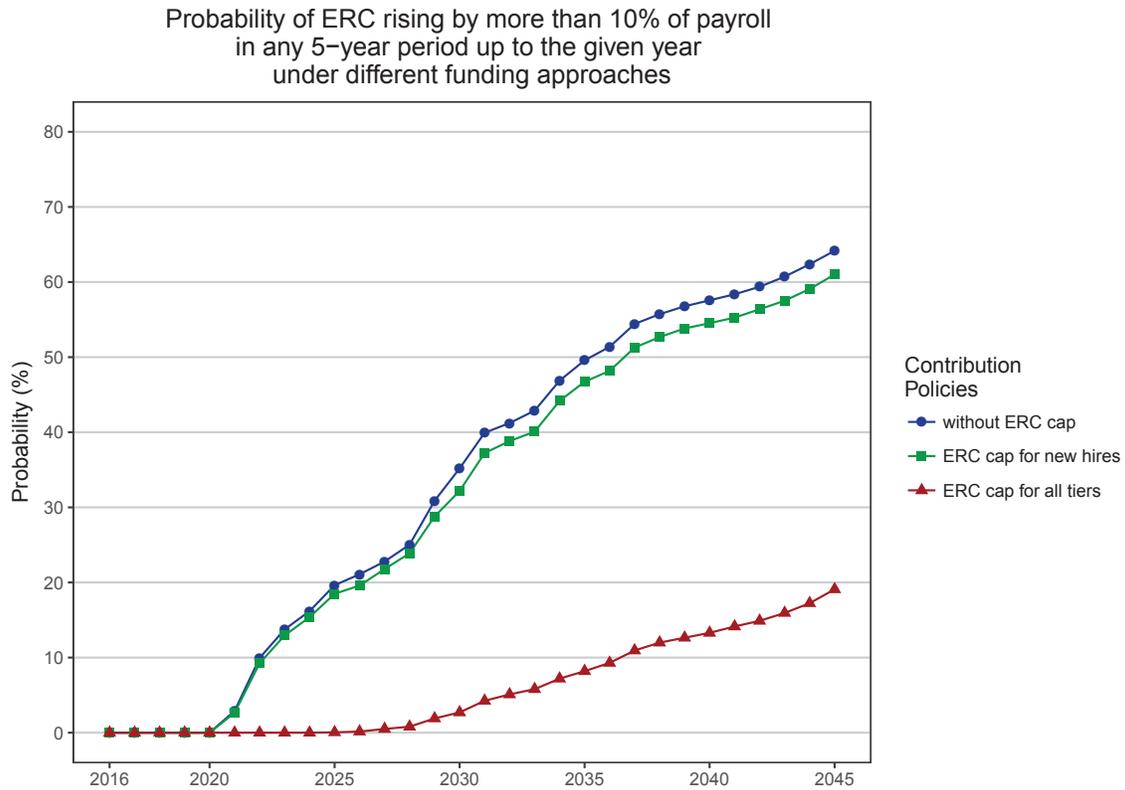
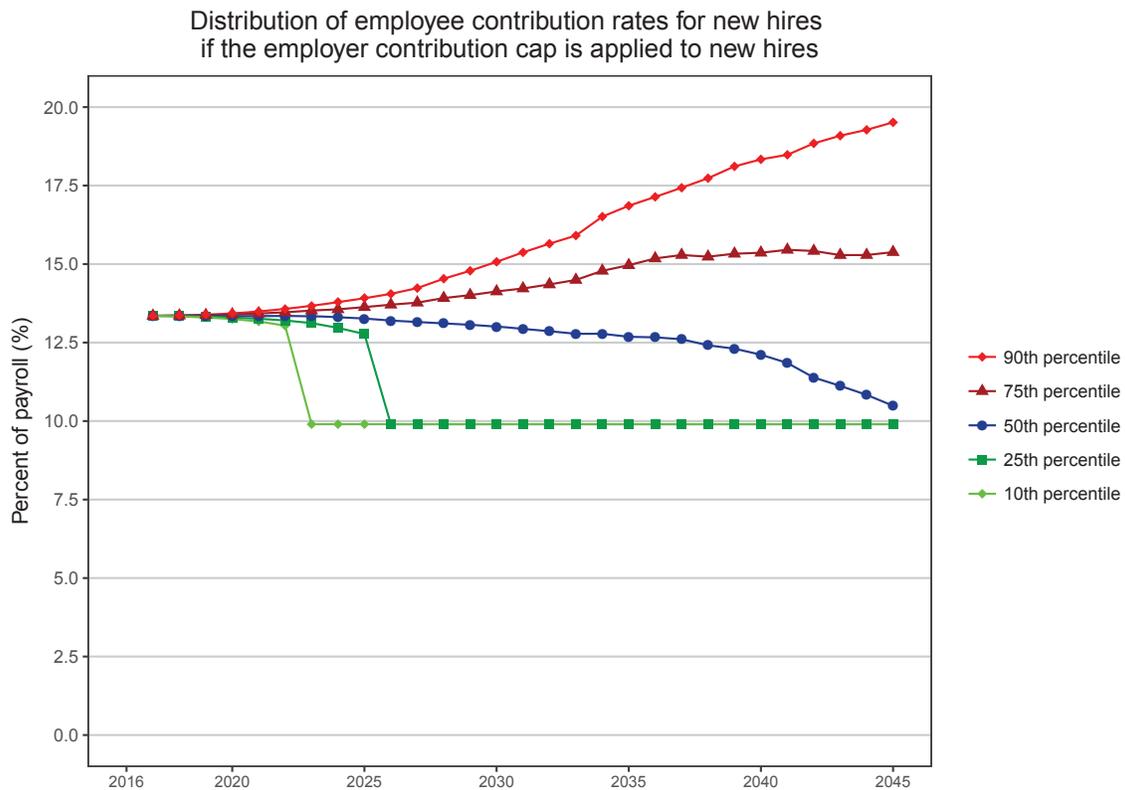
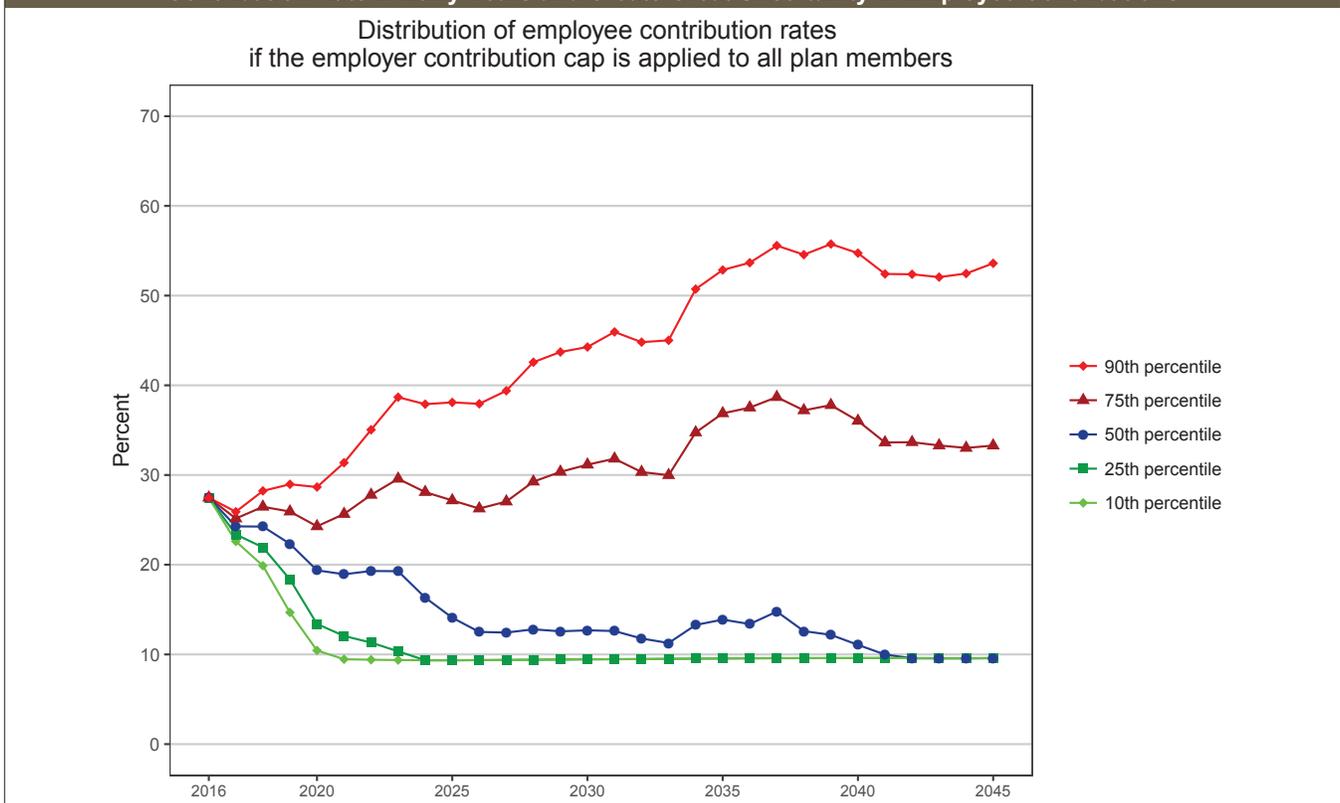


Figure 13. Applying The ERC Cap to the Cost of New Employees Creates Uncertainty in Employee Contribution Rates for New Employees



If the employer contribution cap is applied to all plan members, the employees will have to bear much greater contribution risks. Figure 14 shows that the total employee contribution would be around 27.5 percent of payroll in year one, which is almost triple the amount under the current policy that has no employer contribution cap.¹⁹ Although the median employee contribution rate declines over time as the initial unfunded liabilities are paid off, there would still be a non-negligible chance that the employees will have to contribute a prohibitively high portion of their salary: By the end of year thirty, there is a 25 percent chance that the employee contribution will be 33.3 percent of the payroll or higher, and a 10 percent chance that the employee contribution will be 53.6 percent of payroll or higher.

Figure 14. Applying the ERC Cap to All Active Employees Will Almost Triple the Employee Contribution Rate in Early Years and Create Great Uncertainty in Employee Contributions



Realistically, increases in employee contributions of this magnitude might be extremely unattractive to employees, and might lead to pressure to change retirement plans for workers.

The Impact on Employee Contributions Under Alternative Investment-Return Scenarios

We also examined the impact that an employer contribution cap would have on employee contributions under alternative investment-return scenarios. In general, the alternative scenarios, which have lower returns, higher volatility, or both, result in even greater risks to employees. See the appendix, *The Impact of an*

Employer Contribution Cap Upon Employee Contributions, Under Alternative Investment-Return Scenarios, for details.

Summary of Impacts on the LAFPP Funded Ratio and on Employer Contributions

Table 4 summarizes the impacts of the five stochastic investment-return scenarios over the thirty-year period. (We do not include *Scenario 1: Assumption Achieved: Deterministic* because there are no risks of funding shortfalls or employer contribution surprises). The first column describes the measure that appears in each row. The next five columns show the five stochastic return scenarios under the current funding policy which has no employer contribution cap. The next five columns do the same for the funding policy with the proposed employer contribution cap applied to new employees hired after 2016. The final five columns are for the policy with the employer contribution cap applied to all current and future plan members.

The table shows that LAFPP has very limited exposure to the risk of severe underfunding, which is largely attributable to the high initial funded ratio and relatively short amortization period. But LAFPP faces a very high risk of experiencing large increases of employer contributions in short time periods under the current funding policy. Even under Scenario 2, where the earnings assumption is met, there is a nearly two thirds chance that the employer contribution will rise by more than 10 percent in a five-year period in the next thirty years. The risk is even higher in the other scenarios with low expected returns or high volatility.

The effect of applying the employer contribution cap to new employees grows over time as the share of new employees affected by the policy rises, but this will be a slow process and the impact on contribution risks will be limited over a long period of time. The model projects that the payroll of new employees accounts for 8 percent of the total payroll in 2019, 40 percent in 2029, and 86 percent in 2045; the actuarial liability of new employees accounts for 0.2 percent of the total liability in 2019, 6 percent in 2029, and 37 percent in 2045. With only a portion of the plan members affected, the employer contribution cap applied to new hires will have very limited effect in alleviating the overall contribution risks for LAFPP in the short term.

If the employer contribution cap is applied to all plan members, the employer will be able to shed off most of the contribution risks, at the expense of increasing the contribution burden of employees considerably. (See the discussion of Table 5 below.)

Table 5, in which the columns are structured the same way as Table 4, summarizes the risk of very high employee contributions for employees affected by the proposed risk-sharing funding policy. The risk measures for funding policy with no employer contribution cap are also presented in Table 5 for comparison. Note that the risk measures are calculated only for employees who are affected by the risk-sharing policy: For the policy with the

Table 4. Summary of Results: Risk Measures for Funded Ratio and Employer Contribution

Probability of crisis-level funding or of significant employer contribution increases under different investment return scenarios and funding policies

All scenarios are stochastic

Potential impact of employer contribution caps in ballot initiative proposals

Risk Measures	LAFPP current funding policy: No employer contribution cap						Employer contribution cap applied to new employees hired after 2016						Employer contribution cap applied to all plan members (i.e., as if the initiative had been in effect for many years)					
	<i>Investment return scenarios</i>						<i>Investment return scenarios</i>						<i>Investment return scenarios</i>					
	Scenario 2 (Assumption Achieved: Stochastic Base Case)	Scenario 3 (5 Years of Low Returns)	Scenario 4 (15 Years of Low Returns)	Scenario 5 (High Volatility)	Scenario 6 (Target Asset Allocation)	Scenario 2 (Assumption Achieved: Stochastic Base Case)	Scenario 3 (5 Years of Low Returns)	Scenario 4 (15 Years of Low Returns)	Scenario 5 (High Volatility)	Scenario 6 (Target Asset Allocation)	Scenario 2 (Assumption Achieved: Stochastic Base Case)	Scenario 3 (5 Years of Low Returns)	Scenario 4 (15 Years of Low Returns)	Scenario 5 (High Volatility)	Scenario 6 (Target Asset Allocation)			
*Probability of crisis-level funding sometime in the next 30 years (%)	3.4	4.3	8.3	15.0	13.3	3.4	4.3	8.3	15.0	13.3	3.4	4.3	8.3	15.0	13.3			
**Probability of a significant employer contribution increase sometime in the next 30 years (%)	64.2	70.3	80.5	72.7	82.9	61.0	66.9	78.0	70.8	80.2	19.1	13.8	9.9	27.8	21.0			

Notes on return scenarios:
 Scenario 2(Assumption Achieved; Stochastic Base Case): Constant expected return over 30 years. Expected compound return is 7.5%, consistent with actuarial assumption of 7.5%.
 Scenario 3 (5 Years of Low Returns): Expected returns gradually rise from 5% to 7.5% over years 1-6, then remain at 7.5%; 30-year compound return is about 7.1%.
 Scenario 4 (15 Years of Low Returns): Expected returns are 5% in years 1-10, 6.5% in years 11-15, and 7.5% in years 16-30; 30-year compound return is about 6.6%.
 Scenario 5 (High Volatility): Constant expected return over 30 years. Expected compound return is 7.5%, standard deviation is 17.2%.
 Scenario 6 (Target Asset Allocation): Constant expected return over 30 years. Expected compound return is 6.1%, standard deviation is 13.4%.
 * Probability that funded ratio falls below 40% in at least 1 year out of the next 30 years.
 ** Probability that employer contribution rises by at least 10 percentage points in any 5-year period in the next 30 years.

Table 5. Summary of Results: Risk Measure for Employee Contribution

Likely contribution burdens of employees when investment returns are relatively bad under different funding policies and investment return scenarios

All scenarios are stochastic

Potential impact of employer contribution caps in ballot initiative proposals

	Investment return scenarios						Investment return scenarios								
	Scenario 2 (Assumption Achieved: Stochastic Base Case)	Scenario 3 (5 Years of Low Returns)	Scenario 4 (15 Years of Low Returns)	Scenario 5 (High Volatility)	Scenario 6 (Target Asset Allocation)	Scenario 2 (Assumption Achieved: Stochastic Base Case)	Scenario 3 (5 Years of Low Returns)	Scenario 4 (15 Years of Low Returns)	Scenario 5 (High Volatility)	Scenario 6 (Target Asset Allocation)	Scenario 2 (Assumption Achieved: Stochastic Base Case)	Scenario 3 (5 Years of Low Returns)	Scenario 4 (15 Years of Low Returns)	Scenario 5 (High Volatility)	Scenario 6 (Target Asset Allocation)
LAEPP current funding policy: No employer contribution cap (values for ALL active employees)	9.6	9.6	9.6	9.6	9.6	15.4	15.6	16.2	15.4	18.7	33.3	32.7	39.3	41.6	51.0
Employer contribution cap applied to new employees hired after 2016 (For NEW employees only)															
Employer contribution cap applied to all plan members (i.e., as if the initiative had been in effect for many years. For ALL active employees)															

*Likely employee contribution as a percentage of payroll in 2045 if invest returns are relatively bad in the next 30 years (%)

Notes on return scenarios:

- Scenario 2 (Assumption Achieved: Stochastic Base Case): Constant expected return over 30 years. Expected compound return is 7.5%, consistent with actuarial assumption of 7.5%.
- Scenario 3 (5 Years of Low Returns): Expected returns gradually rise from 5% to 7.5% over years 1-6, then remain at 7.5%; 30-year compound return is about 7.1%.
- Scenario 4 (15 Years of Low Returns): Expected returns are 5% in years 1-10, 6.5% in years 11-15, and 7.5% in years 16-30; 30-year compound return is about 6.6%.
- Scenario 5 (High Volatility): Constant expected return over 30 years. Expected compound return is 7.5%, standard deviation is 17.2%.
- Scenario 6 (Target Asset Allocation): Constant expected return over 30 years. Expected compound return is 6.1%, standard deviation is 13.4%.

* 75th percentile of employee contribution as a percentage of payroll in year 30 (2045). Under each scenario, the 75th percentile is higher than the values in 75 percent of simulations.

employer contribution cap applied to new hires, the measures are calculated based the payroll of and the employee contributions made by employees hired after 2016, and the fixed employee contribution rates still apply to current workers; for the policy with the employer contribution cap applied to all current and future workers, the measures are calculated based on the payroll and contributions of the entire workforce.

Under the current funding policy with no risk-sharing, the employee contribution rate stays almost constant at around 9.6 percent in all scenarios. For the funding policies with the employer contribution cap, Table 5 shows the 75th percentiles of the employee contribution rate, reflecting the likely contribution burdens of employees in simulations with relatively bad investment returns. With the employer contribution cap for new hires, the 75 percentile employee contribution rates range from 15 percent to 19 percent depending on the return scenarios, all of which are a substantial increase compared to the rates under the policy with no employer contribution cap.

If the employer contribution cap is applied to all plan members, the employees would be required to contribute over one-third of their salary to LAFPP, and the high employee contribution rate is likely to continue into the future if the earnings assumption is not met. Under Scenario 6, in 25 percent of the simulations the employees will have to contribute more than half of their payroll in 2045.

How Would Investment-Return Uncertainty Affect the City of Los Angeles's Budget?

In this section, we examine the potential fiscal pressure that LAFPP may create for the City of Los Angeles. We measure fiscal pressure as employer contributions to LAFPP as a percentage of city general fund revenue, which is the major source from which the pension contributions are paid. Our modeling is focused on pension contributions, and we do not include the LAFPP Health Subsidy program. Therefore, our fiscal pressure measures are generally not comparable to those in reports and news articles that include contributions for the Health Subsidy program.

To calculate our fiscal pressure measure, we need forecasts of employer pension contributions, which come from our simulation model, and forecasts of city general fund revenue, which we describe below.

Projecting General Fund Revenue of the City of Los Angeles

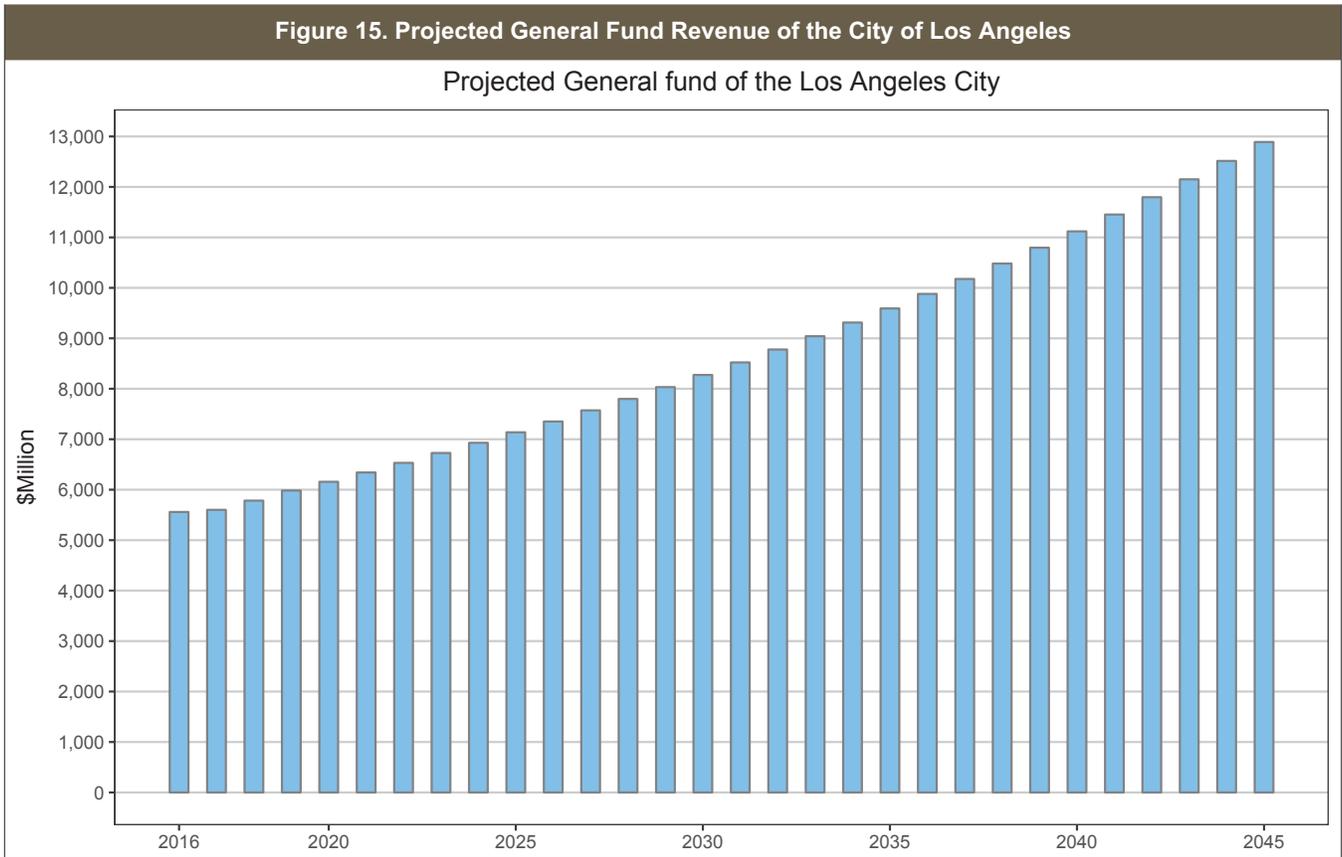
We constructed a thirty-year projection of the City of Los Angeles general fund revenue as follows:

- For fiscal years 2016 to 2020, we used projections from the City of Los Angeles Revenue Outlook (2016-2017).
- For fiscal year 2021 to 2045, we projected revenue using an annual growth rate of 3 percent, which is the average growth rate for 2016-2020 in the city's projection.

The resulting revenue projections are shown in Figure 15.

A caveat about using deterministic revenue growth rates, rather than allowing them to vary as investment returns vary, is that it ignores the potential correlation between tax revenues and employer contributions. If investment returns and taxes both are correlated with economic growth, then investment returns and taxes will be higher when the economy grows rapidly, and lower when the economy does poorly. Contribution increases resulting from investment-income shortfalls might be required in an already fiscally stressed period. Therefore, ignoring the correlation between tax revenues and contributions may lead to an underestimate of fiscal pressure. We leave to future research a modeling approach that takes into account the correlation between taxes and contributions.

Figure 15. Projected General Fund Revenue of the City of Los Angeles



Deterministic Results

We first examine the fiscal pressure that LAFPP pension contributions could create under scenarios with deterministic investment returns. Figure 16 shows city contributions to LAFPP as a percentage of general fund revenue during the next thirty years under deterministic runs of two scenarios – that is, runs in which the scenarios’ expected returns are achieved every year, without variation. The scenarios are *Scenario 1: Assumption Achieved: Deterministic*, and a deterministic version of *Scenario 6: Target Asset Allocation*. Scenario 2 is the base case, in which LAFPP’s assumption

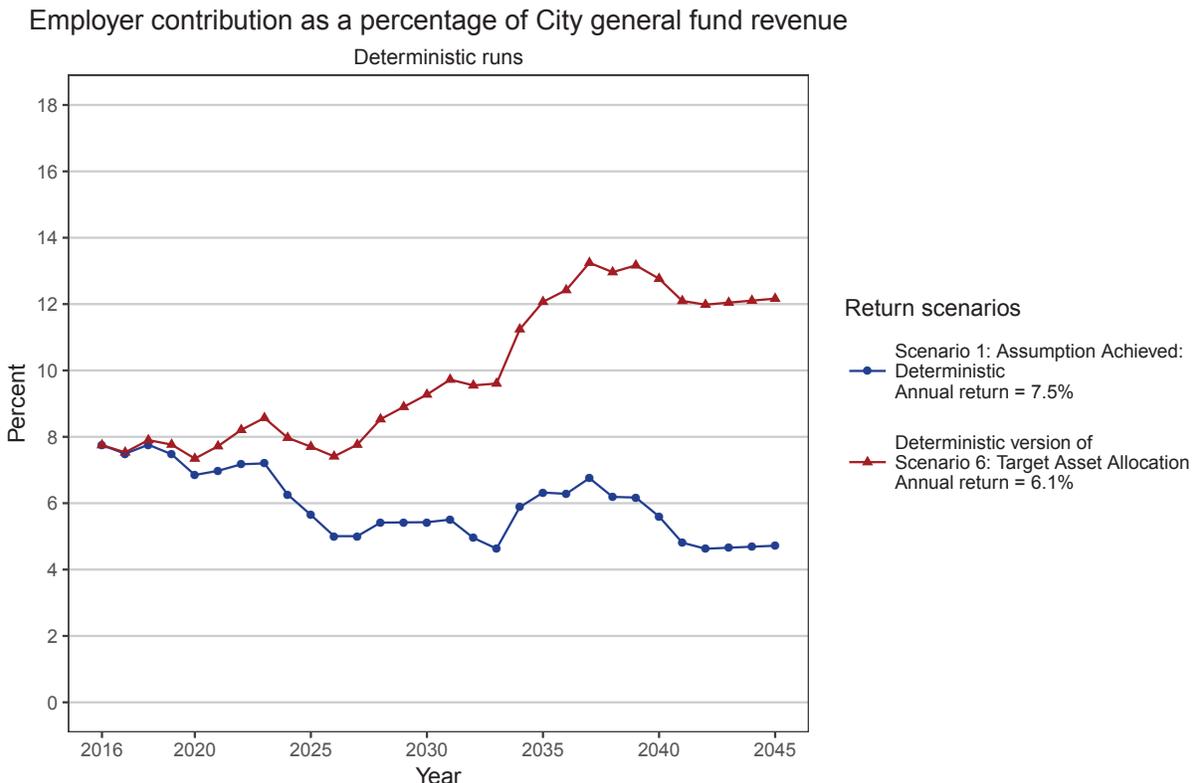
of a 7.5 percent return is achieved each year. The deterministic version of Scenario 6, based on the target portfolio of LAFPP, has an annual return of 6.1 percent every year.

The fiscal pressure from LAFPP pension contributions is quite sensitive to realized investment returns. Under base-case *Scenario 1: Assumption Achieved: Deterministic* in which the earnings assumption of 7.5 percent is met every year, city contributions as a percentage of general fund revenue decline from nearly 8 percent in 2016 to less than 5 percent in 2045. The decline is largely attributable to the decrease in amortization payments on the current unfunded liability, which account for about 30 percent of the total employer contribution in 2016 and drop to zero in twenty-six years as the unfunded liabilities are paid off.

In the deterministic version of *Scenario 6: Target Asset Allocation*, in which the annual returns are 1.4 percentage points lower than the assumed rate throughout the thirty-year period, city contributions would rise to about 12 percent of the general fund in 2045.

Thus, under LAFPP assumptions, the fiscal pressure from pension contributions will fall significantly, particularly over the next twenty years, but if investment returns fall short contributions could place significantly increasing pressure on the city (see Figure 16).

Figure 16. The Fiscal Pressure From LAFPP Employer Contributions Will Drop Substantially if the Earnings Assumption Is Met; but Will Be Much Higher If Actual Returns Fall Short of the Earnings Assumption

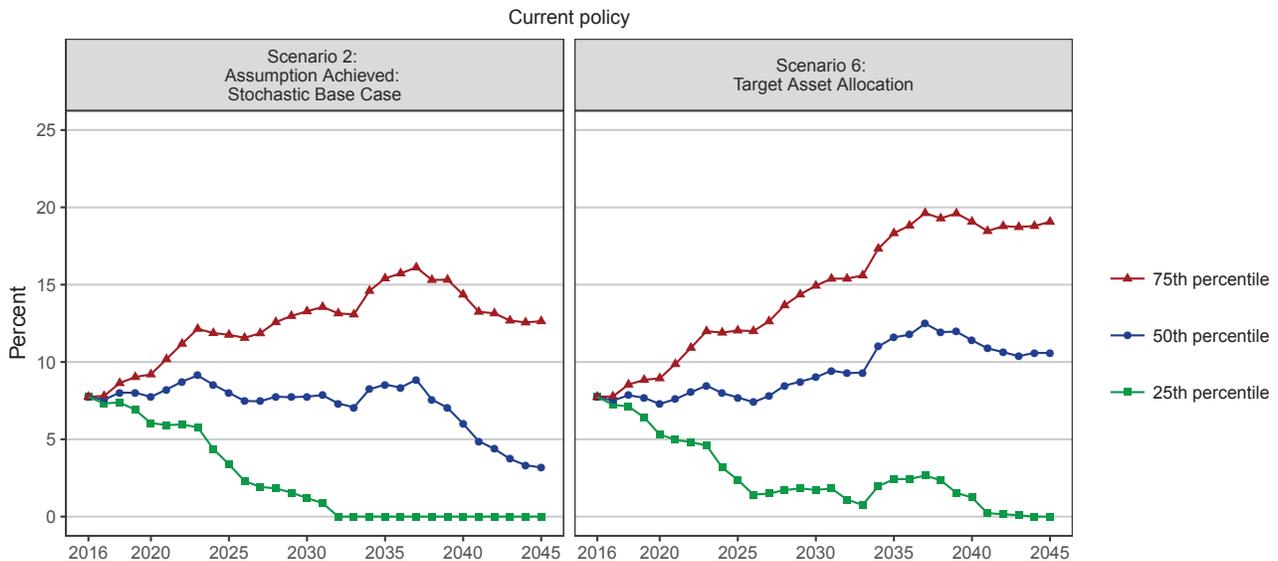


Stochastic Results

In scenarios with stochastic investment returns, the City of Los Angeles faces great uncertainty from fiscal pressure related to employer contributions to LAFPP. Figure 17 shows the distribution of the LAFPP employer contributions as a percentage of the general fund under two different return scenarios. Under *Scenario 2: Assumption Achieved: Stochastic* with an expected compound return of 7.5 percent and a standard deviation of 12 percent (left panel), although the median share of LAFPP employer contributions (blue line) drops to about 3 percent after thirty years, in one quarter of the simulations the share of LAFPP employer contributions will become 13 percent or higher in 2045 (see the 75th percentile represented by the red line). The 25th percentile line (green line), which represents the share of LAFPP employer contributions in simulations with relatively good investment returns, drops to zero after ten years. The risks of significant increases in the fiscal pressure from LAFPP employer contributions are even higher under the lower-return *Scenario 6: Target Asset Allocation*. The 75th percentile LAFPP employer contribution in 2045 is about 19 percent of the projected general fund under Scenario 6 (red line in right panel).

Figure 17. There Is Substantial Uncertainty in the Fiscal Pressure of LAFPP Employer Contributions Under Scenarios With Stochastic Returns

Distribution of employer contribution as a percentage of City general fund revenue under different return scenarios



Notes:
 Scenario 2: Expected compound return is 7.5%, standard deviation is 12%
 Scenario 6: Expected compound return is 6.1%, standard deviation is 13.4%

Correlated Fiscal Pressure From City Contributions to LACERS

The other major public pension system of the City of Los Angeles is Los Angeles City Employees’ Retirement System (LACERS), the budgeted employer contribution for which is about

90 percent as much as that for LAFPP (including the Health Subsidy) in fiscal year 2016-17. Because many pension funds have similar investment approaches and similar investment risk, when LAFPP does well, LACERS is likely to do well, and when it does poorly LACERS is likely to do poorly. Thus, the risks for the city that we describe in this report are likely to be compounded when LACERS is taken into account.

Conclusions

Our analysis suggests that if LAFPP's investment-return assumption is approximately correct over the long run, the plan has very little risk of becoming severely underfunded in the next thirty years, even if investment returns vary significantly from year to year. The main reasons for this are LAFPP's good current funded status, its relatively conservative method of determining contributions, and our assumption that the City of Los Angeles will continue its good track record of fully paying actuarially determined contributions. However, this means that even if the long-run expected return is reasonable, the city bears the full risk of year-to-year variation in returns and could face large contribution increases relative to payroll and to its general fund revenue. Under plausible alternative investment-return assumptions, the risks of severe underfunding remain small but the city's contribution risks are greater.

If California voters approve an initiative that caps employer contributions for new hires and requires the new employees to bear investment risk above the cap, there will be very little impact on employer contributions over the next thirty years, although impacts could be large for individual new employees. In the very long-run, after such a policy is fully in effect, there would be a large transfer of risk from the city to its employees, with a substantial risk that employee contributions will become prohibitively high. Should voters adopt such an initiative, it would be important for the plan and the city to communicate these risks clearly to the public and potential future employees of the City of Los Angeles.

The broader lessons from this analysis are that if a plan has a relatively good funded status and a conservative contribution policy, and if participating governments pay full actuarially determined contributions in all years, the plan has minimal chance of facing a funding crisis even if investment returns are quite volatile. However, the participating governments face a risk of substantial contribution increases, and those contributions can be large relative to a government's budget, particularly if the plan benefits are relatively expensive.

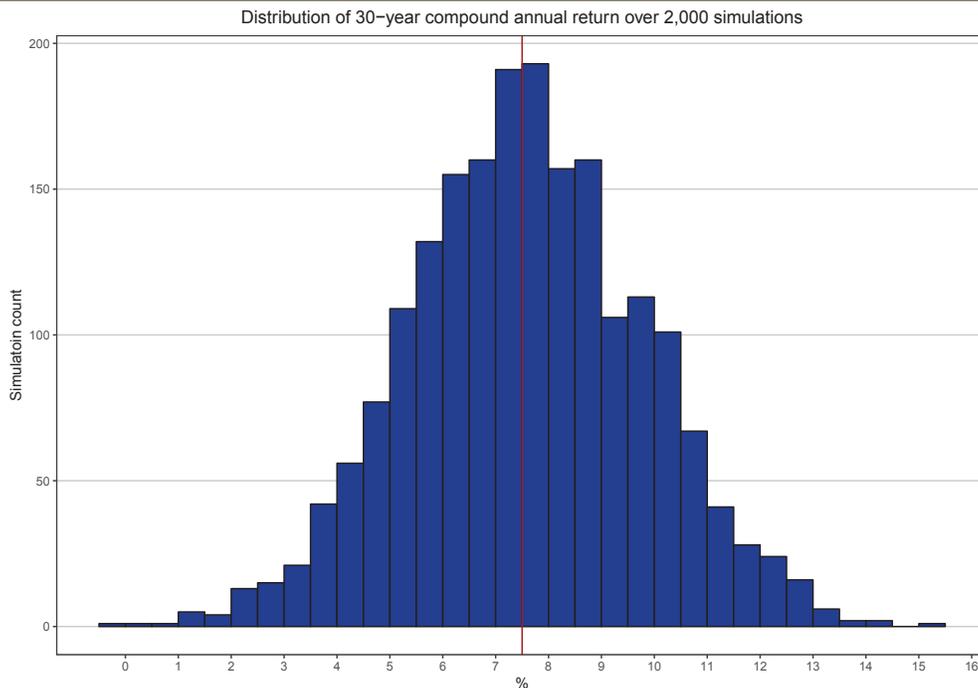
Appendices

Variability in Investment Returns

A 12 percent standard deviation results in considerable variability in annual investment returns. On average about a quarter of the annual returns will be negative and nearly a sixth will be greater than 20 percent. The risk to plan funding stemming from the variability in annual investment returns is twofold: first, there is uncertainty in the thirty-year annual compound return and there is no guarantee that the expected compound annual return of 7.5 percent will be achieved in any single simulation; second, even when the assumed return is achieved on average over the thirty years, the year-to-year changes in investment returns can still lead to substantial underfunding in certain periods.

Although the annual investment returns are drawn from a statistical distribution with an expected long-run compound return of 7.5 percent, there is no guarantee that the thirty-year compound return will be 7.5 percent in any single simulation – some simulations will be quite bad, some will be quite good, and many will be near the expected average. However, over the 2,000 simulations the average long-run compound return in our model will be approximately 7.5 percent. Figure 18 shows the distribution of compound annual returns at the thirty-year mark. The median compound average return, marked by the red vertical line, is approximately 7.5 percent.

Figure 18. Thirty-Year Compound Returns Are Symmetric Around Average



The compound annual return becomes less variable as the investment horizon increases, but this does not suggest investment becomes less risky in the long run. If the simulation horizon is only five years, about 8 percent of the 2,000 simulations result in negative annual compound returns; if the simulation period extends to thirty years, the likelihood of negative annual compound return becomes negligible. Although compound returns are less variable in the long run, future asset values become more variable because the impact of compounding investment returns over a longer period outweighs the narrowing of the range around expected returns, causing asset values to be more uncertain as the investment horizon lengthens.

Even if assumed returns are achieved on average, investment returns can vary significantly from year to year, potentially leading to years of substantial underfunding even in simulations in which, after thirty years, investment returns exceed assumed returns. In simulations in which the assumed return is not achieved over 30 years, volatility can be greater and outcomes worse.

Modeling DROP

In this appendix we describe how the DROP program is modeled in our simulations. It is difficult to model the cash flows of the DROP program explicitly and accurately because detailed data of the demographics of DROP participants and their DROP account balances are not publicly available. We therefore decided to model the DROP program in a simplified way such that the simplification does not have significant impact on the overall cash flow of LAFPP.

Initial DROP Participants

As of June 30, 2016, there are 1,243 DROP members, accounting for 9.5 percent of the covered workforce, and the total estimated value of the DROP accounts are approximately \$240 million, accounting for 1.4 percent of the total market value assets. There are three types of cash flows for DROP members: 1) payouts of DROP balance; 2) regular retirement benefits after they leave DROP; and 3) employee contributions. Below we describe how we approximate these cash flows in the simulation model.

- **Payouts of DROP balance.** The initial DROP members have accumulated a total balance of approximately \$240 million, and they will continue to receive benefit payments to their DROP accounts before they leave the program. As DROP members can stay in the program for no more than five years, the total DROP balance of the initial members, including both the current balance and the amount to be accumulated, will be paid out in five years. We estimated that the DROP balance that will be accumulated over the next five years is approximately \$280

million. Therefore the estimated total DROP payout over the next five years is about \$520 million. We assume that the DROP payout in fiscal year 2016-17 (year 2016 in the model) is equal to the budgeted amount of \$105 million, and the remaining balance will be paid out evenly over the next four years, with 5 percent fixed interest rate on the annual balance in each year. The present value of future DROP payouts is added to the total actuarial liability in each year.

- **Service retirement benefits:** DROP participants will begin to receive regular service retirement benefits after they leave the program. In the simulation model, the 1,243 initial DROP participants are treated as active members: They begin to receive regular retirement benefit payments as they are expected to retire according to the probability of retirement in the decrement table for active members. This simplification will affect the timing of the cash flows for the initial DROP members and make a portion of the initial DROP members begin to receive regular retirement benefit later than they would in the real world. All initial DROP participants in the real world are expected to leave the program and become regular service retirees in five years, but when modeled as actives they will retire gradually over a longer time span. For example, a DROP member at age fifty-seven, which is the average age of the DROP members as of June 2016, will leave the program and begin to collect regular retirement benefit payments in less than five years; if this DROP member is modeled as an active member, there will be about a one-in-four chance that she will still remain in the workforce after five years, and she can stay in the workforce for up to eight years according to the decrement table.
- **Employee contributions:** DROP participants make employee contributions as active members do. Because the initial DROP members are modeled as active members, they make employee contribution based on their salary and contribution rates. The initial DROP members in the model may make employer contributions for a longer time than the real-world DROP members would.

Although the simplification will affect the cash flow for the initial DROP members, the deviations should not be large enough to change our conclusions since the initial DROP participants only account for 10 percent of the workforce and their share will decline over time.

New DROP Participants After 2016

DROP participants who join the program after 2016, the initial year in the simulation model, are modeled as regular service

retirees, except that they still make employee contributions for five years as the real-world DROP participants would do. In the actuarial valuations, active members expected to retire with a service benefit are projected to have a 95 percent probability to elect the DROP if they are eligible, and DROP participants are assumed to remain in the program for five years. In the simulation model, we do not model the DROP explicitly and assume that all active members expected to retire with a service benefit will become regular service retirees and begin to receive annual benefit payments. In order to approximate the payroll of the real-world DROP members and their employee contributions, the model assumes that 95 percent of the regular service retirees still get paid for five years as if they did not retire, and make employee contributions based on their salaries.

We have verified that the difference in the present value of future benefits for a DROP participant and a regular service retiree is quite small. It also can be shown that when the DROP members are modeled as service retirees, their aggregate cash flow would be similar to the cash flow of the original DROP payouts, as long as the number of new DROP participants is close to the number of those who exit DROP in each year. (We assume this holds true for LAFPP since DROP was introduced fifteen years ago and the number of DROP participants should be relatively stable so far.)

The Impact of an Employer Contribution Cap Upon Employee Contributions, Under Alternative Investment-Return Scenarios

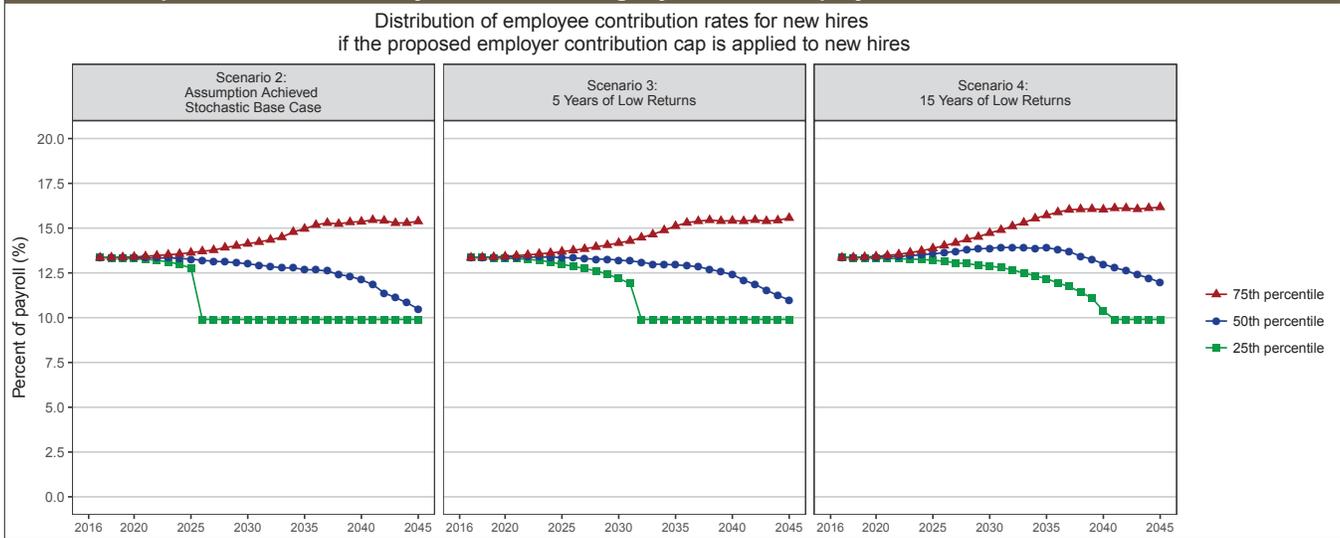
In the body of the report we examined the impact of a cap on employer contributions that shifted risk to employees under our base case *Scenario 2: Assumption Achieved: Stochastic Base Case*. In this appendix, we examine the impact of alternative investment return scenarios.

A Period of Low Returns (Scenarios 3 and 4)

In this section we compare the impact under *Scenario 3: Five Years of Low Returns* and *Scenario 4: Fifteen Years of Low Returns*, to *Scenario 2: Assumption Achieved: Stochastic*.

Under an employer contribution cap, the contribution risk borne by employees increases when expected returns are low in early years. Figure 19 shows the median employee contribution rate, as well as the 25th percentile and 75th percentile, with the employer contribution cap applied to new hires after 2016. The impact of low expected returns in early years on employee contribution rates of new hires is relatively small. Compared with the base-case scenario, the median and 75th percentile employee contribution rates in 2045 in the scenario with fifteen years of low expected returns rise by 1.6 percentage points and 0.8 percentage point, respectively.

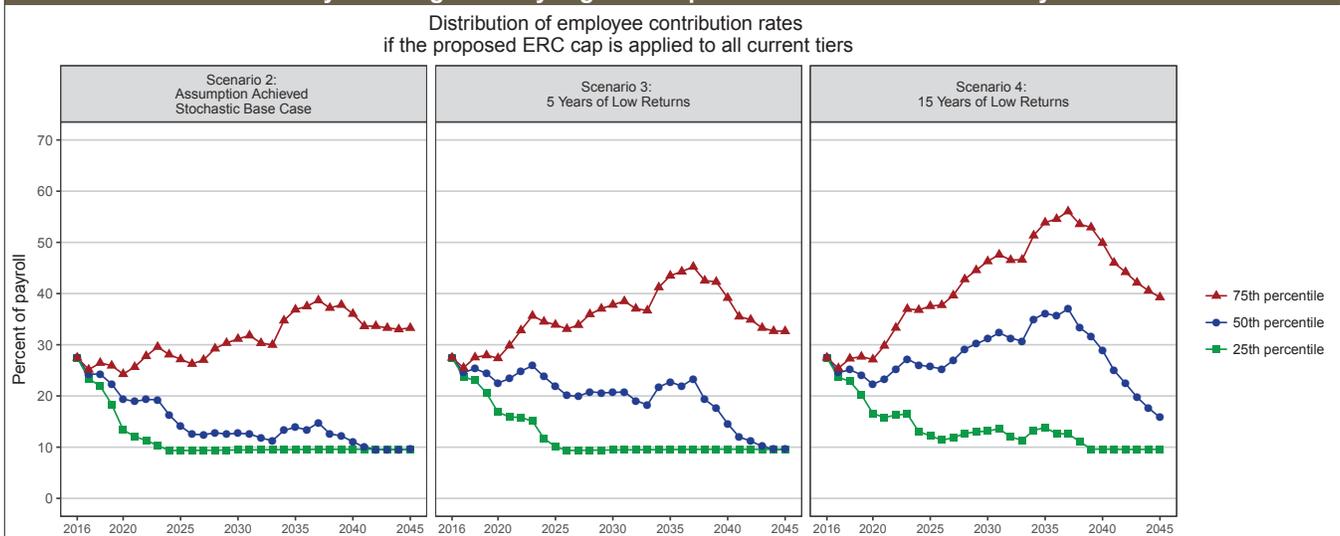
Figure 19. With the Employer Contribution Cap Applied to the Costs For New Hires, Low Expected Returns in Early Years Would Slightly Increase Employee Contribution Rates of New Hires



The employee contributions of new hires are less affected by low expected returns in early years mainly because the new hires, which can be considered a new and growing tier in LAFPP, have relatively small accrued liabilities and corresponding assets in early years (the ratio of liability to payroll in year fifteen is 2 for new hires and 20 for existing employees and beneficiaries), and therefore the investment losses and gains of the assets and the resulting supplemental costs are small compared to the payroll.

The low expected returns in early years have a much larger impact on employee contributions if the employer contribution cap is applied to all active employees. Figure 20 shows the median employee contribution rate, 25th percentile and 75th percentile, under this funding policy in three different return scenarios. When there are fifteen years of low expected returns, the 75th

Figure 20. With the Employer Contribution Cap Applied to All Plan Members, Employee Contribution Rates Are Likely to be Significantly Higher If Expected Returns are Low in Early Years



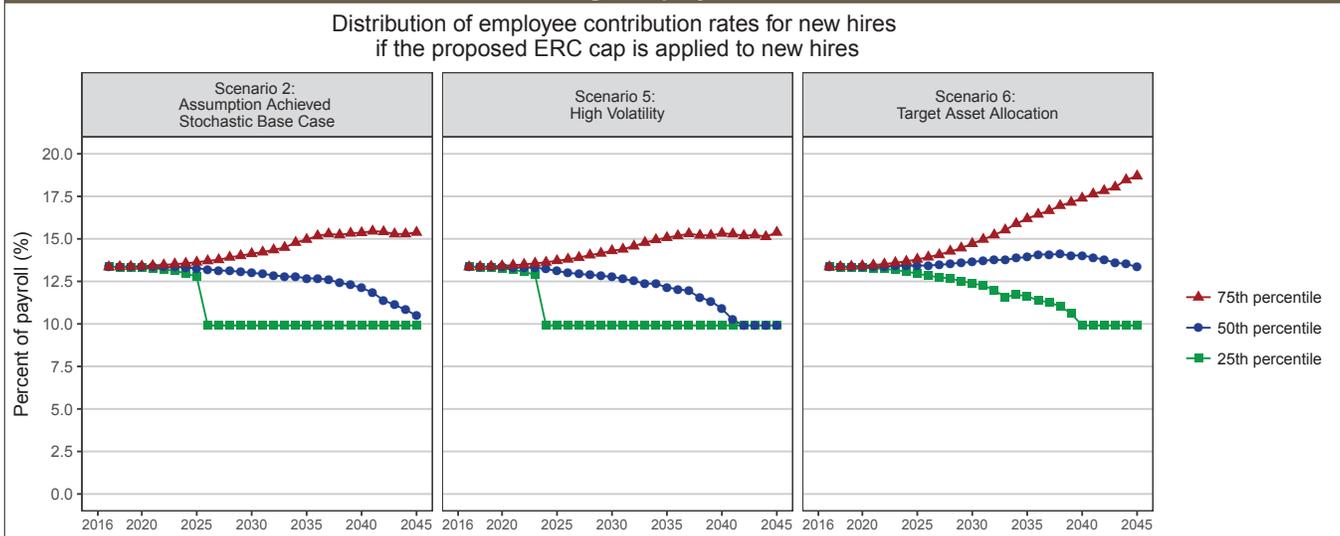
percentile employee contributions are about 55 percent of payroll or higher during 2035 to 2039, while the 75th percentile employee contributions in the base-case scenario are generally below 40 percent.

Greater Investment-Return Volatility or Lower Expected Return (Scenarios 5 and 6)

In this section we compare the impact under *Scenario 5: High Volatility* and *Scenario 6: Target Asset Allocation*, to *Scenario 2: Assumption Achieved: Stochastic Base Case*.

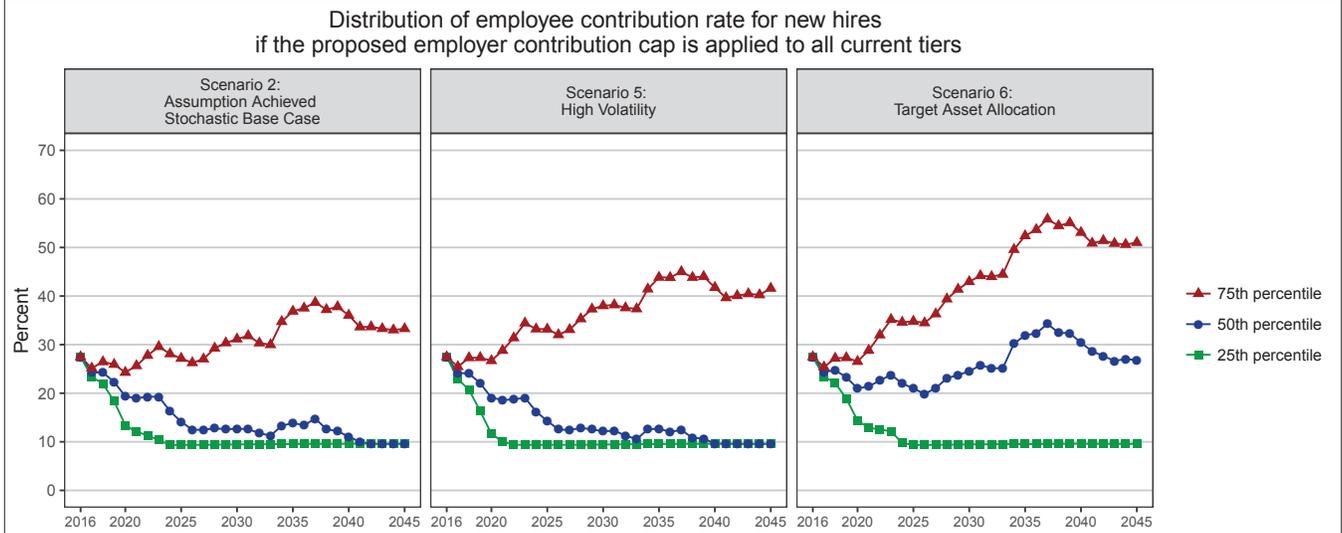
Figure 21 shows that if the employer contribution cap is applied only to new hires, then in 25 percent of the simulations under the lower-return higher-volatility Scenario 6 the employee contributions made by the new hires will be more than 19 percent of their total salary by the end of year thirty.

Figure 21. With the Employer Contribution Cap Applied to New Hires, the Low-Return Scenario Will Lead to Greater Risk of High Employee Contribution Rate for New Hires



Applying the employer contribution cap to the costs for all current and future plan members will lead to substantial risk that employees will have to bear an extremely high share of the total contributions. As shown in Figure 22, under the high-volatility Scenario 5, there is a 25 percent chance that the employee contribution will be more than 40 percent of payroll by year thirty; under the low-expected-return Scenario 6, there is a 25 percent chance that the employee contribution will be 51 percent of payroll or higher.

Figure 22. With the Employer Contribution Cap Applied to All Plan Members, the Risk of High Employee Contribution Rate Is Higher in the High-Volatility Scenario and the Low-Return Scenario



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Rockefeller Institute staff contributing to the publication, dissemination, and communication of the report include Institute Deputy Director for Operations Robert Bullock, Director of Publications Michael Cooper, Assistant Director for Research Management Heather Trela, and Director of Information Systems Joe Chamberlin.

Endnotes

- 1 This scenario is only used for illustrating the variability of investment returns, and is different from the scenarios that are used in our analysis in the following sections.
- 2 Except where noted, data in this section are from either *2015 Annual Report* (Los Angeles: Los Angeles Fire and Police Pension System, 2015), <https://www.lafpp.com/sites/default/files/reports/financial/lafpp-2015ar-12816-web.pdf>, or from *City of Los Angeles Fire and Police Pension Plan: Actuarial Valuation and Review Of Retirement and Other Postemployment Benefits (OPEB) as of June 30, 2015* (San Francisco: Segal Consulting, November 9, 2015), <https://www.lafpp.com/sites/default/files/reports/financial/opeb-valuation-063015-gas67-addendum-033116-for-web-final.pdf>.
- 3 The Los Angeles Fire and Police Pension System has two major components: the Pension Plan and the Health Subsidy Plan. The abbreviation “LAFPP” is used to refer to the Los Angeles Fire and Police Pension System in the LAFPP Annual Reports, while in the actuarial reports “LAFPP” refers to the Pension Plan under the system. In this report, we follow the usage of “LAFPP” in the actuarial reports – in other words, LAFPP refers to the pension plan.
- 4 According to the Public Plans Database (PPD), the 90th percentile for the 2015 actuarial-value-of-assets funded ratio of 160 large plans was 89.8 percent. (The market-assets funded ratio is not reported in the PPD.) LAFPP’s actuarial funded ratio in 2015 was 91.5 percent, according to the 2015 actuarial valuation.
- 5 According to the LAFPP actuarial valuation report, the employee contribution rate for Tier 6 members with less than twenty-five years of service is 9 percent normal contribution plus 2 percent additional contributions to support funding of retirees’ health benefits which is credited to the pension fund. The 2 percent additional contributions are not modeled in our simulations.
- 6 When we use the term “expected long-term compound return,” we mean it in a statistical sense, where investment return is a “random variable” – we do not know what the return will be in any given year or even over a long period of time, but we know what it is likely to be. We are not referring to what a pension plan actuary expects or assumes. In fact, the statistical or true “expected return” could be different from what the actuary expects, and we model such a scenario later in this report. It is important to understand that the “expectation” is taken across simulations, meaning in any single simulation the realized compound return can be higher or lower than the “expected long-term compound return,” but the mean compound return of a large number of simulations will be close to the “expected long-term compound return.” That is one of the reasons we typically run at least 1,000 simulations of any particular analysis.
- 7 When investment returns are variable, the long-run compound return will be lower than the expected annual return. Thus, we use an annual expected return that is greater than 7.5 percent but is designed to achieve a long-run compound return of 7.5 percent in the average simulation. We calculate the annual expected return via a widely used approximation formula under which the long-run compound return equals the annual expected return minus one half of the annual variance.
- 8 This is broadly consistent with other estimates of risk associated with public pension plan portfolios. CalPERS has used a 12.96 percent standard deviation, Biggs assumed a 14 percent standard deviation, and Bonafede et al. estimated a 12.5 percent standard deviation. See *Annual Review of Funding Levels and Risks as of June 30, 2012* (Sacramento: California Public Employees’ Retirement System, March 2013), <https://www.calpers.ca.gov/docs/forms-publications/annual-review-funding-2012.pdf>; Andrew G. Biggs, “The Public Pension Quadrilemma: The Intersection of Investment Risk and Contribution Risk,” *Journal of Retirement* 2, 1 (2014): 115–27; Julia K. Bonafede, Steven J. Foresti, and Russell J. Walker, *2015 Report on State Retirement Systems: Funding Levels and Asset Allocation* (Santa Monica: Wilshire Consulting, February 25, 2015), https://www.wilshire.com/media/38890/wilshire_2015_state_funding_report.pdf.
- 9 It is broadly consistent with, but a bit more optimistic than, assumptions in *Asset/Liability Study: Los Angeles Fire and Police Pension System* (Portland: RVK, Inc., October 2015). It is quite consistent with assumptions of Callan Associates reported in Timothy W. Martin, “Pension Funds Pile on Risk Just to Get a Reasonable Return,” *Wall Street Journal*, May 31, 2016, Markets section, <http://www.wsj.com/articles/pension-funds-pile-on-the-risk-just-to-get-a-reasonable-return-1464713013>. Callan Associates has noted that it sympathizes with public pension funds given the challenges that professionals face in achieving assumed returns in the current interest rate environment.

- 10 Based on our analysis of assumptions in *Asset/Liability Study: Los Angeles Fire and Police Pension System*.
- 11 The unfunded liability existing at the start of the simulation is amortized using assumptions from the 2015 actuarial valuation.
- 12 We apply the cap to employees hired after 2015, the first year in our model. If such an initiative is adopted, the first year would, of course, be in the future.
- 13 For a more detailed discussion of the trade-off between these two kinds of risk, see Donald J. Boyd and Yimeng Yin, *Public Pension Funding Practices: How These Practices Can Lead to Significant Underfunding or Significant Contribution Increases When Plans Invest in Risky Assets* (Albany: The Nelson A. Rockefeller Institute of Government, June 2016), http://www.rockinst.org/pdf/government_finance/2016-06-02-Pension_Policy_Brief.pdf.
- 14 The Public Plans Data (PPD) website is developed and maintained through a collaboration of the Center for Retirement Research at Boston College, the Center for State and Local Government Excellence, and the National Association of State Retirement Administrators, <http://publicplansdata.org/>.
- 15 A note on nomenclature: In the tables and graphs that follow, we label each plan fiscal year by the year in which it begins. For example, 2016 is the year beginning July 1, 2016, also called the 2016-17 fiscal year. The year labeled 2045 is the 2045-46 fiscal year.
- 16 Payments for administrative expenses, which is about 0.9 percent of payroll in 2015, are not included in the simulation.
- 17 As CalPERS, the nation's largest public pension fund, has explained: "Rate volatility is heavily influenced by the ratio of plan assets to active member payroll. Higher asset to payroll ratios produce more volatile employer rates. To understand this, consider two plans, one with assets that are 4 times active member payroll, and the other with assets that are 8 times active member payroll. In a given year, let's see what happens when assets rise or fall 10 percent above or below the actuarial assumption. For the plan with a ratio of 4, this 10 percent gain or loss in assets is the same in dollars as 40 percent of payroll. For the plan with a ratio of 8, this is equivalent to 80 percent of payroll. If this gain or loss is spread over 20 years (and we oversimplify by ignoring interest on the gain or loss), then the first plan's rate changes by 2 percent of payroll while the second plan's rate changes by 4 percent of payroll." See *CalPERS, Annual Review of Funding Levels and Risks, 2014* (Sacramento: California Public Employees' Retirement System, November 18, 2014), <https://www.calpers.ca.gov/docs/forms-publications/annual-review-funding-2014.pdf>. For a more detailed analysis of this issue, see Donald J. Boyd and Yimeng Yin, *How Public Pension Plan Demographic Characteristics Affect Funding and Contribution Risk* (Albany: The Nelson A. Rockefeller Institute of Government, December 2016), http://www.rockinst.org/pdf/government_finance/2016-12-07-Pension_Demographic_Characteristics.pdf.
- 18 This result is generally true in stochastic simulations with positive compound returns. In our 2,000 simulations, the plan with ninety-one initial funded ratio earns more investment income than the plan with seventy-five initial funded ratio in 1,998 of the 1,999 simulations with positive thirty-year compound return. (The only one that is not the case has a near-zero thirty-year compound return.)
- 19 Note that the employee contribution rates are substantially higher in Figure 9 than in Figure 8. Figure 8 presents employee contribution rates for new employees when the ERC cap is only applied to new employees. In our simulation model, the new hires affected by the ERC cap are treated as an independent new tier that only requires contributions for its own normal costs and losses and gains, and does not share the amortization payments for the initial unfunded liabilities of the old tiers. In Figure 9, the ERC cap is applied to the entire plan and therefore the contributions include the amortization payments for initial unfunded liabilities, which accounts for about 9.3 percent of payroll in 2016.

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