

RESEARCH REPORT

The Impact of Recent Pension Reforms on Teacher Benefits: A Case Study of California Teachers

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Contents

Executive Summary	iv
Introduction	1
How Are Pension Benefits Calculated?	3
How Do We Project Future Pension Benefits?	5
How Much Annual Income Will Retirees Receive?	7
How Much Will Retirees Receive over Their Lifetimes?	9
How Are Pension Benefits Distributed across California’s Public School Teachers?	16
How Did Recent Changes Affect California Teachers?	20
How Could Pensions Be Distributed More Fairly?	23
Conclusions	30
Notes	32
References	33

Executive Summary

Teacher pension plans throughout the nation face serious financial problems. Between 2007 and 2015, contributions to teacher retirement plans by school districts and state and local governments increased 65 percent, raising costs on taxpayers and diverting resources from other educational and social needs. In addition, most states cut benefits or raised mandatory teacher contributions over the past decade. Yet, most teacher pension plans remain seriously underfunded, suggesting that governments, school districts, and teachers must contribute even more or benefits must be cut further.

California provides an informative case study of the impact of recent pension reforms on teacher benefits. The California State Teachers' Retirement System (CalSTRS) has been grossly underfunded for the past decade. By its actuaries' 2013 calculations, CalSTRS holds enough assets to fund only 67 percent of the pension benefits promised to the state's public school teachers. State policymakers have responded by cutting plan benefits for new hires and raising teachers' required plan contributions. Additional reforms will likely be necessary to balance the plan. Yet, there has been little attention paid to how much retirement security the plan provides to California's public school teachers—who are not covered by Social Security—or how its benefits are distributed across the teacher workforce.

To inform the continuing teacher pension reform debate in California and across the country, this report evaluates the retirement benefits paid to public school teachers in the state. It projects annual and lifetime pension benefits for newly hired teachers, under the assumption that they earn average salaries over their careers and leave public employment at the rates estimated by the plan actuaries. Retired teachers receive pensions equal to a multiple of their final average salary times years of completed service. The multiplier that enters the benefit formula depends on when a teacher begins collecting payments, rising from 1.16 percent for those who first collect at age 55 to 2.4 percent for those who wait until age 65. After retirement, pensions automatically increase 2 percent a year. Teachers must contribute a portion of their salaries to CalSTRS to defray part of their pension costs. The mandatory contribution rate was 8 percent in 2013–14, but it will gradually increase to 9.205 percent over the next three years for those hired after 2012. The calculations shown here apply the higher teacher contribution rate to all service years for those hired after 2012. Upon termination, teachers may elect a refund of their contributions, with interest, instead of collecting a pension. The annual interest rate on refunded contributions is currently 4.5 percent, less than the 7.5 percent annual return that the CalSTRS trustees assume the plan assets will earn.

How well California's existing retirement plan serves public school teachers depends crucially on when teachers were hired and how long they taught. Teachers who spend a full career in the plan receive large pensions. For example, teachers hired today at age 25 who earn average salaries over their careers will receive pensions worth \$90,200 at age 75 (in 2014 constant dollars) if they remain employed for 40 years. Over a lifetime, those benefits are worth \$1.3 million, when measured in constant 2014 dollars at the time teachers separate from public employment. Teachers' required contributions finance more than half of those lifetime benefits. Nonetheless, the portion that school districts and the state fund is worth \$523,000, which employers could finance by contributing 7.1 percent of teachers' salaries to the retirement fund every year throughout teachers' careers.

Older hires receive substantial pensions even if they are not employed very long, especially when pensions are measured relative to career earnings. For example, an age-55 hire who teaches for 10 years and earns an average salary receives a pension worth \$11,700 a year at age 75. Although that pension would be worth only \$100,000 over a lifetime, net of the teacher's required plan contributions, it is equivalent to an annual retirement-fund contribution from the state and school district of 16.8 percent of salary throughout the teacher's career.

However, teachers who join the plan when they are relatively young and who spend less than a full career in the classroom do not accumulate many retirement benefits. For example, a 25-year-old hire who joins the plan today and separates after 20 years of service would receive \$11,900 in annual pension benefits at age 75. These benefits are worth \$123,000 over a lifetime, less than the value of his or her required plan contributions. Age-25 hires must remain employed for at least 28 years to collect benefits worth more than the value of their plan contributions. Those who separate earlier lose money in the mandatory plan; they would have better financial outcomes if they had the opportunity to opt out of the plan and invest their contributions elsewhere. These teachers—many of whom taught for decades—subsidize the large pensions received by the longest-tenured teachers and oldest hires.

Relatively few California public school teachers remain employed long enough to benefit much from their retirement plan. Half of all newly hired teachers complete no more than 11 years of service, and only a quarter complete at least 20 years of service. As a result, the median age-75 pension benefit for today's new hires will total only \$5,900 a year. Only 35 percent of all new hires will receive pensions worth more than the value of their required plan contributions, including only 47 percent of teachers who remain employed for at least five years.

Another drawback of the existing retirement plan for California teachers is that it penalizes work at older ages. Teachers who remain employed after they may begin collecting their pensions forgo a year

of benefits for every year they remain on the job, cutting their total compensation; these losses create strong incentives to retire. For age-25 hires, for example, the value of lifetime benefits net of teacher contributions is only half as high for those who separate after 47 years as for those who separate after 40 years. The value of net lifetime benefits falls because additional service years do not raise annual payments enough to offset the decline in the number of checks continuing workers receive and the additional contributions they must make. Such incentives are increasingly problematic as the workforce ages.

Changing CalSTRS's benefit formula could distribute pension benefits more equitably across the workforce. For example, policymakers could raise benefits for older workers by increasing the plan multiplier for those who retire after the normal retirement age. They could change the computation of final average salary so that the measure on which benefits are based increases each year that separated teachers wait to collect, allowing pensions to grow—instead of remaining frozen—during that period. Additionally, tying the plan multiplier to years of service would reduce benefits for older hires, because they do not accumulate many years of service and would not experience the benefit boost provided to those who separate before becoming eligible to collect benefits. Such changes would make employment in public education more appealing to younger adults who spend less than a full career in the classroom and older adults who wish to prolong their careers.

Introduction

Teacher pension plans throughout the nation face serious financial problems. Our analysis of financial reports for all state-administered teacher retirement plans show that between 2007 and 2015, contributions to teacher retirement plans by school districts and state and local governments increased 65 percent, raising costs on taxpayers and diverting resources from other educational and social needs. In addition, most states cut benefits or raised mandatory teacher contributions over the past decade (Brainard and Brown 2016). Between 2007 and 2015, teacher contributions to retirement plans increased 43 percent. Yet, most teacher pension plans remain seriously underfunded (Pew Charitable Trusts 2017), suggesting that governments, school districts, and teachers must contribute even more or benefits must be cut further.

California provides an informative case study of the impact of recent pension reforms on teacher benefits. The California State Teachers' Retirement System (CalSTRS) paid \$11.5 billion in benefits to 868,000 retired educators and their beneficiaries in 2013 (Milliman 2014). The world's largest retirement plan for educators, CalSTRS holds assets worth \$166 billion. Yet, that balance covers only 67 percent of the plan's future obligations, a \$74 billion shortfall.¹ State policymakers have been grappling with the system's funding gap for several years and have taken several measures to cut plan costs. In 2012, Governor Edmond G. "Jerry" Brown Jr. signed legislation creating a new tier of retirement benefits for newly hired public school teachers, featuring a higher retirement age and lower monthly pensions than in the retirement package available to California's incumbent public-school teachers. In 2014, the governor signed additional legislation raising teachers' required contributions to the state's retirement plan.² Many observers argue that additional cuts are necessary to balance the teachers' retirement plan (Nation 2011).³

Efforts to control state retirement costs have paid little attention to the adequacy of retirement benefits provided to California's public school teachers—who are not covered by Social Security—or how those benefits are distributed across the teacher workforce. Traditional defined benefit pension plans that base benefits on teachers' final average salaries and years of completed service, such as California's plan, generally provide substantial pensions to long-serving teachers but much smaller pensions to teachers who spend less than a full career in the plan. Moreover, teachers in these plans must forgo a year of benefits for every year they remain employed beyond the plan's retirement age, thus reducing their total compensation and encouraging early retirement. Such features are becoming increasingly problematic as employees change jobs more frequently than before and the workforce grows older.

To inform the continuing teacher pension reform debate in California, this report evaluates the retirement benefits paid to the state's public school teachers. We project annual and lifetime pension benefits for newly hired teachers, assuming they earn average salaries over their careers and leave public employment at the rates estimated by the plan actuaries.

Our results show that retirement benefits vary widely depending on when teachers begin their careers and how long they teach. Teachers who spend a full career in the plan receive large pensions. Older hires also receive generous pensions relative to their career earnings. However, teachers who join the plan at relatively young ages and spend less than full careers in the classroom accumulate few retirement benefits, and those benefits are often worth less than the value of the teachers' required plan contributions. Relatively few California public school teachers remain employed long enough to benefit much from the retirement plan. Only 35 percent of all new hires will receive pensions worth more than the value of their required plan contributions. As policymakers address CalSTRS's funding problems, they should consider altering the plan's benefit formula to more equitably distribute pension benefits across the workforce.

How Are Pension Benefits Calculated?

California public school teachers hired on or after January 1, 2013 qualify for lifetime pensions beginning at age 55 once they have completed five or more years of service. Starting benefits are computed as a percentage of teachers' final average salaries (computed over the three consecutive years with highest earnings) multiplied by completed years of service. The multiplier that enters the benefit formula depends on when a teacher begins collecting payments. The multiplier begins at 1.16 percent of salary (for each completed year of service) for those first collecting at age 55 and rises 0.12 percentage points each year that a teacher delays collecting until age 62, when it reaches 2 percent. The multiplier rises another 0.1333 percentage point for each additional year of delay up to age 65, so that a teacher who begins collecting at age 65 receives a pension worth 2.4 percent of his or her final average salary multiplied by years of service. After retirement, pensions automatically increase 2 percent per year. California public school teachers are not covered by Social Security.

Teachers must contribute a portion of their salaries to CalSTRS to defray part of their pension costs. The mandatory contribution rate was 8 percent in 2013–14, but it will gradually increase to 9.205 percent over the next three years for those hired after 2012. Upon termination, teachers may elect a refund of their contributions, with interest, instead of collecting a pension. The annual interest rate on refunded contributions is currently 4.5 percent.

California teachers hired before 2013, who participate in the “CalSTRS 2% at 60” tier of the retirement plan, receive larger pensions than those hired later, who participate in the “CalSTRS 2% at 62.” For pre-2013 hires with at least 25 completed years of service, final average salary is based on the highest 12 consecutive months of earnings, instead of the highest three consecutive years. These early hires may begin collecting their pensions at age 50 if they have completed at least 30 years of service (or at age 55 if they have completed less than 30 service years but at least 5 service years). Moreover, the multiplier in the benefit formula is higher at younger ages for these early hires; it begins at 1.1 percent for those who first collect benefits at age 50 and rises gradually with age, reaching 1.4 percent at age 55, 2.0 percent at age 60, and 2.4 percent at age 63. The plan boosts the multiplier by another 0.2 percentage points for those with at least 30 years of service, but it may never exceed 2.4 percent. Retirees also receive longevity bonuses based on service completed by the end of 2010. Those with 30 service years receive an additional \$200 per month, those with 31 service years receive an additional \$300 per month, and those with 32 or more service years receive an additional \$400 per month.

In addition to these traditional final average salary defined benefit pensions, CalSTRS offers employees cash balance plans and defined contribution plans. From 2001 to 2010 CalSTRS invested a portion of teachers' mandatory retirement plan contributions into a cash balance plan, known as the Defined Benefit Supplement Account. One-quarter of teachers' 8 percent required contributions (or 2 percent of salary) was deposited into the cash balance plan, where it earned a guaranteed minimum return equal to the average 30-year Treasury bond rate. (The remaining 6 percent of salary went to the traditional defined benefit plan to help finance those benefits.) Participants could earn more if the actual earnings of the supplemental account assets exceeded the guaranteed rate. Benefits vest immediately. When participants leave state employment, they may collect their account balances as lump sums or annuities. Full-time educators are no longer allowed to invest in this cash balance plan. Instead, all teacher contributions go to the traditional defined benefit plan. However, employers may offer part-time educators a similar cash balance plan, which they may choose instead of the traditional defined benefit plan.

CalSTRS's defined contribution plan allows participants to supplement their pensions by investing a portion of their salaries into tax-advantaged savings accounts. Participation in this supplemental plan is voluntary and employers do not contribute to these accounts.

How Do We Project Future Pension Benefits?

Our analysis simulates the pension benefits that California public school teachers will receive at age 75 and over their lifetimes. We compute total benefits and, to see how much teachers receive from their employers and the state, benefits net of teachers' required contributions. Our results show benefits for new hires, who participate in the CalSTRS 2% at 62 tier, assuming they contribute 9.205 percent of their salaries to their retirement plan, the rate that is being phased in by 2017. We compare those benefits with what they would have earned under the CalSTRS 2% at 60 rules in effect in 2012, when the contribution rate was 8 percent. The analysis does not consider supplemental cash balance plan accounts, because contributions to these accounts ceased in 2010, nor the supplemental defined contribution plan, because employers do not contribute to them. The analysis also excludes cash balance plans for part-time educators.

Teachers are assumed to earn the average salaries for their ages and years of service among those hired in the fall of 2013, as projected by the plan actuaries (Milliman 2014). The actuaries assume, for example, that salaries grow about 5 percent a year for the first five years of service, about 3 percent a year for the next five years, and about 1 percent a year thereafter. Additionally, they assume that the entire salary schedule increases 3.75 percent a year, faster than the assumed annual inflation rate of 3 percent. Our simulations project final service years by applying separation probabilities that vary by age and years of service as estimated by the plan actuaries. We assume plan participants discount future benefits by 7.5 percent a year, the nominal interest rate adopted by the plan trustees (California State Teachers' Retirement System 2013). All financial amounts are expressed in constant 2014 dollars.

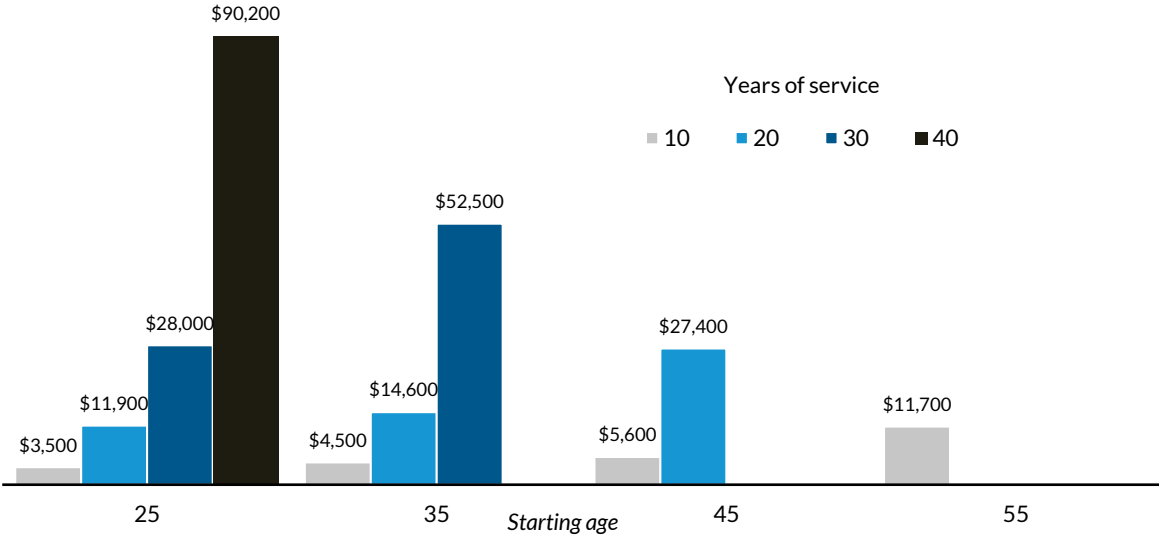
We compute annual pension benefits by applying the benefit formula to our assumed salary histories. The calculations assume that all plan participants receive their payments as single-life annuities—forgoing survivor benefits for any spouse—and that they begin collecting their pensions at the age that maximizes the lifetime value of their benefits. We compute the value of lifetime benefits by summing all future annual payments, discounting them by 7.5 percent a year and by the probability that teachers will die before they can collect. The value is measured at the year that plan participants leave state employment. Mortality probabilities are derived from unisex life tables compiled by the Social Security Administration. The simulated value of teachers' lifetime plan contributions assumes that those contributions would earn 7.5 percent annual returns if invested outside the pension plan. This assumption corresponds to an inflation-adjusted annual return of 4.5 percent, which is similar to the

average return since 1926 for a portfolio split evenly between stocks and bonds, after adjustments for investment fees.⁴ When we estimate the value of lifetime benefits, we further assume that plan participants will elect to have their contributions refunded instead of receiving pensions, if the refunds are worth more.

How Much Annual Income Will Retirees Receive?

Figure 1 shows projections for annual pension income at age 75 for public school teachers hired in 2013 who earn average salaries throughout their careers. Benefits increase sharply with years of service. A teacher hired at age 25 who completes 10 years of service receives annual benefits at age 75 equal to only \$3,400 (in constant 2014 dollars). Those annual benefits increase to \$11,900 after 20 years of completed service and \$28,000 after 30 years. Annual pension benefits soar to \$90,200, however, for teachers who spend 40 years in the classroom.

FIGURE 1
Annual Pension Benefits at Age 75
CalSTRS 2% at 62



Source: Authors’ calculations based on plan documents and actuarial reports.
Notes: All monetary amounts are in constant 2014 dollars. Estimates assume benefits are collected at the age that maximizes the value of lifetime payments.

The state pension backloads payments late in employees’ careers because the benefit formula directly ties payments to years of service. Final average salary also increases with tenure, so the earnings base partially replaced by the plan grows as employees work longer. Additionally, the multiplier increases as teachers wait to begin collecting payments. For example, pensions that 25-year-

old hires who retire after 30 years of service receive at age 55 are based on a 1.16 percent multiplier, compared with a 2.4 percent multiplier for their counterparts who retire after 40 years at age 65. Future retirement benefits erode over time when employees separate before they may begin receiving payments because the benefit is not adjusted for inflation in the interim.

The same general pattern is evident for employees who join the state workforce at older ages, except that they receive larger pensions than those who join at younger ages and separate with the same number of completed service years. Older hires receive higher annual benefits because they do not have to wait as long to begin collecting, so their benefits are reduced less by inflation. A teacher who serves 10 years earns an annual pension worth \$11,700 (in 2014 dollars) if hired at age 55—more than three times as much than if he or she were hired at age 25.

How Much Will Retirees Receive over Their Lifetimes?

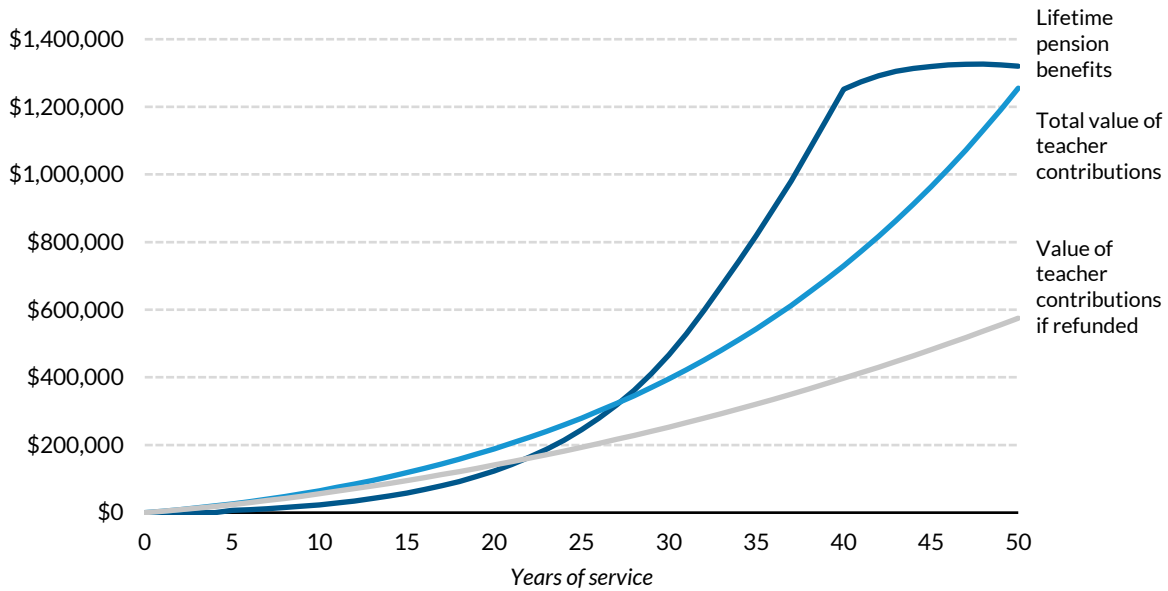
Comparing annual pension payments by years of completed service can be misleading because teachers who begin collecting at relatively young ages receive more benefit checks over their lifetimes than those who begin collecting older ages. For example, 25-year-old hires who retire after 30 years of service collect payments for 10 more years than those who retire after 40 years of service. How well teachers are served by the state retirement plan depends on how much they receive over their lifetimes, not in a single year.

Figure 2 shows how the value of lifetime pension benefits increases with years of service for teachers in the CalSTRS 2% at 62 tier hired at age 25. Teachers who separate before completing five years of service do not receive any pension benefits, because they have not yet vested in the plan. Age-25 hires do not receive many benefits over their lifetimes immediately after they vest at age 30—their lifetime benefits are worth only \$6,500 in 2014 dollars—because they must wait 25 years to begin collecting and, as shown in figure 1, their benefits are based on the relatively low salaries they earned in their late-20s. Additional years of service, however, raise lifetime benefits at an increasing rate. They rise to \$123,000 after 20 years of service, \$466,000 after 30 years, and \$1.3 million after 40 years. The lifetime value of benefits grows more slowly after 40 years of service. Additional service years no longer boost the multiplier, which has already reached its maximum value of 2.4 percent, and the annual payment increase of 2.4 percent of final average salary is largely offset by the benefit checks lost by working additional years.

FIGURE 2

Value of Teacher Contributions and Future Benefits

Age 25-hires, CalSTRS 2% at 62



Source: Authors' calculations based on plan documents and actuarial reports.

Notes: All monetary amounts are in constant 2014 dollars. Future benefits are discounted at 7.5 percent and the annual inflation rate is assumed to be 3 percent, the rates adopted by the teacher retirement system.

Under CalSTRS changes signed into law in 2014, teachers hired after 2012 will soon have to contribute 9.205 percent of their salaries to the plan and thus must work many years before their future retirement benefits are worth more than those contributions. If teachers could earn as much on their contributions outside the plan as CalSTRS assumes it will earn on its investments, their contributions would be worth three times as much as their future pension benefits after 9 years of service, twice as much after 15 years of service, and 1.5 times as much after 20 years of service. Age-25 hires must remain in the plan for 28 years before their future benefits are worth more than their contributions. After just a few more years on the job, however, future benefits in the mandatory plan are worth much more than what teachers contributed.

Teachers who separate before earning a large portion of pension benefits may have their contributions refunded, but they receive only 4.5 percent interest each year, much less than what the plan assumes could be earned on those contributions (see figure 2). All age-25 hires separating with less than 22 years of service are better off taking a refund than waiting for a future pension. Even with a refund, though, they lose money by participating in CalSTRS because they could have earned more by investing their contributions outside the plan. Using the plan trustees' investment-return assumptions,

we estimate that teachers hired at age 25 who separate with 15 years of completed service forfeit \$37,000 by participating in the plan. Teachers who complete 22 or more years of service are better off collecting a pension than a refund. Nonetheless, those who separate with less than 28 years of service lose money in the plan because their future pensions are worth less than their contributions combined with the investment returns they could have earned on those contributions outside the plan, even though their pensions are worth more than those contributions when refunded with only 4.5 percent interest. These teachers—many of whom taught for decades—subsidize the large pensions received by the longest-tenured teachers.

Most California teachers do not complete 25 years of service. Our calculations based on data from the CalSTRS actuaries show that half of all newly hired teachers complete no more than 11 years of service, and only a quarter will complete at least 20 years of service (Milliman 2014). Completed service is higher among those who remain employed for some minimum period, and state policymakers may prefer a pension plan that favors longer-serving teachers. Among teachers with at least 5 years of completed service, half remain on the state payroll for no more than 15 years and only one-quarter remain for at least 23 years. Among teachers with at least 10 years of completed service, half remain on the payroll for no more than 19 years and one-quarter remain for at least 25 years.

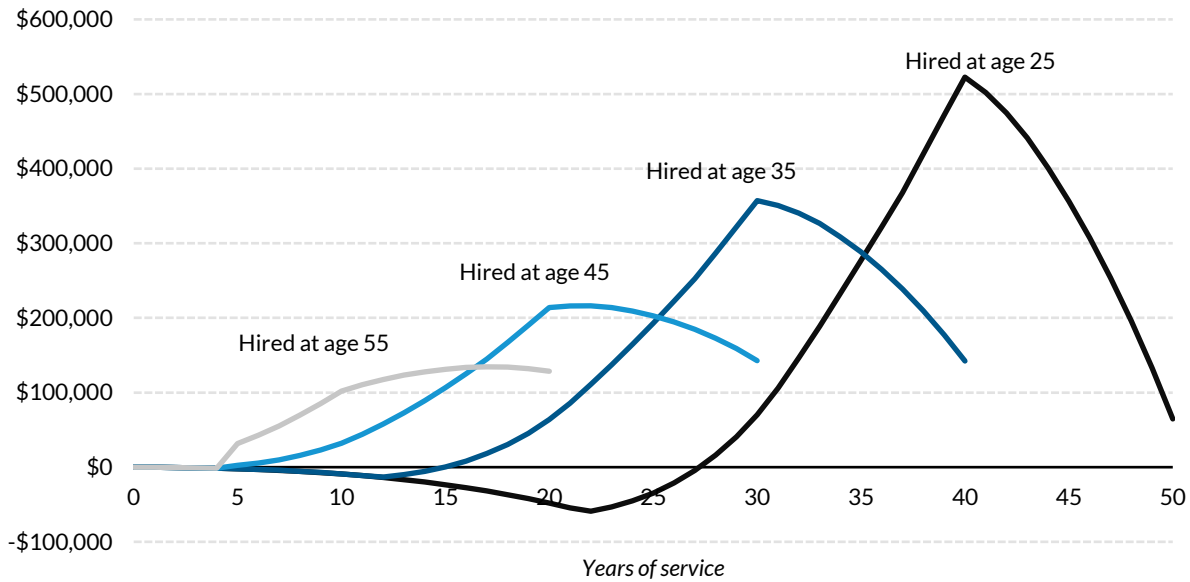
Relatively few teachers are hired at age 25. According to CalSTRS actuaries, 17 percent of teachers join the state payroll before age 25, 29 percent join between ages 25 and 29, 30 percent join while in their 30s, 15 percent join while in their 40s, and 9 percent join at age 50 or older (Milliman 2014). Given this diversity, focusing on a single entering cohort could generate misleading results. Thus, we broaden our analysis to consider outcomes for teachers hired at various ages.

Figure 3 shows how the expected value of lifetime pension benefits net of teacher contributions changes with years of service for teachers hired at ages 25, 35, 45, and 60. For age-25 hires, the figure highlights the plan-related financial losses experienced by those separating with more than 15 years of service but less than 28 years, the gains experienced by those remaining on the job between 30 and 40 years, and the sharp drop in net lifetime benefits for those who remain in the state plan for more than 40 years. For example, teachers with 40 years of service accumulate lifetime benefits net of their own contributions worth \$523,000, more than seven times as much as those with 30 years of service. However, the value of net lifetime benefits is cut in half for teachers who remain on the job for 47 years. The value of net lifetime benefits decreases after 40 years of service because additional service years do not raise annual payments enough to offset the decline in the number of checks received by those who continue working and the additional contributions they must make.

FIGURE 3

Value of Teacher Contributions and Future Benefits

Net of teacher contributions by starting age, CalSTRS 2% at 62



Source: Authors' calculations based on plan documents and actuarial reports.

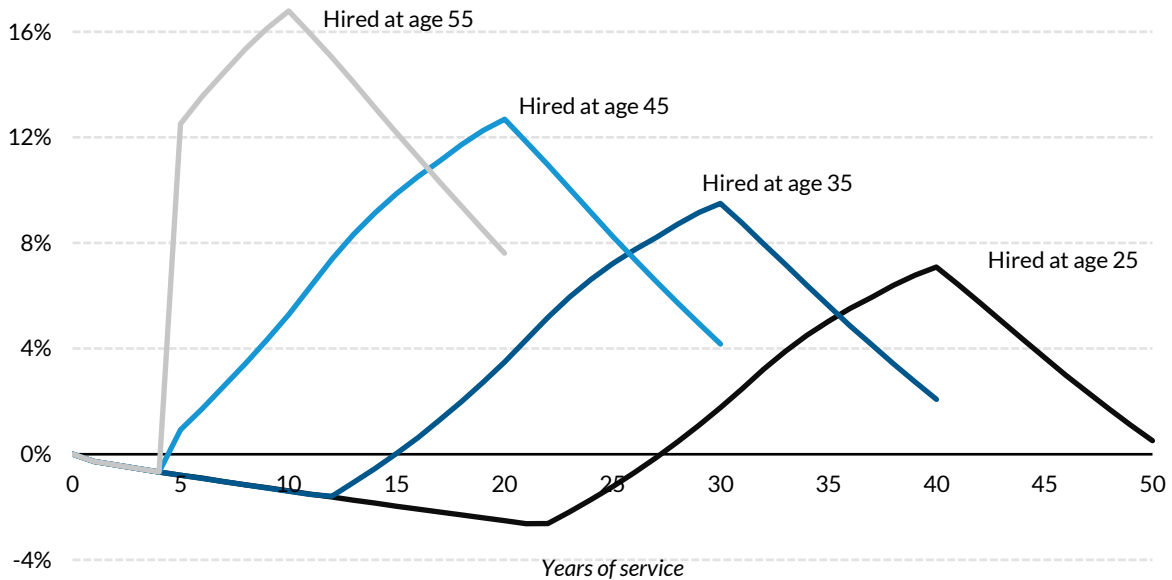
Notes: All monetary amounts are in constant 2014 dollars. Future benefits are discounted at 7.5 percent and the annual inflation rate is assumed to be 3 percent, the rates adopted by the teacher retirement system.

Lifetime pension benefits net of teacher contributions grow at similar rates for teachers hired at older ages, except that benefits for older hires accumulate more quickly and fall sooner. For example, lifetime benefits first exceed that value of teachers' required contributions after 15 years of service for those hired at age 35 and 5 years of service for those hired at age 45, compared with 28 years of service for those hired at age 25. After 30 years of service, employer- and state-financed benefits are worth five times as much for teachers hired at age 35 than those hired at age 25. A 55-year-old hire accumulates lifetime benefits worth about \$100,000, net of his or her required contributions, after only 10 years of service. Yet, the value of lifetime benefits net of teacher contributions begins falling after 30 years of service for age-35 hires and after 22 years of service for age-45 hires.

An alternative to measuring the expected value of lifetime benefits net of teacher contributions in dollars is to express it as the portion of salary that school districts and the state would have to set aside each year (with teacher contributions) to finance the stream of future benefits that teachers will receive once they retire. These calculations show how much retirement benefits supplement teacher salaries, averaged over their careers, assuming that teacher contributions earn 7.5 percent nominal returns, the rate assumed by the plan trustees.

The CalSTRS 2% at 62 plan significantly reduces salaries for teachers hired at age 25 who separate before completing 28 years of service because, as we saw earlier, future pension benefits for teachers with less seniority are worth less than their required contributions. For age-25 hires who leave after completing 22 years of service, for example, the pension plan reduces their salaries by 2.6 percent each year they work (figure 4). The plan supplements salary for those who remain on the job for at least 28 years, but how much they benefit depends on how long they stay. For instance, the plan supplements salaries 1.1 percent each year for those who separate after 29 years of service and 7.1 percent each year for those who separate after 40 years of service. The annual supplement then falls each year that age-25 hires remain on the job beyond 40 years, declining to 5.1 percent after 43 years of service and 3.7 percent after 45 years of service.

FIGURE 4
Career-Average Annual Employer Cost as Share of Salary
CalSTRS 2% at 62



Source: Authors' calculations based on plan documents and actuarial reports.

Notes: All monetary amounts are in constant 2014 dollars. The figure reports the fixed percentage of teachers' salaries that employers would have to contribute each year to finance promised benefits. Future benefits are discounted at 7.5 percent and the annual inflation rate is assumed to be 3 percent, the rates adopted by the teacher retirement system.

Teachers hired at older ages get much more out of the plan for each year of service than those hired at younger ages. For example, the plan supplements salaries 12.7 percent each year for age-45 hires

who separate after 20 years of service and 16.8 percent each year for age-55 hires who separate after only 10 years of service.

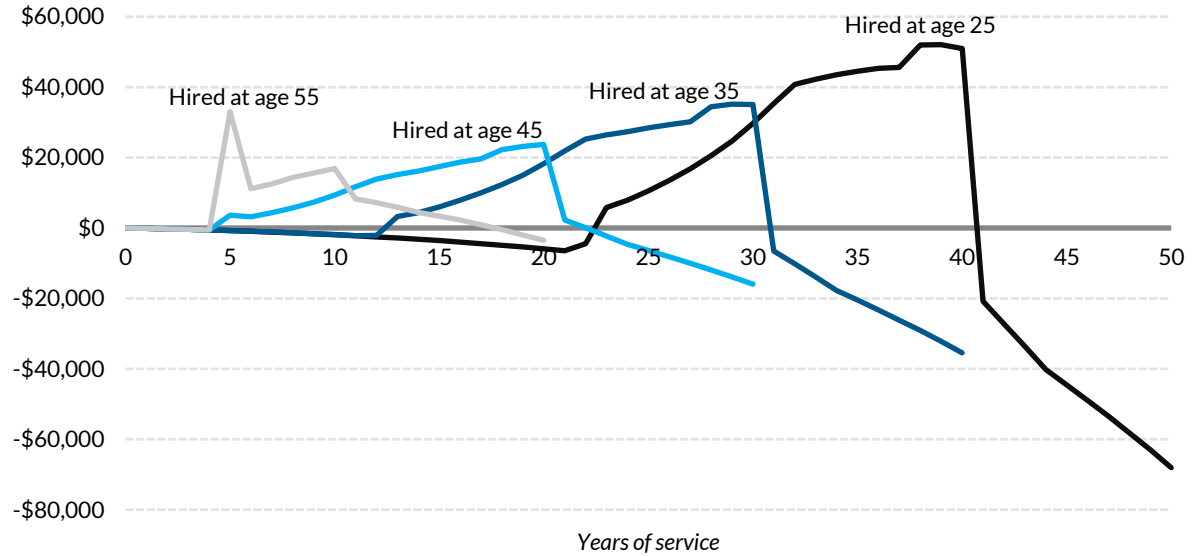
The change in lifetime retirement benefits from working an additional year can significantly affect teacher compensation. Another year of service sometimes substantially increases the value of lifetime pension benefits, boosting total compensation. Sharp spikes in the growth of lifetime benefits can create strong incentives for teachers to remain on the job until they realize those rewards, even if the job is a poor match with their skills and they could be more productive elsewhere. However, working an additional year after the plan's retirement age can also reduce lifetime pension benefits because teachers forfeit a year of benefits for every year they remain on the job, cutting total compensation and creating strong incentives to retire.

Figure 5 shows the annual increment to the expected value of lifetime pension benefits net of teacher contributions. For a 25-year-old hire, CalSTRS reduces total compensation until teachers have served for 21 years. The value of future pension benefits grows in the years that immediately follow, augmenting teacher compensation. During the 32nd year of service, for example, the increment to future benefits amounts to about \$41,000 (in constant 2014 dollars), roughly 40 percent of salary. During the 40th year of service, the value of lifetime benefits net of teacher contributions rises by about \$51,000, about 45 percent of salary. Lifetime benefits then decline, reducing total compensation and encouraging employees to retire. During the 41st year of service, the value of net lifetime benefits declines by \$21,000, 18 percent of salary. Similar patterns exist for teachers hired at older ages.

FIGURE 5

Annual Increment to Lifetime Benefits

Net of teacher contributions by starting age, CalSTRS 2% at 62



Source: Authors' calculations based on plan documents and actuarial reports.

Notes: All monetary amounts are in constant 2014 dollars. Future benefits are discounted at 7.5 percent and the annual inflation rate is assumed to be 3 percent, the rates adopted by the teacher retirement system.

How Are Pension Benefits Distributed across California's Public School Teachers?

Table 1 simulates the distribution of projected pension benefits for newly hired public school teachers, under the assumption that these new hires must contribute 9.205 percent of their salaries to the plan for their entire careers. Overall, annual age-75 pension benefits will average \$11,000 in constant 2014 dollars, and total lifetime pension benefits will average \$154,000. About three-quarters of those pension benefits will be financed by teachers' own contributions. Lifetime benefits net of teacher contributions will average only \$48,200. On average, those benefits are equivalent to a 1.9 percent salary supplement received throughout teachers' careers. Average benefit levels will be higher among those who remain in the plan for at least a few years. For teachers who complete at least five years of service, annual benefits will average \$14,700, total lifetime benefits will average \$206,800, and lifetime benefits net of teacher contributions will average \$64,900, which could be financed by a state contribution of 1.8 percent of salary throughout teachers' careers.

Pension benefits vary widely across the workforce.⁵ Focusing on those who complete at least five years of service, we estimate that one-quarter of newly hired teachers will receive at least \$20,400 in annual pension benefits each year (the 75th percentile, as reported in table 1), and one-tenth will receive at least \$33,700 per year (the 90th percentile). However, half will receive less than \$9,800 per year (the 50th percentile, or median value), and one-quarter will receive less than \$4,500 (the 25th percentile). In terms of lifetime benefits net of teacher contributions, one-quarter of teachers with five years or more of completed service will accumulate at least \$107,100, and one-tenth will accumulate at least \$237,300. However, half of newly hired teachers who complete at least five years of service will accumulate less than \$8,800 in lifetime benefits net of their own contributions, and one-quarter will lose more than \$7,900 by participating in CalSTRS, because the pension or refund that they collect will be worth less than the contributions they are required to make.

TABLE 1.

Distribution of Projected Pension Benefits
CalSTRS 2% at 62

	Annual benefits at age 75	Total lifetime benefits	Lifetime benefits net of employee contributions	
			Dollar amount	Share of career salary (percent)*
Average				
All participants	11,000	154,000	48,200	1.9
At least 5 years of service	14,700	206,800	64,900	2.6
At least 10 years of service	18,500	263,400	83,400	2.9
10th Percentile				
All participants	0	0	-17,300	-1.3
At least 5 years of service	2,300	17,300	-21,700	-1.4
At least 10 years of service	5,300	46,500	-26,200	-1.5
25th Percentile				
All participants	0	0	-3,700	-0.7
At least 5 years of service	4,500	43,200	-7,900	-0.9
At least 10 years of service	7,900	88,800	-12,100	-1.1
50th Percentile				
All participants	5,900	61,300	-100	-0.1
At least 5 years of service	9,800	121,100	8,800	0.7
At least 10 years of service	14,100	190,300	37,400	1.7
75th Percentile				
All participants	16,000	221,200	63,500	3.6
At least 5 years of service	20,400	303,600	107,100	5.6
At least 10 years of service	24,700	375,400	152,100	6.0
90th Percentile				
All participants	29,400	457,900	199,000	8.6
At least 5 years of service	33,700	530,200	237,300	9.8
At least 10 years of service	38,000	589,300	276,100	9.7

Source: Authors' calculations based on plan documents and actuarial reports.

Note: All monetary figures are in constant 2014 dollars. Future benefits are discounted at 7.5 percent and the annual inflation rate is assumed to be 3 percent, the rates adopted by the teacher retirement system.

* Indicates the fixed percentage of employees' salary that the state would have to contribute each year of employees' careers to finance promised benefits.

The variation in pension benefits that we measure arises solely from differences in years of service across teachers. It is not surprising that long-serving teachers receive more lifetime pension benefits, just as they receive higher lifetime salaries. To evaluate the distribution in lifetime pension benefits, it is

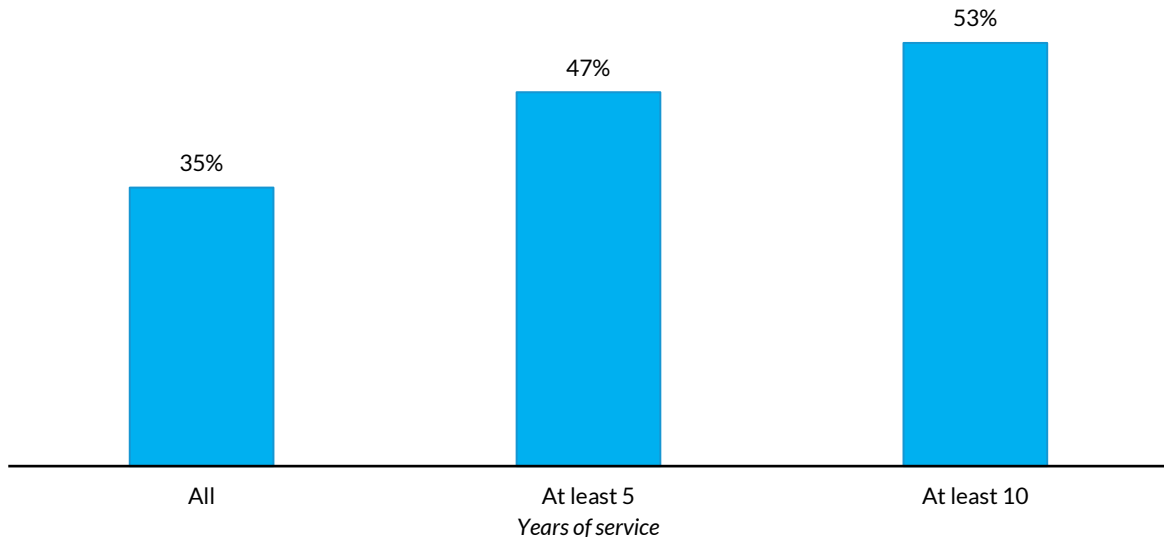
instructive to express them as the share of teachers' salaries that the state would have to contribute each year of their careers to finance promised benefits. If all groups were treated equally, then we would expect that these shares would not vary much across the workforce. However, we find sharp differences. The median employer and state contribution for teachers who complete at least five years of service is 0.7 percent of salary, but a quarter of teachers receive contributions that exceed 5.6 percent of salary and a tenth receive contributions that exceed 9.8 percent. For another quarter of teachers, the pension plan essentially reduces salaries by more than 0.9 percent over their careers, because the pensions (or refunds) they receive fall short of their required paycheck deductions.

Only 35 percent of teachers who participate in the CalSTRS 2% at 62 tier will receive pension benefits that are worth more than their required plan contributions (figure 6). The other 65 percent will lose money in the plan, because they would fare better financially if they could have opted out and invested 9.205 percent of their salaries outside the plan. Longer-serving teachers will fare better in the plan, with 47 percent of those who complete at least 5 service years and 53 percent of those who complete at least 10 service years earning pensions that exceed the value of their required contributions.

FIGURE 6

Share of Teachers Whose Lifetime Pension Benefits Are Worth More than Their Required Plan Contributions

CalSTRS 2% at 62

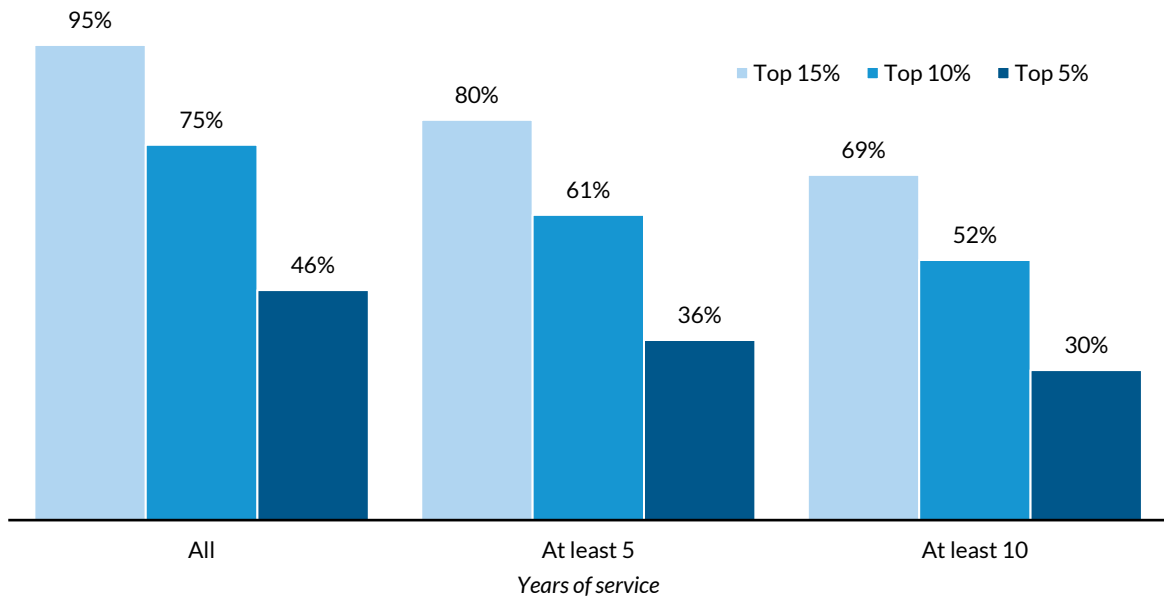


Source: Authors' calculations based on plan documents and actuarial reports.

Notes: The analysis assumes an annual interest rate of 7.5 percent and inflation rate of 3 percent, the rates adopted by the teacher retirement system.

Under the CalSTRS 2% at 62 tier, 95 percent of all employer- and state-financed pension benefits go to the 15 percent of teachers receiving the most benefits (figure 7). The remaining 85 percent of the workforce receive only 5 percent of all employer- and state-financed benefits. The top 5 percent receive 46 percent of all payments. Even among teachers who complete at least 10 years of service, 69 percent of all employer- and state-financed benefits go to the top 15 percent of beneficiaries, and 30 percent go to the top 5 percent.

FIGURE 7
Percentage of Employer- and State-Financed Pension Benefits Going to the Largest Beneficiaries
CalSTRS 2% at 62



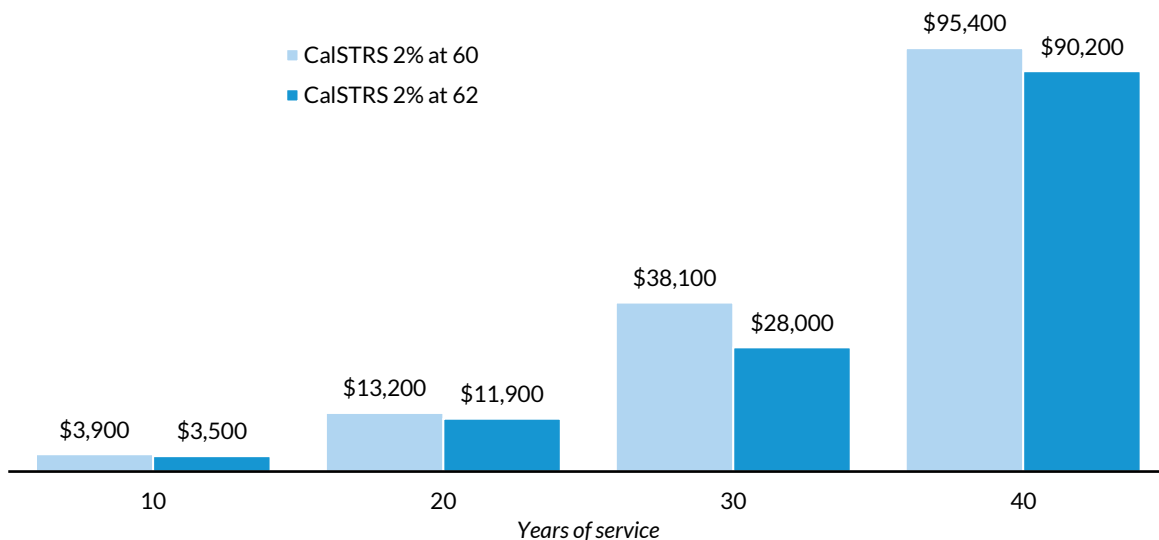
Source: Authors' calculations based on plan documents and actuarial reports.

Notes: Beneficiaries are ranked by the value of lifetime benefits they receive. The analysis assumes an annual interest rate of 7.5 percent and inflation rate of 3 percent, the rates adopted by the teacher retirement system.

How Did Recent Changes Affect California Teachers?

The 2012 law that created the CalSTRS 2% at 62 tier, which applies to teachers hired after 2013, significantly reduced pensions to future retired teachers by reducing the plan multiplier and lengthening the period over which final average salary is computed for long-term plan participants. For example, teachers hired at age 25 who retire with 30 years of service would receive annual age-75 pension benefits of \$38,100 under CalSTRS 2% at 60 versus \$28,000 under CalSTRS 2% at 62—a 36 percentage point difference (figure 8).

FIGURE 8
Impact of 2012 Pension Changes on Annual Age-75 Benefits
Age-25 hires



Source: Authors' calculations based on plan documents and actuarial reports.

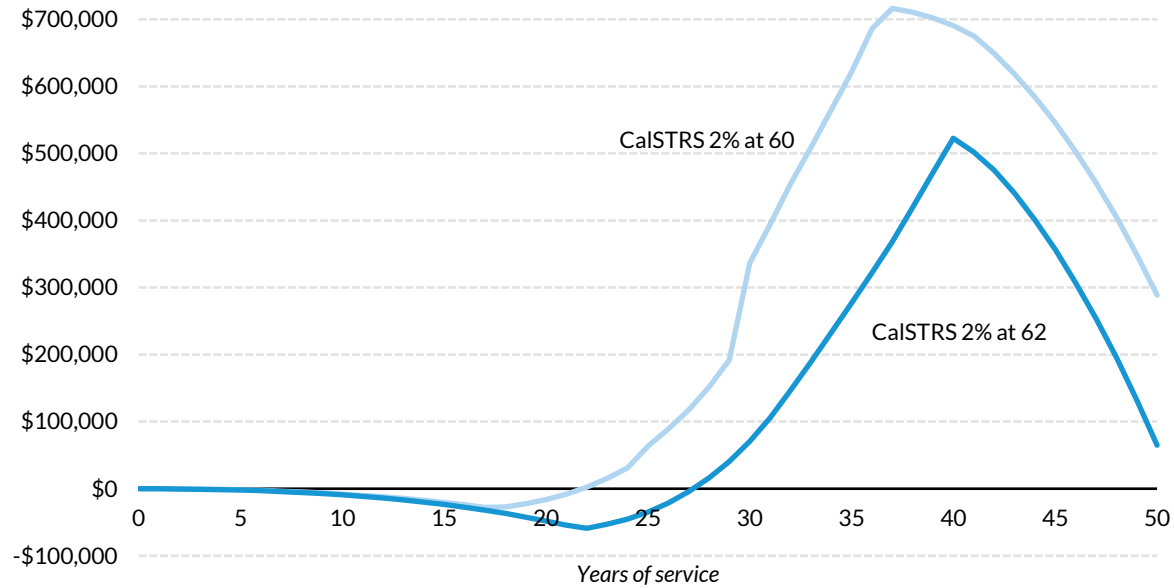
Notes: All monetary amounts are in constant 2014 dollars. Estimates assume benefits are collected at the age that maximizes the value of lifetime payments.

Measured on a lifetime basis, pension benefits for age-25 hires peak at \$720,000, net of required teacher contributions, when computed under the old-tier rules and the required contribution rates effective in 2012, compared with \$520,000 under the new-tier rules and higher contribution rates that will prevail in 2017 (figure 9). Because the new tier provides fewer benefits, teachers must now remain

in the plan for six years longer than in the old tier before their pension benefits exceed the value of their plan contributions. Thus, the 2012 changes have made the pension plan less attractive to new hires who may not expect to spend their entire careers as California public school teachers.

FIGURE 9
Impact of 2012 Pension Changes on Lifetime Benefits

Net of teacher contributions, age-25 hires



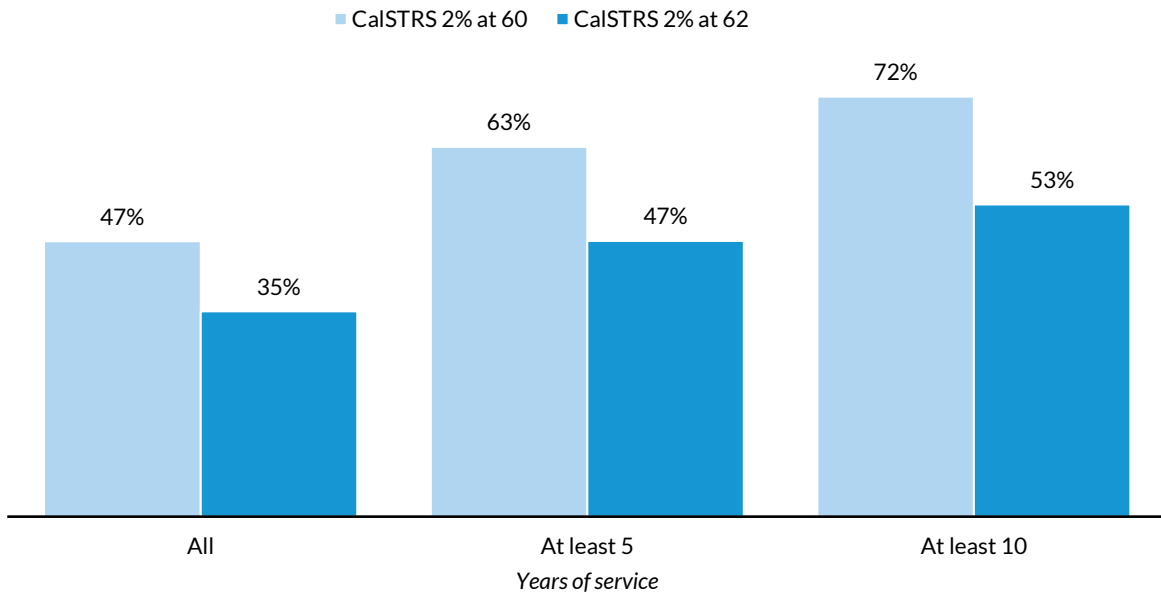
Source: Authors' calculations based on plan documents and actuarial reports.

Notes: All monetary amounts are in constant 2014 dollars. Future benefits are discounted at 7.5 percent and the annual inflation rate is assumed to be 3 percent, the rates adopted by the teacher retirement system.

The 2012 pension changes reduce average lifetime pension costs for teachers, measured at time of hire, by 58 percent. Under the CalSTRS 2% at 60 tier, school districts and the state would have to set aside \$26,400 (in 2014 dollars) when hiring new teachers to cover their expected lifetime pension benefits, compared with only \$11,200 under the CalSTRS 2% at 62 tier. Today, fewer new hires will ever receive pensions with any financial contributions from the state or their employers. Under the old-tier rules and past teacher contribution rates, 47 percent of all new hires would receive pensions worth more than the value of their contributions, compared with 35 percent under the new tier (figure 10). Among teachers completing at least 10 years of service, 72 percent of new hires under the old tier would receive pensions worth more than the value of their contributions, compared with 53 percent under the new tier.

FIGURE 10

Share of Teachers Whose Lifetime Pension Benefits Are Worth More than Their Required Plan Contributions



Source: Authors' calculations based on plan documents and actuarial reports.

Notes: Future benefits are discounted at 7.5 percent and the annual inflation rate is assumed to be 3 percent, the rates adopted by the teacher retirement system.

How Could Pensions Be Distributed More Fairly?

Shorter-tenured California public school teachers receive few, if any, employer- or state-funded pension benefits, while long-tenured teachers receive large pensions. Pensions increase rapidly with tenure because service years and final average salaries—on which benefits are based—rise with experience, and the multiplier increases as teachers delay retirement. Additionally, teachers who leave state employment at relatively young ages must wait many years before they can begin collecting their pensions, and their accumulated benefits remain frozen in the interim, earning no interest and eroding with inflation. The reduction in the formula multiplier for new hires and the recent boost in required teacher contribution rates make the pension plan even less attractive to young teachers who do not expect to spend their entire careers in the public sector.

The plan also treats many teachers older than 65 unfairly. Future annual pension benefits do not increase much when California teachers remain on the job past age 65, generally causing the value of their lifetime pension benefits to fall because they must forgo pension checks until they stop teaching in public schools. These financial losses reduce the financial gain from working at older ages and encourage teachers to retire, an undesirable incentive for productive teachers who want to remain in the classroom, especially as the population ages and the availability of younger teachers stagnates.

Transitioning away from the traditional final average salary defined benefit format is one way to distribute benefits more evenly across the workforce and make teaching more appealing to both younger and older adults. For example, CalSTRS used to provide a supplemental cash balance plan to teachers and still allows school districts to offer part-time teachers cash balance plans instead of the traditional defined benefit plan. This cash balance plan treats all teachers fairly because school districts and the state contribute the same share of a teacher's salary to all teacher retirement accounts, regardless of a teacher's age or years of service. Teachers who separate from public employment at relatively young ages fare better in a cash balance plan than a traditional defined benefit plan because their cash balance accounts may continue to earn interest after they separate. By contrast, the traditional plan freezes benefits for teachers who separate before they may begin collecting their pensions. Additionally, cash balance plan participants do not forfeit retirement benefits by remaining employed at older ages because they continue to receive employer contributions throughout their careers and their account balances can continue to rise.

Moving to a 401(k) plan, either as a replacement to the traditional defined benefit plan or a supplement to it can also help equalize retirement benefits among teachers. All participants in these defined contribution plans can receive the same employer contribution relative to their salaries, regardless of age or years of service, and their retirement accounts can continue to grow until they begin collecting benefits, even after they leave public employment. Transitioning to a 401(k)-type plan would also prevent employers and the state from underfunding future pension obligations and shifting costs to future generations. By definition, 401(k) plans are fully funded, because employees own their account balances as soon as they vest. Critics of defined contribution plans note that these plans have not worked well in the private sector, where they now dominate. Many employees offered such plans by their employers do not participate and few participants contribute enough to generate significant retirement income in old age (Munnell 20014; Munnell and Sunden 2004). Additionally, relatively few 401(k) participants annuitize their balances, exposing them to the risk of depleting their retirement funds before they die (Johnson, Burman, and Kobes 2004). These potential shortcomings can be easily overcome in the public sector, however, by requiring employees to contribute to their retirement plans (which is already commonplace) to annuitize their account balances.

Defined contribution and cash balance plans expose teachers to some investment risk, in that their pensions could shrink if interest rates or equity returns fall. As a result, many teachers (and teacher unions) prefer the traditional defined benefit format, because it insulates teachers from such risks. Teachers could be protected from investment risks and benefits could be distributed more equally across the workforce by retaining the traditional defined benefit structure but altering the benefit formula. By retaining the traditional pension structure, however, taxpayers would continue to bear all the investment risks associated with the plan, and the state and the employer would still be able to shift benefit costs to coming generations of taxpayers by underfunding future pension obligations.

The distribution of pension benefits can be assessed by computing the career-average percentage of a teacher's salary that an employer (or the state) must contribute to generate the expected lifetime stream of pension benefits and measuring how much that average percentage varies by years of service and age of hire. To distribute benefits more equitably and equalize the average percentage of salary contributed, CalSTRS must provide larger pensions to teachers who retire at older ages or separate at relatively young ages, and provide smaller pensions to teachers who join the plan relatively late in their careers. Increasing the plan multiplier for those who retire after the normal retirement age would raise benefits for older workers. One way of boosting benefits to teachers who separate early is to raise the final average salary on which their benefits are based, allowing benefits to grow—instead of remaining frozen—while separated plan participants wait to collect. Additionally, tying the plan multiplier to years

of service would reduce benefits for older hires, because they do not accumulate many years of service and would not experience the benefit boost provided to those who separate before becoming eligible to collect benefits.

To measure how such plan formula changes could affect the distribution of California teacher pensions, we simulate benefits under a new plan tier that provides a final average salary pension with the following features:

- Participants may first begin collecting benefits at age 62.
- Final average salary is based on the top three consecutive earnings years, but, for teachers who separate before they begin collecting, their pension final average salary would increase 7.5 percent each year that they wait to collect.
- The plan multiplier equals 1 percent for service years 1 to 9, 1.1 percent for years 10 to 14, 1.2 percent for years 15 to 19, 1.3 percent for years 20 to 24, 1.8 percent for years 25 to 29, 2 percent for years 30 to 34, and 2.2 percent for years 35 and more.
- Annual benefits increase 4 percent for each year that participants delay retirement past age 62.
- After retirement, annual benefits increase by the percentage change in the consumer price index.
- Benefits vest after one year.
- Teachers must contribute 8 percent of their salary to the plan.
- Upon separation, teachers may withdraw their contributions from the plan with 7.5 percent interest—the same rate that the plan trustees assume these contributions earn—and forfeit any future pension benefits.

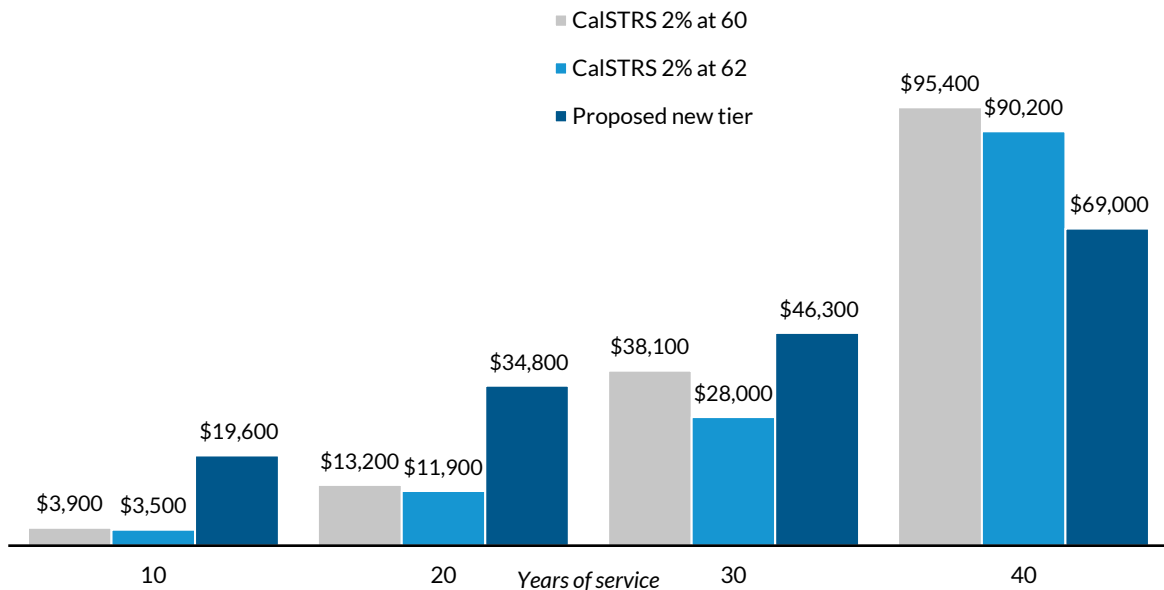
A plan with this benefit formula would cost slightly more than the existing CalSTRS 2% at 62 tier covering new hires, but much less than the CalSTRS 2% at 60 tier covering teachers hired before 2013. Using salary and retention projections from the plan actuaries (Milliman 2014), we estimate that under existing benefit rules school districts and the state would have to set aside \$11,200 as each new teacher is hired to cover fully his or her future expected pension benefits. Under the new benefit formula we propose, the average cost would rise 8 percent, to \$12,100. The proposed new tier would, however, be substantially less expensive than the old tier for teachers hired before 2013, which would cost \$26,700, on average, for every new hire, more than twice as much as the benefits provided under the existing plan tier or the proposed new tier.

Figure 11 shows simulated age-75 benefits for California teachers hired at age 25 under the proposed new tier, and compares them with benefits provided under the CalSTRS 2% at 60 and the CalSTRS 2% at 62 tiers. The proposed new tier would provide much higher benefits for those who spend no more than 30 years as a California public school teacher and lower benefits for those with at least 35 years of service. For example, 25-year-old hires who separate after 10 years of service would receive \$19,600 in annual pension benefits at age 75 (in 2014 dollars), more than five times as much as they would collect under the existing tiers. The proposed new tier would provide annual benefits to those who retire after 20 years of service that are worth more than twice as much as the benefits provided under the existing tiers. However, age 25 hires employed for 40 years as California public school teachers would experience about a one-quarter cut in annual age-75 pension benefits if they were enrolled in the proposed new tier. Nonetheless, those who spend a full career in the proposed plan would likely receive enough benefits to live comfortably in retirement, with their pensions replacing 70 percent of their age-55 earnings at age 75. (By contrast, the replacement rate for teachers with 40 years of completed service reaches 97 percent under the CalSTRS 2% at 60 tier and 92 percent under the CalSTRS 2% at 62 tier.)

FIGURE 11

Impact of Proposed New Tier on Annual Age-75 Benefits

Age-25 hires



Source: Authors' calculations based on plan documents and actuarial reports.

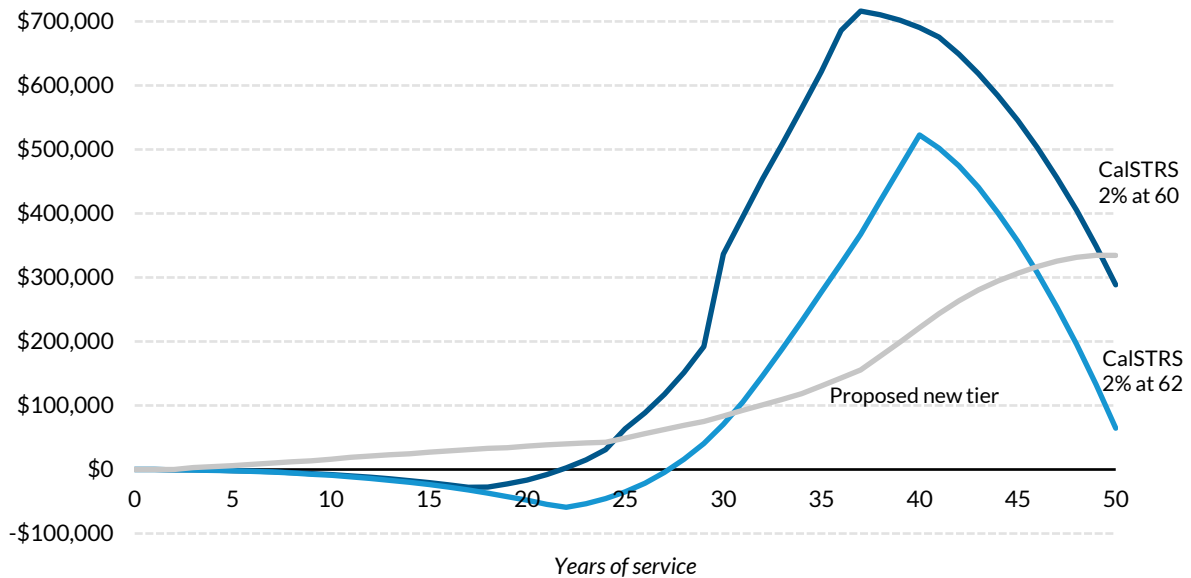
Notes: All monetary amounts are in constant 2014 dollars. Estimates assume benefits are collected at the age that maximizes the value of lifetime payments.

Unlike the existing plan tiers for California public school teachers, the proposed new tier would provide teachers with pensions that are worth more than the value of their required plan contributions after only three years of service and that continue to increase in value regardless of how long they remain employed. After 20 years of completed service, for example, teachers hired at age 25 under the proposed new tier would accumulate future pension benefits worth \$36,000 net of their own contributions (figure 12). By contrast, future benefits for age-25 hires who separate after 20 years are worth \$16,000 less than their own contributions under the CalSTRS 2% at 60 tier and \$48,000 less than their own contributions under the CalSTRS 2% at 62 tier. Because the proposed new tier credits interest on refunded contributions at the rate that teachers could earn outside the plan, teachers would never lose money by contributing to the plan. The proposed tier also encourages experienced teachers to remain in the classroom. After 41 years of service, for example, an additional year of teaching raises expected net lifetime pension benefits by \$20,000 under the proposed new tier, but reduces it by \$26,000 under the CalSTRS 2% at 60 tier and by \$27,000 under the CalSTRS 2% at 62 tier. However, long-tenured would generally accumulate more lifetime benefits under the existing tiers, especially the 2% at 60 tier, than the proposed new tier.

FIGURE 12

Impact of Proposed New Tier on Lifetime Benefits

Net of teacher contributions, age-25 hires



Source: Authors' calculations based on plan documents and actuarial reports.

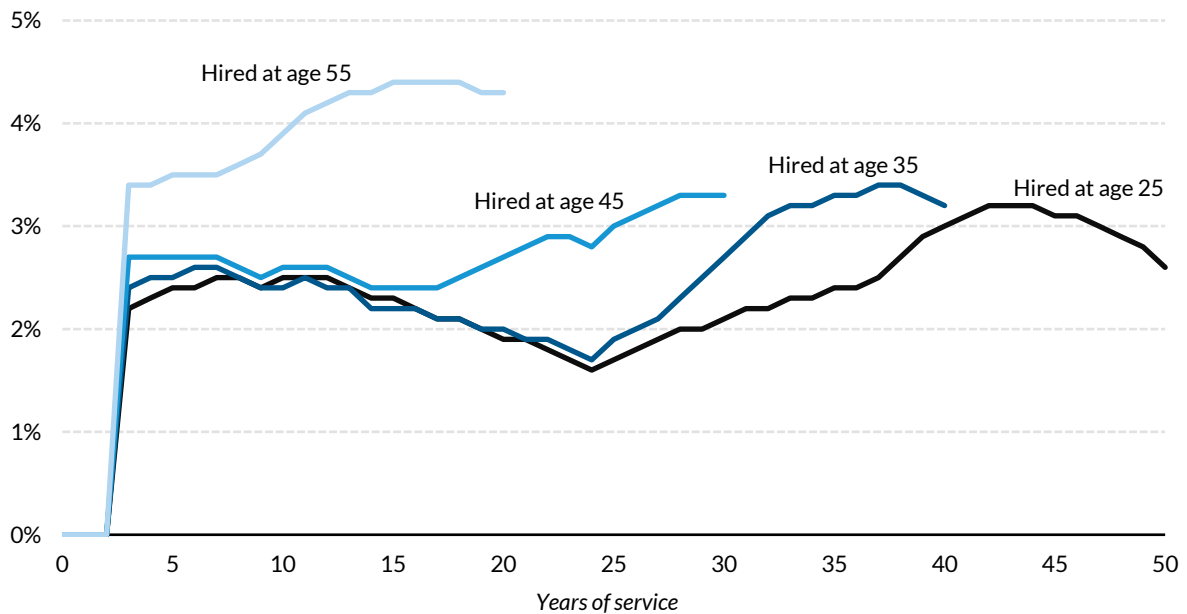
Notes: All monetary amounts are in constant 2014 dollars. Future benefits are discounted at 7.5 percent and the annual inflation rate is assumed to be 3 percent, the rates adopted by the teacher retirement system.

An important feature of the proposed new tier is that career-average employer costs, measured as a percentage of career-average salary, would not vary much by hire age and service years after the first three service years, indicating that the proposed new tier would provide roughly the same benefit per service year for all teachers. Career-average employer costs would vary from 1.6 percent of salary for an age-25 hire who completes 24 years of service to 4.4 percent of salary for an age-55 hire who completes 15 years of service (figure 13). By contrast, as we saw earlier, career-average employer costs under the CalSTRS 2% at 62 tier vary from -2.6 percent of salary for a teacher hired at age 25 who completes 22 years of service to 16.8 percent of salary for a teacher hired at age 55 who completes 10 years of service.

FIGURE 13

Career-Average Annual Employer Cost as Share of Salary

Proposed new tier



Source: Authors' calculations based on plan documents and actuarial reports.

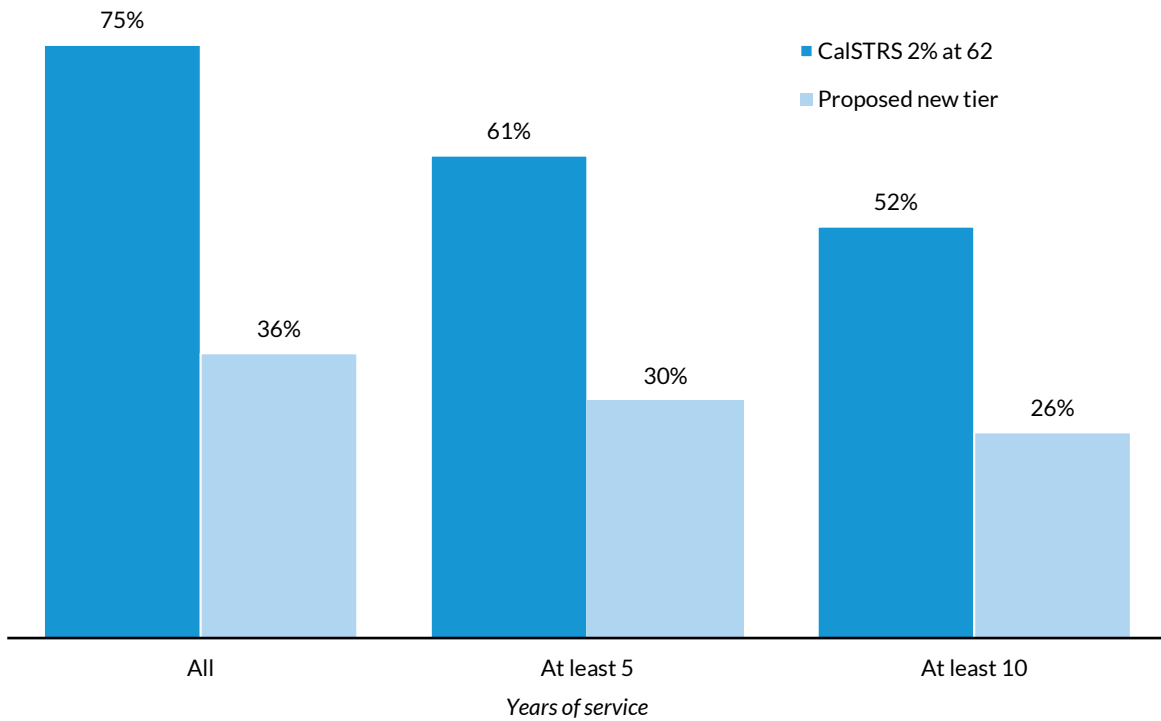
Notes: The figure reports the fixed percentage of teachers' salaries that employers would have to contribute each year to finance promised benefits. Future benefits are discounted at 7.5 percent and the annual inflation rate is assumed to be 3 percent, the rates adopted by the teacher retirement system.

Because the new tier would provide larger pensions to teachers with limited tenures than the existing tiers and smaller pensions to those with many years of completed service, it would distribute benefits more equitably across the workforce. For example, the new tier would distribute 36 percent of all pension benefits to the top 10 percent of beneficiaries, compared with 75 percent under the CalSTRS 2% at 62 tier (figure 14). Among teachers who complete at least 10 years of service, the top 10 percent

of beneficiaries would receive 26 percent of all benefits under the proposed new tier and 52 percent of all benefits under the CalSTRS 2% of 62 tier.

FIGURE 14

Share of Employer- and State-Financed Pension Benefits Going to the Top 10 Percent of Beneficiaries



Source: Authors' calculations based on plan documents and actuarial reports.

Notes: Future benefits are discounted at 7.5 percent and the annual inflation rate is assumed to be 3 percent, the rates adopted by the teacher retirement system.

Conclusions

How well California's existing retirement plan serves public school teachers depends crucially on when teachers begin their public-sector careers and how long they teach. Teachers who spend a full career in the plan receive large pensions. Older hires also receive substantial pensions even if they are not employed very long, especially when pensions are measured relative to their career earnings. However, teachers who join the plan at relatively young ages and spend less than a full career in the classroom accumulate few retirement benefits. For example, 25-year hires who join the plan today, earn average salaries over their careers, and separate after 20 years of service would receive \$11,900 in annual pension benefits at age 75. These benefits are worth \$123,000 over their lifetimes, less than the value of their required plan contributions. Age-25 hires must remain employed for at least 28 years to collect benefits worth more than the value of their plan contributions. Those who separate earlier lose money in the mandatory plan; they would have better financial outcomes if they had the opportunity to opt out of the plan and invest their contributions elsewhere. These teachers—many of whom taught for decades—subsidize the large pensions received by the longest-tenured teachers.

Relatively few California public school teachers remain employed long enough to benefit much from their retirement plan. Half of all newly hired teachers complete no more than 11 years of service, and only a quarter complete at least 20 years of service. As a result, the median age-75 pension benefit for today's new hires will total only \$5,900 per year. Only 35 percent of all new hires will receive pensions worth more than the value of their required plan contributions, including only 47 percent of teachers who remain employed for at least five years.

Another drawback of the existing retirement plan for California teachers is that it penalizes work at older ages. Teachers who remain employed after the plan's retirement age forgo a year of benefits for every year they remain on the job, cutting their total compensation and creating strong incentives to retire. For age-25 hires, for example, the value of lifetime benefits net of teacher contributions is only half as high for those who separate after 47 years as for those who separate after 40 years. The value of net lifetime benefits falls because additional service years do not raise annual payments enough to offset the decline in the number of checks continuing workers receive and the additional contributions they must make. Such incentives are increasingly problematic as the workforce ages.

Various plan changes could distribute benefits more evenly across the workforce and make teaching more appealing to both younger and older adults. For example, the state could switch to a cash balance plan, which could treat all teachers fairly because school districts and the state could contribute

the same share of a teacher's salary to all teacher retirement accounts, regardless of a teacher's age or years of service. Moving to a 401(k) plan, either as a replacement to the traditional defined benefit plan or a supplement to it, could also help equalize retirement benefits among teachers. In a 401(k)-type plan, all participants could receive the same employer contribution relative to their salaries, regardless of age or years of service, and their retirement accounts can continue to grow until they begin collecting benefits, even after they leave public employment. Such changes, however, would expose teachers to some investment risk, in that their pensions could shrink if interest rates or equity returns fall.

Alternatively, CalSTRS could distribute pension benefits more equitably across the workforce by altering the benefit formula. For example, policymakers could raise benefits for older workers by increasing the plan multiplier for those who retire after the normal retirement age. They could change the computation of final average salary so that the measure on which benefits are based increases each year that separated teachers wait to collect, allowing pensions to grow—instead of remaining frozen—in the interim. Additionally, tying the plan multiplier to years of service would reduce benefits for older hires, because they do not accumulate many years of service and would not experience the benefit boost provided to those who separate before becoming eligible to collect benefits. Such changes would make employment in public education more appealing to younger adults who spend less than a full career in the classroom and older adults who wish to prolong their careers.

Notes

1. This estimated funding gap is from Milliman (2014), based on the interest rate adopted by the plan trustees. Some analysts maintain that this estimate understates unfunded obligations, because the assumed interest rate used to discount future benefit payments is too high (Novy-Marx and Rauh 2011).
2. California State Teachers' Retirement System, "New Legislation Stabilizes CalSTRS Funding," news release, June 24, 2014, <http://www.calstrs.com/news-release/new-legislation-stabilizes-calstrs-funding>.
3. See also, Victor Nava, "Victor Nava: Recent Pension Fixes Don't Go Far Enough," *Orange County Register*, July 25, 2014, <http://www.ocregister.com/articles/pension-629831-percent-california.html> and Chuck Reed, "Viewpoints: California Needs Substantial Pension Reform," *The Sacramento Bee*, April 13, 2014. <http://www.sacbee.com/opinion/california-forum/article2595384.html>.
4. Between 1926 and 2013, the average annual compound growth rate for a portfolio evenly split between stocks and bonds was 5.38 percent (Morningstar 2014).
5. Our estimated variation is derived solely from differences in service years, because we assume that all teachers earn the same average salary for their age and years of service. Actual pension benefits received by teachers vary more because salaries differ across teachers with the same hire date and years of completed service.

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