

# CALSTRS

## **2020 Review of Funding Levels and Risks**

Presented December 9, 2020

# INTRODUCTION

This is the fifth annual edition of the CalSTRS *Review of Funding Levels and Risks* report. The CalSTRS *Review of Funding Levels and Risks* report provides the Teachers' Retirement Board, stakeholders, policy makers and the public information to assess the soundness and sustainability of the CalSTRS Defined Benefit Program and to promote a better understanding of how well the CalSTRS Funding Plan is expected to accomplish its goal of achieving full funding by 2046.

To better understand the risks associated with funding the system, this report examines a range of potential negative outcomes, both economic and demographic, that could endanger the long-term funding of the system and prevent the system from reaching full funding.

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This report is based on the June 30, 2019, annual actuarial valuation of the Defined Benefit Program and reflects all relevant changes that have occurred since the valuation, including the 3.9% investment return reported for the 2019–20 fiscal year and the 2020–21 budget for the State of California, which redirected supplemental payments already contributed to the Teachers' Retirement Fund in 2019 away from reducing the unfunded actuarial obligation to instead provide short-term contribution rate relief.

In this report, the focus is on:

- The path to full funding, including a discussion of significant changes in the past year and their impact on long-term funding.
- The various measures of plan maturity and how increasing maturity levels impact contribution rate volatility.
- Risks to long-term funding, including longevity risk, risks related to membership decline and future payroll growth and investment volatility.
- The ability of the funding plan to react to potential recessions to allow the Defined Benefit Program to reach full funding.

## EXECUTIVE SUMMARY

The California State Teachers' Retirement System was founded in 1913 with 120 retired members and 15,000 active members. More than 100 years later, CalSTRS remains committed to its mission to secure the financial future and sustain the trust of California's educators and to provide retirement, disability and survivor benefits to them and their families.

To that end, CalSTRS has come a long way. Just a few years ago, the CalSTRS Defined Benefit Program was expected to run out of assets in about 30 years. Today, CalSTRS is financially stronger and better positioned to react to a potential recession and achieve full funding thanks to the 2014 adoption of the funding plan through Assembly Bill 1469.

CalSTRS continually monitors the funding plan and the financial health of the fund and provides formal assessments of funding levels and risks to the board twice a year. These formal assessments are presented in the spring through the annual actuarial valuation report and in the fall through the *Review of Funding Levels and Risks* report. Monitoring the funding plan has been critical in the last year as the COVID-19 pandemic caused extreme volatility in investment markets and impacted economies across the world. CalSTRS will continue to monitor the current COVID-19 situation closely since it has the potential for affecting the three main risks identified in this report.

CalSTRS is also required by statute to provide a report to the Legislature every five years on the progress of the funding plan. The first progress report was completed and provided to the Legislature in June 2019. The next progress report is due in June 2024.

As shown in this year's *Review of Funding Levels and Risks* report, CalSTRS still expects the Defined Benefit Program to make progress toward full funding, with both the state and the employers expected to be able to eliminate their share of CalSTRS unfunded actuarial obligation by 2046. However, as a result of the impact of the COVID-19 pandemic on world economies and investment markets and the changes made to both the employer and state contribution rates as part of the budget for the State of California for fiscal year 2020–21,

funding progress is expected to be slower than previously anticipated over the next few years.

Key results and findings of this report include:

- Long-term contribution levels for both employers and the state are expected to be higher than previously estimated in the most recent actuarial valuation.
- Some of the improvements in funding levels in 2019 that resulted from additional supplemental contributions made by the state were taken away through changes in contribution rates adopted as part of the 2020–21 budget for the State of California.
- Changes made to contribution rates through the adoption of the 2020–21 budget for the State of California have slightly weakened the funding plan long term by increasing the risk it may not be able to react adequately to a potential recession.
- The CalSTRS Defined Benefit Program continues to mature, which increases the system's sensitivity to investment volatility, especially for the state contribution rate.
- The largest risk facing CalSTRS' ability to reach full funding remains risk from investment volatility.
- Decreases in the size of the active membership or lower than anticipated increases in future payroll could put significant strain on CalSTRS' ability to achieve full funding, especially if caused by a recession that also results in a period of lower investment returns.
- By having a funding plan in place, CalSTRS is better positioned today than it was 10 years ago to be able to react to and absorb the impact of a recession.

# PATH TO FULL FUNDING

One of CalSTRS' main goals is to ensure a financially sound retirement system for California's educators. Progress toward this goal was made possible in 2014 with the passage of the CalSTRS Funding Plan.

The funding plan set out a measured schedule of contribution rate increases for members, employers and the state with the goal of achieving full funding by 2046. It also provided the board with limited authority to adjust rates to help keep the funding plan on schedule.

This section discusses how significant changes in the past year have impacted future funding levels and the contribution rates needed for the state and employers to continue the progress toward reaching full funding by 2046.

## Significant changes in the past year

Once again, CalSTRS took several actions in the past year that contributed to its long-term sustainability and its goal of achieving full funding.

First, CalSTRS completed a review of the actuarial assumptions used in the funding of the system. When performing actuarial projections, actuaries rely on the use of various demographic and economic assumptions. It is important to periodically review these assumptions to ensure they remain reasonable, reflect the actual experience of the system and are appropriate for assessing funding levels and determining contribution levels needed to achieve full funding. In January 2020, the board adopted new actuarial assumptions to be used in the funding of the system. These assumptions were implemented in the June 30, 2019, actuarial valuation that was completed and presented to the board in May 2020.

In May 2020, the board exercised its authority to increase the state contribution rate by 0.5% of payroll, the maximum allowed by the funding plan. This was the fourth year in a row the board adopted the maximum increase in the state contribution rate. This increase was needed to ensure the state remained on track to eliminate its share of CalSTRS' unfunded actuarial obligation by 2046. However, as explained in detail below, this increase was not implemented on July 1, 2020.

In response to the economic slowdown that has been felt worldwide as a result of the COVID-19 pandemic, on June 29, 2020, the State of California adopted the fiscal year 2020–21 budget that contained provisions providing short-term rate relief to both the state and employers, affecting CalSTRS and its funding plan.

Specifically, the 2020 Budget Act redirected supplemental payments that were already contributed to CalSTRS in 2019 away from reducing the employers' share of CalSTRS' unfunded actuarial obligation to instead provide short-term contribution rate relief to employers. The State of California also suspended the board's rate setting authority for the state contribution rate for fiscal year 2020–21 and froze the state rate, for one year, at the fiscal year 2019–20 level. In effect, the 0.5% of payroll rate increase adopted by the board in May 2020 was never implemented. However, to ensure CalSTRS was made whole for 2020–21, the state sent \$297 million to CalSTRS on July 1, 2020, using Proposition 2 revenues. About \$170 million will be used to cover the increase of 0.5% of payroll that was expected to go into effect for fiscal year 2020–21, leaving \$127 million to reduce the state's share of CalSTRS unfunded actuarial obligation, allowing the state to make further progress toward reducing its share of CalSTRS' unfunded actuarial obligation.

Combined, these changes will result in slower improvements in funding levels, in the short term, than projected in the June 30, 2019, actuarial valuation. Consequently, to ensure the CalSTRS Defined Benefit Program continues its path toward full funding, contribution levels will need to be higher, long term, than those estimated in the 2019 valuation.

Even though CalSTRS was made whole for the state contribution rate being frozen for one year, the lack of a "catch-up" provision for the state contribution rate could affect CalSTRS' ability to remain on track toward full funding. In the spring of 2021, the board will be setting the state contribution rate for fiscal year 2021–22. The statutory language added through the budget only allows the board to raise the state rate

# PATH TO FULL FUNDING

to a maximum of 8.328% in fiscal year 2021–22, 0.5% higher than the current frozen state contribution rate of 7.828% in effect for 2020–21. When the June 30, 2019, valuation was completed, it was expected that the 2021–22 state contribution rate would eventually be set at 8.828%. A “catch-up” provision would have allowed the board to set the state contribution rate at 8.828%. Unless additional contributions are provided to CalSTRS through other mechanisms such as Proposition 2 revenues, state contributions in the next few years are likely to be below the levels originally intended by the funding plan because of the lack of a “catch-up” provision.

As a result, the state contribution rate will need to reach higher levels long term, leaving less room for the board to adjust the state contribution rate in the event of less favorable experience, caused, for example, by a recession. This has weakened the funding plan slightly and could affect CalSTRS’ ability to reach full funding, especially if investment returns remain below expectations in the short term and a recession also results in a drop in the number of teachers in California.

This increased risk will be demonstrated in more detail throughout this report.

In addition to the actions taken by the California Legislature, the investment performance for 2019–20 will also affect future contribution rates and funding levels. In July 2020, CalSTRS reported a 3.9% investment return for 2019–20. This return was 3.1% lower than the assumed investment return of 7%. Although large fluctuations in the annual investment return are normal and expected based on the CalSTRS target asset allocation, investment return fluctuations can have a significant impact on projected funding levels and contribution rates, especially the state contribution rate.

Overall, the 3.9% investment return for fiscal year 2019–20 is expected to decrease short-term funding levels by about 2% compared to funding levels projected in the June 30, 2019, actuarial valuation. Based on the rules set in the funding plan, the state contribution rate will be most impacted by the 3.9% return. Long term, it is expected the state will have to contribute about an additional 1.5% of payroll as a result of the 3.9% investment return. Future contribution rates are discussed in more details in the next section.

## Projected contribution rates

When the funding plan was adopted in 2014, the required increases in the employer contribution rate were phased-in over several years to avoid a large and sudden increase in the contribution rate and to ensure employers had time to prepare and budget for the rate increases. The funding plan included a schedule of increases to gradually bring the employer rate to 19.1% of payroll over a seven-year period.

As part of the 2019–20 budget for the State of California, the state made a supplemental payment to CalSTRS of \$2.246 billion. Of that, \$606 million was used to provide short-term rate relief while \$1.64 billion was intended to reduce the employers’ share of CalSTRS’ unfunded actuarial obligation. Reducing the unfunded actuarial obligation was expected to provide long-term rate relief to employers.

With the changes implemented through the 2020–21 budget of the State of California, the entire \$2.246 billion will now be used to provide additional short-term rate relief to employers, taking away long-term savings that were expected following the 2019–20 budget. Below is a table showing the reductions in the employer contribution rate in effect following the 2020–21 budget.

### Impact of 2020–21 budget on the employer contribution rate

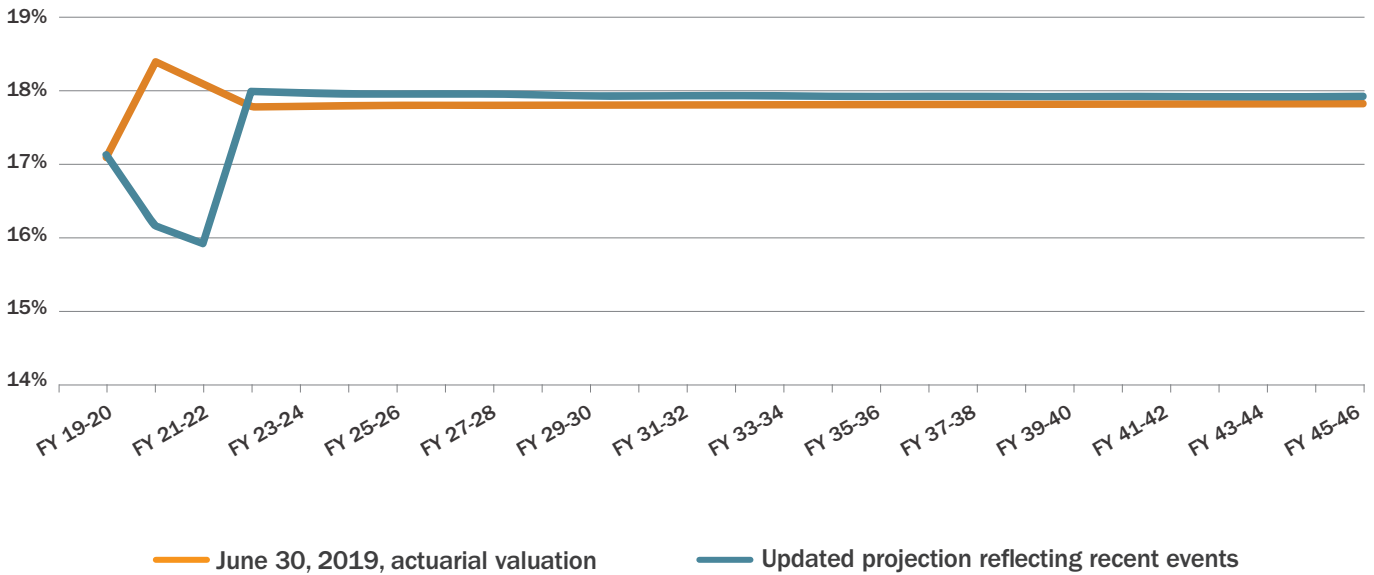
Fiscal Year	Employer contribution rate as per CalSTRS Funding Plan	Rate reduction as per 2020–21 California budget	Effective employer contribution rate
2019–20	18.13%	(1.03%)	17.1%
2020–21	19.1%	(2.95%)	16.15%
2021–22	Set by the board	(2.18%)	Employers will pay 2.18% less than the rate set by the board

# PATH TO FULL FUNDING

When the June 30, 2019, actuarial valuation was completed in May 2020, future funding levels and contribution rates were projected assuming the fund would earn 7% in fiscal year 2019–20 and assuming no changes would be made to the application of the \$2.246 billion supplemental payment provided to CalSTRS in 2019.

To illustrate the impact the 3.9% investment return and the 2020–21 budget of the State of California have had on projected employer contribution rates, below is a chart comparing the projections from the 2019 actuarial valuation and the revised projection reflecting these recent events. The chart also assumes that future investment returns will be 7% each year. The impact of future investment returns is discussed later in this report in the investment risk section.

**Projected employer contribution rates (% of payroll)**



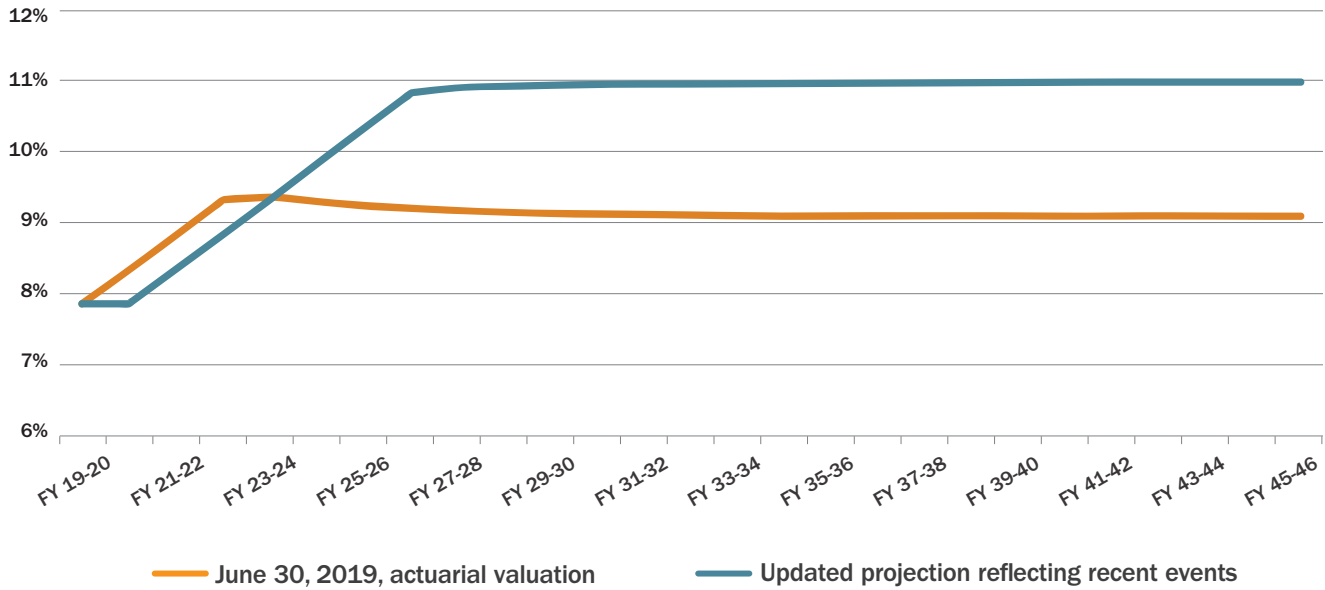
As can be seen above, the employer contribution rate has been reduced to 16.15% in fiscal year 2020–21 and is expected to drop slightly below 16% of payroll in fiscal year 2021–22. The board will set, for the first time ever, the employer contribution rate for fiscal year 2021–22. At this time, it is expected that the board will be asked to adopt a rate of 18.1% of payroll. Based on the changes in the 2020–21 budget, employers will contribute 2.18% less than the rate set by the board, resulting in a projected rate of 15.92% of payroll. As a result of these temporary reductions, employers will be faced with an increase in contribution rate of about 2% of payroll in fiscal year 2022–23. Such an increase will be the highest ever single year increase in the employer contribution rate.

In the long term, the employer contribution rate is now expected to be slightly higher than previously estimated in the June 30, 2019, valuation.

As discussed earlier, the changes implemented through the 2020–21 budget of the State of California resulted in a freeze of the state contribution rate for 2020–21, keeping it at 7.828%, the rate in effect in fiscal year 2019–20. Next is a chart comparing the projections from the 2019 actuarial valuation and the revised projections reflecting both the 3.9% investment return for 2019–20 and the freeze of the state contribution rate.

# PATH TO FULL FUNDING

Projected state contribution rates (% of payroll)



As can be seen above, the state contribution rate is now expected to increase to 11% of payroll long term, about 2% of payroll higher than originally estimated in the June 30, 2019, valuation. The 3.9% investment return for 2019–20 accounts for about 1.5% of the increase. Even if the state sent \$297 million to cover the frozen state contribution rate in fiscal year 2020–21, the lack of a “catch-up” provision will compound over time and is expected to result in a long-term increase of 0.5% of payroll. The projected rate increase caused by the lack of a “catch-up” provision could be avoided if the state were to send additional contributions annually to make up the contribution shortfall. In addition, the state pays another 2.5% of payroll to fund the Supplemental Benefit Maintenance Account, CalSTRS’ inflation protection program.

## Projected funding levels

When the June 30, 2019, actuarial valuation was completed, it reflected the supplemental payments made by the state in July 2019 to pay down, ahead of schedule, a portion of the unfunded actuarial obligation for the Defined Benefit Program. In total, CalSTRS

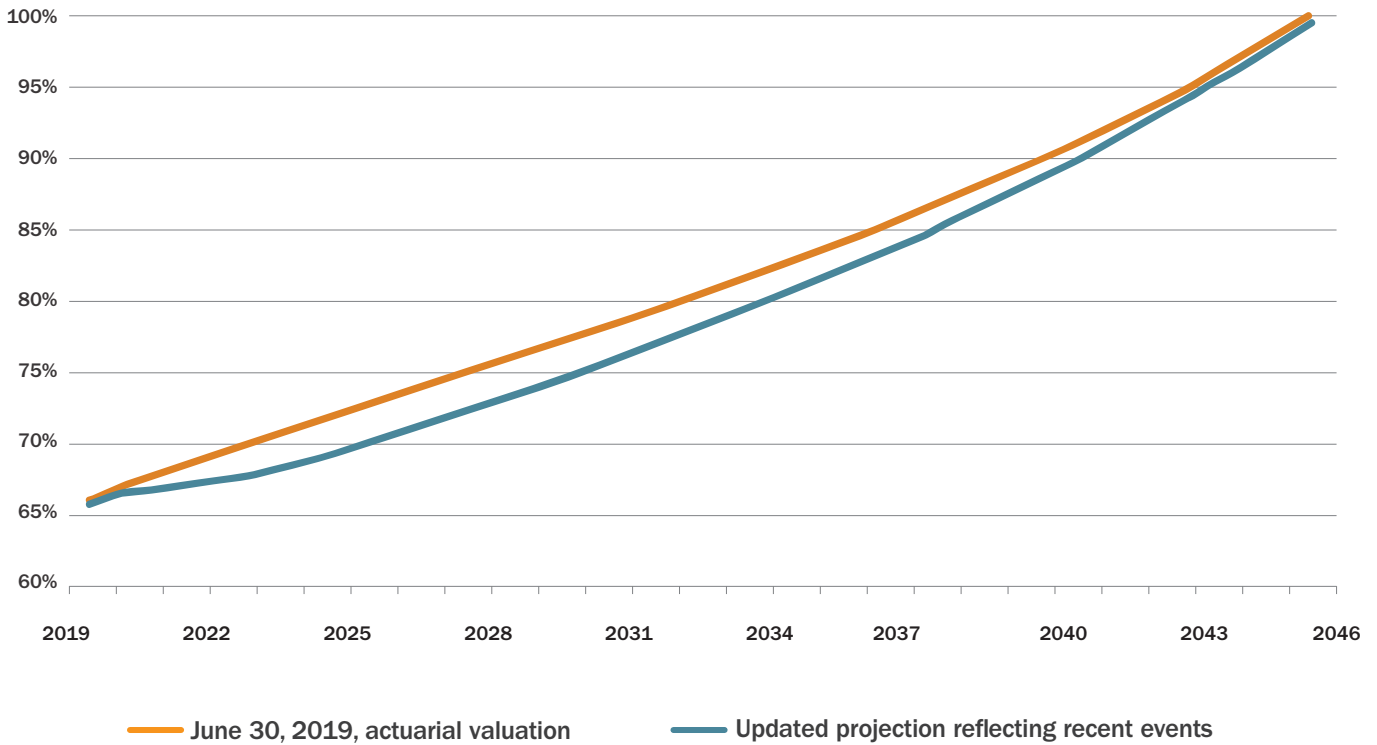
received about \$3.3 billion dollars in supplemental payments. Of that amount, \$1.1 billion was used to reduce the state’s share of the unfunded actuarial obligation and \$1.6 billion was used to reduce the employers’ share. The rest, about \$600 million, was used to provide employers with short-term rate relief.

With the changes adopted by the 2020–21 budget for the State of California, only the \$1.1 billion paid to reduce the state’s share of the unfunded actuarial obligation is still being used for that purpose. The remaining supplemental payments were redirected to provide short-term rate relief to employers. As a result, funding progress will be slower than originally projected in the June 30, 2019, actuarial valuation.

The following chart compares projected funding levels presented to the board in May 2020 as part of the June 30, 2019, actuarial valuation to the revised projected funding levels reflecting both the 3.9% investment return and the 2020–21 budget for the State of California.

# PATH TO FULL FUNDING

## Projected funded status



As shown above, funding levels are now projected to be slightly lower than anticipated in the June 30, 2019, actuarial valuation. The lower than assumed investment return of 3.9% for 2019–20 is the main reason for this lower trajectory. Note that the rate setting authority granted to the board is expected to be sufficient to allow both the employers and the state to eliminate their share of CalSTRS unfunded actuarial obligation by 2046 and to allow CalSTRS to continue on the path toward full funding.

### Projected unfunded actuarial obligation

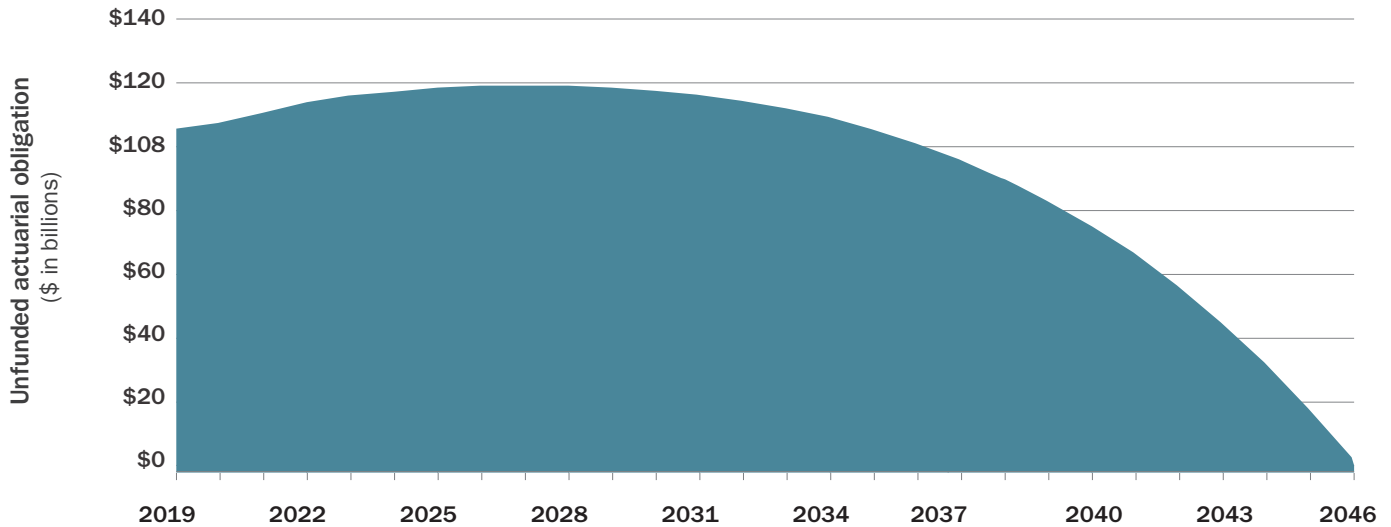
Although the system is currently on a path to full funding, it is important to understand how the unfunded actuarial obligation is expected to change over time.

The following chart shows the projected unfunded actuarial obligation, reflecting both the 3.9% investment return and the changes to contribution rates adopted through the 2020–21 budget for the State of California.



# PATH TO FULL FUNDING

## Projected unfunded actuarial obligation



As can be seen above, the unfunded actuarial obligation of the Defined Benefit Program is expected to continue to grow over the next decade, reaching almost \$120 billion before starting to decrease. There are several reasons for this expected increase.

To smooth out the impact of the 3.9% investment return for 2019–20, the impact of this lower-than-assumed return will be reflected over a three-year period in accordance with the board asset smoothing policy. The 3.9% investment return resulted in an increase of about \$10 billion in the projected unfunded actuarial obligation.

Also contributing to the increase is the fact the contributions over the next few years are not expected to be enough to cover the interest that will accrue on the unfunded actuarial obligation. When pension plans are less than 100% funded, contributions in excess of the normal cost are needed in order to pay down the unfunded actuarial obligation and to make progress toward being 100% funded. In order to ensure the unfunded actuarial obligation does not increase on a year-to-year basis, the payments toward the unfunded actuarial obligation must be greater than the interest that will be accrued on the unfunded actuarial

obligation. Failing to contribute an amount in excess of the interest will result in the unfunded actuarial obligation increasing from year to year. This is referred to as negative amortization. For CalSTRS, in order to avoid negative amortization, the payment toward the unfunded actuarial obligation must be more than 7% of the unfunded actuarial obligation.

As a result of the contribution rate changes adopted through the 2020–21 budget, contributions toward the unfunded actuarial obligation are projected to represent about 4.5% of the unfunded actuarial obligation for the next two years. Beyond the next two years, contributions will gradually cover more of the interest as the state contribution rate increases, but they are not projected to cover the full 7% interest until fiscal year 2027–28. The unfunded actuarial obligation is projected to increase each year and peak at about \$120 billion on June 30, 2027.

Note that negative amortization is generally the result of funding practices. For CalSTRS and many other public plans, contributions to eliminate the unfunded actuarial obligation are determined as a level percentage of the payroll. This approach has the advantage of providing budget stability at the expense of resulting in negative amortization when combined with a longer amortization period.

## PATH TO FULL FUNDING

The key assumption with this approach is the payroll growth assumption. For CalSTRS, payroll is assumed to increase annually at a rate of 3.5%. This means payments toward the unfunded actuarial obligation are expected to grow annually at a rate of 3.5%. The payments will be larger in 20 years than they are today even if the contribution rates remain the same. It is important to note that contribution rates and CalSTRS' ability to reach full funding could be negatively affected in the future if payroll growth is less than 3.5%. This risk is discussed in more detail later in this report.

### Unallocated unfunded actuarial obligation

While the funding plan has helped improve the long-term sustainability of the system, there are limitations in the plan as prescribed by statute. The constraints in the rate setting authority provided to the board, as well as other provisions in the funding plan, mean the entire unfunded actuarial obligation in place today cannot be totally eliminated.

Pursuant to statute, the state is responsible for any unfunded actuarial obligation related to benefits that were in effect on July 1, 1990. This responsibility applies to all service performed by CalSTRS members. The board can increase, if necessary, the state contribution rate by 0.5% of payroll each year to pay down the state's share of the unfunded actuarial obligation.

The employers are responsible for any unfunded actuarial obligation that can be attributed to the new benefit structure, that is, any benefit increases on or after July 1, 1990—but that responsibility is limited to service accrued before July 1, 2014. In fiscal year 2021–22, the board will be able, if necessary, to adjust the employer contribution rate by no more than 1% of payroll each year, never to exceed 20.25% of payroll, to pay down the employers' share of the unfunded actuarial obligation.

Since the employer's share of the unfunded actuarial obligation is limited to service earned prior to July 1, 2014, the board cannot adjust contribution rates for any unfunded actuarial obligation that may develop for the new benefit structure and service accrued on or after July 1, 2014. The unfunded actuarial obligation related to post-1990 benefit increases and post-July 1, 2014, service is referred to as the "unallocated unfunded actuarial obligation."

Since the start of the funding plan, an unallocated unfunded actuarial obligation has developed resulting mostly from a combination of investment experience and changes made to the actuarial assumptions. The size of the unallocated unfunded actuarial obligation has generally been small relative to the overall unfunded actuarial obligation since it is only for service after July 1, 2014. It was estimated to be \$245 million as of June 30, 2019. As a result of the 3.9% return in 2019–20, combined with the fact the board cannot adjust contribution rates to pay for the unallocated unfunded actuarial obligation, it is projected to increase every year in the future. Current projections show the amount will double in the short term and ultimately reach \$3 billion by 2046. Because of the unallocated unfunded actuarial obligation and the constraints around the board's rate-setting authority, the system is projected to be 99.6% funded by 2046.

The unallocated unfunded actuarial obligation could increase significantly if investment returns fall well below the assumed 7%. Similarly, it could be eliminated if investment returns exceed 7% over the long term. If the unallocated unfunded actuarial obligation were to be funded on an actuarial basis with a funding target of June 30, 2046, additional contributions of about 0.1% of payroll would be required effective July 1, 2020.

# MEASURES OF PLAN MATURITY AND VOLATILITY

As expected, CalSTRS continues to mature as a pension plan. As pension plans mature, they become more sensitive to certain risks. Understanding plan maturity and how it affects the ability of CalSTRS to tolerate risk is essential when analyzing how investment return volatility, improvements in longevity, or even growth in payroll and size of active membership could impact the ability of CalSTRS to reach full funding.

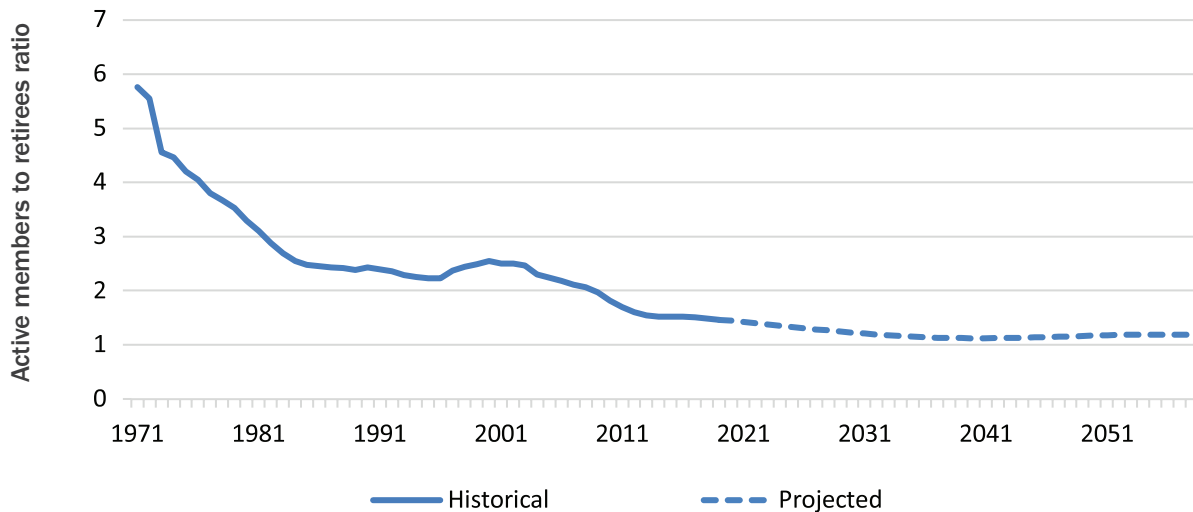
In this section, the maturity of the system is examined in the context of the number of active members to retirees, the projected cash flows and the volatility ratios, which measure the volatility in contribution rates in response to the volatility in investment returns.

## Active members to retirees ratio

The aging of the population and the retirement of the baby boomers has been felt by all retirement systems across the nation. This demographic shift has long been predicted by actuaries and reflected in the funding of the system. Even though it was anticipated, this demographic shift has increased the amount of risk faced by the system, which will be demonstrated throughout this report.

There are various ways to assess the maturity level of a retirement system. One is to look at the ratio of active members to retirees. In the early years of a retirement system, the ratio of active to retired members will be very high as the system will be mostly composed of active members. As the system matures, the ratio starts declining. A mature system will often have a ratio near or below one. For CalSTRS and other retirement systems in the U.S., these ratios have been steadily declining in recent years. The chart below illustrates CalSTRS' historical and projected active members to retirees ratio.

CalSTRS active members to retirees ratio



As can be seen in the previous chart, the ratio of active to retired members for CalSTRS was about 6-to-1 in 1971. The ratio has steadily decreased over time. Today the ratio is about 1.5-to-1. The ratio is projected to approach 1-to-1 over the next 40 years. Assuming the number of active members in the system remains the same at about 450,000, this ratio is not expected to go below 1-to-1 over that time period.

# MEASURES OF PLAN MATURITY AND VOLATILITY

A decline in the CalSTRS active member population could accelerate this trend and push the ratio below one. Similarly, if improvements in life expectancy end up being greater than the improvements currently built into the actuarial assumption, it would impact the active to retiree ratio and potentially bring the ratio closer to one over a shorter time period and even possibly below one.

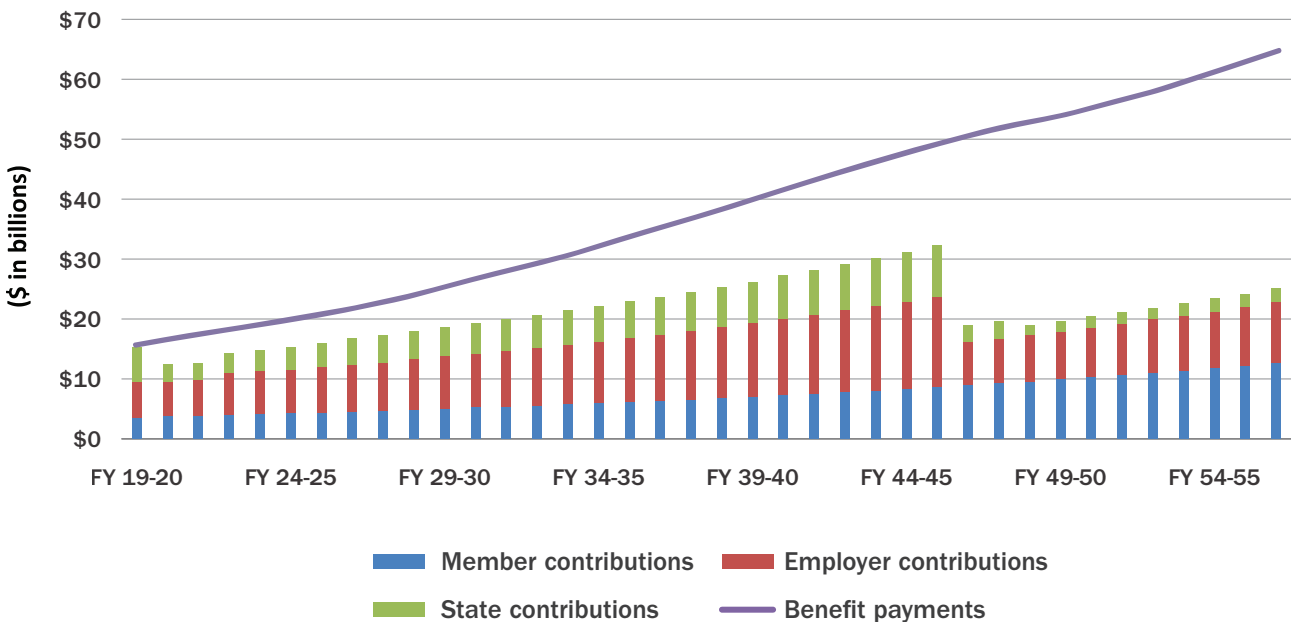
## Projected cash flows

The cash flows for a retirement system are another good indicator of the maturity level of the system. As a pension plan matures, it is normal for benefit payments to exceed contributions coming into the system. Having negative cash flows does not indicate

the plan has been poorly managed. When prefunding a pension plan, it is important to remember that the objective is to accumulate assets to pay benefits. Put another way, the objective of prefunding is to ultimately create negative cash flows.

CalSTRS first experienced negative cash flows in 1999. The gap between contributions and benefits paid increased over time, peaking at about \$6 billion in fiscal year 2013–14. With the passage of the funding plan and the increased contributions from members, employers and the state, the gap has narrowed the last few years. The following chart shows the projected cash flows for the CalSTRS Defined Benefit Program and Supplemental Benefit Maintenance Account combined.

Projected cash flows for CalSTRS



As can be seen on the chart above, the benefit payments and contributions are expected to be about equal in fiscal year 2019–20 due to the additional contributions made by the state as part of the 2019–20 budget. Note that for accounting purposes, some of the additional contributions made by the state in July 2019 were recognized as 2018–19 contributions in the CalSTRS financial statements. In fiscal year 2020–21, cash flows are expected to once again be negative and be higher than originally anticipated as a result of the short-term rate relief granted to both the employers and the state as part of the 2020–21 budget for the State of California. Over time, the gap between benefits and contributions will start to increase every year in the future. Beyond 2046, the gap is expected to sharply increase once the employers and the state have eliminated their share of CalSTRS’ unfunded actuarial obligation and their contribution rates have reverted to pre-funding plan levels.

## MEASURES OF PLAN MATURITY AND VOLATILITY

Even if negative cash flows are a natural state for any mature pension fund and must be taken into account as part of the asset liability management process of a pension plan, negative cash flows do not necessarily imply the system will have to sell assets to make benefit payments. Cash generated from investments such as coupons on bonds, rent on real estate and dividends must be considered as well as the relative size of the cash flows compared to the total assets in the fund.

Today, enough cash is being generated from investment income to cover the gap. The gap between projected benefit payments and future contributions is expected to represent between 1% and 2% of the assets for the next 30 years. Cash generated by investments would have to be at least 2% of total assets to avoid having to sell assets to pay benefits. Over the last 30 years, cash generated by investments has averaged 2.7%.

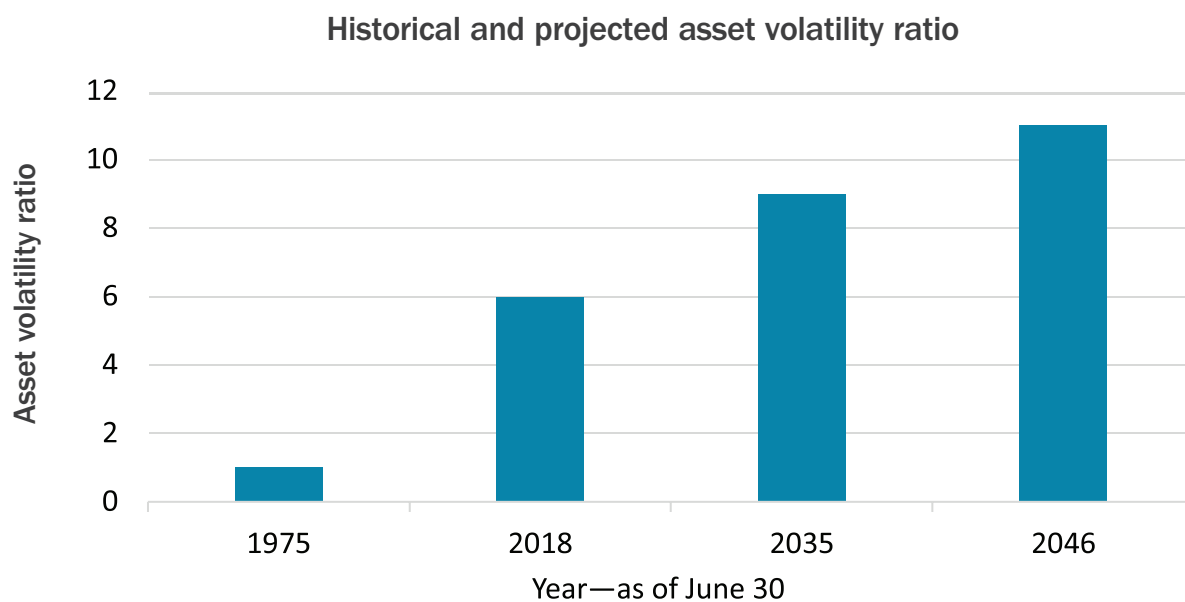
### Increasing volatility

As retirement systems become more mature, these systems are subject to increased volatility in the contribution rates needed to fully fund the benefits.

The drop in the active-to-retiree ratio over the last decade has increased the contribution volatility risk for CalSTRS, and this volatility risk will continue to increase as the ratio continues to drop in the future.

One indicator of the contribution volatility is the asset volatility ratio. The asset volatility ratio is the ratio of the market value of assets over the total payroll for active members. Plans with a high ratio will be subject to higher contribution volatility.

The asset volatility ratio for CalSTRS has increased significantly over the last 40 years. Back in 1975, the asset volatility ratio was at about one, meaning the assets of the plan were about the same size as the payroll. The size of the assets, when compared to payroll, has steadily increased over time. As of the most recent actuarial valuation, the asset volatility ratio was 6.8. This is typical for a mature system like CalSTRS. This means that the contribution volatility is currently about seven times higher than it was in 1975. As shown on the following chart, the asset volatility ratio for CalSTRS is expected to continue to increase over time, reaching 11 by the end of the funding plan.



## MEASURES OF PLAN MATURITY AND VOLATILITY

There are various reasons why the asset volatility ratio is projected to increase over time. One is expected improvements in funding levels. As of the June 30, 2019, actuarial valuation, the Defined Benefit Program was about 66% funded. If the system was 100% funded today, the asset volatility ratio would be 9.8. As additional contributions flow into the system pursuant to the funding plan, the funded ratio is projected to improve and move toward the target of being 100% funded. As a result, the asset volatility ratio will increase over time. In addition, the system has not yet reached its full maturity stage. As more members retire, the asset volatility ratio is expected to continue to increase.

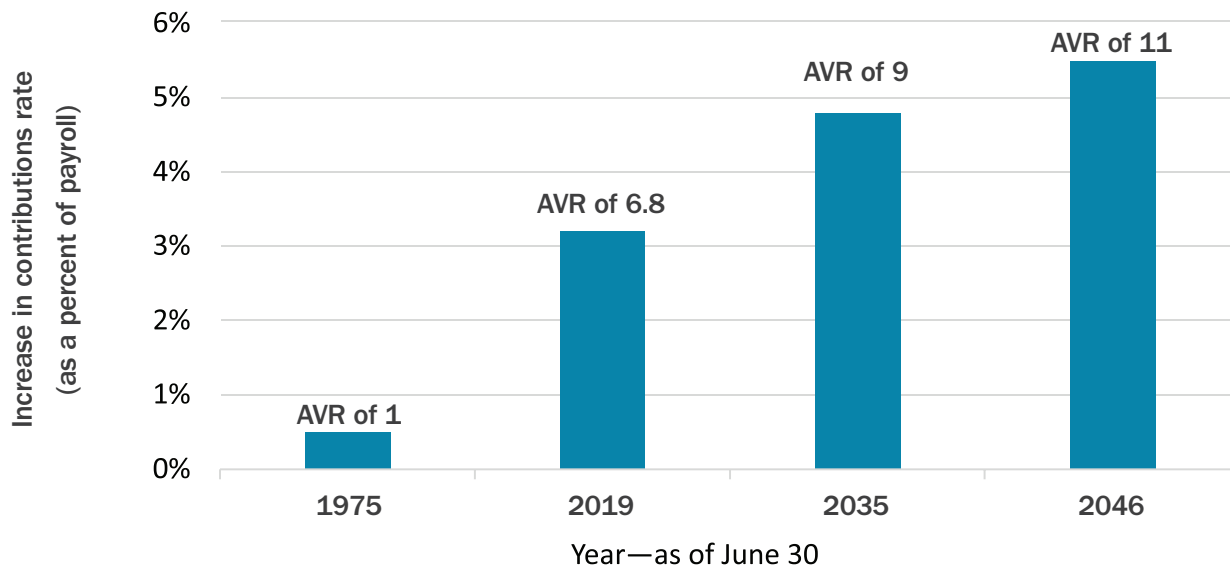
It is important to keep in mind that there is nothing to “fix” if the asset volatility ratio is high. A high asset volatility ratio simply indicates that there is more money invested for the plan—a good thing overall. It should, however, serve as a reminder that the more

money invested, the more of an impact investment gains and losses will have on the contribution levels needed to fully fund the system.

With the expected increases in asset volatility ratio over time, the funding risk of the system will be greater in 20 years than it is today, resulting in greater volatility in the level of contributions that would be needed to ensure the plan remains 100% funded over the long term.

To help demonstrate this increased contribution volatility, the following chart displays the cost to eliminate, over a 30-year funding period, the unfunded actuarial obligation created from a 10% investment loss. Note that a 10% investment loss represents a return of -3%, or a return 10% less than the assumed 7% investment return. Over the last 20 years, the system has experienced a loss of this magnitude or worse on four occasions.

**Estimated increase in contribution rates  
to fund a 10% investment loss**



Further compounding contribution rate volatility is an aspect of the funding plan that is often overlooked. The fixed time frame for paying down the unfunded actuarial obligation by 2046 will result in a declining amortization period, increasing contribution volatility going forward. Today, the existing shortfall is amortized through 2046, over a period of 26 years. In 10 years, any remaining shortfall will be amortized over 16 years. If markets were to fall short of expectations in 20 years, the shortfall would have to be paid over a six-year period, requiring higher contributions than would normally be needed if the funding period was 30 years. As a result, the limited rate setting authority granted to the board is more likely to be insufficient in 20 years, following an economic downturn, due to the combined impact of the funding period shortening and maturity levels increasing.

# THE RISK ENVIRONMENT

The events of the past year have brought risk into stark focus. The emergence of the COVID-19 pandemic has had far-reaching effects on our lives and society as a whole. For CalSTRS, the full impact of the pandemic will not be known for many years, however, it highlights the importance of taking a holistic approach to the consideration and analysis of the risks encountered in the funding of the system. Previous reports on funding levels and risks have highlighted the fact that as a system, CalSTRS faces risk in several facets, but most significant are investment risk, the risk of a decline in payroll and longevity risk. The COVID-19 pandemic could potentially impact all three of these risks both in the short and long-term. For this report, these risks are first examined individually and together by analyzing the impact of potential future recessions.

In addition to the above risks, another important aspect of funding is the other various demographic assumptions CalSTRS uses to assess funding levels and determine future costs. As discussed earlier in this report, the board adopted new actuarial assumptions in January 2020. These assumptions were developed and adopted under “normal” conditions. In a global pandemic it’s reasonable to wonder if members will behave as they would normally. There have been reports around the country that teachers may be retiring at a greater rate in response to schools going to distance learning during the pandemic. Although the assumptions were adopted for the very long term and are thus most likely still appropriate, short-term deviations can have long-term financial impacts on the funding plan.

This section will examine the risk associated with longevity, payroll growth, and investments with emphasis placed on the impact of the COVID-19 pandemic.

## Longevity risk

Each year, this report updates and examines the impact of longevity on the funding of the system. Longevity risk refers to the potential that members live longer than anticipated and thus the lifetime benefit they receive last longer than expected. The COVID-19 pandemic threatens to complicate this analysis. It is reasonable to wonder if CalSTRS will experience a spike in mortality due to the virus. This section analyzes longevity from a historical perspective and how CalSTRS addresses the risk using generational mortality. The section concludes with a discussion of the steps CalSTRS has taken to monitor the impact of COVID-19 on the longevity of CalSTRS members.

The following chart shows the historical trend of life expectancy for a CalSTRS member retiring at age 62. As illustrated, there is small variation from year to year, but the overall trend is of increasing life expectancy over the past 30 years. In fact, since 1990, both male and female members have seen an almost 2 1/2-year increase in life expectancy.

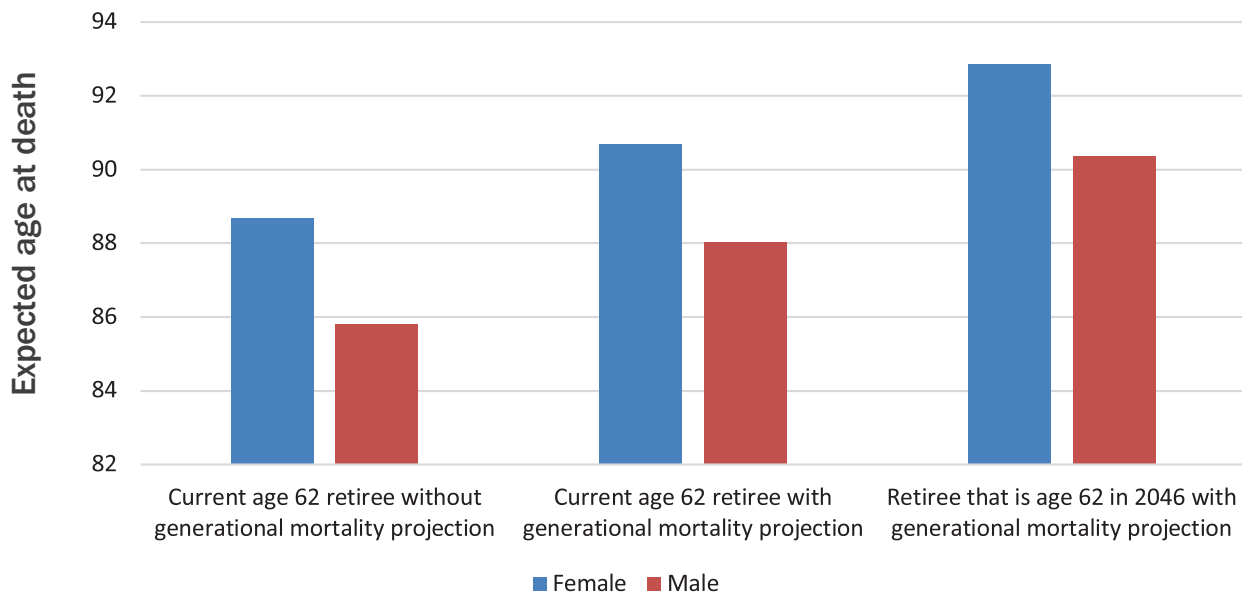
How has life expectancy changed?



## THE RISK ENVIRONMENT

To account for the historical trend of increasing life expectancy, CalSTRS uses a technique known as generational mortality with a mortality improvement factor of 1.1% in each year for most ages. This technique anticipates future improvements in life expectancy in the funding of the system, recognizing potential improvements in mortality ahead of time. The following chart illustrates the impact of generational mortality on a typical member retiring at age 62. Without generational mortality, a member retiring today would be expected to live to the age of about 89 for a female and age 86 for a male. By including generational mortality, the same member would be expected to live to age 91 for a female and age 88 for a male. This effect compounds over time as the chart shows, by 2046 a member retiring at age 62 would be anticipated to live two additional years, to age 93 for a female and age 90 for a male.

How does generational mortality impact life expectancy?



To get an idea of the financial implications of the improvement in life expectancy, consider that, for the 2019–20 fiscal year, CalSTRS paid over \$15 billion in benefits. If each member receiving a benefit today lives an additional two years, that would result in an additional \$30 billion in benefits over the life of the members over what would have been paid if there were no improvements in mortality over time.

By adopting generational mortality, CalSTRS is accounting for these increases in benefits and

is in a stronger funding position as a result. CalSTRS reaffirmed its assumptions on both mortality rates and the 1.1% mortality improvement factor when it adopted the 2020 Actuarial Experience Analysis in January 2020. In addition to the formal review of actuarial assumptions every four years, CalSTRS monitors life expectancy annually through this report. This year, CalSTRS took additional steps to monitor mortality in relation to the COVID-19 pandemic, as discussed in the next section.



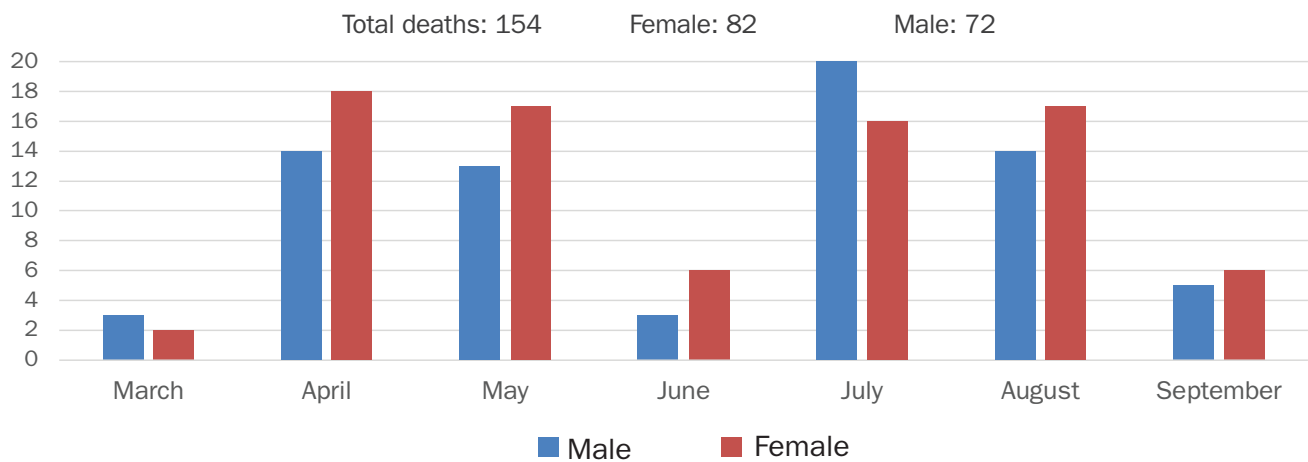
# THE RISK ENVIRONMENT

## Tracking COVID-19 deaths

The COVID-19 pandemic adds extra uncertainty to CalSTRS projections of life expectancy. It is not clear whether the pandemic will have long-term impacts on mortality or is just a short-term blip in the long-term trend of increasing life expectancy. CalSTRS will not know the full impact on mortality for several years. To monitor the potential impact, in April 2020, CalSTRS began a process of tracking mortality and collecting information for deaths of members and beneficiaries related to COVID-19. CalSTRS relies on the death certificates indicating COVID-19 as a reason of death. From these certificates, CalSTRS then collects the associated demographic information (e.g., age, gender, geographical location, and CalSTRS membership status). The first known COVID-19 related death of a CalSTRS member was reported in March 2020.

The following chart summarizes the number of COVID-19 related deaths of CalSTRS members by month since the beginning of the pandemic. Note, based on previous reporting, there is a lag on when data is available and the numbers for September are likely to increase from what is shown in the chart.

**CalSTRS members COVID deaths by gender and month**



As illustrated, there have been a total of 154 COVID-related deaths through September, of which 11 were active members. It is unclear whether these COVID-19 deaths will be in addition to the 8,000 to 9,000 deaths experienced by CalSTRS each year for the last several years. CalSTRS will continue to monitor the situation to determine whether the COVID-19 pandemic will impact long-term life expectancies.

## Membership and payroll growth risk

Another area of risk that is likely to be influenced by the COVID-19 pandemic is the risk associated with membership and payroll growth. CalSTRS assumes the payroll will grow by 3.5% annually over the long term. This assumption is key in determining contribution rates and whether the funding plan will successfully eliminate the current unfunded actuarial obligation by 2046 since CalSTRS collects contributions as a percentage of payroll.

If the payroll declines or fails to grow as assumed, for example either due to salary freezes or a decrease in total active membership, CalSTRS ability to make progress towards full funding could be at risk.

Several factors could cause payroll growth to be lower than anticipated. The COVID-19 pandemic has caused the United States economy to officially enter a recession. Past recessions have resulted in either slower payroll growth or reductions in the payroll. It is reasonable to expect this recession will be no different and will affect payroll growth for the next few years. In fact, the number of active members in the Defined Benefit Program as of June 30, 2020, declined for the first time in seven years, decreasing from about 451,000 active members on June 30, 2019, to about 448,000 on June 30, 2020. In addition, over the last year the total payroll increased by about 2.4%, slower than the assumed annual growth of 3.5%.

## THE RISK ENVIRONMENT

The next few months and years will be important when it comes to the payroll upon which CalSTRS collects contributions, especially when considering the potential for increasing numbers of retirements. Some media reports around the country have suggested that teachers are retiring at a greater rate either out of concern over safety when returning to the classroom during the pandemic or in response to the changes in the nature of the job due to social distancing requirements. Although CalSTRS saw slightly fewer retirements in fiscal year 2019–20 compared to fiscal year 2018–19, retirements are up by about 900 in the first quarter of fiscal year 2020–21 when compared to the same quarter last year. In addition, CalSTRS has seen an increase in the number of requests for retirement estimates when compared to the same

time period in prior years. An increase in the number of retirements, especially if combined with school districts freezing hiring and leaving positions vacant as teachers leave or retire to reduce budget pressure, could negatively impact future payroll growth. Payroll growth would also be impacted if school districts were to rely on layoffs to address budget issues.

The following table illustrates how various decreases in active membership would impact the ability for CalSTRS to reach full funding by 2046. For the purposes of these projections, the number of active members was assumed to remain stable following the initial decline, and all other assumptions were assumed to be met in all years.

Scenario (projection of active membership)	Decrease in membership	2046 funded status
No reduction in active population	0	100%
10% reduction over 2 years	45,000	99%
15% reduction over 5 years	70,000	99%
25% reduction over 5 years	110,000	92%

The first scenario represents a 10% reduction in the total number of members over a two-year period. This scenario is equivalent to what would happen if CalSTRS were to experience a 10% increase in retirements over a two-year period and a complete freeze on replacing active members who have left, either through retirement or termination of employment. In this scenario the fund would still be able to reach near full funding; however, both the state and employer contribution rates would need to be about 1% of payroll higher long-term for the duration of the funding plan. The second and third scenarios represent an increasing loss of membership over a five-year period, if the population were to be reduced by 15%, or about 70,000 members, the fund would still reach near full funding. However, the employer rate would need to be at the maximum of 20.25% for the duration of the funding plan while the state rate would be 1.5% higher long term. If the population fell by 25%, the fund would only attain a 92% funded status by 2046, the employer rate would again reach the maximum of 20.25% and the state rate would be 3% higher long-term.

It is important to realize that when the payroll fails to increase as assumed, it does not increase the overall cost to fund the retirement benefits nor does it change the dollar amount required to eliminate the unfunded actuarial obligation. However, the contribution rates needed to collect these contributions need to increase just to collect the same amounts. If the increases in the contribution rates exceed the limits imposed by the funding plan, CalSTRS may not be able to reach full funding by 2046.

In addition to the factors discussed above that could result in near term decreases in active members and payroll, there are considerations that could further impact the long-term payroll growth assumption. Recent projections by the California Department of Finance suggest that the overall K–12 student population will decline by about 7% over the next 10 years which could suppress the need for teachers. A key component of the current payroll growth assumption of 3.5% is the underlying general price inflation assumption of 2.75%. This assumption was reaffirmed by the board in January 2020.

## THE RISK ENVIRONMENT

However, inflation has been at historical low levels for several years now, and the Social Security Administration recently lowered their long-term inflation assumption to 2.4%. The next few years will play a key role in determining whether it may be necessary for CalSTRS to reconsider the inflation assumption with the next experience study. Lowering the inflation assumptions would have a corresponding effect on the payroll growth assumption. Finally, CalSTRS continues to observe the trend of charter schools selecting non-CalSTRS retirement benefits, which could impact future membership levels.

The following table highlights the impact to the long-term contribution rates for the state and employers if future payroll growth is lower than the currently assumed 3.5% per year. This analysis assumes all other assumptions will be met in the future, including meeting the 7.0% investment return assumption. As illustrated, the funding plan would still have capacity to reach near full funding levels even if payroll growth is lower than assumed. However, it would require higher contribution rates for both the state and employers, reducing the capacity of the funding plan to respond to other stresses in the future.

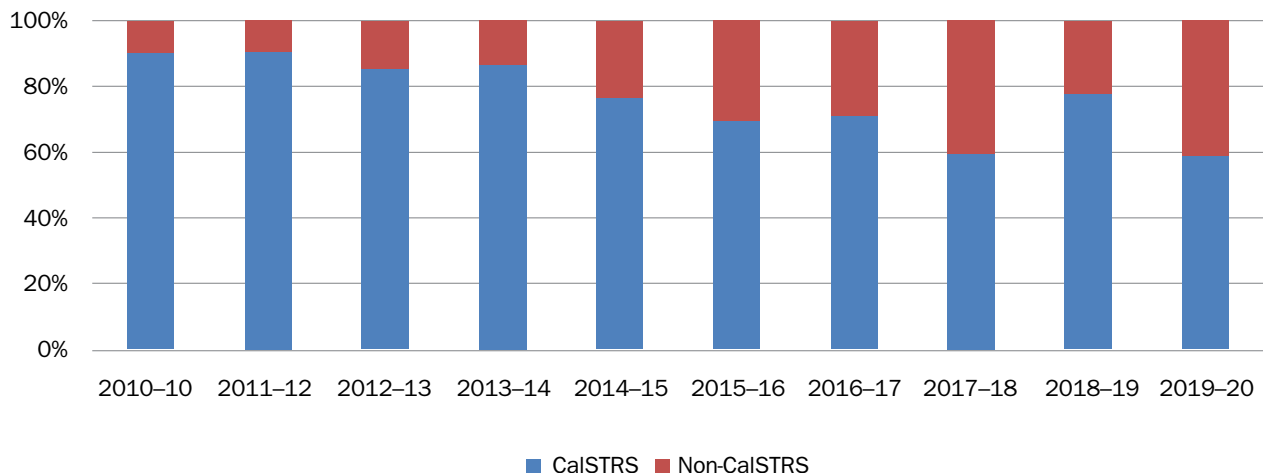
Future payroll growth	Long-term state contribution rate	Long-term employer contribution rate	2046 funded status
3.50%	10.9%	17.8%	99%
3.25%	11.5%	18.6%	99%
3.00%	12.0%	19.5%	99%

In all scenarios, the 2046 funded status is just below 100% due to the fact the funding plan does not address the unallocated unfunded actuarial obligation, as described earlier in this report.

### Update on charter schools not electing CalSTRS

For the past several years, CalSTRS has observed a trend amongst newly created charter schools of selecting a retirement system other than CalSTRS. When initially created, a charter school has the option to join CalSTRS or provide an alternate retirement benefit. Before passage of the funding plan, it was typical to have over 90% of newly created charter schools selecting CalSTRS benefits. However, as the following chart shows, since about 2014, an increasing number of newly created charter schools have been selecting an alternate retirement system. In both the 2017–18 and the 2019–20 fiscal years less than 60% selected CalSTRS.

### Which retirement system are new charter schools selecting?



## THE RISK ENVIRONMENT

Despite this recent trend, most charter schools still provide CalSTRS benefits to their teachers. In the 2019–20 fiscal year, about 88% of the 1,290 charters provided a CalSTRS benefit. In terms of number of teachers, based on data from the California Department of Education, there were approximately 37,000 full-time equivalent teachers working in charter schools in the 2018–19 fiscal year, the latest year for which data was available. Of those, about 32,200, or 87%, are covered by CalSTRS, and 4,800 have a non-CalSTRS benefit. Note that 4,800 represents just over 1% of CalSTRS' active member population. It is likely that if all these charter schools had instead elected to provide CalSTRS benefits, CalSTRS payroll would be about 1% higher today.

If the total payroll was 1% higher, the contribution rates required for both the state and employers to fully fund their share of the unfunded actuarial obligation by 2046 would be projected to be lower. The employer contribution rate would be lower by about 0.15% of payroll while the state contribution rate would be about 0.09% of payroll lower. Note that a higher payroll would not result in a lower unfunded actuarial obligation and would not impact the overall dollar amount needed to pay it down. However, as a percentage of payroll, the contribution rates would be lower.

### Investment risk

Although the COVID-19 pandemic is primarily a healthcare crisis, the main financial impact for CalSTRS has come from the investment volatility and the economic slowdown that has occurred as a result. Investment volatility remains the greatest risk facing CalSTRS today. The combination of a maturing system and the decreasing time frame of the funding plan only serves to exacerbate this risk.

The funding plan interacts with investment volatility risk in several ways. First, when investment returns are below expectations, the unfunded actuarial obligation increases, requiring additional contributions to bridge the gap. The funding plan provides the board limited authority to increase contribution rates for both the state and employers through 2046 for this purpose.

Second, although employers are currently responsible for the greatest share of the unfunded actuarial obligation, the state bears the greatest risk as a result of investment volatility. This is due to rules set in the funding plan that allocate the largest share of the assets to the state. As a result, their share of the unfunded actuarial obligation is most sensitive to investment volatility.

Third, the specific restrictions that the funding plan places on contribution rate increases for both the state and

employers limit CalSTRS' ability to respond to investment volatility. The board has authority to increase the state's contribution rate by a maximum 0.5% of payroll each year with no limit on the maximum rate. The employer rate can be increased by 1.0% of payroll each year with a limit of 20.25% maximum rate for employers. The limit on the state is particularly restricting given the sensitivity to investment volatility on the state's share.

Finally, the fact that the funding plan has an expiration date results in a declining period over which to fund any existing and new unfunded actuarial obligation. The funding plan set the target of 2046 to fully fund the Defined Benefit Program, after which the board's authority to adjust contribution rates expires. As the 2046 deadline approaches, CalSTRS' capacity to withstand economic stresses will be limited.

This section examines these factors through various stress tests and stochastic simulations.

### Risk of sustained low returns

As a result of the COVID-19 pandemic, the U.S. economy has now entered a recession. It is still unclear how long this recession will last and what the shape of the recovery will look like. There is a risk that investment returns will be suppressed over a period of time. The first stress test determines how the funding plan would respond to a sustained period of investment returns below the expected return.

Since 1985, the worst five-year compounded return the system has ever earned was the period from 2007 through 2012 when the compounded return over that period was 0.1%. During the period between 2000 through 2010, the portfolio returned its worst 10-year compounded return, which was about 2.4%. The worst 15-year period occurred from 2000 through 2015, when the average compounded return was 5.5%.

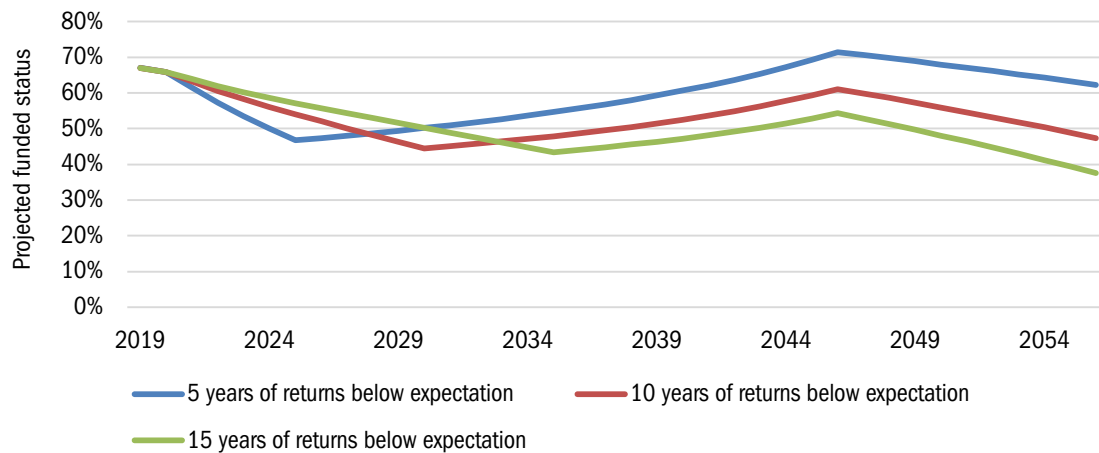
# THE RISK ENVIRONMENT

This stress test examines the impact of earning a 10th percentile compounded return over a five-year, 10-year and 15-year period. Based on the asset allocation and the capital market assumptions adopted by the board in 2019, the 10th percentile return over a five-year period is -0.25%. For a 10-year period, the 10th percentile return is about 2.25%, and for a 15-year period it is about 3.25%. To understand what this means, the 10th percentile indicates that, for example, over any given five-year period in the future there is a 10% probability that the compounded return over that period will be -0.25% or lower.

The following chart shows the projected funded status during and after each period of sustained low investment returns. For each scenario, it was assumed that the system would earn 7% for all years following the low return period. Further, it was assumed the board would exercise its authority to increase contribution rates in response to the investment experience.

## Impact of sustained low returns on funded status

(Based on the 10th percentile return)



The above chart illustrates that, in all cases, the system fails to fully recover, and the funded status is well below 100% by 2046 in all cases. Although the funding plan allows for steady recovery following the period of sustained low returns, there just is not sufficient time to fully recover before the 2046 expiration date. In all scenarios, the board would be asked to increase the state's contribution rate by the maximum 0.5% of payroll each year through 2046, eventually reaching a peak rate of 20.3% for the 2045–46 fiscal year. Despite these increases, funding levels are unable to recover much beyond where they are today in all scenarios. If CalSTRS were to experience such a sustained period of low

investment returns, changes would likely be needed to the funding plan either to allow for higher contribution rates or to extend the funding plan.

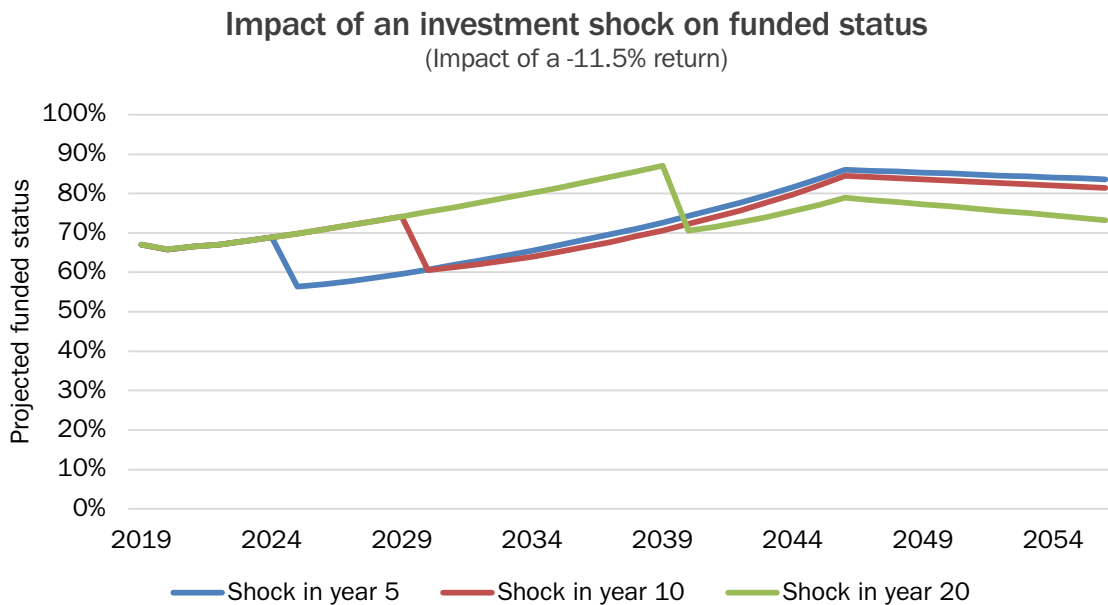
### Impact of a “shock” in a single year

As the COVID-19 pandemic began to spread across the world and into the U.S. in February and March 2020, investment markets responded with precipitous declines. Although they rebounded in the following months, in March 2020 CalSTRS was on track to miss its expected return of 7% by a significant margin. The second stress test examines what the impact could be of a significant investment shock in a single year.

## THE RISK ENVIRONMENT

If an investment shock were to occur, its impact on the funding plan would depend on both the magnitude of the shock and the timing. As the system matures, investment losses will be harder to withstand and recover from. This stress test examines how funding levels would be impacted if CalSTRS experiences a 5th percentile investment return in five, 10 or 20 years from now.

Based on the current asset allocation and capital market assumptions adopted by the board in 2019, there is a 5% probability that the investment return will be -11.50% or lower in any given year. For this stress test it was assumed that the fund returned 7% in every year except for the year of the shock.



At least two conclusions can be drawn from the above chart. First, the magnitude of the drop in funded status increases the later the shock occurs. Second, the funding plan's ability to recover decreases the later the shock occurs. If the shock were to occur five years from now, the funding level would drop by 12%, to about 56% funded in 2025. Funding levels would eventually recover to about 86% by 2046. Conversely, if the shock were to occur 20 years from now, funding levels would drop by 16%, from about 87% in 2039 to 71% in 2040, at which point there are only six years left in the funding plan to recover. Funding levels would only improve to 79% by 2046.

The impacts of a 1st percentile and a 10th percentile return were also analyzed. For reference, the 1st percentile return is -20.25%, meaning that there is a 1% chance in any given year that the investment return will be -20.25% or lower. The 10th percentile return is -7% given the current asset allocation and capital market assumptions. The following table shows the projected funded status in the year immediately following the shock as well as the projected funded status in 2046.

# THE RISK ENVIRONMENT

Timing of shock	-7% shock return		-20.25% shock return	
	Funded status after shock	Funded status in 2046	Funded status after shock	Funded status in 2046
In 5 years	60%	89%	50%	77%
In 10 years	64%	88%	54%	72%
In 20 years	75%	84%	62%	67%

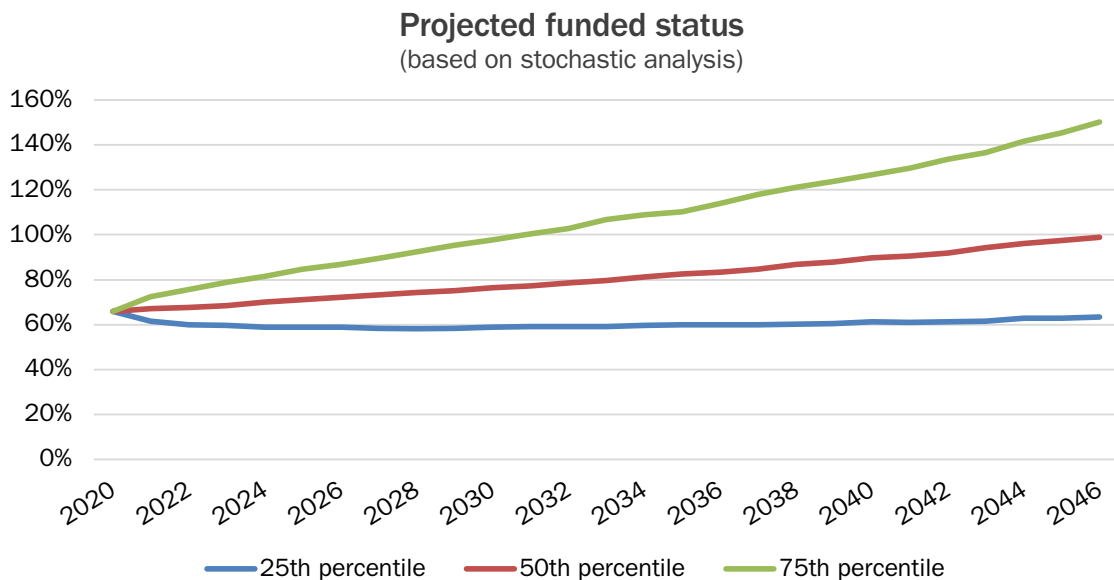
As illustrated above, if a -20.25% return was to occur sometime around the 10- to 20-year timeframe, the funded status would be around 70% in 2046. CalSTRS would then be in a situation like before the adoption of the funding plan and would be expected to run out of assets in the following 30 to 40 years. To avoid this situation, the resulting unfunded actuarial obligation would need to be addressed either through higher contributions, a longer funding period or a combination of the two.

### Impact of long-term investment performance

Thus far, this report has examined risk by primarily considering specific deterministic scenarios and examining how the funding plan responds to those scenarios. This is a useful method to get a deeper understanding of the risks to and limitations of funding the system. However, there are limits to this method as well. Deterministic scenarios assume the investment return will equal the assumed 7% in most years. In addition, deterministic scenarios do not provide a sense of how likely the specified scenario is. To overcome these limitations, it is useful to look at a stochastic model.

A stochastic model uses a technique known as Monte Carlo simulation in which a large number of random hypothetical scenarios are generated. These scenarios are calibrated to have the statistical characteristics of the CalSTRS investment portfolio, using both the capital market assumptions and asset allocation adopted by the board in 2019. For this analysis, 5,000 simulations of hypothetical future returns were generated. For each simulation, the assets and liabilities for the system were projected forward for the next 30 years. With this information, it is possible to assess the impact of long-term investment performance and volatility on the funding levels.

The following chart shows the 25th, 50th and 75th percentiles of the projected funded status for the Defined Benefit Program. Note that the compounded investment return over the 30-year period was about 5.7% for the 25th percentile and just above 8.6% for the 75th percentile.



# THE RISK ENVIRONMENT

These simulations illustrate clearly just how much volatility there is in the future funding of the system. In 2046, the 25th percentile funded status is 63% and the 75th percentile is 150%. This means there is a one in two chance that the funded status in 2046 will fall in this wide range. Furthermore, the 50th percentile in 2046 is 99%; thus, there is also a one in two chance that the 2046 funded status will be above, or below, this level. It is also important to point out that in the 2019 version of this report, there was a 52% probability that funding levels would reach 100% by 2046. In this year's report, that probability has gone down to 48%, illustrating a point made earlier in the Path to full funding section that the events that took place over the last 12 months have weakened the funding plan slightly and impacted CalSTRS' ability to reach full funding.

## Reacting to a recession

After years of growth, the U.S. economy fell into a recession in 2020 as a result of the COVID-19 pandemic. Although investment markets have largely recovered from their initial declines at the beginning of the year, the broader economy has only shown gradual improvement and unemployment remains high. During a recession, many of the risks already discussed may come into play simultaneously. Specifically, in past recessions, CalSTRS has experienced both periods of low investment returns combined with significant reductions in the number of active members and payroll. These are the situations that will most stress the funding plan. This section will examine three potential recession scenarios of varying severity and illustrate how the funding plan will approach its goal of achieving full funding by 2046.

The following table summarizes the scenarios that will be analyzed:

Scenario	Impact on active population	Investment return
Baseline	Stable, no decrease	7% for all years
Mild recession	5% decrease over a 3-year period	5% each year for 3 years
Medium recession	7% decrease over a 3-year period	3% each year for 3 years
Severe recession	10% decrease over a 5-year period	0% return each year for 5 years

For this analysis, it was assumed that all assumptions were met outside of the recession period. After the initial losses during the recession, the active membership was assumed to remain stable; payroll growth was assumed to continue increasing by 3.5% for each year; and investment returns were assumed to be 7.0% in each year.

The following table summarizes the analysis. For each scenario, the funded status and contributions were projected through 2046, and the table reports the peak employer contribution rate, the peak state contribution rate and the funded status in 2046.

Scenario	Peak employer contribution rate	Peak state contribution rate	Funded status in 2046
Baseline	18.0%	11.0%	99%
Mild recession	18.7%	19.1%	99%
Medium recession	18.9%	20.3%	88%
Severe recession	20.25%	20.3%	61%

Several conclusions can be drawn from this analysis:

First, except for the severe recession scenario, the employer contribution rate is minimally affected by these scenarios. The main factor influencing the employer contribution rates in all cases is the reduction in payroll as the employer rate is relatively stable in response to investment volatility and, as mentioned previously, tends to decrease when returns are below the expected 7.0%. In the severe recession scenario, the employer rate reaches 20.25%, which is the maximum allowed in statute.



# THE RISK ENVIRONMENT

Second, in contrast, the state rate is highly impacted in all cases, increasing by the maximum permissible 0.5% in each year through 2046, except for the mild scenario in which the increases stop after 2043–44. In both the medium and severe recession scenarios, the peak state rate reaches 20.328%, which is the maximum possible before the funding plan expires.

Third, these scenarios highlight the capacity of the funding plan to respond to a recession. Under the mild recession scenario, the funding plan is in fact able to still reach near full funding, and even in the medium recession scenario, significant progress is made towards reaching a 100% funded status. Only under the severe recession scenario is it clear that the funding plan is insufficient and additional steps to ensure progress would be necessary.

Finally, it is worth noting that these scenarios do not assume that an economic recovery will occur. Past recessions were typically followed by some level of economic rebound, and teacher counts and payrolls tended to recover to pre-recession levels. Any recovery that was to occur following future recessions would likely relieve some of the stress placed on the funding plan's capacity to recover funding levels.

## Risk measures

This section updates the risk measures that were introduced in previous reports on funding levels and risks.

These measures were reassessed for this report using the 5,000 stochastic scenarios discussed earlier, which were calibrated to simulate possible future investment returns from the recently adopted asset allocation and capital market assumptions. These measures are intended to assess three main risks:

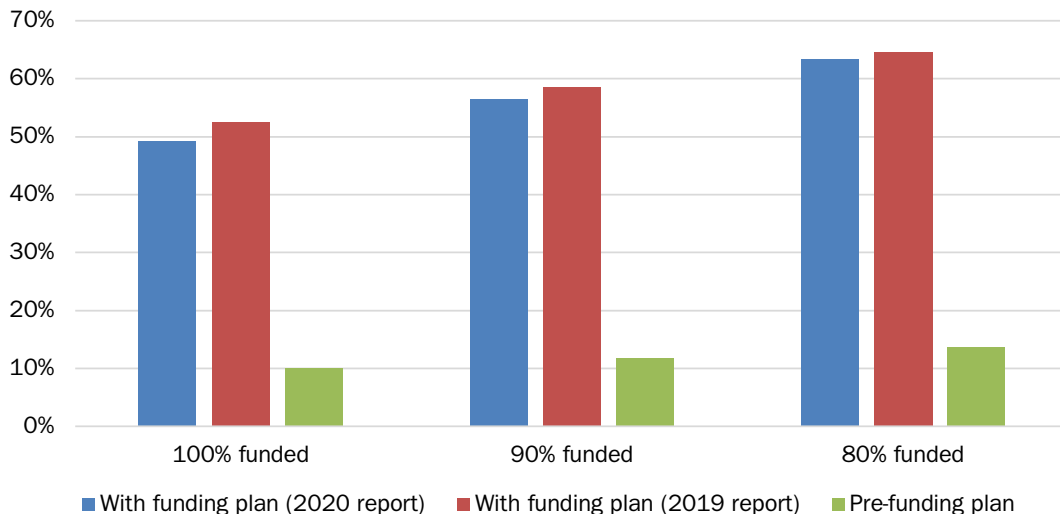
- Ability of achieving full funding
- Risk of low funding levels
- Risk of high state contribution rates

### Probability of achieving full funding

The funding plan sets a target of achieving a 100% funded status by the target year of 2046. As discussed previously, the fund is currently projected to reach a funded status near but just below 100% by 2046. As this risk section has illustrated, there is a great deal of uncertainty in this projection. To better understand how likely the plan is to make progress towards its goal of reaching full funding by 2046, the first risk measure quantifies the probability that the funded status attains specific funding thresholds by the 2046 target date.

The following chart illustrates the probability that, by the 2046 target year, the fund will have attained a funded status of either 100%, 90% or 80%. For comparison, the chart also shows the risk measure's levels from the previous year's report.

Probability of achieving higher funding levels by 2046



# THE RISK ENVIRONMENT

One aspect that stands out from the previous chart is that the probabilities of reaching each of the threshold funding levels has decreased since the previous report. This is due to several factors. Most significantly, the investment return for fiscal year 2019–20 was below expectations, which has lowered the starting point funded status from last year. In addition, the changes made to the funding plan in the state budget, more specifically the lack of a “catch-up” provision, have reduced future potential state contribution rates slightly, reducing the funding plan’s ability to reach full funding.

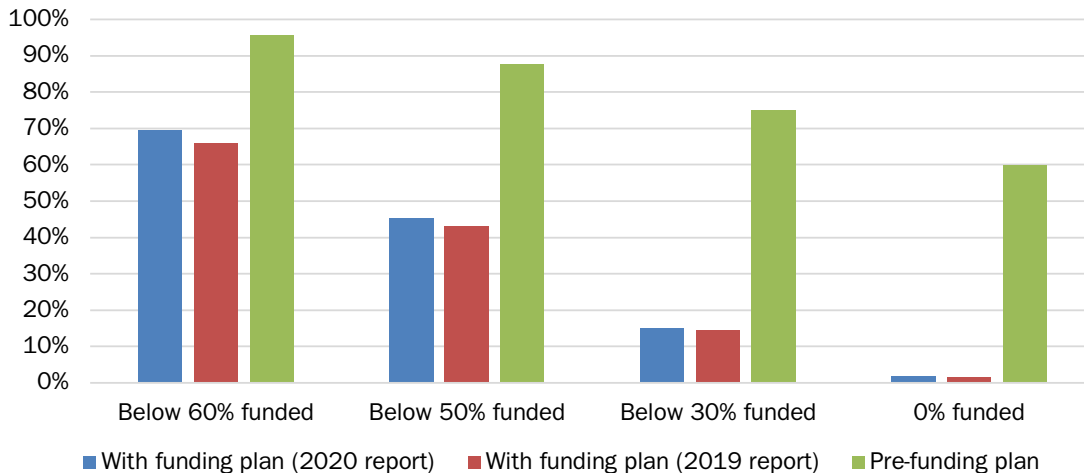
Despite the decrease in this measure from the previous year, the chart still demonstrates that the funding plan has made a significant contribution towards improving likely future funding levels. Had the funding plan not been implemented, the fund would have had only a one-in-10 chance of reaching full funding by 2046 compared to the about one-in-two chance under the funding plan.

## Probability of low funding levels

Prior to the passage of the funding plan in 2014, the fund was projected to run out of assets by 2046. Although the funding plan has almost eliminated the risk of completely depleting the assets by 2046 there is still a risk that the funded status declines and falls to uncomfortably low levels. This risk will never be fully eliminated due to the maturity level of the system, investment volatility and limitations on contribution rates.

The second risk measure quantifies the risk of funding levels declining by measuring the probability that the funded status will fall below certain thresholds at any point over the next 30 years. The following chart shows the probability that the funded status will fall below 60%, 50%, 30% or down to 0% at some point over the next 30 years. It compares how this risk measure has changed over the last year and compares to the probabilities had the funding plan not been adopted.

**Probability of low funded status of the next 30 years**



As illustrated above, the probability the fund runs out of assets in the next 30 years has been almost eliminated, falling to below 2%. Had the funding plan not been adopted, there would be a greater than 50% chance of running out of assets. Furthermore, the chart illustrates that there is still a significant probability that the funded status falls below 60% or even 50%. This probability is driven by the current funding levels, the limitations on contribution rates and the volatility of the investment markets. It would only take a few years of returns below the assumed rate of return to drive the funded status below 60% or 50%. Finally, the chart shows that there is a slightly higher probability of falling to low funded status this year as compared to last year. This is due to the same factors discussed above: the investment return for fiscal year 2019–20 being below expectation as well as the changes made to the funding plan in the state budget in response to the COVID-19 pandemic.

# THE RISK ENVIRONMENT

## Probability of high contribution rates

The final risk measure considers the likelihood that the state contribution rate increases to specified thresholds. This risk measure focuses specifically on the state because the employers have a cap of 20.25% on their contribution rate, and the employer rate is generally not materially impacted by investment performance under the rules of the funding plan. Thus, the risk is essentially mitigated in statute for employers. Furthermore, the state’s share of the unfunded actuarial obligation has greater sensitivity to volatility in the investment returns, increasing the risk that the state rate will need to be increased in the future.

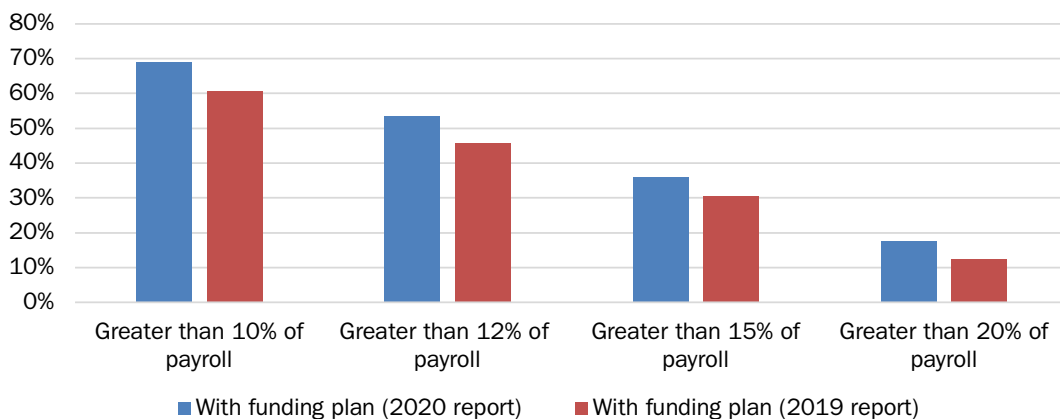
Under the funding plan, the state contribution rate can increase each year by no more than 0.5% of payroll with no limit on the actual rate. As a result of the state contribution rate freeze implemented through the 2020-21 budget for the State of California, the state supplemental rate is 5.811% for fiscal year 2020–21. This supplemental rate is in addition to the state base rate of 2.017%. In total, the state contributes 7.828% of payroll to fund its share of the unfunded actuarial obligation of the Defined Benefit Program for fiscal year

2020–21. In addition, the state pays another 2.5% of payroll to fund the Supplemental Benefit Maintenance Account.

When the state contribution rate was frozen for fiscal year 2020–21, no “catch-up” provision was included. This means that once the board can adjust the rate again for the 2021–22 fiscal year, the board will only be able to increase the rate by the usual maximum 0.5% of payroll. If the board maintains the ability to increase the rate by the maximum 0.5% in each future fiscal year through 2045–46, the highest rate the state could be required to pay to the Defined Benefit Program is a rate of 20.328% of payroll in fiscal year 2045–46. Note that had the state rate not been frozen for fiscal year 2020–21, the maximum potential rate would have been 20.828% in fiscal year 2045–46.

The following chart updates the probabilities that the state contribution rate exceeds specified thresholds over the next 30 years. For context, the state contribution rate is currently projected to peak at 10.9% of payroll. The rates do not include the 2.5% for SBMA. For comparison, the chart also shows the probabilities that were reported for this risk measure last year.

**Probability of high state contribution rate over the next 30 years**



The above chart shows that, at all levels, the probability the state experiences a high contribution rate has increased since the previous year. These measures have increased for the reasons previously discussed: the lower than expected investment return for fiscal year 2019–20 and the changes to the funding plan enacted in the 2020-21 budget for the State of California. In fact, this risk measure will be more sensitive to the freeze in the state contribution rate since a delay in increasing the contribution rate will result in an ultimately higher rate in most scenarios.

## CONCLUSION

This report discusses a variety of risks associated with the funding of the system. Even if the Defined Benefit Program is on a path to reach full funding, significant risks remain that could prevent the system from reaching full funding by 2046.

The next few years will be critical for the funding plan. The full impact of the COVID-19 pandemic on the economy, employment patterns and employers' budgets is still uncertain. The COVID-19 pandemic has the potential to affect investment performance, the number of teachers working in California and the longevity of CalSTRS members, the three main risks that CalSTRS has been monitoring for the last few years.

Although the risks related to longevity and to active membership decline and future payroll growth are real and important, the fact remains that the largest risk facing CalSTRS is risk from investment returns falling short of the assumed return. This risk will continue to increase over time simply due to the natural maturing of the system.

CalSTRS will continue to monitor the COVID-19 pandemic and how it may affect the funding of the system over the next few years, especially as the effect of the current recession on investment markets unfolds.

In the longer term, CalSTRS will also monitor and be on the lookout for the possibility the COVID-19 pandemic will have lasting consequences on CalSTRS and economic outlooks. The COVID-19 pandemic could potentially impact long-term actuarial assumptions such as price inflation, wage growth, investment return and longevity. Even though actuarial assumptions are formally reviewed every four years, with the most recent review completed in January 2020, CalSTRS constantly monitors the appropriateness of the actuarial assumptions adopted by the board. If any events or changes were to warrant an adjustment to actuarial assumptions, the issue would be brought to the board for discussion, even if it meant such discussion would occur ahead of the normal four-year review cycle.