

CALSTRS

2019 Review of Funding Levels and Risks

Presented November 8, 2019

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 provide retirement, disability and survivor benefits to them and their families.

To that end, CalSTRS has come a long way. Just five years ago, the fund was projected to run out of assets in about 30 years. Today, CalSTRS is financially stronger and better positioned to 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 by assessing funding levels and risks twice a year: once in the spring through the annual actuarial valuation process and again in the fall through this annual report. As required by statute, CalSTRS is also required 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 purpose of the CalSTRS Review of Funding Levels and Risks report is to assist the Teachers' Retirement Board, stakeholders, policymakers and the public in assessing the soundness and sustainability of the CalSTRS Defined Benefit Program and to promote a better understanding of how well the funding plan is expected to achieve its goal in light of uncertainties related to investment risk, longevity risk, and risks related to payroll and membership growth.

This is the fourth annual edition of the CalSTRS Review of Funding Levels and Risks report. As shown in this year's report, CalSTRS is slightly better positioned today

than last year thanks in part to additional supplemental contributions made by the State of California in July 2019 as part of the 2019–20 California State budget.

Key results and findings of this report include:

- Additional supplemental contributions by the state have improved projected funding levels and mitigated some of the expected increases in the state and employer contribution rates.
- 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 is 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 combined with a period of lower investment returns.

INTRODUCTION

The CalSTRS Review of Funding Levels and Risk report provides the board and stakeholders information to assess the soundness and sustainability of the system. 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.

This report is based on the June 30, 2018, Annual Valuation of the Defined Benefit Program and reflects all relevant changes that have occurred since the valuation, including the 6.8 percent investment return reported for the 2018–19 fiscal year and the additional contributions made by the state as part of the 2019–20 California State budget to reduce the unfunded actuarial obligation and reduce both short- and long-term contribution rates.

In this report, the focus is on:

- Measures of plan maturity and how increasing maturity levels impact contribution rate volatility.
- The path to full funding, including a discussion of significant changes in the past year and their impact on long-term funding.
- Risks to long-term funding, including investment volatility, longevity risk and risks related to membership decline and future payroll growth.

MEASURES OF PLAN MATURITY AND VOLATILITY

Like other pension systems across the U.S., CalSTRS continues to mature. 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 before a more in-depth analysis is performed on how investment return volatility, improvements in longevity, or even growth in payroll and size of active membership could impact CalSTRS' ability to reach full funding.

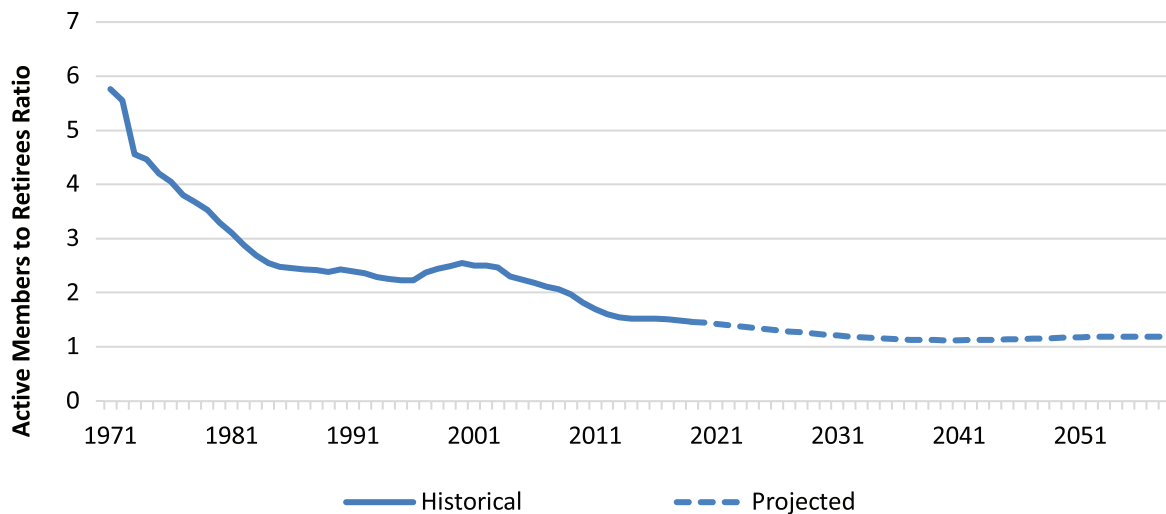
In this section, the maturity of the system is examined in the context of the number of active members to retirees, the projected cash flows, and the volatility ratios, which measure the volatility in contribution rates in response to the volatility in investment returns.

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 taken into account in the funding of the system. Even though it was anticipated, this demographic shift is impacting the system and 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 comprised 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 seen in the chart above, the ratio of active to retired members for CalSTRS was about six to one in 1971. The ratio has steadily decreased over time. Today the ratio is about 1.5 to one. The ratio is projected to approach one over the next 40 years, but it is not expected to go below one over that time period.

MEASURES OF PLAN MATURITY AND VOLATILITY

Note that the chart on the previous page was prepared assuming the number of active members would remain constant in the future at about 450,000. A decline in the CalSTRS active 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.

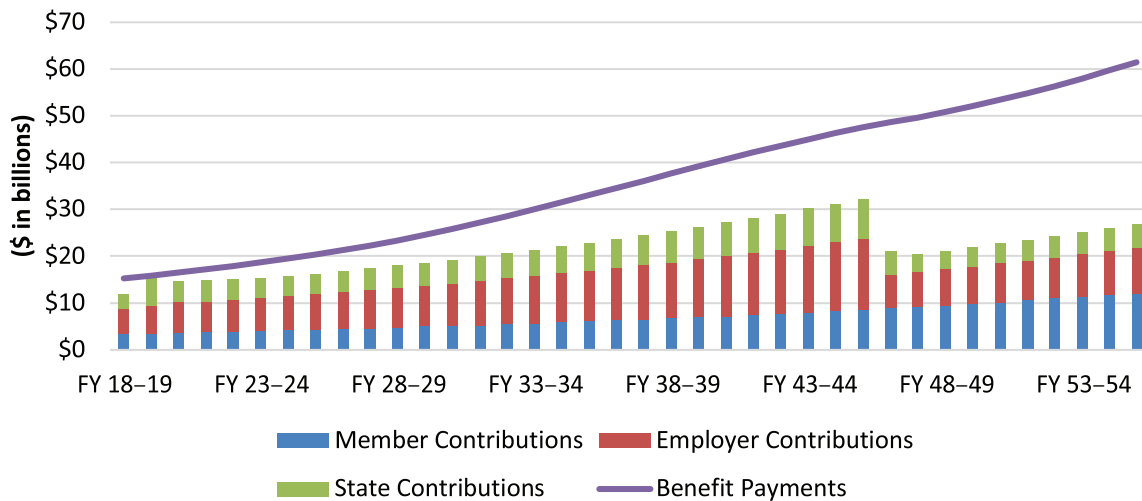
Projected Cash Flows

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 pre-funding a pension plan, it is important to remember that the objective is to accumulate assets to pay benefits. Put another way, the objective of pre-funding 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, the state and employers, 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



In 2018–19, benefit payments exceeded contributions by about \$3 billion. As seen on the chart above, CalSTRS is expected to have slightly positive cash flow in fiscal year 2019–20 due to the additional contributions made by the state as part of the 2019–20 Budget Act. Note that for accounting purposes, some of the additional contributions made by the state in July 2019 were recognized as 2018–19 contributions in CalSTRS financial statements. In fiscal year 2020–21, cash flows are expected to once again be negative and remain negative in perpetuity. Over time, the gap between benefits and contributions is expected to continue to increase, especially after 2046 when contribution rates for both the state and employers will revert to pre-funding plan levels.

MEASURES OF PLAN MATURITY AND VOLATILITY

Even though 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 percent and 2 percent of the assets for the next 30 years. Cash generated by investments would have to be at least 2 percent 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 percent.

Increasing Volatility

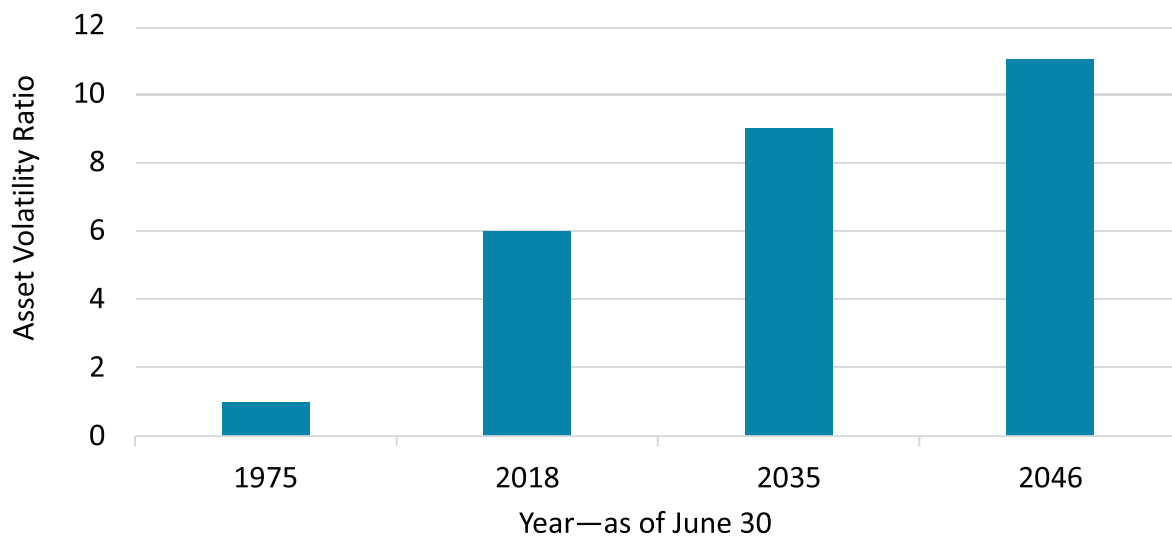
As retirement systems become more mature, these systems are subject to increased volatility in the contribution rates needed to fully fund the benefits.

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. 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 six. This is typical for a mature system like CalSTRS. This means that the contribution volatility is currently six times higher than it was in 1975. As shown on the chart below, the asset volatility ratio for CalSTRS is expected to continue to increase over time, reaching 11 by the end of the funding plan.

Historical and Projected Asset Volatility Ratio



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, 2018, actuarial valuation, the Defined Benefit Program was about 64 percent funded. If the system was 100 percent funded today, the asset volatility ratio would be close to 10. As additional contributions flow into the system as per the funding plan, the funded ratio will improve and move toward the target of being 100 percent 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, we expect the asset volatility ratio to continue to increase slightly.

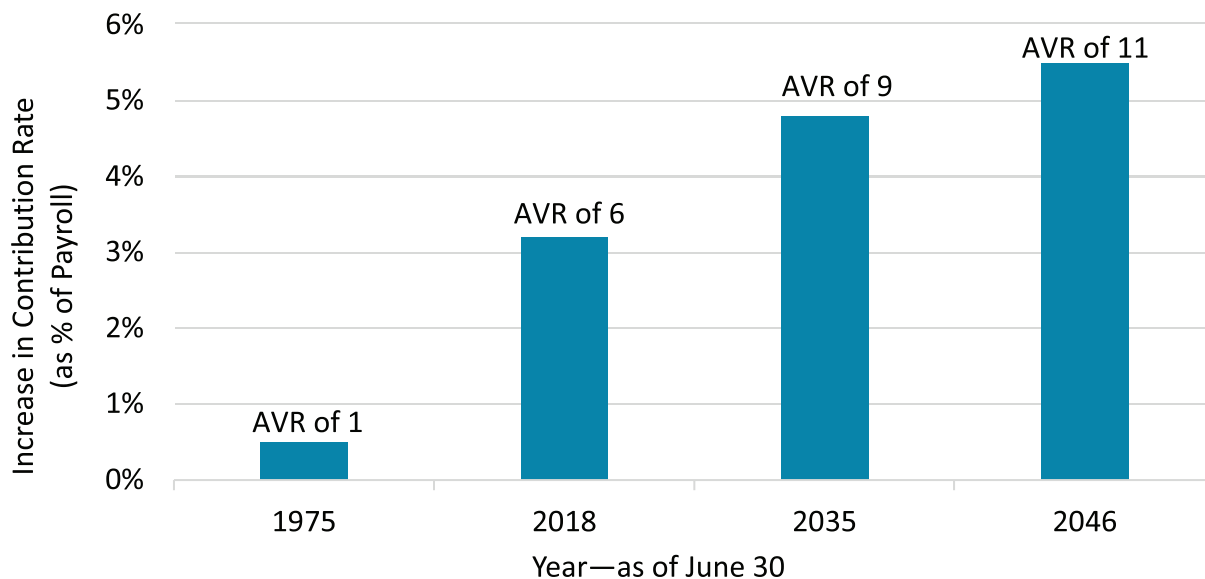
It is important to keep in mind that there is nothing to “fix” if the asset volatility ratio is high. A high asset volatility ratio simply indicates that there is more money invested for the plan—a good thing overall. It should, however, serve

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 to 30 years than it is today, resulting in greater volatility in the level of contributions that would be needed to ensure the plan remains 100 percent 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 percent investment loss. Note that a 10 percent investment loss represents a return of –3 percent, or a return 10 percent less than the assumed 7 percent 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 27 years. In 10 years, any remaining shortfall will be amortized over 17 years. If markets were to fall short of expectations in 20 years, the shortfall would have to be paid over a seven 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, as a result of the combined impact of the funding period shortening and maturity levels increasing

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 and ensure funding of the plan remains on schedule.

This section discusses the impact recent changes had on projected funding and contribution levels and highlights the reasons why improvements in funding levels and changes in the unfunded actuarial obligation are expected to be minimal over the next decade.

Significant Changes in the Past Year

CalSTRS took further steps toward achieving full funding in the past year. In May 2019, the board exercised its authority to increase the state contribution rate by the maximum allowed 0.5 percent of payroll. This was the third year in a row the board adopted an increase in the state contribution rate. Further increases are projected to be necessary to ensure the state's share of the unfunded actuarial obligation is eliminated by 2046.

Another significant step toward full funding took place this year when additional supplemental contributions were sent to CalSTRS by the state as part of the 2019–20 California State budget. These supplemental payments were provided to CalSTRS to reduce both the state and the employers' share of the unfunded actuarial obligation as well as to reduce the statutorily required increases in the employer contribution rate for the next two fiscal years.

Below is a table showing the additional contributions that were adopted as part of the 2019–20 California State budget.

Fiscal Year of Contribution	Additional Contributions for the State (\$ in millions)	Additional Contributions on Behalf of Employers (\$ in millions)
2019–20 ¹	\$1,117	\$2,246
2020–21	\$802 ²	n/a
2021–22	\$615 ²	n/a
2022–23	\$345 ²	n/a

In July 2019, the state sent a payment of \$2.246 billion to CalSTRS on behalf of employers. From this payment, \$606 million is a pre-payment of employer contributions that will be used to lower the employer contribution rate for fiscal year 2019–20 from 18.13 percent of payroll down to 17.1 percent of payroll and to reduce the 2020–21 employer contribution rate from 19.1 percent of payroll down to 18.4 percent of payroll. The remaining \$1.64 billion will be used to reduce the employers' share of the unfunded actuarial obligation. Reducing the employers' share of the unfunded actuarial obligation is expected to result in a lower employer contribution rate over the long term. It is estimated the additional \$1.64 billion will result in an employer contribution rate that will be about 0.3 percent of payroll lower over the long term.

In July 2019, the state also contributed \$1.117 billion to reduce the state's share of the unfunded actuarial obligation. As shown in the table above, the state has indicated its intention to contribute an additional \$1.762 billion over the next three years, for a total of about \$2.9 billion, to reduce the state's share of the unfunded actuarial obligation. The amount is subject

1 For accounting purposes, some of the additional contributions made by the state in 2019–20 were recognized as 2018–19 contributions in CalSTRS financial statements.

2 Estimate provided by the Department of Finance based on projected future revenues. Subject to change.

PATH TO FULL FUNDING

to change and will be dependent on future revenues. Although the state will not see an immediate reduction in its contribution rate, the reduction in the state's share of the unfunded actuarial obligation will translate into a lower state contribution rate over the long term. It is estimated that the additional contributions of \$2.9 billion will lower the long-term state contribution rate by about 0.5 percent of payroll.

The impact of these additional contributions on both the funded status and on projected contribution rates are illustrated on the following charts and are reflected in the risk analysis performed later in this report.

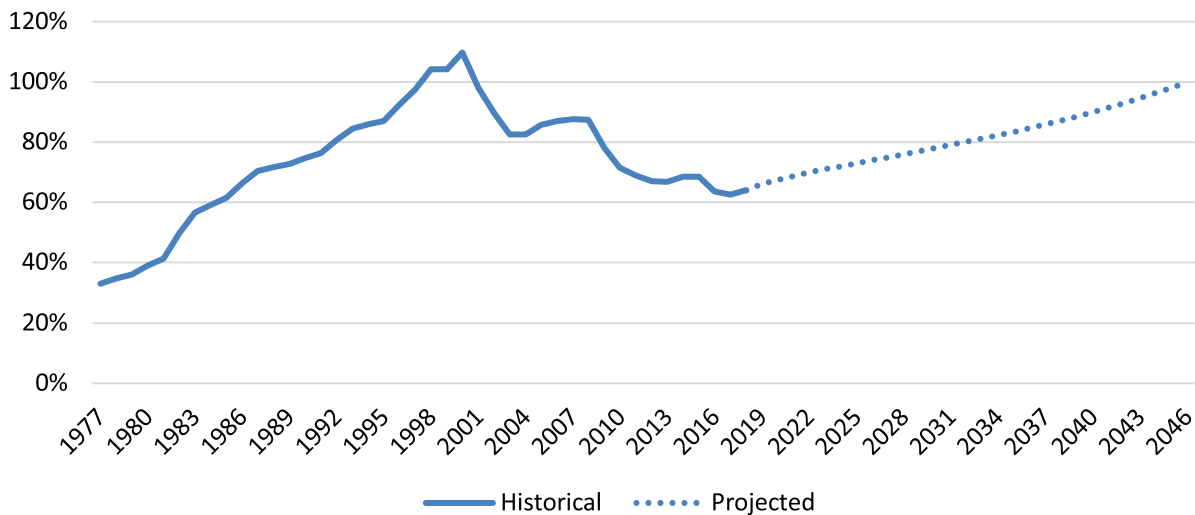
Another event impacting funding levels and projected contribution rates was the investment performance for fiscal year 2018–19. In July 2019, CalSTRS reported a 6.8 percent investment return for 2018–19. As illustrated later in this report, investment performance can have a significant impact on projected contribution rates and funding levels, especially when these returns are significantly above or below the investment return assumption of 7 percent. Since the 2018–19 return

was just below the long-term assumed rate of return of 7 percent, it is expected to have a minimal impact on funding levels and projected contribution rates.

Overall, the 6.8 percent investment return for fiscal year 2018–19 is expected to decrease the June 30, 2019, funded status by about two tenths of one percent below where it was projected to be when the June 30, 2018, actuarial valuation was completed. However, the additional contributions made by the state in July 2019 will help improve funding levels. The June 30, 2019, funded status is now expected to be about one percent higher than projected when the June 30, 2018, actuarial valuation was completed. As a result, contribution rates for both the employers and the state will not have to increase as much as previously estimated.

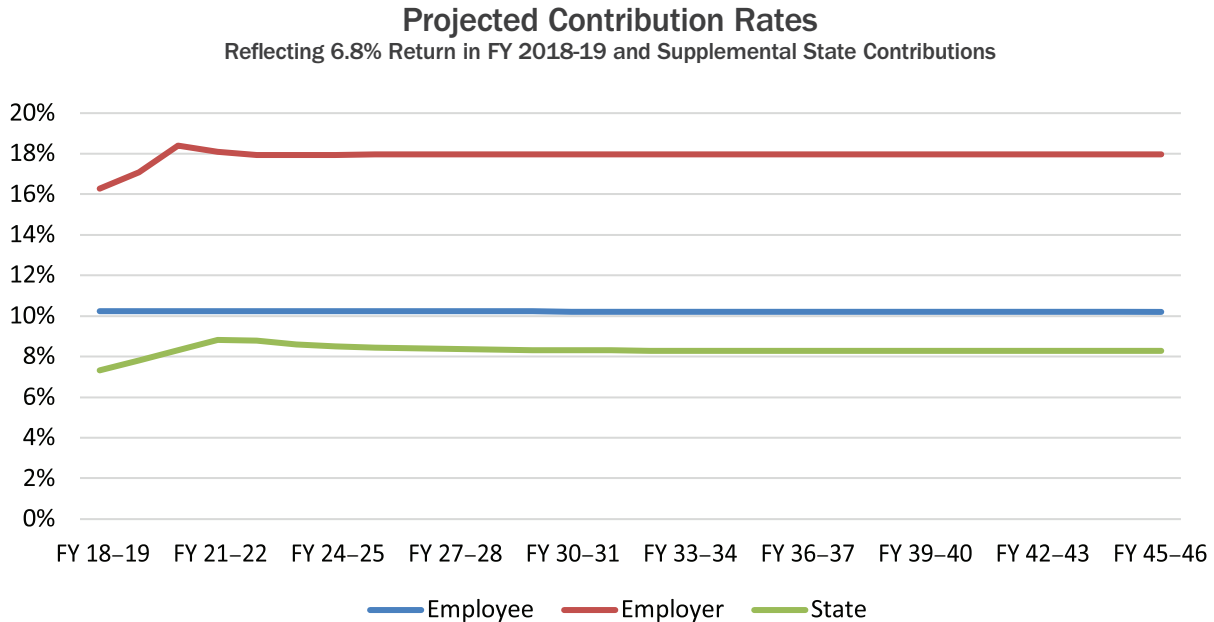
The chart below shows the historical and projected funded status for the Defined Benefit Program which reflects the 6.8 percent return in the 2018–19 fiscal year as well as the supplemental contributions made by the state. It also assumes the fund will earn 7 percent annually thereafter.

Historical and Projected Funded Status
Defined Benefit Program—Actuarial Value of Assets Basis



PATH TO FULL FUNDING

The chart below shows the projected contribution rates that will be needed to achieve the projected funded status shown above. It also assumes the fund will earn 7 percent annually thereafter.



The employer contribution rate was minimally impacted by the 6.8 percent return, however the supplemental contributions made by the state on behalf of employers have directly reduced the employer contribution rates over the next two fiscal years, by 1.03 percent in 2019–20 and by 0.7 percent in 2020–21. Furthermore, the portion that went toward the employers’ share of the unfunded actuarial obligation has resulted in a decrease of about 0.3 percent of payroll in the long-term employer contribution rate compared to what was projected before the additional contributions.

For the state, the additional contributions made to pay down the state’s share of the unfunded actuarial obligation have decreased both the peak and the projected long-term state contribution rate by about 0.5 percent of payroll. However, as a result of the 6.8 percent investment return being below the assumed investment return of 7 percent, the projected state contribution rate will be about 0.1 percent of payroll greater than what it would have been had the return assumption been met. When combining the impact of both events, the projected peak and long-term state contribution rate is expected to be about 0.4 percent lower than what had been projected in May 2019 as part of the June 30, 2018, actuarial valuation.

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.

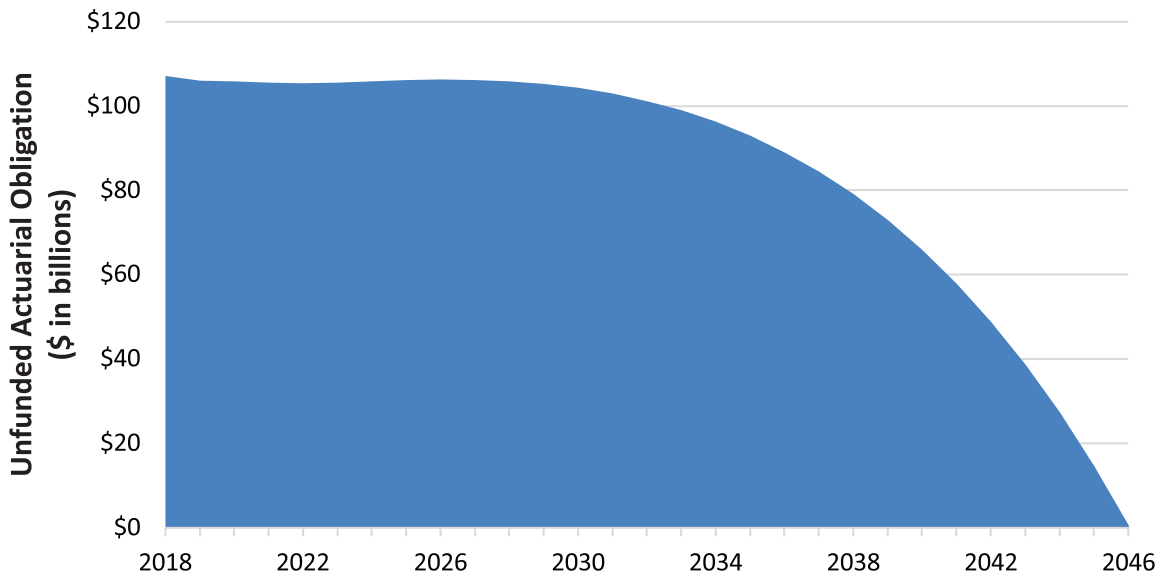
When pension plans are less than 100 percent funded, contributions in excess of the normal cost are needed in order to pay down the unfunded actuarial obligation and to make progress toward being 100 percent funded. In order to ensure the unfunded actuarial obligation does not increase on a year-to-year basis, the payments toward the unfunded actuarial obligation have to 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 has to be more than 7 percent of the unfunded actuarial obligation.

In fiscal year 2019–20, the contributions toward paying down the unfunded actuarial obligation were originally expected to represent 4.8 percent of the total unfunded actuarial obligation. With the addition of the state’s

PATH TO FULL FUNDING

supplemental contributions, the total contributions toward the unfunded actuarial obligation are now expected to represent about 8 percent of the total unfunded actuarial obligation. As a result, the unfunded actuarial obligation is expected to slightly decrease next year. Below is a chart showing the projected unfunded actuarial obligation.

Projected Unfunded Actuarial Obligation



As shown above, the unfunded actuarial obligation is initially going to slightly decrease from \$107 billion to about \$106 billion as a result of the additional contributions made by the state as part of the 2019–20 California State budget. It is expected to continue to slightly decrease just below \$106 billion for the following four years as the additional scheduled supplemental contributions toward the state’s share of the unfunded actuarial obligation are received. Once all the additional contributions have been provided to CalSTRS, the unfunded actuarial obligation will slowly increase since contributions are not expected to be sufficient to exceed 7 percent of the total unfunded actuarial obligation until the 2026–27 fiscal year. The unfunded actuarial obligation is expected to increase back to just above \$106 billion by 2026 when it will start decreasing again, as payments beyond 2026 are expected to be more than 7 percent of the total unfunded actuarial obligation. Previously, it was expected to peak at about \$111 billion without the supplemental contributions by the state.

Despite the fact the unfunded actuarial obligation is expected to remain near current levels through 2026, the funded status is projected to improve each year as the

growth in the total liabilities will be faster than the growth in the unfunded actuarial obligation, thus the unfunded actuarial obligation will represent a smaller percentage of the total liability.

Note that negative amortization is fairly common among public plans and is generally the result of the funding practice. For most public plans, contribution requirements are expressed as a percentage of the payroll. Historically, this has long been the preferred approach to provide budget stability. Because payroll is expected to increase over time, contribution amounts will increase as well, even if contribution rates remain stable.

For CalSTRS, payroll is assumed to increase annually at a rate of 3.5 percent. This means that payments toward the unfunded actuarial obligation 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 impacted in the future if payroll growth is less than 3.5 percent. 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 board cannot adjust contribution rates to pay for the entire unfunded actuarial obligation in place today.

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 percent 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. Effective with fiscal year 2021–22, the board will be able, if necessary, to adjust the employer contribution rate by no more than 1 percent of payroll each year, never to exceed 20.25 percent of payroll, to pay down the employer's 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, a small unallocated unfunded actuarial obligation has developed resulting mostly from a combination of investment experience and changes made to the actuarial assumptions that were adopted by the board in February 2017. The size of the unallocated unfunded actuarial obligation is very small relative to the overall unfunded actuarial obligation since it is only for service after July 1, 2014. It was estimated to be \$300 million as of June 30, 2018. Since the board cannot adjust contribution rates to pay for the unallocated unfunded actuarial obligation, it is projected to increase to almost \$600 million by 2046 due to interest alone. Because of the unallocated unfunded actuarial obligation and the constraints around the board's rate setting authority, the system is projected to be 99.9 percent funded by 2046.

The unallocated unfunded actuarial obligation could increase significantly if investment returns fall well below the assumed 7 percent. Similarly, it could be eliminated if investment returns exceed 7 percent 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 0.04 percent of payroll would be required effective July 1, 2019.

THE RISK ENVIRONMENT

This section examines several risks—investment risk, membership and payroll growth risk, and longevity risk—that could pose challenges to CalSTRS’ ability to reach full funding by 2046. In order to understand the extent of the risks faced, several stress tests were performed to determine the impact on funding levels and the ability of the funding plan to withstand and recover from these stress scenarios. It is important to note that although each risk was examined in isolation, the system has the potential to face these challenges in combination, which could have a compounding effect.

Investment Risk

Investment return volatility is the greatest risk facing CalSTRS today. As the system continues to mature over time, investment returns will have a greater impact on the funding of the system than they currently do. When investment returns are below expectations, the unfunded actuarial obligation increases and additional contributions are needed to bridge the gap. With the passage of the funding plan, the board can increase contribution rates for the state and employers within the limitations established in statute in order to eliminate the unfunded actuarial obligation by 2046.

As one looks at investment risk, it is important to understand that even though employers are responsible for the greatest share of the existing unfunded actuarial obligation, the state’s share of the unfunded actuarial obligation is most likely to materially increase or decrease as a result of economic and demographic experience. This is a direct result of the rules set in the funding plan. As per these rules, the state is currently responsible for about 80 percent of CalSTRS’ overall actuarial obligation and the assets that support them. As a result, CalSTRS’ ability to reach full funding following a period of low investment return will be directly related to the ability of the board to increase the state contribution rate to the necessary levels.

In May 2019, the CalSTRS Investment Committee approved a new set of capital market assumptions. This was a key step in the larger Asset Liability Study, which is conducted every four years, and is expected to result in the selection of a new asset allocation in November 2019. Updating the capital market assumptions allows CalSTRS to better reflect changes in the investment environment and recalibrate the CalSTRS Asset Liability Management

Framework to be in line with future expectations. These new capital market assumptions are reflected in the analysis presented in this section.

This section updates several of the stress tests and risk measures related to investment return volatility that were performed in last year’s 2018 report. In general, the analysis shows slight improvements in both the capacity to withstand stress and the risk measures, which reflects the improved funded status due primarily to the supplemental contribution made by the state as part of the 2019–20 California State budget. It is important to emphasize that over the long term, as the expiration of the funding plan approaches, CalSTRS’ capacity to withstand economic stresses will be limited despite expected increases in funding levels.

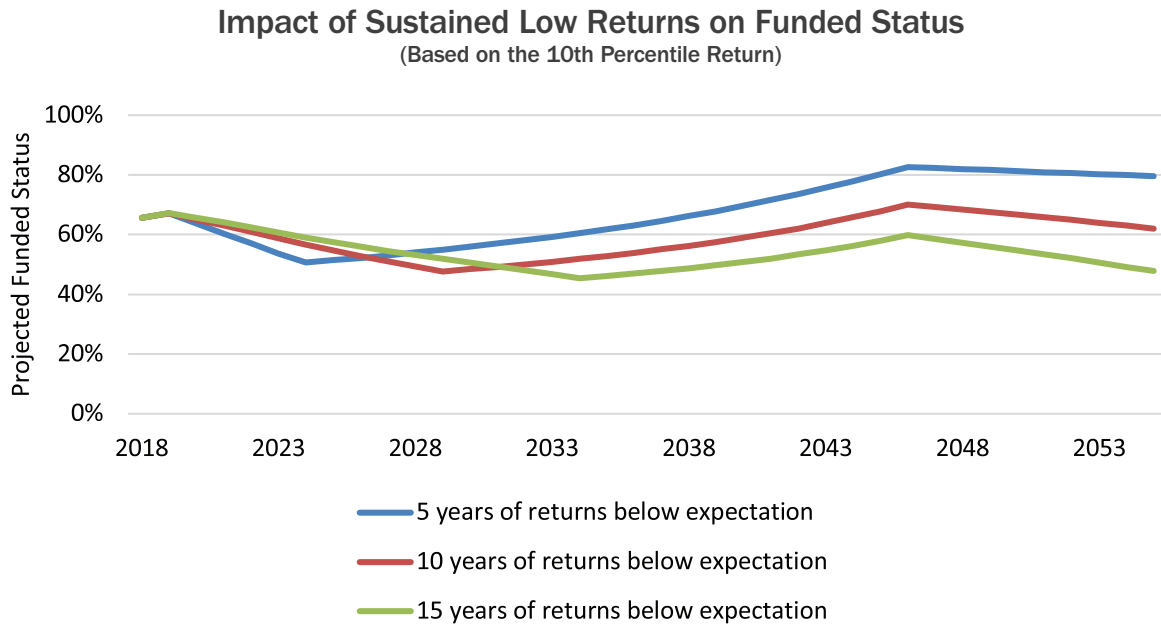
Risk of Sustained Low Returns

The first stress test determines how the funding of the system would be impacted by a sustained period of investment returns below the expected return. Specifically, this analysis examines the impact of earning a 10th percentile compounded return over a 5-year, 10-year and 15-year period.

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 percent. The worst 15-year period occurred from 2000 through 2015 when the average compounded return was 5.5 percent. Based on the current asset allocation and the capital market assumptions adopted by the board in May 2019, the 10th percentile return over a 5-year period is 0.5 percent. For a 10-year period, the 10th percentile return is about 2.5 percent and for a 15-year period it is about 3.25 percent.

THE RISK ENVIRONMENT

The following chart shows the projected impact on the funded status of the system following a period of sustained low investment returns based on the 10th percentile return. For each scenario it was assumed that the board would exercise its authority to increase contribution rates in response to the investment experience.



As seen in the chart above, in all three scenarios the sustained periods of low returns would prevent the system from reaching full funding by 2046. This analysis illustrates one of the key risks inherent with the funding plan—the fact that the plan expires after 2046. In all three scenarios, the system improves funding levels and recovers from the lowest funding level but each time falls short of full funding by 2046.

Since the state bears most of the responsibility when it comes to having to contribute more following investment performance below expectations, in all three scenarios the state contribution rate would have to increase each year by the maximum 0.5 percent of payroll allowed to a peak rate of 20.8 percent in fiscal year 2045–46. Even with these increases, funding levels do not fully recover by 2046. In these three test scenarios, higher contributions or a longer funding period would be needed to achieve full funding.

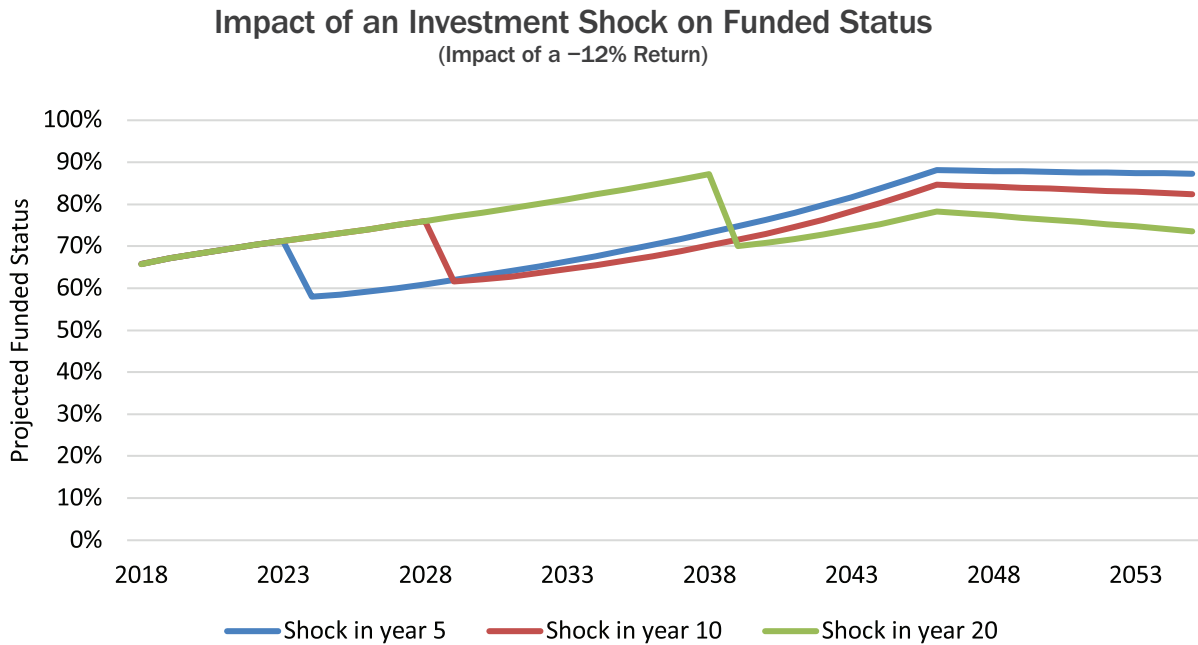
Risk of a “Shock” in a Single Year

Following the financial market crash in 2008–09, the funded status of the system dropped by more than 30 percent in a single year, resulting in the need for the funding plan to avoid a future depletion in assets.

CalSTRS remains at risk if another investment return shock were to occur in the future. The impact of a decline will also depend greatly on the timing. As the system continues to mature, investment declines will be harder to absorb the later they occur in the duration of the funding plan. Over the next decade with funding levels expected to remain below 70 percent, a large shock could have a drastic impact on the long-term funding of the system, which brings additional risks, including a political risk of low funding levels.

THE RISK ENVIRONMENT

Based on the current asset allocation and the capital market assumptions adopted by the board in May 2019, there is a 5 percent probability that in any given year the investment return will be –12 percent or worse. The following chart shows the impact a –12 percent investment return in a single year would have on the system if it were to occur 5, 10 or 20 years from now. To conduct this stress test, it was assumed that the fund would earn 7 percent in every year except for the year of the shock. Once again, the funded status was projected assuming the board exercises its authority to increase contribution rates.



As shown in the chart above, the timing of the shock greatly influences the funded status at the end of the funding plan. If the shock were to occur five years from now, funding levels would drop to just below 60 percent but would have time to increase back to almost 90 percent by 2046. If the shock were to occur 20 years from now when funding levels are almost 90 percent, funding levels would drop to close to 70 percent but would not have time to recover as much and would be below 80 percent by 2046. The chart also shows that in all three cases, following the end of the funding plan, the funding levels would be expected to slightly decline each year in the future. The impact of shocks with a 1 percent and 10 percent probability were also analyzed. Based on the current asset allocation, there is a 10 percent probability that returns in a single year will be –7.5 percent or lower and a 1 percent probability the returns will be –21 percent or lower. The following table shows the projected funded status in the year following the shock as well as the projected funded status in 2046.

Timing of Shock	–7.5 % Shock Return		–21% Shock Return	
	Funded Status After Shock	Funded Status in 2046	Funded Status After Shock	Funded Status in 2046
In 5 Years	51%	91%	51%	78%
In 10 Years	65%	88%	54%	71%
In 20 Years	75%	84%	61%	67%

Once again, the above projections assumed financial markets would provide a return of 7 percent in all other years. It is also worth highlighting that if funding levels are at or below 70 percent in 2046, the system would once again be projected to run out of assets over the following 30 to 40 years. To avoid this situation, the resulting unfunded liability would need to be addressed, through higher contributions or through a longer funding period.

THE RISK ENVIRONMENT

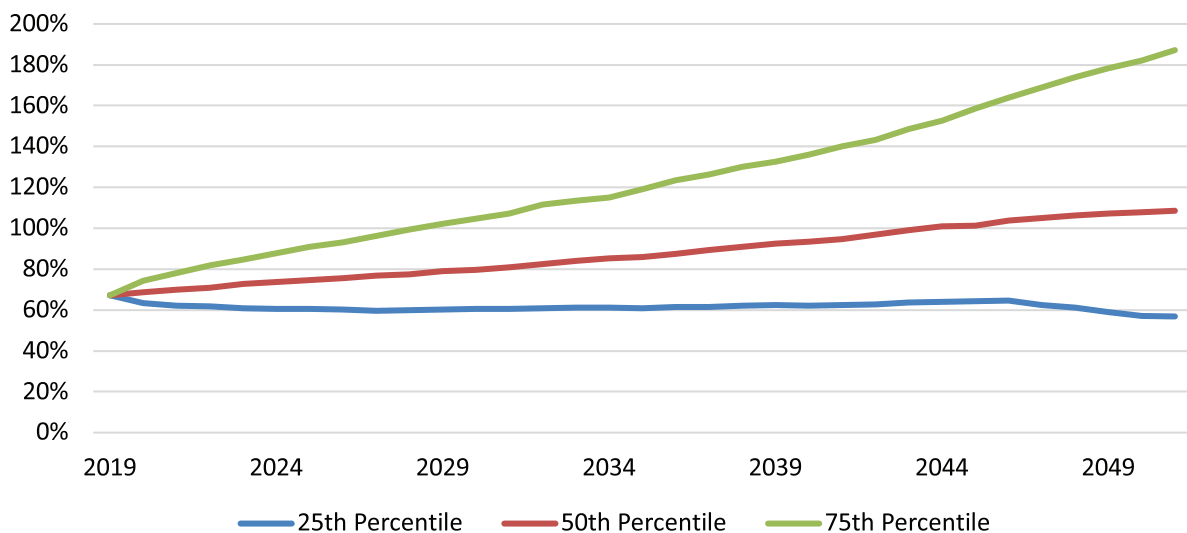
Impact of Long-Term Investment Performance

The analyses above focused on deterministic scenarios in which the expected return of 7 percent was met in most years. In practice, it is unlikely that the system will have a return of exactly 7 percent in any year due to year-to-year volatility. To better understand this volatility, a stochastic model was used to generate 5,000 sets of Monte Carlo simulations based on the current asset allocation and the capital market assumptions adopted in May 2019.

Each of these 5,000 simulations represent a hypothetical future set of returns that are reasonable given the assumptions. For each simulation, the assets and liabilities for the system were projected 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 percentile of the projected funded status for the Defined Benefit Program. Note that the compounded investment return over the 30-year period was just under 5.75 percent for the 25th percentile and just above 8.7 percent for the 75th percentile.

Projected Funded Status
(Based on Stochastic Analysis)



The goal of these stochastic simulations is to provide a realistic estimate of the range of possible future outcomes. In this report, projected funding levels have improved slightly from what was expected in the previous report due to the supplemental contribution by the state as part of the 2019–20 California State budget. As such, the projected funded status has improved from the previous report, reaching slightly above 100 percent by 2046 under the 50th percentile.

The stochastic analysis also shows that the range between the 25th and 75th percentiles is quite large, illustrating the volatility expected in funding the system. Ideally, this range would be tightly bound around a scenario reaching 100 percent by 2046. The size of this range is heavily influenced by both the structure of the funding plan, in particular how quickly contributions can be increased to make up for shortfalls, as well as the volatility of the simulated investment return scenarios.

THE RISK ENVIRONMENT

Risk Measures

The previous funding levels and risk reports introduced a series of risk measures that focus on risks related to funding levels and contribution levels. These measures were re-assessed for this report using the same 5,000 Monte Carlo simulations described earlier and reflecting changes that took place in the last year. These measures are intended to assess three main risks:

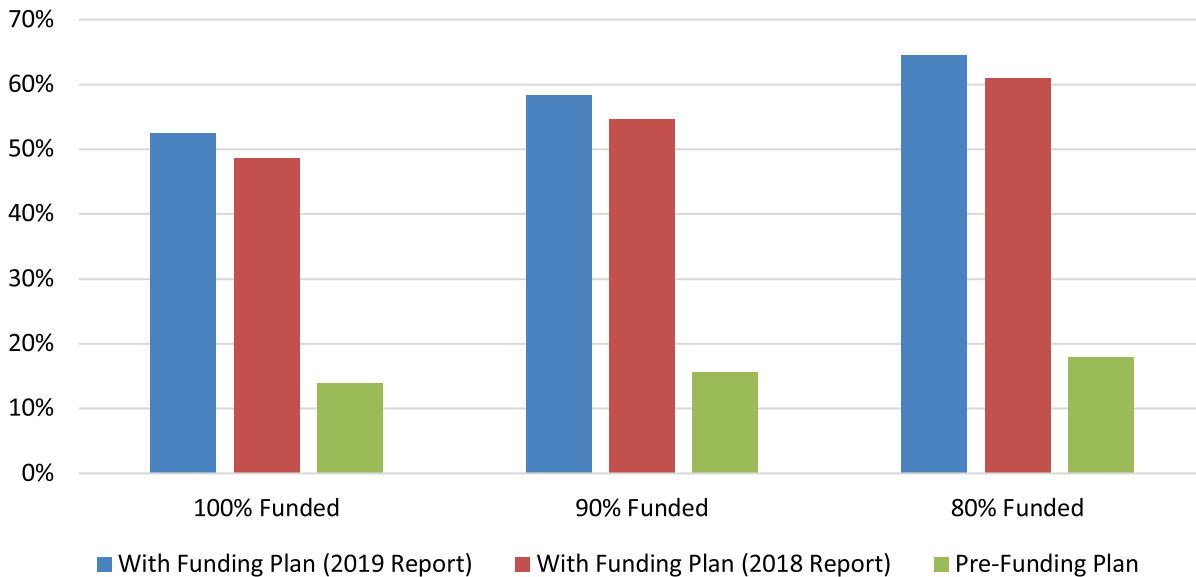
- Ability of achieving full funding
- Risk of low funding levels
- Risk of high state contribution rates

Probability of Achieving Full Funding

The first risk measure studied in this report is the probability of achieving a 100 percent funded status by 2046, the target set in the funding plan. As a result of the volatility inherent in CalSTRS' asset allocation, there is a chance that the system may not achieve full funding by 2046 due to the possibility of having long-term investment performance below the assumed 7 percent.

The impact of investment volatility on the ability for the system to achieve full funding is illustrated in the following chart. For comparison, the chart also shows the probabilities of achieving full funding from last year's 2018 report as well as assuming the funding plan had never been adopted. As the chart illustrates, the system has experienced small improvements in this risk measure over the last year due primarily to the supplemental contribution made by the state. In fact, the Defined Benefit Program is now projected to achieve full funding by 2046 in over half of the 5,000 hypothetical scenarios.

Probability of Achieving Higher Funding Levels by 2046



Although achieving 100 percent funding is the long-term goal, it is important to ensure progress toward being fully funded is always made. With the board's ability to adjust contribution rates under the funding plan, it is expected that the system will make progress toward full funding, even if investment returns are below expectations. To that end, the chart above also shows the probability that the system will attain either an 80 percent or 90 percent funding level by 2046.

THE RISK ENVIRONMENT

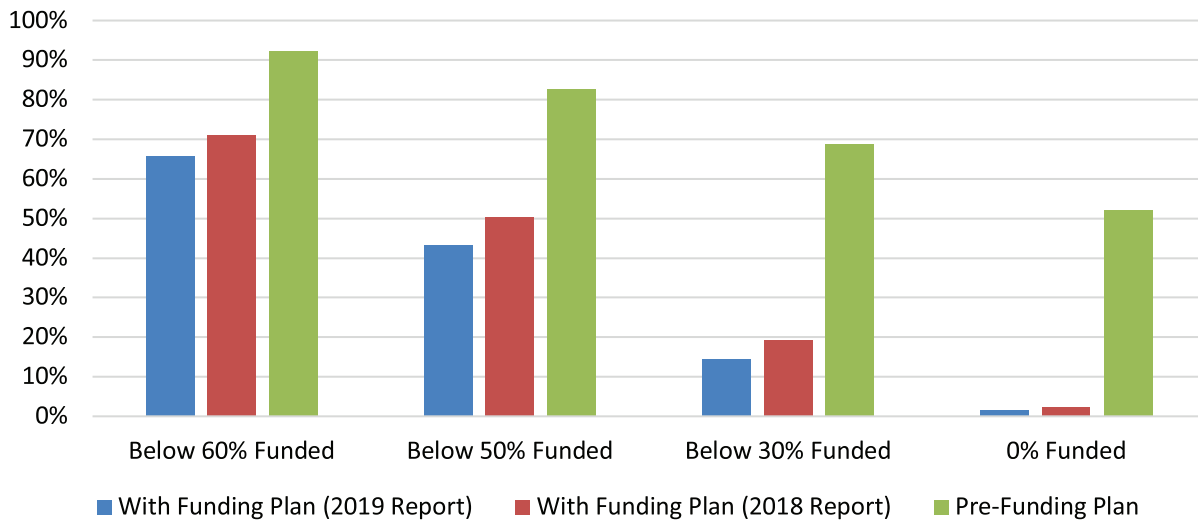
As shown in the chart on the previous page, the funding plan has greatly reduced the funding risk facing the system with probabilities of reaching higher funding levels having more than tripled with the passage of the funding plan. Although the probabilities have improved greatly, the probabilities are less than 100 percent. It is important to realize these probabilities are not expected to ever reach 100 percent as a result of the investment volatility inherent in an asset allocation with an expected return of 7 percent and the board's limited rate setting authority.

Probability of Low Funding Levels

The second risk measure being studied is the probability of the system reaching low funding levels or even running out of money. The risk has been reduced considerably with the adoption of the funding plan. However, that risk has not been eliminated and may never be fully eliminated as a result of the maturity level of the system, investment volatility and the board's limited rate setting authority.

The following chart shows the probability of low funding levels over the next 30 years.

Probability of Low Funded Status Over the Next 30 Years



The chart above shows the probability of the system running out of money, that is, dropping to zero percent funded. Before the passage of the funding plan, running out of assets was a very likely scenario. Today, that probability is very low. Of the 5,000 simulations that were performed, the system ran out of assets in less than 2 percent of these simulations. Without the funding plan, the probability of running out of assets would be more than 50 percent.

Although improved slightly from the prior year, the probability of falling below 60 percent or even 50 percent funded is still quite large. This is driven mostly by the current funding level of the system and the fact short-term contributions toward the unfunded actuarial obligation are not expected to be sufficient to cover the interest on the unfunded actuarial obligation, as was discussed earlier in the report. In May, the board was informed that the funded status was 64 percent as of June 30, 2018. Although the supplemental contribution made by the state has increased funding levels by about one percent, it would take only one or two years of lower than expected returns in the near term to push the funded status below 60 percent or even below 50 percent.

THE RISK ENVIRONMENT

Probability of High Contribution Rates

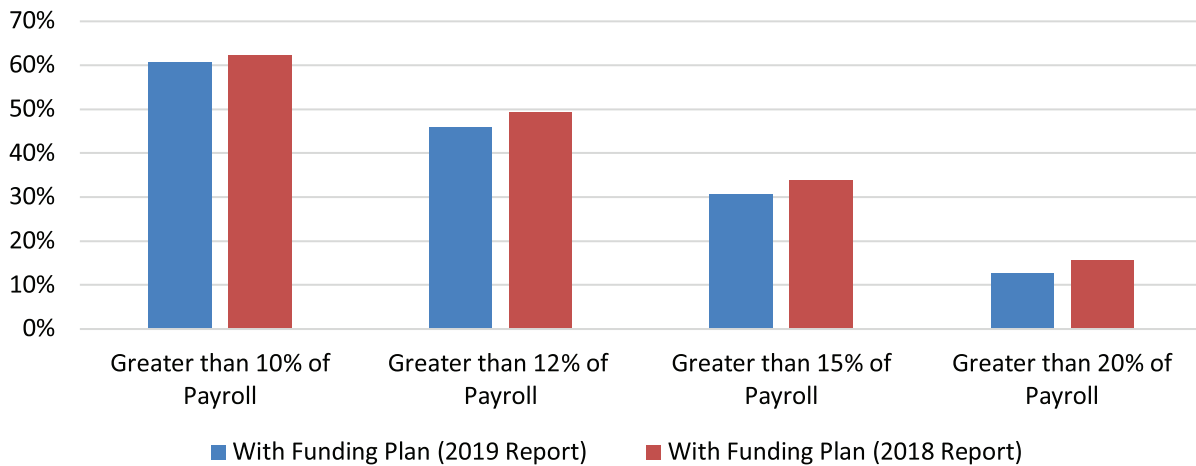
The last risk measure relates to the probability of seeing high contribution rates for the state. Because of the 20.25 percent cap on the employer contribution rate and the fact that the state's share of the unfunded actuarial obligation is most likely to materially increase or decrease as a result of economic and demographic experience, only the state contribution rate is being analyzed in this section.

The state contribution rate can increase each year by no more than 0.5 percent of payroll with no limit on the actual rate. In May 2019, the board exercised its authority to increase the state's supplemental rate by 0.5 percent to 5.811 percent of payroll for the 2019–20 fiscal year. This supplemental rate is in addition to the state base rate of 2.017 percent of payroll to fund Defined Benefit Program benefits. The state also contributes an additional 2.5 percent of payroll to fund the Supplemental Benefit Maintenance Account, CalSTRS' inflation protection program.

In fiscal year 2019–20, the state pays 7.828 percent of payroll to fund its share of the unfunded actuarial obligation of the Defined Benefit Program and 2.5 percent to SBMA. For each future fiscal year through 2045–46, the board will have the ability to adjust the Defined Benefit Program contribution rate by up to 0.5 percent each year if needed to eliminate the state's share of the unfunded actuarial obligation by 2046. As a result, the highest rate the state could be required to pay to the Defined Benefit Program is a rate of 20.828 percent of payroll in fiscal year 2045–46.

The following chart provides probabilities for the state contribution rate to reach certain levels as a percentage of payroll over the next 30 years. For context, the state's contribution rate is currently projected to peak at 8.8 percent of payroll. The rates do not include the 2.5 percent toward SBMA.

Probability of High State Contribution Rate Over the Next 30 Years



THE RISK ENVIRONMENT

Membership and Payroll Growth Risk

One of the key actuarial assumptions in the funding of the system is the assumed growth in payroll. The current payroll growth assumption adopted by the board is 3.5 percent annually. Implicit in this assumption is that the number of active members in the system will remain stable over time. Note that even if the number of active working teachers remains stable over time, CalSTRS' total membership is expected to continue to grow. In fact, as the ratio of active members to retirees continues to drop, CalSTRS' total membership is expected to increase by at least 150,000 members over the next 30 years.

Contribution rates and projected funding levels could be impacted if there was a sudden material shift in CalSTRS active membership or if payroll growth increased at a rate lower than assumed. When the payroll of CalSTRS active members either declines or increases slower than anticipated, it requires increases in contribution rates to ensure full funding, even if the unfunded actuarial obligation has remained the same. The overall cost to fund retirement benefits is not increasing and the contributions required to eliminate the unfunded actuarial obligation are still the same in dollar terms. However, since contributions are collected as a percentage of payroll, contribution rates need to increase to collect the same dollar amount. There is a risk that the rate setting limitations combined with declines in payroll could prevent the board from being able to set contribution rates to the levels necessary to ensure full funding.

Similarly, faster than expected growth in payroll and active membership could help the long-term funding of the system, resulting in lower contribution rates. When the funding plan was adopted by the Legislature in June 2014, the June 30, 2013, actuarial valuation was used as the basis for determining the contribution rates needed to

achieve full funding. At the time, the payroll was projected to increase at a rate of 3.75 percent per year. Since the passage of the funding plan, total payroll has increased at a rate of about 4.6 percent per year, resulting in a total payroll that is greater than projected back in 2014. This is the main reason why the employer contribution rate is projected to be lower long term than originally anticipated in the funding plan.

Future payroll growth could be lower than anticipated for various reasons. In the past, recessions have generally resulted in either slower payroll growth or reductions in payroll. Declines in the California student population could result in a reduction in the number of teachers. Based on the most recent student projection prepared by the California Department of Finance, the overall student population of California is expected to slowly decline by a minimal amount for the next 10 years. A continued growth in the number of charter schools in California could also impact future membership levels since charter schools can elect whether or not to participate in the CalSTRS Defined Benefit Program at the time of their creation. Another possibility is a shift in technology and the way education is delivered in California. For example, increased offering of online courses could potentially decrease the need for teachers in the classroom, especially at the community college level.

Of the above risks, a slower growth than anticipated in the total payroll could have the most impact on the ability of CalSTRS to reach full funding, especially if caused by a recession that combines both declines in payroll and lower investment returns. Although charter schools still represent a small portion of all schools in California and do not yet pose an issue, recent trends in charter schools not electing CalSTRS could eventually pose an issue. These two risks are discussed in further detail below.

THE RISK ENVIRONMENT

Risk Related to Payroll Growth and Decline in Active Membership

The current payroll growth assumption adopted by the board is 3.5 percent annually. To the extent future growth is lower, contribution rates will have to increase to reach full funding by 2046. Below is a table comparing the long-term contribution rates that are expected to be needed to eliminate both the state and employers' share of the unfunded actuarial obligation by 2046 assuming future payroll growth is 3.5 percent, 3.25 percent and 3 percent.

Future Payroll Growth	Long-Term State Contribution Rate	Long-Term Employer Contribution Rate	2046 Funded Status
3.50%	8.3%	18.0%	100% ³
3.25%	8.4%	18.4%	100% ³
3.00%	8.5%	18.9%	100% ³

The above table shows the impact of a long-term slower growth in payroll. Payroll is still increasing year after year but at a slower rate than assumed. The ability to reach full funding could be further impacted if payroll decreased. Historically, payroll has often declined over a short time period when staffing levels in schools were reduced during periods of severe and prolonged fiscal troubles. For example, following the 2008–09 global financial crisis, the number of active CalSTRS members decreased by about 45,000 over a five-year span. Today, the number of active members in the system has yet to recover to the levels seen in 2008.

If a similar decline were to occur once again following a recession, contribution rates would have to increase for both employers and the state simply to be able to keep collecting the same amount of contributions to eliminate the unfunded actuarial obligation by 2046. Depending on how quickly a reduction in staffing occurred and how large it would be, the rate setting authority granted to the board may be insufficient to reach full funding by 2046. In addition, increases in the supplemental rate during a time when employers and the state are attempting to cut costs could lead to a further decrease in staff, potentially exacerbating the problem further.

³ Due to the unallocated unfunded actuarial obligation, the Defined Benefit Program is expected to be 99.9 percent funded in 2046.

THE RISK ENVIRONMENT

The following table shows 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.

Scenario (Projection of Active Membership)	Decrease in Membership	2046 Funded Status
No reduction in active population	0	100% ⁴
2% reduction per year for 5 years	45,000	99%
5% reduction per year for 5 years	101,000	92%
2% reduction per year for 10 years	85,000	97%

In each of the above scenarios where the active population decreases, the limitations imposed by statute would prevent the board from increasing the employer contribution rate to the levels necessary to pay down the employers' share of the unfunded liability by 2046. The same issue does not exist for the state contribution rate since it does not have an upper bound. The board would have sufficient authority in each of the scenarios to raise the state contribution rate to levels high enough to eliminate the state's share of the unfunded liability by 2046, despite the decreases in payroll.

Once again, it is important to emphasize that if CalSTRS active membership were to significantly decline, it would not increase the unfunded actuarial obligation. It would simply reduce CalSTRS' ability to fund that obligation and potentially prevent CalSTRS from reaching full funding by 2046.

Note that the above table reflects only the anticipated impact of a decline in active membership. During recessions, investment returns are often lower than in periods of economic growth. Having lower investment performance combined with a decline in active membership would compound the impact of these events, making it even harder for CalSTRS to reach full funding, unless an economic recovery occurred shortly thereafter, returning membership and payroll levels to be in line with what they are today.

Below is a table showing the impact of both a decline in membership and lower investment returns. Investment returns averaging 3.5 percent over five years and 5 percent over 10 years were selected for this analysis.

Scenario (Projection of Active Membership)	Decrease in Membership	Average Investment Return Over the Time Period	2046 Funded Status
No reduction in active population	0	7% for all years	100% ⁴
2% reduction per year for 5 years	45,000	3.5% for next 5 years, followed by 7%	89%
5% reduction per year for 5 years	101,000	3.5% for next 5 years, followed by 7%	74%
2% reduction per year for 10 years	85,000	5.0% for next 10 years, followed by 7%	80%

As can be seen in the table above, a sustained period of decreases in membership combined with lower investment returns would greatly impact CalSTRS' ability to reach full funding. If such a scenario were to occur, only a strong economic recovery or additional contributions would allow CalSTRS to reach full funding by 2046.

Recent Growth in Charter Schools Not Electing CalSTRS

When a charter school is created, it must decide as part of the chartering process whether or not to provide CalSTRS benefits to its employees. Since the passage of the funding

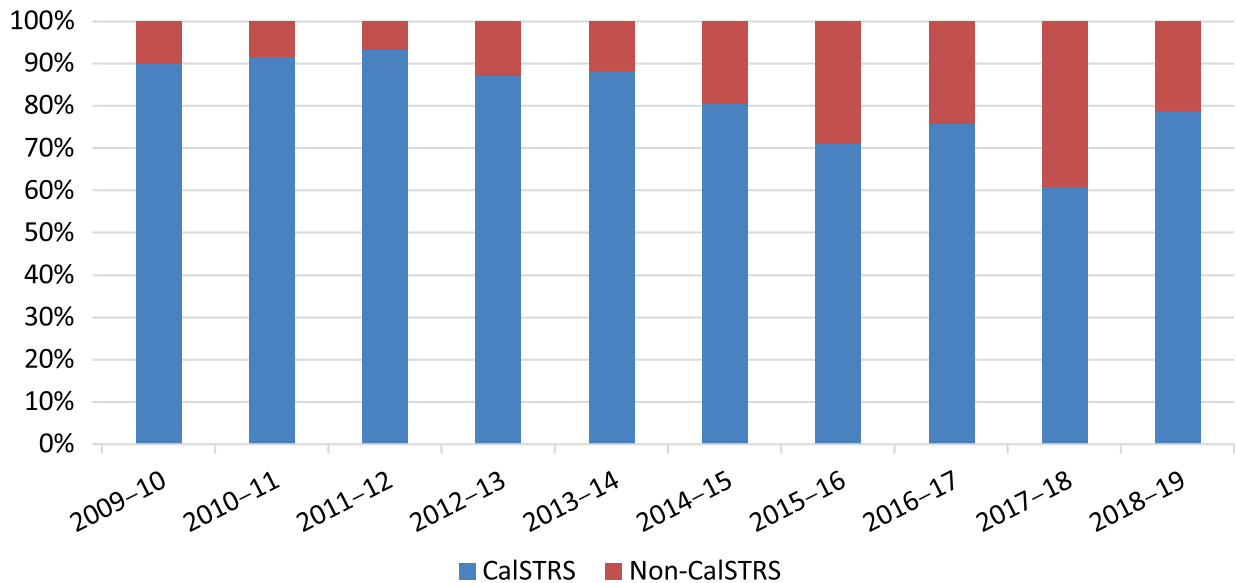
plan, the percentage of newly created charter schools not electing CalSTRS has been above historical levels. Prior to the funding plan, about 90 percent of all charter schools had elected CalSTRS. Since the passage of the funding plan, the percent of charter schools not electing CalSTRS has increased, reaching a peak of 40 percent in 2017–18.

⁴ Due to the unallocated unfunded actuarial obligation, the Defined Benefit Program is expected to be 99.9 percent funded in 2046.

THE RISK ENVIRONMENT

The following chart shows the percentage of charter schools that elected to participate and not participate in CalSTRS for the last 10 years.

Selection of Retirement Benefits by New Charter Schools



Note that in last year's 2018 report, it was reported that more than 50 percent of new charter schools had not elected CalSTRS in fiscal year 2017-18. In an attempt to have a more accurate and comprehensive database of information on charter schools, in 2018-19 CalSTRS took steps to formalize its collaboration with the California Department of Education to better understand their process and the data elements available. CalSTRS staff also partnered directly with charter school administrators in order to collect more details regarding the types of retirement benefits offered by all charter schools in California. With the completion of this effort, CalSTRS has developed a more comprehensive database of information on charter schools, providing CalSTRS a better understanding of the chartering process and the selection of retirement benefits made by each charter schools. The chart above reflects the most up-to-date information available to CalSTRS.

As of June 2019, there were 1,278 charter schools in operation in California. Of these, 1,121, or about 88 percent, had elected CalSTRS while 157 charter schools, or about 12 percent, had not elected CalSTRS. Based on the most recent information available from the California Department of Education, charter school employees were estimated to number about 34,000.

Of these, about 30,000 currently participate in CalSTRS while about 4,000 do not participate in CalSTRS. Overall, teachers and administrators working for charter schools not covered by CalSTRS represent a population that is equivalent to about 1 percent of CalSTRS active membership.

If all these charter schools had instead elected to provide CalSTRS benefits to their employees, the payroll for CalSTRS active members would probably be 1 percent higher today. If the total payroll was 1 percent higher, contribution rates required for both the state and the employers to fully fund their share of the unfunded actuarial obligation by 2046 would be projected to be lower. For employers, the contribution rate would be lower by about 0.17 percent of payroll starting in fiscal year 2021-22. For the state, the contribution rate would be lower by about 0.08 percent of payroll. Note that for the state, the amount needed to eliminate their share of the existing unfunded actuarial obligation would not be impacted and the dollar impact on the overall state's budget would be unchanged.

CalSTRS will continue to monitor this risk and will provide updates on the charter school population annually as part of this report.

THE RISK ENVIRONMENT

Longevity Risk

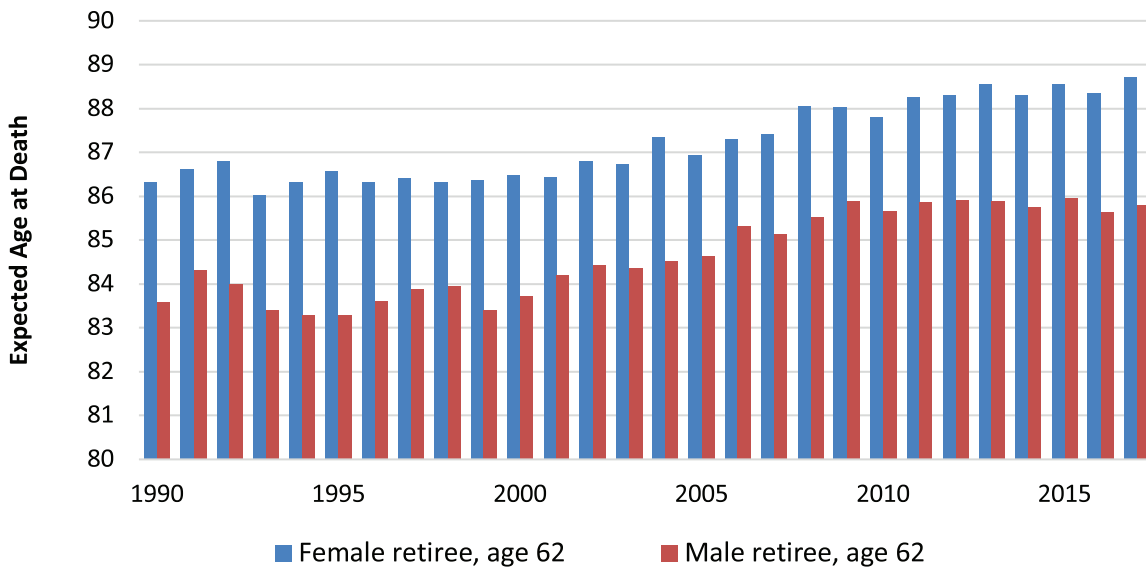
Longevity risk refers to the risk borne by the system from increasing life expectancy of its members. Compared to investment risk, in which a shock in a single year can have a significant and lasting impact, longevity risk is a slowly developing demographic phenomenon that will potentially take decades before it is recognized. Longevity improvements historically have occurred with incremental improvements in public health and advancement in medical technology, and these changes take time to impact whole populations.

Despite the slow nature of longevity risk, it is important that it is not ignored. In February 2017, the board took an important step by adopting assumptions that recognize

that teachers' life expectancies have been increasing over time and will most likely continue to do so in the future. CalSTRS adopted the use of generational mortality using a mortality improvement factor of 1.1 percent in each year for most ages.

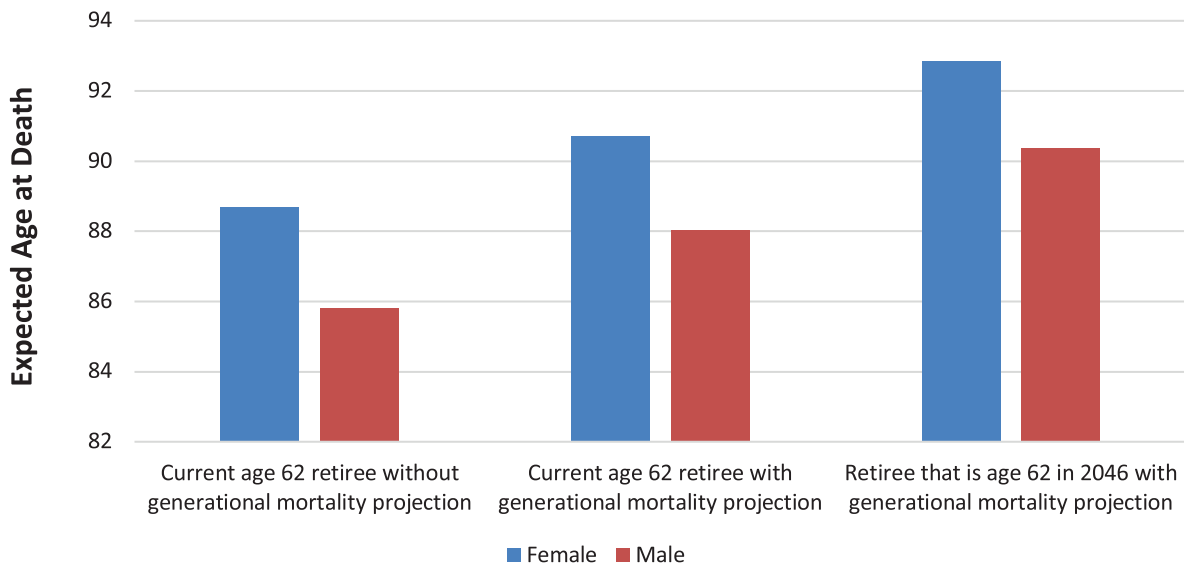
The chart below shows how life expectancy for a CalSTRS member retiring at age 62 has changed over time. These life expectancies are a static snapshot of mortality for each year and do not consider any future improvements in mortality. As shown below, over the past 30 years, the life expectancy for a 62 year old retiree has improved by over two years for both male and female.

How Has Life Expectancy Changed?



With the adoption of generational mortality, CalSTRS is anticipating future improvements in life expectancy in the funding of the system. This assumption has strengthened the ability of CalSTRS to reach full funding by 2046 by recognizing ahead of time potential improvements in life expectancy. The following chart illustrates the impact generational mortality has on life expectancy. The first pair of bars illustrate the life expectancy for an age 62 retired member, for both male and female, under the most recent static mortality table. Without consideration for future improvements in life expectancy, males are expected to live to about age 86 and females to age 89. The middle bars illustrate the improvements in life expectancy that are expected through the use of generational mortality. As shown below, by assuming improvements in mortality going forward it is anticipated that an age 62 retiree will live an additional two years for both males and females. Looking ahead into the future, as mortality continues to improve, it is anticipated that by 2046 a retiree who is 62 in that year will be expected to live to almost 93 for females and over 90 for males, a full two years more than someone retiring today.

How Does Generational Mortality Impact Life Expectancy?



When considering that CalSTRS paid over \$15 billion in benefits in fiscal year 2018–19, one can see how improvements in life expectancy have a direct impact on long term cost. A member retiring at age 62 today is expected to collect benefits for four to five years longer than someone who retired at age 62 in 1990. In terms of benefits paid by CalSTRS today, this is equivalent to an additional \$60 billion to \$75 billion in benefits. A member retiring at age 62 in 2046 is projected to live two to three years longer than someone retiring at age 62 today.

Monitoring life expectancy of CalSTRS members is extremely important for the long-term sustainability of the system, and CalSTRS actuarial staff monitors changes on an annual basis. In addition, a full review of all actuarial assumptions is performed every four years through the experience study. The next experience study is expected to be completed and presented to the board in January 2020.

Note that in recent years, CalSTRS has experienced a slowdown in mortality improvement, particularly among its male members. Life expectancy is still improving but not as fast as assumed. It is important not to read too much into short term trends. Over the past 30 years, periods in which mortality improvements slowed down were often followed by periods of faster improvements. Over the last 30 years, the average mortality improvement for CalSTRS members has been over 1.3 percent per year. Over the last century,

mortality rates have improved on average at a rate of about 1 percent per year for the U.S. population, consistent with the assumption of 1.1 percent adopted by the board.

If mortality rates improve faster than assumed, costs will increase over time, and the improvements may also impact CalSTRS' ability to reach full funding by 2046. Currently, it is estimated that the funding plan has enough flexibility to sustain mortality improvements of up to 2 percent per year on average.

CalSTRS has developed a stochastic mortality model in an attempt to understand how likely it is that mortality rates will improve above the current assumptions given the historical data. Initial results from this model suggest that CalSTRS would have less than a 5 percent chance that mortality rates would improve by more than 2 percent per year, each year into the future.

Although it appears that the likelihood of not being able to reach full funding is low when looking at longevity risk alone, a combination of faster than expected increases in longevity combined with a sustained period of decline in membership and low investment returns could have an undesirable impact on the long-term funding of the system. CalSTRS will continue to monitor mortality improvements annually and report back its findings as part of this report.

CONCLUSION

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

CalSTRS has several ways to manage and monitor these risks.

CalSTRS continually monitors these risks and reports to the board twice a year on the funding progress of the system: once in the spring through the annual actuarial valuation process and again in the fall through this report. Monitoring these risks is important to identify trends that could impact the long-term funding of the system early and to ensure they are understood by the board and CalSTRS stakeholders.

In 2017–18, CalSTRS created an internal Asset Liability Management team and implemented an ALM Framework that integrates assets and liabilities in order to manage

and assess funding risk. The ALM Framework was established as a tool to help guide future board decisions related to investment strategy, cash management and actuarial policies.

The board is currently in the process of reviewing the asset allocation to decide the most appropriate way to invest the assets long-term to best fulfill CalSTRS mission. Furthermore, CalSTRS' actuarial consultant, Milliman, is working on an experience study to review the appropriateness of the actuarial assumptions used in the funding of the system. Board decisions related to the asset allocation and actuarial assumptions are expected to occur in November 2019 and January 2020.