Pension Benefit Design Study

TEACHER RETIREMENT SYSTEM OF TEXAS DECEMBER 2018

TRS
TEACHER RETIREMENT SYSTEM OF TEXAS

MISSION STATEMENT

Improving the retirement security of our members by prudently investing and managing the Trust assets and delivering benefits that make a positive difference in their lives.

MAJOR FINDINGS

1. A total of 96 percent of public school employees do not participate in Social Security.

2. The current defined benefit plan provides current benefits at a lower cost than alternative plans.

3. Moving new hires to an alternative plan will not eliminate existing liabilities.

4. A contribution rate increase of 1.82 percent beginning in fiscal year 2020 will lower the funding period to 30 years.

5. A phased-in contribution rate increase of 2 percent beginning in fiscal year 2021 will lower the funding period to 31 years.

6. Combined employee and employer contribution rates for TRS are the lowest in the nation among teacher plans.

7. The value of the retirement benefit available to TRS members is 30 percent less than the average benefits available to members of peer systems.

8. Active members have borne approximately 70 percent of plan changes since 2005.

9. All plan structures carry differing levels of risk. When examining important aspects of pension plan design, the current defined benefit plan places more risk with the State and generally offers more favorable outcomes for TRS members.

10. The majority of TRS members will do significantly worse investing on their own in a plan with a defined contribution component.

CONTENTS

EXECUTIVE SUMMARY

1

A total of 96 percent of public school employees do not participate in Social Security.

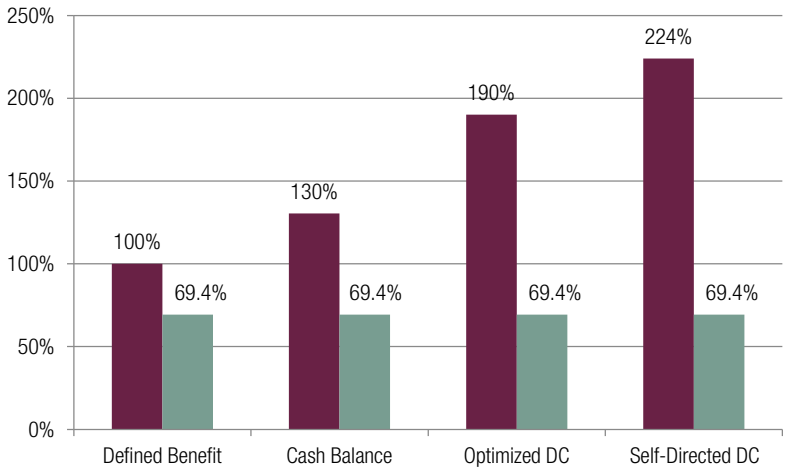
In fiscal year 2018, 78 percent of members in the Teacher Retirement System of Texas (TRS), a figure that includes 96 percent of public school TRS members, did not participate in Social Security. For many TRS members, the only source of lifetime income in retirement is their TRS benefit. A lifetime benefit, such as TRS or Social Security, mitigates the risk of a retiree who — due to longevity, market volatility or failure to invest adequately — outlives his or her savings. Moreover, participation in TRS is more cost effective for employers because the availability of TRS as a qualified replacement plan to Social Security saves Texas public school employers an estimated $1.65 billion annually.

2

The current defined benefit plan provides current benefits at a lower cost than alternative plans.

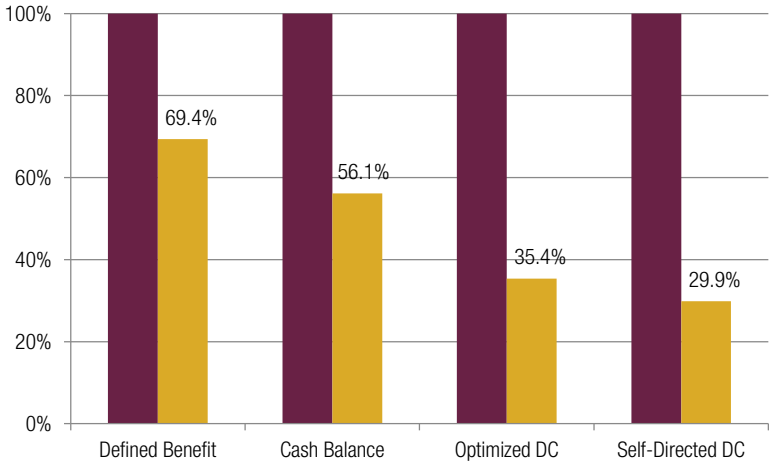
TRS modeled alternative retirement plans using two different approaches — Targeted Benefit and Targeted Contribution. The TRS benefit, as currently designed, replaces roughly 69 percent of a career employee's pre-retirement income when the employee initially retires. Therefore, TRS modeled the plans in the Targeted Benefit Approach to provide the same level of benefit as the current plan regardless of cost. As shown below, TRS determined that the alternative plans would be 30 percent to 124 percent more expensive than the current defined benefit plan to provide the same level of benefit when the employee initially retires. Note, this estimate does not include costs associated with paying off any unfunded liability.

FIGURE 1.1: TARGETED BENEFIT APPROACH



SOURCE: GRS

FIGURE 1.2: TARGETED CONTRIBUTION APPROACH



SOURCE: GRS

Conversely, under the Targeted Contribution Approach, TRS modeled the alternative plans to cost the same as the current plan, regardless of the benefit level provided. Under this approach, TRS determined that the alternative plans would replace 29.9 percent to 56.1 percent of preretirement income for a career employee retiring at age 62.

3

Moving new hires to an alternative plan will not eliminate existing liabilities.

Based on current expectations, the outstanding liability to provide benefits for current active members is $58.7 billion. This consists of an unfunded liability of $46.2 billion for benefits already earned and an assumption that current active members will earn $12.5 billion in employer provided benefits before retiring. Closing the current plan to future hires would not eliminate these liabilities. In fact, closing the plan would increase the unfunded liability by approximately $15.5 billion due to lower expected investment earnings on the plan assets, as any decrease in investment earnings would have to be offset with higher contributions.

Just as individuals are advised to change their asset allocation as they near retirement, so too would the plan if it were closed and had to wind down. If the State closed the plan, then over time, the monthly cash flow needs to pay retiree benefits would increase. This would force TRS to invest the plan assets in a more liquid asset allocation with shorter-term investments and anticipated lower returns. The expected lower investment returns would bring the outstanding liabilities to $74.2 billion in total.

Given that these liabilities remain, the State would have to determine how to finance the $74.2 billion over an appropriate period of time, while at the same time, ensuring a sufficient retirement contribution for new members into a 401(k)-style plan. The State would have options when determining how to finance the costs associated with closing the current plan and establishing and funding a new plan. These options could include a combination of direct payment schedules, lump sums, and/or percentage of payroll contributions.

4

A contribution rate increase of 1.82 percent beginning in fiscal year 2020 will lower the funding period to 30 years.

While the plan currently does not have a depletion date and there is an expectation of paying off the unfunded liability in 87 years, this is the optimal time to get the plan's funding goals back on track. Small improvements now will have a big impact over time. The longer the unfunded liability takes to pay off, the more expensive addressing the problem becomes.

In 2013, the legislature increased State and member contributions, provided a new revenue source from non-Social Security school districts, and adjusted benefits. Together, these actions greatly improved the funding status of the plan. In the subsequent years, however, TRS has had to adjust its mortality assumptions to reflect retirees living significantly longer and most recently adjusted the return assumption to expect lower future returns based on financial modeling and recommendations from the plan's investment advisors and actuary. Moreover, since 2008, the plan has accumulated almost $8 billion in unpaid interest because the revenue available to pay down the unfunded liability has been insufficient to annually pay both the principal and the full interest. This is called negative amortization and is analogous to taking out a loan and then not only failing to make any payment toward the principal but also failing to pay the full amount of interest due on the bill.

While the pension fund does not owe a creditor interest in the traditional sense, the plan finances benefits by investing funds that earn the assumed rate of return. An unfunded liability represents funds that are not on hand to be invested. So, sound actuarial practice necessitates that the unfunded liability be charged interest at the assumed rate of return to keep the plan's funding goals on track. For TRS, the interest charge is the 7.25 percent assumed rate of return, and the longer the unfunded liability is allowed to persist, the more it will cost to ultimately pay off. In fact, if all current plan assumptions are met and the plan takes 87 years to pay off the unfunded liability, it will end up costing over $800 billion in interest charges to pay off what is currently an unfunded liability of $46.2 billion. This means that the $800 billion will be used over the next 87 years to pay for benefits known today that are not currently funded. If the unfunded liability were paid off sooner, then the $800 billion could, instead, be used to pay for retiree cost-of-living increases or create a cushion for when the plan encounters adverse experience such as low investment returns.

To get the fund back on a path to full funding and begin to address negative amortization, TRS requested a permanent contribution rate increase of 1.82 percent in its Legislative Appropriations Request. This would require an All Funds increase of $843 million in fiscal year 2020 and $868 million in fiscal year 2021 for a total increase of $1.7 billion for the biennium. While TRS did not address who should pay for the contribution increase, possible revenue sources include the State, employers, active members, or any combination of these.

FIGURE 1.3: 1.82% INCREASE STARTING IN 2020

Fiscal Year	Contribution Rate	Funding Period	Funding (in millions)
2020	17.23%	30	$843**
2021	17.23%	29	$868**
2022	17.23%	28	$894
2023	17.23%	27	$921
2024	17.23%	26	$949
2025	17.23%	25	$977

*Funding period in years from beginning of given fiscal year.
**Amounts in Legislative Appropriations Request are $29 million lower due to timing of request.

SOURCE: GRS

5

A phased-in contribution rate increase of 2 percent beginning in fiscal year 2021 will lower the funding period to 31 years.

Rather than providing an immediate contribution increase, an alternative would be to phase in a contribution increase over a period of years. For example, a 2 percent increase phased in over four fiscal years beginning in fiscal year 2021 would lower the funding period to 31 years. This would require an All Funds increase of $238 million in the second year of the 2020-21 biennium.

FIGURE 1.4: 2% INCREASE STARTING IN 2021
(0.5% INCREASE PER YEAR)

Fiscal Year	Contribution Rate	Funding Period	Funding (in millions)
2020	15.41%	31	-
2021	15.91%	30	$238
2022	16.41%	29	$491
2023	16.91%	28	$759
2024	17.41%	27	$1,042
2025	17.41%	26	$1,074

*Funding period in years from beginning of given fiscal year.

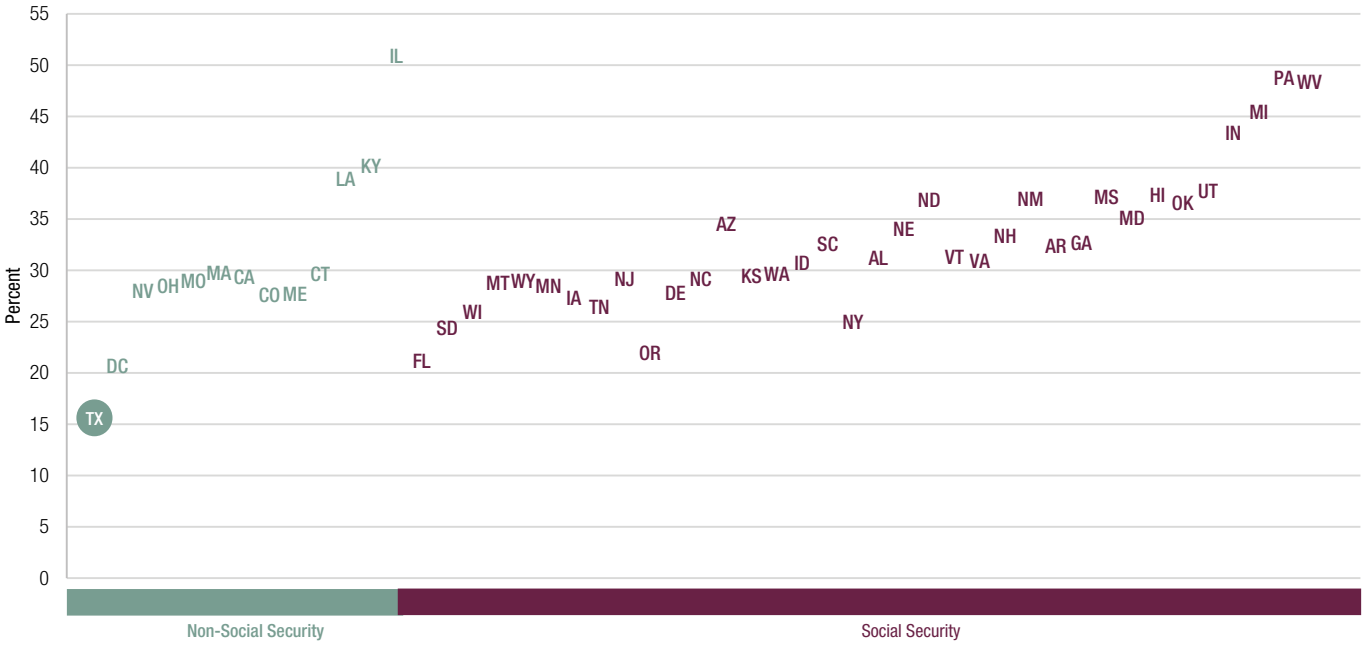
SOURCE: GRS

6

Combined employee and employer contribution rates for TRS are the lowest in the nation among teacher plans.

Compared to other plans, TRS offers a modest benefit that does not contain an automatic cost-of-living adjustment. The combination of three elements have contributed to low TRS contribution rates: a modest plan design, consistent investment returns, and the State not taking any funding holidays. While the plan has not always received all of the required actuarial funding, the State has always contributed at least the constitutional 6 percent minimum contribution, which stands in contrast to other states that have taken funding holidays.

FIGURE 1.5: TEACHER PLANS – COMBINED EMPLOYEE & EMPLOYER CONTRIBUTION RATES (PENSION & SOCIAL SECURITY)*



*Data reflects available contribution rates for statewide teacher pension plans. Rates shown reflect actual contributions paid by employees and employers as a percentage of the plan's payroll base, as reported in system annual financial reports. Some plans have multiple rates for different benefits tiers; in those cases, rates reflect weighted average rates as calculated by NASRA.

SOURCE: NASRA, 2017

7

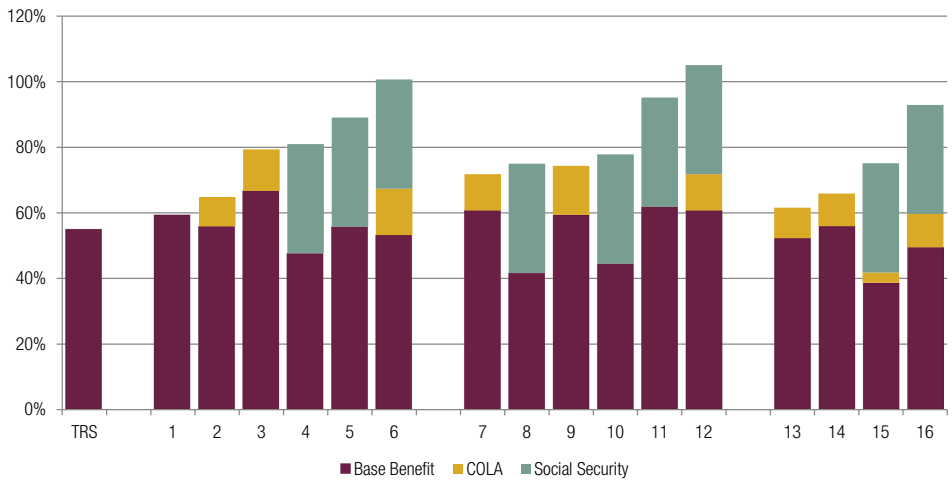
The value of the retirement benefit available to TRS members is 30 percent less than the average benefits available to members of peer systems.

TRS examined the value of its members' benefits relative to the benefits provided by a variety of peer systems, including large plans in Texas and other large or regional statewide public employee and teacher systems. A prototypical TRS career employee, one who retires at age 62 with 32 years of service credit, receives a benefit that equates to 69 percent of preretirement income when the employee initially retires. This is very comparable to the peer group when only looking at replacement income at retirement from the plan sponsor's retirement plan as the average peer replaces 68 percent for the same member. However, members in nine of the sixteen peer systems also participate in Social Security and ten have cost-of-living increases as a provision in the system itself. Throughout the TRS retiree's expected lifetime, the TRS benefit only effectively replaces 55 percent due to a loss of purchasing power. Including cost-of-living adjustments (COLA) and the impact from Social Security, the average value of benefit available to the same prototypical employee of the peer plans examined during their retirement years was 79 percent. Note, the percentage for the peer systems is lower than the 82 percent reported in the 2012 TRS Pension Benefit Design Study due to a number of plans implementing cost-saving measures in the past six years.

The modesty of TRS' benefit is due, primarily, to the lack of an automatic cost-of-living increase. Members of the peer plans examined received some type of purchasing power protection either through automatic COLAs or because the members participate in both a retirement plan and Social Security.

TRS is the only system in the comparison that does not have either a built-in COLA or Social Security, or the ability to elect an indexed payment option.

FIGURE 1.6: RELATIVE BENEFIT INDEX



SOURCE: GRS

8

Active members have borne approximately 70 percent of plan changes since 2005.

There have been several adjustments to the plan since the 2005 legislative session, including benefit changes and contribution increases. The value from these changes has been a total concession of approximately $45 billion as of 2018, made up of $17 billion in lower projected liabilities and $28 billion in additional projected future contributions. However, the distribution of concessions varies widely across the various stakeholders. Figure 1.7 illustrates the distribution of these changes by stakeholder group.

FIGURE 1.7: PRESENT VALUE OF PREVIOUS CONCESSIONS (IN BILLIONS)

Group	Benefit Changes	Additional Contributions	Total Concession	Portion of Concessions
Retirees	$ (0.4)	$ 0.0	$ (0.4)	(1%)
Grandfathered Actives	-	0.1	0.1	0%
Vested as of 2014 Actives	4.1	2.6	6.6	15%
Nonvested as of 2014 Actives and Future Hires	13.3	11.0	24.3	54%
State	-	4.2	4.2	9%
Local Employers	-	10.5	10.5	23%
Total	$ 16.9	$ 28.4	$ 45.3	100%

SOURCE: GRS

Nonvested Actives and Future Hires have borne the largest portion of the previous changes, with more than 50 percent of the total net change. Active employees in general have borne approximately 70 percent of the net reduction in value from all previous changes. Local Employers have taken 23 percent of the net concession, while the State follows at 9 percent.

The retiree group has a net opposite impact as there was a COLA and a supplemental payment during this time. Otherwise, benefits have not been reduced for these members and most of them retired before higher member contribution rates went into effect. While pension benefits have not been reduced for retirees, they have not received a COLA from the pension plan since 2013 and recent health care premiums and out-of-pocket expenses for retirees in TRS-Care have increased substantially.

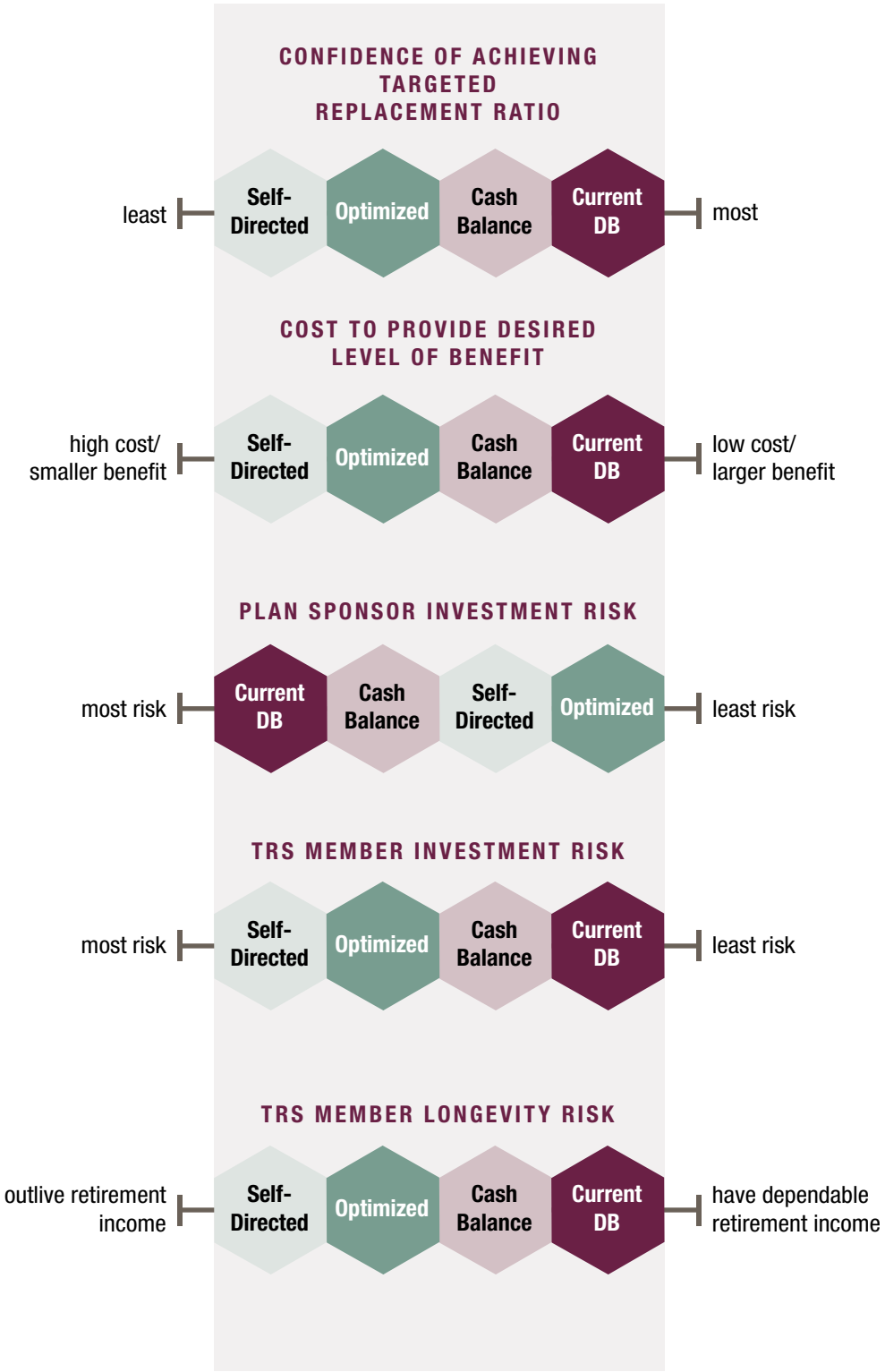
9

All plan structures carry differing levels of risk. When examining important aspects of pension plan design, the current defined benefit plan places more risk with the State and generally offers more favorable outcomes for TRS members.

When examining important aspects of pension plan design, the current defined benefit plan generally provides more favorable outcomes for TRS members. These plan design metrics include replacement income, efficiency, investment and longevity risks, workforce management, portability, fees, access to asset classes, insulation from poor behavioral tendencies, and Social Security.

Figure 1.8 provides a brief summary of each of the modeled plan designs in the context of the various considerations in plan design. The four plans (Current Defined Benefit, Cash Balance, Optimized Defined Contribution, and Self-Directed Defined Contribution) are placed on a scale relative to the plan consideration. Placement on the scale represents order only, not magnitude.

FIGURE 1.8: ALL PLANS COMPARED TO CONSIDERATIONS IN PLAN DESIGN



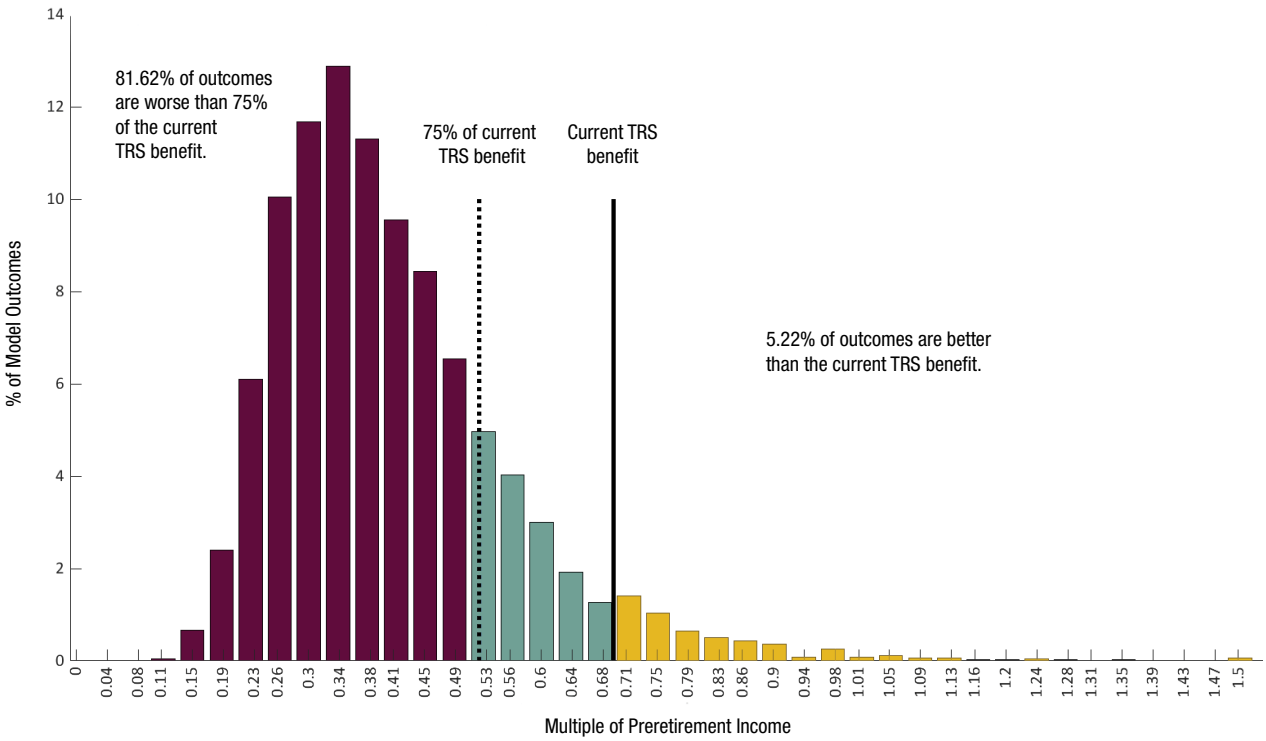
SOURCE: TRS

10

The majority of TRS members will do significantly worse investing on their own in a plan with a defined contribution component.

In a plan with a self-directed defined contribution component, TRS members would make their own investment decisions. The resulting difference between individual returns would likely be very wide. TRS modeling has shown that under a defined contribution plan, 94.7 percent of retirees will ultimately receive less than the current defined benefit. As illustrated below, modeling showed that more than four-fifths of the members would receive no more than 75 percent of the current benefit. Only a handful — about 5.2 percent — of the members would receive more than the current defined benefit. The estimated underperformance is attributable to lower investment returns from a shorter investment period, access to fewer asset classes, less-disciplined investment approaches that lead to poor behavior tendencies, and potentially higher fees.

FIGURE 1.9: INDIVIDUAL SELF-DIRECTED RETIREMENT INCOME COMPARED TO TRS BENEFIT



SOURCE: TRS

PURPOSE AND OVERVIEW

PURPOSE AND OVERVIEW

The purpose of this study is to provide information on the respective values of the current defined benefit plan, a cash balance plan, and different types of defined contribution plans to decision makers with oversight of the Teacher Retirement System of Texas (TRS) and stakeholders who contribute to or receive benefits from the plan.

The study provides information on a number of topics, including a review of pension plan concepts and terminology, a profile of the TRS plan, recent activity impacting the fund, considerations in plan design, as well as an analysis of different types of retirement plans compared to the current defined benefit plan and potential costs relating to implementation of a new plan structure. The report is structured to provide general information on a given topic followed by in-depth analysis as it relates specifically to TRS. The study was prepared by TRS, in coordination with TRS' pension actuary, Gabriel, Roeder, Smith and Company (GRS).

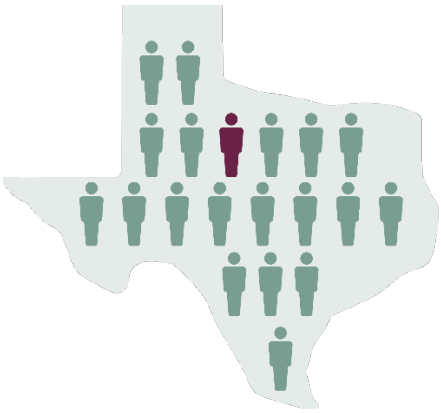
Background

TRS was established in 1936 by a Texas Constitutional Amendment and since then has grown from 38,000 members to more than 1.5 million members today.[1] TRS is the seventh largest pension fund in the nation[2], with a pension trust fund balance of approximately $147 billion.[3] The system is governed by a nine-member board of trustees appointed by the governor.

FIGURE 2.1: CURRENT MEMBERSHIP

SOURCE: TRS

TRS has three core business functions – Pension Benefit Services (Benefit Services), Health and Insurance Benefits (HIB), and Investment Management. Benefit Services assists members and retirees and their beneficiaries by providing accurate and timely processing of benefits and delivering comprehensive information to help participants make important decisions about their TRS annuity. Benefit Services also coordinates and administers online resources for reporting entities to submit reports and to find information on topics such as eligibility, compensation, and legislative updates. HIB works with outside contracted vendors to administer the health care plans offered under TRS-Care and TRS-ActiveCare. HIB processes health care plan selections by members and retirees and disseminates important information about TRS-Care and TRS-ActiveCare to members. HIB also supports the Long Term Care Insurance program for active members and retirees. Finally, the Investment Management Division prudently invests the assets of the pension trust fund in a highly diversified portfolio with the goal of achieving the assumed rate of return. Investments are made based on the asset allocation and within the risk parameters established by the board.

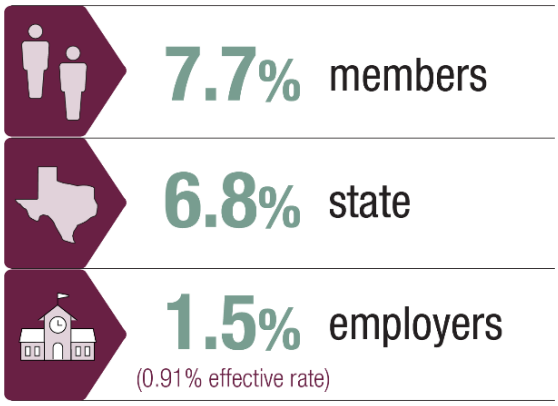


One out of twenty Texans relies on TRS for retirement, disability and survivor benefits.

Plan Features

The TRS retirement plan is a defined benefit plan providing service retirement, disability retirement, and active member death benefits. As a defined benefit plan, the amount of retirement benefits paid is determined by a formula established by law. The formula to calculate a normal-age monthly standard annuity includes three factors — years of service, final average salary, and a multiplier of 2.3 percent. Cost-of-living-adjustments are not automatic and may only be authorized by the legislature when the fund is actuarially sound. TRS members, the State, and certain employers prefund the retirement plan by contributing a

FIGURE 2.2: CONTRIBUTIONS



SOURCE: TRS

combined 15.41 percent of payroll to the pension plan, consisting of 7.7 percent from active members, 6.8 percent from the State, and 1.5 percent from employers. Approximately 60 percent of covered payroll is eligible for the 1.5 percent employer contribution resulting in an effective rate of 0.91 percent.[4] The State's general revenue contribution to the pension fund in the 2018-19 biennium was less than 4 percent per year of the State's general revenue budget.

Active Members

Profile

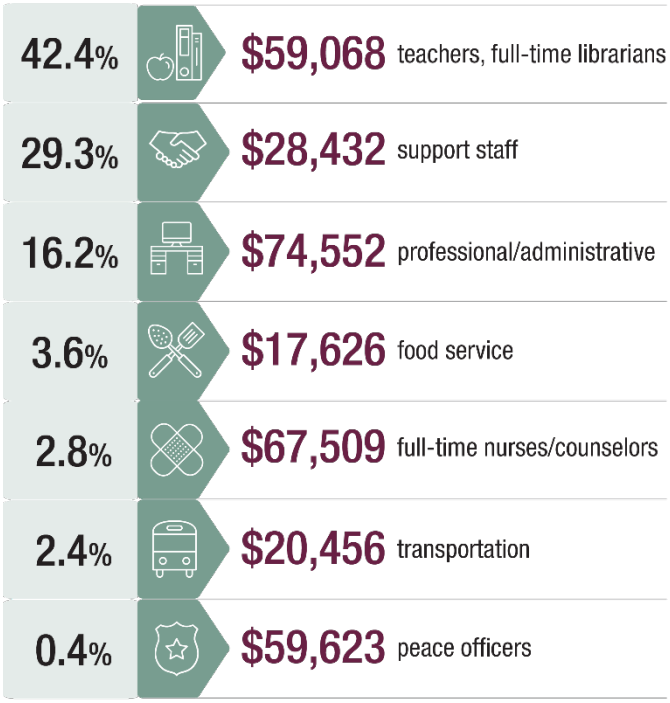
Active contributing members are employed by over 1,300 public and higher education institutions throughout the state. Employers include school districts, charter schools, community and junior colleges, senior colleges and universities, regional service centers, medical schools, other education districts, and one state agency.

FIGURE 2.3: EMPLOYERS

SOURCE: TRS

These members hold various positions, including teachers, full-time librarians, support staff, administrative professionals, nutrition services staff, nurses, counselors, bus drivers, and peace officers. Figure 2.4 shows the percent of members in each position, as well as the average salary by position.

FIGURE 2.4: AVERAGE SALARY BY POSITION



* Percents do not sum to 100 because 3% of members hold multiple positions.

SOURCE: TRS as of August 2018

Financial Preparedness

TRS conducted a Member Satisfaction Survey in 2016 that included, for the first time, a series of questions for active members related to financial preparedness. See Appendix B for results. The survey found that almost 44 percent of survey respondents indicated they were not saving for retirement outside of their TRS pension plan. Of the 56 percent of survey respondents who indicated they were saving outside of their TRS pension, the most popular private savings vehicles were IRAs (40 percent) and 403(b) accounts (40 percent). Over 60 percent of survey respondents indicated that the main reason why they were

not saving for retirement is not having enough money after expenses are paid.

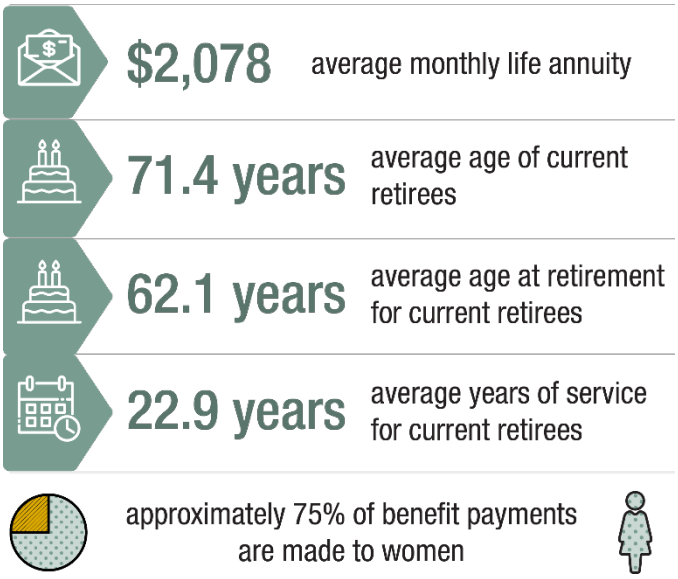
Regarding income in retirement, approximately 64 percent of respondents have not estimated how much income they will need. When asked why they have not estimated how much income they will need, respondents indicated that they do not know how to estimate how much they will need (43 percent) and retirement seems too far away to think about (35 percent).

Less than 50 percent of respondents felt very knowledgeable (11 percent) or knowledgeable (31 percent) about ways to save for retirement outside of their TRS pension plan. Finally, almost 65 percent of respondents indicated that they gathered information on ways to save for retirement outside of their TRS pension plan from financial planners (32 percent) and friends/family (32 percent).

Retirement Recipients

Profile

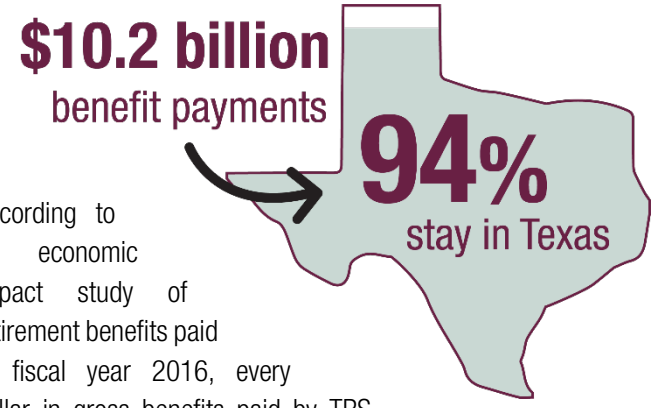
In 2018, there were over 420,000 individuals receiving service, disability and survivor benefits.



SOURCE: TRS

Economic Impact

TRS benefit payments provide a notable economic stimulus to communities throughout the state. In fiscal year 2018, TRS paid pension benefit payments totaling over $10 billion to approximately 420,000 retirees and their beneficiaries.[5] These benefits were funded from a combination of cumulative investment income, member contributions, and State and employer contributions. Over 94 percent of benefit payments go to retirees and their beneficiaries who live and spend these dollars in Texas.

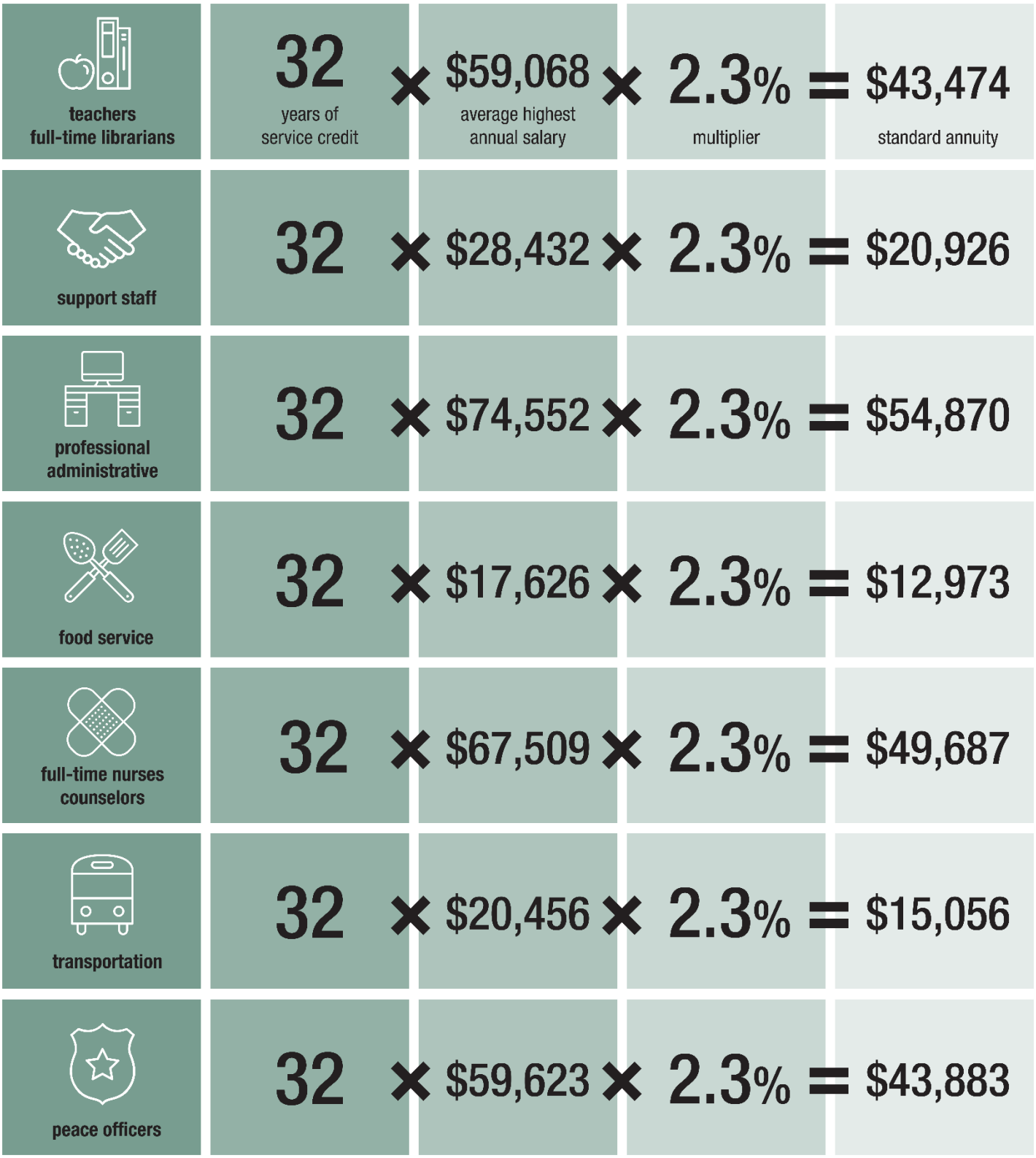


According to an economic impact study of retirement benefits paid in fiscal year 2016, every dollar in gross benefits paid by TRS generates an estimated $2.34 in aggregate spending.[6] The estimated increase in business activity generated annually by the statewide spending associated with benefit payments was found to be more than $9.9 billion in gross product and over 131,000 permanent jobs. Furthermore, economic activity stemming from annuity payments generates over $975 million in state tax receipts and $368 million to local government entities.

Standard Annuity by Position

The average annual lifetime annuity for TRS members in 2017 was $24,936.[7] While an overall average benefit amount is informative, it is more beneficial to examine the average benefit amount by position. To put the average standard benefit into perspective, TRS calculated the average annuity for a career employee retiring in 2018 in different job positions using the retirement benefit formula. For example, a teacher with 32 years of service credit and a final average salary of just over $59,000 would earn a standard benefit of around $43,000 before taxes. Figure 2.5 shows the annual annuity amount for this and other positions.

FIGURE 2.5: AVERAGE STANDARD ANNUITY BY POSITION

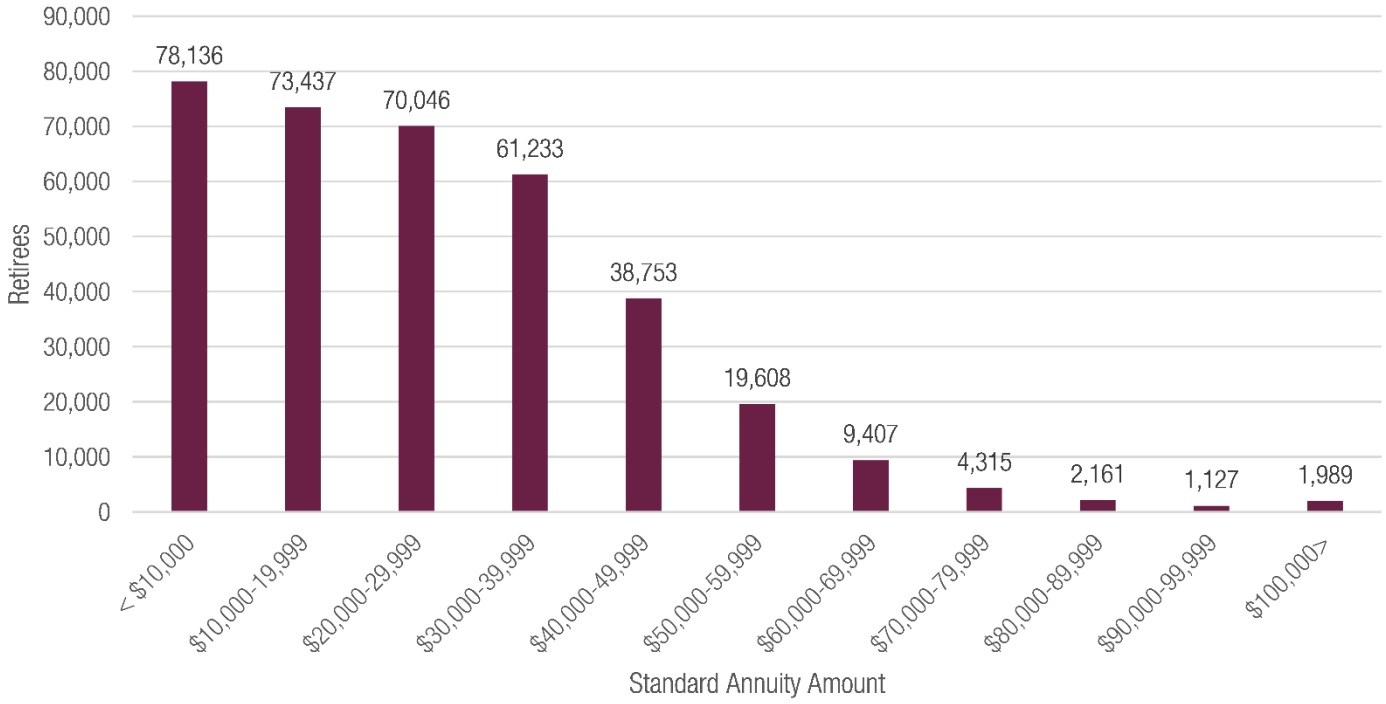


SOURCE: TRS as of August 2018

Distribution of Benefits

Figure 2.6 shows the number of retirees receiving a standard annuity by dollar amount. Approximately 40 percent of retirees receive a standard annuity less than $20,000.

FIGURE 2.6: DISTRIBUTION OF BENEFITS



SOURCE: TRS as of October 2018

Other Considerations

When an active member retires, they have the option of enrolling in TRS-Care, the health care program for retirees. TRS-Care premiums are determined by whether or not a TRS retiree is eligible for Medicare. To be eligible for Medicare, a retiree must be age 65. Figure 2.7 shows the annual premium amounts for most retirees by plan type. Premium amounts are deducted from retirees' monthly annuity benefits.

FIGURE 2.7: 2018 TRS-CARE ANNUAL PREMIUMS

	Medicare	Non-Medicare
Retiree Only	$ 1,620	$ 2,400
Retiree + Spouse	$ 6,348	$ 8,268
Retiree + Child(ren)	$ 5,616	$ 4,896
Retiree + Family	$ 12,240	$ 11,988

SOURCE: TRS

As a point of reference, the 2018 Federal Poverty Guidelines, commonly referred to as the Federal Poverty Level (FPL), are used to determine eligibility for government assistance programs. Frequently, these programs limit a participant's income to a certain percentage of the FPL. Figure 2.8 shows varying FPLs for households with one or two individuals.

FIGURE 2.8: FEDERAL POVERTY LEVELS

Persons in Household	100%	150%	200%	250%
1	$12,140	$18,210	$24,280	$30,350
2	$16,460	$24,690	$32,920	$41,150

SOURCE: U.S. Department of Health & Human Services

PENSION 101

PENSION 101

To understand pension plan design, one must first have a basic understanding of a few key concepts and common terminology. This section will cover the retirement funding equation, the assumptions that underlie the funding equation, the purpose of actuarial valuations, the importance of experience studies, the key financial indicators used to assess the health of any pension fund, the impact of negative amortization, and the role funding policies can play when assumptions change.

Retirement Funding Equation

The retirement funding equation consists of three elements — C + I = B, where C represents contributions from all sources, I represents investment returns, and B represents benefits paid out. For the funding equation to stay in balance, inflows (contributions and investments) must meet or exceed outflows (benefits).

Assumptions

On the inflow side of the equation, the C includes assumptions related to contribution rates and overall payroll growth, while the I includes assumptions related to inflation and the rate of return on investments net of any investment-related fees. On the other side of the equation, the B includes assumptions related to individual wage growth, termination and retirement rates, and mortality rates. This equation also typically includes an E for expenses. For TRS, the administrative expense load is very low and the investment expenses are netted against the investment earnings.

Underlying each element of the funding equation are several individual assumptions. Generally, assumptions fall into two categories — economic and demographic. Economic assumptions include payroll growth, rate of return on investments, wage growth, and inflation. The inflation assumption is a factor in all of the economic assumptions. Demographic assumptions include termination and retirement, as well as mortality rates.

Each assumption carries a certain degree of risk in that future costs might be larger than expected if future experience deviates from the assumption, with some assumptions carrying more risk than others. The three assumptions that can cause the most change in a fund's financial health are mortality, payroll growth, and the rate of return on investments.

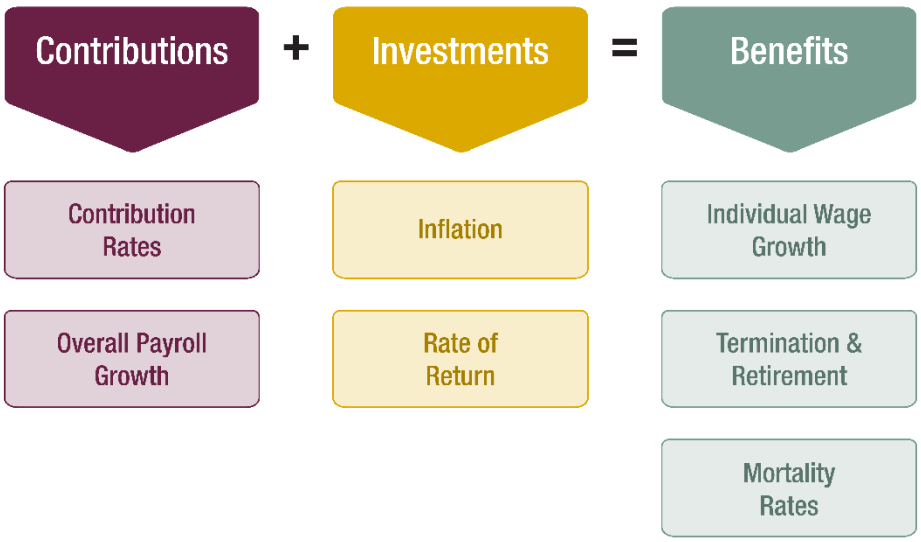
For example, the investment return assumption is used to predict what percentage of future benefit payments will be covered by investment returns and what percentage will be covered by

C + I = B

contributions. When the amount of earnings (I) is assumed to be less in the future, it has the impact of increasing the amount of contributions (C) that are needed to finance the benefit package (B).

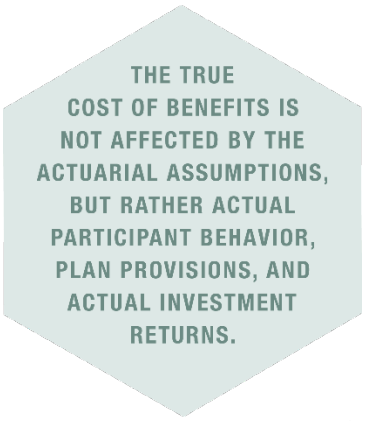
These assumptions are collectively referred to as an assumption set. An assumption set is typically not expected to be suitable

FIGURE 3.1: ASSUMPTIONS



SOURCE: TRS

forever. Accordingly, assumptions should be reviewed and updated regularly as part of an experience study. The use of outdated or inappropriate assumptions can lead to costs that are either understated or overstated. Understated costs can lead to higher future contribution requirements; whereas, overstated costs can place an unnecessarily large burden on the current generation of members, employers, and taxpayers.



Actual funding needs may vary if experience varies from assumptions, but the C + I = B equation and the assumption set provide vital information regarding the expected revenues and liabilities of the fund. It should be pointed out, however, that the true cost of benefits is not affected by the actuarial assumptions, but rather actual participant behavior, plan provisions, and actual investment returns.

Actuarial Valuations

Actuarial valuations assess the current financial health of a pension system and the appropriateness of the funding (or contribution) policy. The valuation process is heavily dependent upon the actuarial assumptions used to project future liabilities and investment earnings.

Experience Study

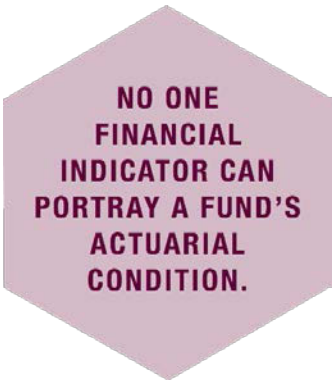
An experience study is a review of assumptions and methods. The purpose of an experience study is to determine if actual behavior, plan provisions, and investment returns have matched assumptions, or if adjustments are necessary. The study also examines whether certain assumptions match anticipated future experience and observable economic data. Both the actuary and retirement system boards have certain fiduciary responsibilities related to adoption of the assumption set.

In conducting an experience study, the actuary follows a prudent process to fulfill fiduciary duties and meet Actuarial Standards of Practice. This includes providing actual experience for each assumption and analyzing how fund experience compares to current assumptions. The actuary estimates possible future economic outcomes based on reasonable economic assumptions and relevant historical and current economic data. Then, they make recommendations regarding the most appropriate assumptions for the plan.

Retirement system boards also follow a prudent process to fulfill their fiduciary duties by considering the actuary's analysis and recommendations. Boards are responsible for considering practices used by similarly situated peers as a reference point, as well as considering how a change to an assumption would affect all members, both current and future. Based on this information, boards select the most reasonable assumptions and level of risk.

Financial Indicators

Key financial indicators used to describe the state of any pension fund include, the funded ratio, funding period, Unfunded Actuarial Accrued Liability (UAAL), and the Actuarially Determined Contribution (ADC). No one financial indicator can portray a fund's actuarial condition; rather, these indicators are used to show trends and develop future expectations about the health of a fund.



The funded ratio is the ratio of actuarial assets to actuarial accrued liabilities. The funding period is the number of years in the future that will be required to fund (i.e. pay off) the UAAL which is the portion of the actuarial accrued liability that exceeds the value of current actuarial assets. Finally, the ADC, previously described as the Annual Required Contribution (ARC), is the Actuarially Determined Contribution (ADC) from employers to keep the fund on a path toward full funding. The ADC may also be referred to as the Actuarially Determined Employer Contribution (ADEC) in some sources.

Normal Cost

The normal cost is the annual accrual cost of providing retirement benefits for service performed in the current year. Contributions in excess of the normal cost are used to reduce the UAAL.

Negative Amortization

Negative amortization occurs when contributions to the pension trust fund do not cover the interest accruing on the UAAL.

Funding Policy

A funding policy is a systematic set of procedures used to make contribution and benefit decisions in a specific year and a series of years. Funding policies provide guidance on when contribution streams should be changed. Most retirement systems have mechanisms in place to automatically make changes when necessary. For example, automatically increasing contributions (C) in situations where investment returns are expected to decrease (I) in order to protect the funded status of the plan and ultimately the benefits (B).

FUNDING POLICIES PROVIDE GUIDANCE ON WHEN CONTRIBUTION STREAMS SHOULD BE CHANGED.

TRS PLAN PROFILE

TRS PLAN PROFILE

To place the study findings in context, it is useful to review, TRS' plan design, including how TRS compares to other defined benefit plans in terms of the retirement funding equation — C + I = B.

The TRS pension plan operates as a defined benefit plan. Under the plan, a portion of the employee's income is contributed to the plan by the State and the member as a type of deferred compensation to prefund retirement benefits. This contribution goes into a pension trust fund that TRS then invests to generate a return.

22 YEARS

AVERAGE AMOUNT OF TIME TRS HAS TO INVEST CONTRIBUTIONS BEFORE A BENEFIT PAYMENT BECOMES DUE.

The time horizon over which TRS invests the contributions is very long. In fact, the average amount of time that TRS has to invest contributions before a benefit payment becomes due is 22 years. Upon retirement, the employee receives the deferred compensation through a retirement benefit based on a formula established by law. The formula includes factors such as how much TRS service credit the employee has earned, an average of the employee's highest years of salary, and a multiplier of 2.3 percent.

Contributions

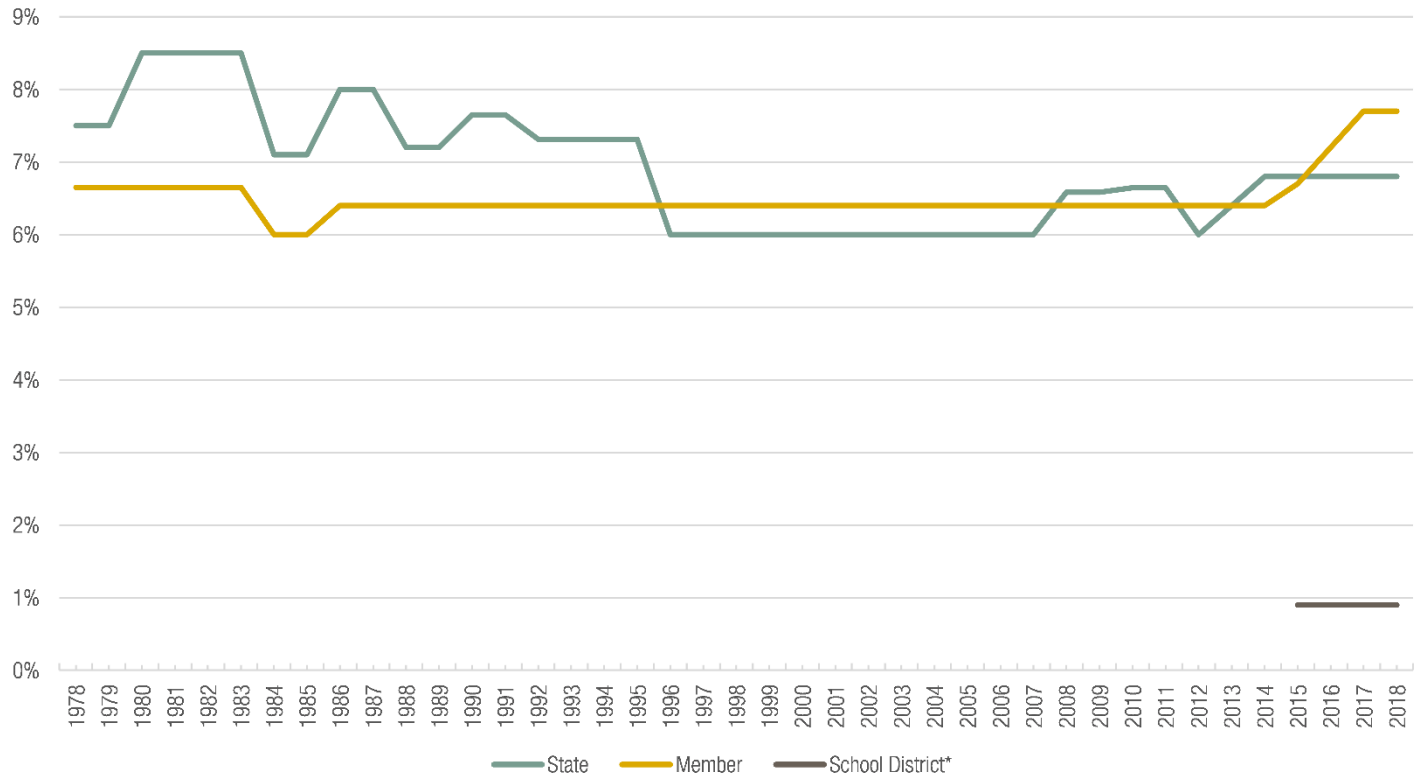
The Texas Constitution establishes a system of retirement for public and higher education employees. While the Constitution does not require that the system be a defined benefit plan, it does set parameters for the system, including a minimum contribution requirement for both the State and members. The Constitution provides that the State must contribute at least 6 percent, but no more than 10 percent, of aggregate payroll of the system and that members must contribute at least 6 percent of their income to the plan. Based on these constitutional bounds, State and member contribution rates are established in statute by the legislature.

Beginning in fiscal year 2015, local employers whose employees were not participating in Social Security and whose positions were subject to the state statutory minimum salary schedule began contributing 1.50 percent of pay. Approximately 60 percent of covered payroll is eligible for the 1.5 percent employer contribution. As a result, the effective rate for the employer contribution is 0.91 percent.

Currently, the State's rate is 6.8 percent and the local employer's rate is 0.91 percent for a combined rate of 7.7 percent and the member rate is 7.7 percent.

Contribution rates have varied since the plan's inception. The following graph shows historical contributions for the past 40 years.

FIGURE 4.1: CONTRIBUTION RATES 1978-2018



SOURCE: TRS

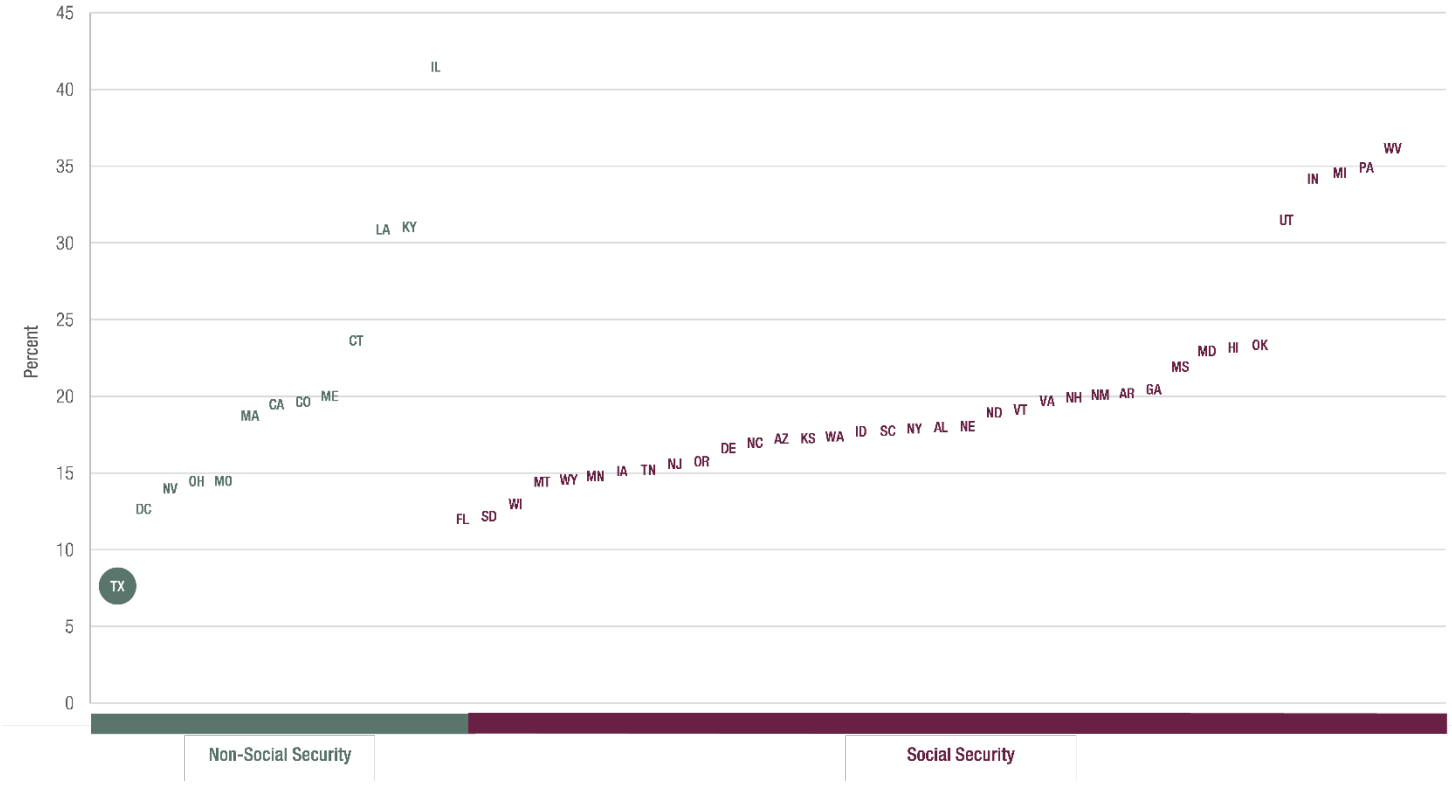
Two significant periods were 1980-95, during which the State's contribution ranged from 7.1 percent to 8.5 percent and 1996-2007, during which the State contributed the constitutional minimum of 6 percent.

While the State and members have always contributed to TRS and have not taken a "funding holiday," the actuarially determined contribution necessary to be actuarially sound per statute has not always been paid. This would be the amount of contributions necessary to be able to pay for the accrual of new benefits plus amortize the UAAL in less than 31 years.

Combined employee and employer contribution rates for TRS are the lowest in the nation among teacher plans. Compared to other plans, TRS offers a modest benefit that does not contain an automatic cost-of-living adjustment (COLA). The combination of three elements have contributed to low TRS contribution rates: a modest plan design, consistent investment returns, and the State not taking any funding holidays. While the plan has not always received all of the required actuarial funding, the State has always contributed at least the constitutional 6 percent minimum contribution, which stands in contrast to other states that have taken funding holidays.

Figures 4.2 and 4.3 show the employer and employee contribution rates for TRS compared to the contribution rates of teacher plans in other states. Figure 4.4 shows the combined contribution rate for TRS compared to other teacher plans. For plans participating in Social Security, contribution amounts include the corresponding Social Security contribution (6.2 percent member and 6.2 percent employer). Figure 4.5 shows the contribution rates for the top ten pension funds in the United States.

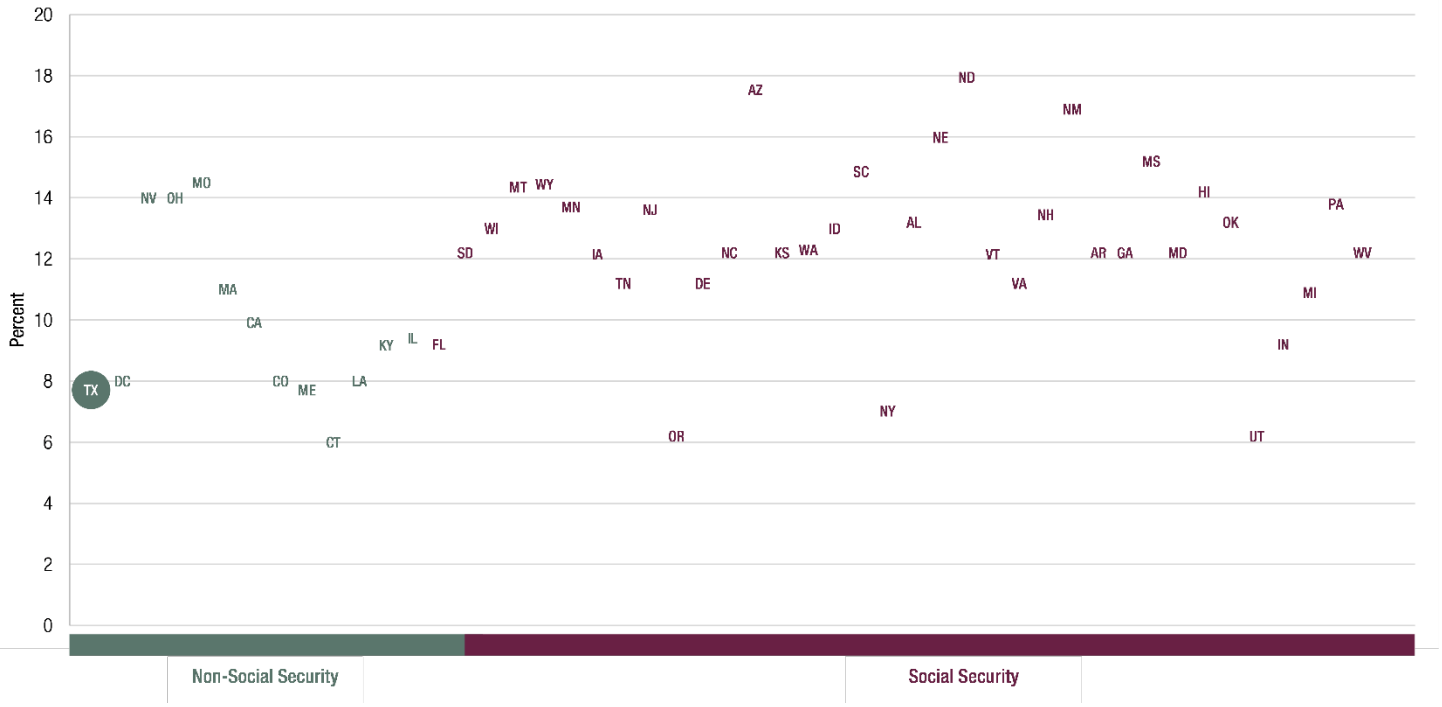
FIGURE 4.2: TEACHER PLANS – EMPLOYER CONTRIBUTION RATES (PENSION AND SOCIAL SECURITY)



*Data reflects available contribution rates for statewide teacher pension plans. Rates shown reflect actual contributions paid by employers as a percentage of the plan's payroll base, as reported in system annual financial reports. Some plans have multiple rates for different benefits tiers; in those cases, rates reflect weighted average rates as calculated by NASRA.

SOURCE: NASRA, 2017

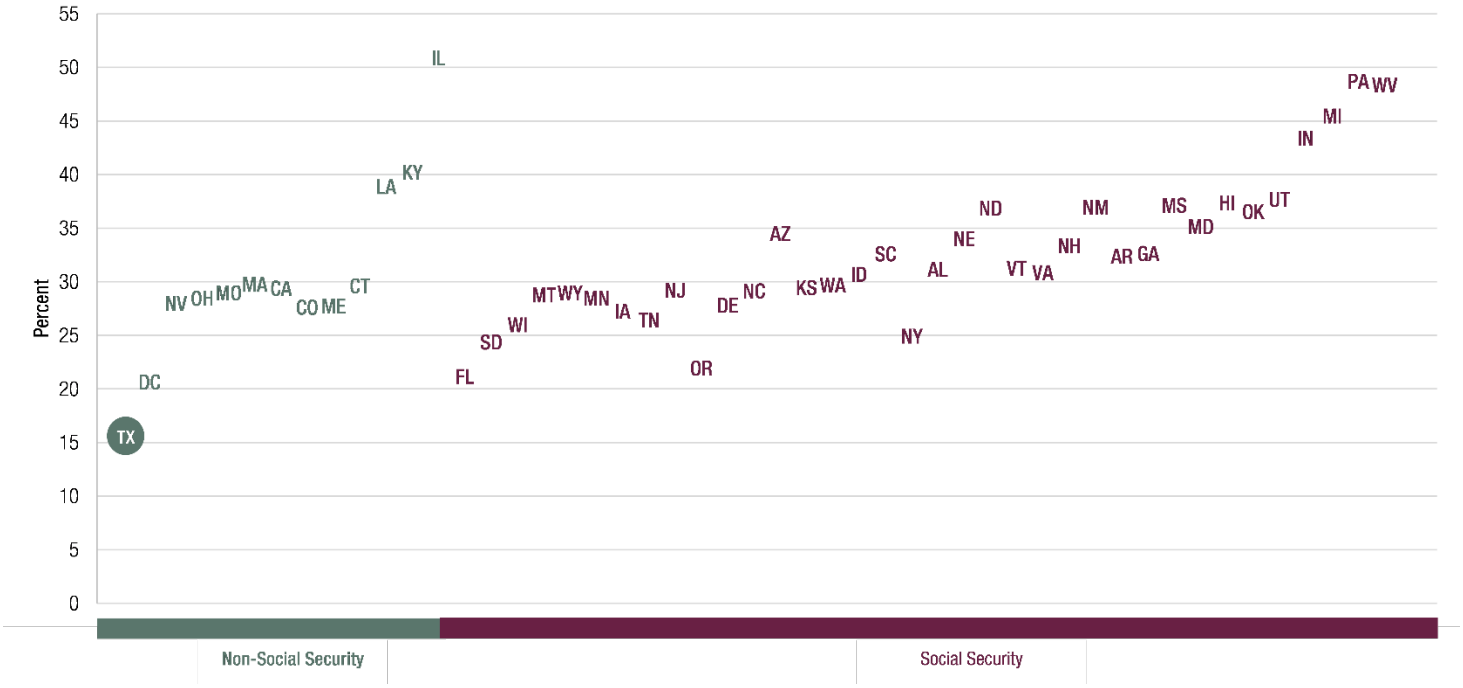
FIGURE 4.3: TEACHER PLANS – EMPLOYEE CONTRIBUTION RATES (PENSION AND SOCIAL SECURITY)*



*Data reflects available contribution rates for statewide teacher pension plans. Rates shown reflect actual contributions paid by employers as a percentage of the plan's payroll base, as reported in system annual financial reports. Some plans have multiple rates for different benefits tiers; in those cases, rates reflect weighted average rates as calculated by NASRA.

SOURCE: NASRA, 2017

FIGURE 4.4: TEACHER PLANS – COMBINED EMPLOYEE & EMPLOYER CONTRIBUTION RATES (PENSION AND SOCIAL SECURITY)*



*Data reflects available contribution rates for statewide teacher pension plans. Rates shown reflect actual contributions paid by employers as a percentage of the plan's payroll base, as reported in system annual financial reports. Some plans have multiple rates for different benefits tiers; in those cases, rates reflect weighted average rates as calculated by NASRA.

SOURCE: NASRA, 2017

FIGURE 4.5: CONTRIBUTION RATES IN TOP 10 U.S. PUBLIC PENSION FUNDS (BY ASSETS)

System	Employee Contribution	Employer Contribution	Social Security	Total	Social Security
New York State and Local Retirement Systems	0-6.0% depending on date of hire	16.96%	12.4%	35.36%	Yes
New York State Teachers' Retirement System	0-6.0% depending on date of hire	11.72%	12.4%	30.12%	Yes
New Jersey Division of Pensions and Benefits	7.42%	9.41% (teachers); 11.85% (PERS)	12.4%	29.23%	Yes
Wisconsin Department of Employee Trust Funds	6.8%	6.8%	12.4%	26.00%	Yes
Florida Retirement System	3.0%	5.8%	12.4%	21.20%	Yes
California Public Employees' Retirement System	8.0% (state); 7.0% (non-certified school)	20.0%	12.4%	39.40%	Mixed
California State Teachers' Retirement System	9.92%	19.49%	-	29.41%	No
State Teachers' Retirement System of Ohio	14.0%	14.48%	-	28.48%	No
Ohio Public Employees' Retirement System	10.0%	13.0%	-	23.00%	No
Teacher Retirement System of Texas	7.7%	7.7%	-	15.40%	No

SOURCE: NASRA, 2017 (does not include Public Safety employees)

Funding Policy

As previously mentioned, this study is designed to share information with the legislature and stakeholders on both the TRS pension plan and also the pension industry in general. Therefore, in discussing contributions to the TRS plan, it is useful to examine not only plan funding compared to peers but also contributions and funding compared to industry best practices, including addressing funding policies and negative amortization which have recently come to the forefront of the actuarial community.

Most retirement systems have a funding policy in place to automatically increase contributions (C) when the funding policy determines the current contribution levels are inadequate. Some have specific formulas that determine the contribution amount with each valuation, while others have set contribution rates that automatically change when certain goals are not being met. TRS, and more specifically its plan sponsor, do not have a funding policy as contributions are established statutorily by the legislature.

A funding policy could include the elements shown in Figure 4.6.

FIGURE 4.6: POSSIBLE ELEMENTS OF A FUNDING POLICY

Category	Example
Funding Objective	100% funded ratio
Amortization Objective	Amortization period not to exceed 20 years
Contribution Rate	Contribution rate that does not decrease until the funding objective is met
Benefit Enhancement Policy	Provides direction when the fund is less than 100 percent funded. For example, benefit enhancements, such as a COLA, should be paid for at the time of adoption with new contributions over a period of less than 20 years.
Funding Excess Policy	Provides direction when the fund is 100 percent funded. For example, potential contribution reductions and benefit enhancements should be balanced with creating a margin for adverse plan experience.

SOURCE: TRS and GRS

Negative Amortization

In recent years, the actuarial community has become focused on a concept known as negative amortization. In addition, the major credit rating agencies have publically stated that negative amortization is seen as an adverse factor in their analysis.

As is the case with any liability, the UAAL accrues interest. When using an increasing amortization policy, naturally the payments made earlier in the pattern are lower than the payments made later in the pattern. With a long period, this can produce payments at the beginning that are quite low and can even be below the amount of interest being charged. This is when negative amortization occurs. The result is an increase in the UAAL from one year to the next, even if the actuarially determined contribution is met. In most cases, this issue arises when the funding period gets beyond 20 years.

The mathematics behind negative amortization at varying funding periods is shown in Figure 4.7. This example shows six different funds with differing amortization periods and a UAAL of $100,000. The interest rate is 7.25 percent and annual payroll growth is 3.00 percent.

As shown, Fund C, with a funding period of approximately 20-years, is in a position to cover the interest charges allowing the principal to be reduced. Funds A and B, with even lower funding periods, have amortization payments that more than cover the interest and are able to materially pay down the principal. This is one of the reasons current industry best practices are focusing on a 20-year amortization period.

For periods greater than 20 years, the UAAL is expected to grow from year to year, even if the required contribution is met. At a 30-year funding period, amortization payments are covering only about 80 percent of the interest charges and the UAAL grows nominally. This holds true even if the payroll is assumed to be increasing and the funding period is decreasing by one year annually. As the payroll growth increases and the contribution stream grows, a greater portion of the interest will be paid. Eventually contributions will allow for interest plus an increasing portion of the principal to be paid and the UAAL will decline.

FIGURE 4.7: NEGATIVE AMORTIZATION

Fund	A	B	C	D	E	F
Funding Period (in Years)	10	15	20	21	25	30
UAAL at Beginning of Year	$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 100,000
Interest on UAAL	$ 7,250	$ 7,250	$ 7,250	$ 7,250	$ 7,250	$ 7,250
Amortization Payment Based on Funding Period	$ (12,407)	$ (9,074)	$ (7,441)	$ (7,211)	$ (6,487)	$ (5,872)
UAAL at End of Year	$ 94,843	$ 98,176	$ 99,809	$ 100,039	$ 100,763	$ 101,378
Net Change	$ (5,157)	$ (1,824)	$ (191)	$ 39	$ 763	$ 1,378

Amortization payments are not sufficient to pay the interest on the UAAL for funding periods greater than 20 years.

SOURCE: TRS

However, this only occurs if the funding period is allowed to decline to 20 years and below. If there are changes, such as contribution decreases or benefit enhancements that routinely keep the funding period above 20 years, the UAAL will actually never be expected to be fully amortized.

For systems that receive contributions as a rate of covered payroll, it is necessary to build in anticipated increases in payroll to accurately calculate the resulting funding period. To ignore the anticipated growth in payroll would overestimate the funding period. Also, assuming no payroll growth would not be consistent with the rest of the assumption set which assumes individuals will get salary increases over time and that the active population will remain constant.

Industry Best Practices

While the definition of actuarial soundness, as established in TRS' enabling statute, is an amortization period of less than 31 years, the standards in the actuarial community have evolved over time

to a shorter amortization period. Best practice is an amortization objective not to exceed 20 years. An amortization period in this range would help the fund avoid negative amortization which occurs when contributions to the pension trust fund do not cover the interest accruing on the UAAL. Plans with funding periods in excess of 20 years, like TRS, experience negative amortization.

The actuarial community has issued funding policy best practices in two publications. The first is an Exposure Draft (ED) of proposed revisions to Actuarial Standard of Practice (ASOP) No. 4, *Measuring Pension Obligations and Determining Pension Plan Costs or Contributions*.[8] ASOP No. 4 is the primary standard for measuring pension obligations. The second is a white paper by the Conference of Consulting Actuaries Public Plans Community (CCA PPC) called *Actuarial Funding Policies and Practices for Public Pension Plans*.[9]

The only binding requirement from these sources is that the ASOP will require disclosure of an "actuarially determined contribution using a contribution allocation procedure that satisfies the following conditions:

a. all significant assumptions are reasonable, in accordance with ASOP Nos. 27 and 35, and the combined effect of the assumptions has no significant bias (i.e., it is not significantly optimistic or pessimistic) except when provisions for adverse deviation are included;
b. if an actuarial cost method is used, it should be consistent with section 3.13. If an actuarial cost method with individual attribution is used, each participant's normal cost should be based on the plan provisions applicable to that participant;
c. if an amortization method is used, it should be consistent with section 3.14;
d. if an asset valuation method is used, it should be consistent with section 3.15;
e. if an output smoothing method is used, it should be consistent with section 3.16;
f. the contribution allocation procedure should be, in the actuary's professional judgment, consistent with the plan accumulating adequate assets to make benefit payments when due, assuming that all actuarial assumptions will be realized and that the plan sponsor or other contributing entity will make actuarially determined contributions when due; and
g. the contribution allocation procedure takes into consideration the time between the measurement date and the contribution date."

According to Section 3.14 of ASOP No. 4, "If the actuary selects an amortization method, the actuary should select an amortization method that **produces amortization payments that exceed nominal interest on the unfunded actuarial accrued liability** or that satisfy the following conditions:

a. the payments do not increase or do not increase more rapidly than expected covered payroll; and
b. **the payments fully amortize the unfunded actuarial accrued liability within a reasonable time period**.

For purposes of determining a reasonable time period, the actuary should consider factors such as the following:

i. the length of time until amortization payments exceed nominal interest on the unfunded actuarial accrued liability;
ii. ii. duration of the actuarial accrued liability;
iii. the source of the unfunded actuarial accrued liability or change in the unfunded actuarial accrued liability; and
iv. the funded status of the plan or period to plan insolvency, if applicable."

In this ED, the ASOP requires an ADC rate that either achieves positive amortization or will achieve positive amortization soon and fully amortize the UAAL over a closed period. For TRS, this means that the current statutory definition of actuarial soundness does not meet the requirements of the proposed ASOP.

Based on this ED, the ADC provided in the valuation report would be, at most, the rate required to achieve a 20-year amortization period because that is the point at which there is no longer negative amortization. If a new funding policy was implemented that amortized the UAAL over a closed 25-year period, then that would also meet the ASOP requirements and could be used as the ADC.

The CCA PPC white paper provides more detail on the range of possible funding policies and categorizes individual policy parameters on a range from Model Practices to Unacceptable Practices. Concerning amortization strategies, the paper offers the following comments:

"The amortization policy should reflect explicit consideration of the level and duration of negative amortization, if any."

"The policy objectives lead to a general preference for level percentage of pay amortization."

"For gains and losses, balancing demographic matching and volatility control leads to an ideal amortization period range of 15 to 20 years.

b. Longer than 20 years becomes difficult to reconcile with demographic matching, the intergenerational aspect of interperiod equity described in general policy objective 2.

i. 20 years is substantially longer than either average future service for actives or average life expectancy for retirees.

c. Periods longer than 20 years also entail negative amortization (which starts at around 16 to 18 years for many current combinations of assumptions).

i. Here negative amortization is an indicator for not enough demographic matching but based on economic rather than demographic assumptions.

iii. As discussed later in this section, negative amortization is a much greater concern when using open or rolling amortization periods."

The authors outline their model practices which include level percent of pay amortizations that would require a 15-20 year funding period. They also list their unacceptable practices as follows:

- Layered fixed period amortization by source of UAAL over longer than 30 years.
- Rolling/open amortization over longer than 25 years of a single combined gain/loss layer.
- Rolling/open amortization of entire UAAL as a single combined layer (exclusive of plan amendments) where the amortization period entails negative amortization.
- Rolling/open amortization of entire UAAL as a single combined layer (including plan amendments) even where the amortization period does not entail negative amortization.

The current statutory definition of actuarial soundness, which is rolling/open amortization as a single combined layer at less than 31 years, is considered an unacceptable practice by the CCA PPC paper. The CCA PPC best practices would find a 25 year rolling amortization policy as unacceptable, and thus the current definition falls outside the guidelines of acceptable.

THE CURRENT STATUTORY DEFINITION OF ACTUARIAL SOUNDNESS DOES NOT MEET THE REQUIREMENTS OF THE PROPOSED ASOP.

Comparison to Other Texas Retirement Systems

There are four large statewide retirement systems in Texas – TRS, Employees Retirement System of Texas (ERS), Texas County and District Retirement System (TCDRS), and Texas Municipal Retirement System (TMRS). Comparing TRS to TCDRS provides an illuminating contrast on the impact that a funding policy providing for sufficient funding can have on the financial health of a retirement plan.

Twenty years ago, TRS and TCDRS were in similar positions. At the end of the 1990's, both systems were well funded (TRS' funding was actually higher) and both had 8 percent investment return assumptions. Over a 20-year period, both systems had roughly the same investment returns at 7 percent. So they started in similar positions, had similar expectations, and had similar experience.

In 2018, before lowering the assumed rate of return, TRS had a funded ratio of 80 percent and a funding period of 32 years, while TCDRS has an 89 percent funded ratio and a funding period of 11 years. If these two systems had such similar starting points and have had similar experience over the past two decades, why are they in such different positions today? It is not the benefit levels, as the average TCDRS benefit package is more valuable than the TRS package and TRS members have experienced benefit reductions during that time.

The difference comes down to funding policy. The main differences between the funding polices of the two systems include the following:

1. The TCDRS plan sponsors are statutorily required to contribute their ADC.
2. The TCDRS ADC is determined based on a closed 20-year layered policy.
3. Any benefit enhancement at TCDRS is required to have a corresponding increase in the ADC.

TMRS has a similar story. The TMRS funding policy is similar in that it is based on a 25-year closed ladder amortization period. With this funding policy, TMRS has seen its funded status steadily improve during the last decade.

For both TCDRS and TMRS, the statute requires the plan sponsor to meet the ADC and sets the minimum ADC as an amount necessary to amortize the UAAL over a period of time consistent with industry best practice. This means both systems avoid negative amortization. As the legislature and stakeholders consider the TRS plan design, it is useful to understand how regular contributions of the ADC driven by funding policy have impacted two of the three statewide peers.

Primary Alternative Contribution Policies

The longer-term pattern of revenue is more important than the amount of contributions in a single year. If a commitment to improve the plan's funded status by an increase in revenue cannot occur in one budgetary cycle, an alternative approach would be to take a reasonable number of years and transition into paying the ADC. However, the cost of a transition into the higher contribution rates is either (1) a longer funding period or (2) a higher ultimate contribution rate. It would be preferable to reach the ultimate rate as soon as practical, as negative amortization is more pronounced during times of transition.

Several funding scenarios have been modeled with varying contribution increases and start dates. These scenarios are listed in order based on their impact to the funding period as of August 31, 2019.

Scenario 1 – If contribution amounts remain the same, the funding period is projected to be 86 years as of September 1, 2019.

Scenario 2 begins a transition September 1, 2020 (FY 2021) with four annual increases of 0.50 percent for a total increase of 2.00 percent. This scenario would have a 31-year funding period as of September 1, 2019 (FY 2020). This would require an All Funds increase of $238 million in the 2020-21 biennium. The UAAL would be projected to peak at $54.8 billion in 2029.

Scenario 3 provides an immediate 1.82 percent increase beginning September 1, 2019 (FY 2020). This scenario is projected to have a 30-year funding period as of September 1, 2019 (FY 2020). This would require an All Funds increase of $843 million in FY 2020 and $868 million in FY 2021 for a total increase of $1.71 billion for the biennium. The UAAL would be projected to peak at $51.9 billion in 2028.

Scenario 4 provides an immediate 2.0 percent increase beginning September 1, 2019 (FY 2020). This scenario would have a 28-year funding period as of September 1, 2019 (FY 2020). This would require an All Funds increase of $926 million in FY 2020 and $954 million in FY 2021 for a total increase of $1.88 billion for the biennium. The UAAL would be projected to peak at $50.8 billion in 2027.

FIGURE 4.8: ILLUSTRATED OPTIONS FOR CONTRIBUTION INCREASES

Fiscal Year	SCENARIO 1 No Contribution Increase			SCENARIO 2 Phased In 2% Increase (0.5% increase/year starting in 2021)		
	Contribution Rate	Funding Period*	Funding (in millions)	Contribution Rate	Funding Period*	Funding (in millions)
2020	15.41%	86	-	15.41%	31	-
2021	15.41%	85	-	15.91%	30	$ 238
2022	15.41%	84	-	16.41%	29	$ 491
2023	15.41%	83	-	16.91%	28	$ 759
2024	15.41%	82	-	17.41%	27	$ 1,042
2025	15.41%	81	-	17.41%	26	$ 1,074

Fiscal Year	SCENARIO 3 1.82% Increase Starting in 2020			SCENARIO 4 2.0% Increase Starting in 2020		
	Contribution Rate	Funding Period*	Funding (in millions)	Contribution Rate	Funding Period*	Funding (in millions)
2020	17.23%	30	**$ 843	17.41%	28	$926
2021	17.23%	29	**$ 868	17.41%	27	$954
2022	17.23%	28	$ 894	17.41%	26	$983
2023	17.23%	27	$ 921	17.41%	25	$1,012
2024	17.23%	26	$ 949	17.41%	24	$1,042
2025	17.23%	25	$ 977	17.41%	23	$1,074

*Funding period in years from beginning of given fiscal year.

**Amounts in LAR are approximately $29 million lower due to timing of request.

SOURCE: GRS

Other Alternative Scenarios

Revenue to address the unfunded liability can come from the State, employers, members, or some combination of these. Phasing in to higher rates especially makes sense for active members whose take home pay would be impacted by the change. It is also worth noting that contributions from the State are more efficient than contributions from the members. This is because increased contribution rates from members lead to higher account balances for members who terminate service and request a refund. The effective rate is approximately 80 percent, meaning for every 1 percent the member rate is increased, the State's rate can decrease by 0.80 percent. In addition, an increase in the member rate is not distributed equitably amongst the members. Younger current and future members pay much more for their benefits over time than other current members. Appendix C includes a table providing various combinations of plan sponsor and member rates, as a percent of payroll, as well as phase in periods with resulting funding periods and effects on projected UAAL.

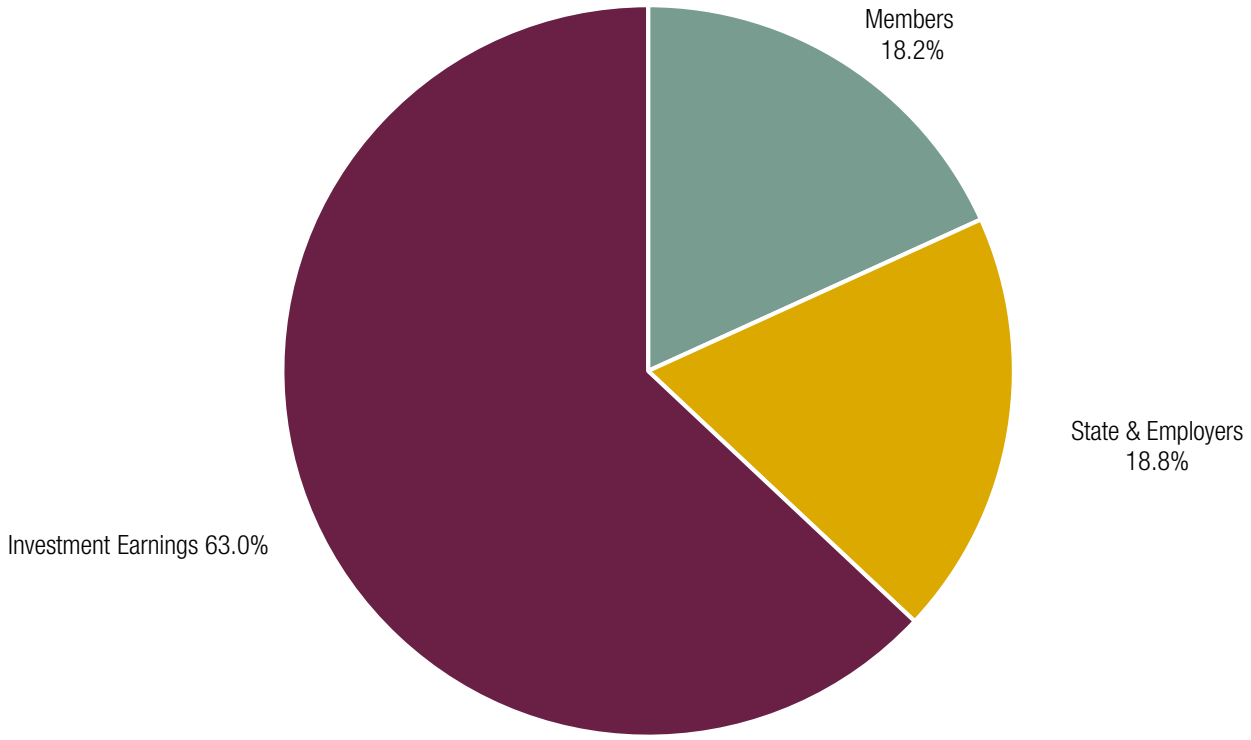
Investments

TRS invests the member and State contributions through the pension trust fund to generate returns, which account for the majority of pension plan revenue. As shown in Figure 4.9, since the inception of the fund, investment earnings have accounted for roughly 63.0 percent of pension fund revenue while member contributions account for 18.2 percent and State & Employers contributions account for 18.8 percent.

TRS approaches investment of the pension trust fund with a long-term perspective and an objective to exceed the board-adopted assumed rate of return over the long term.

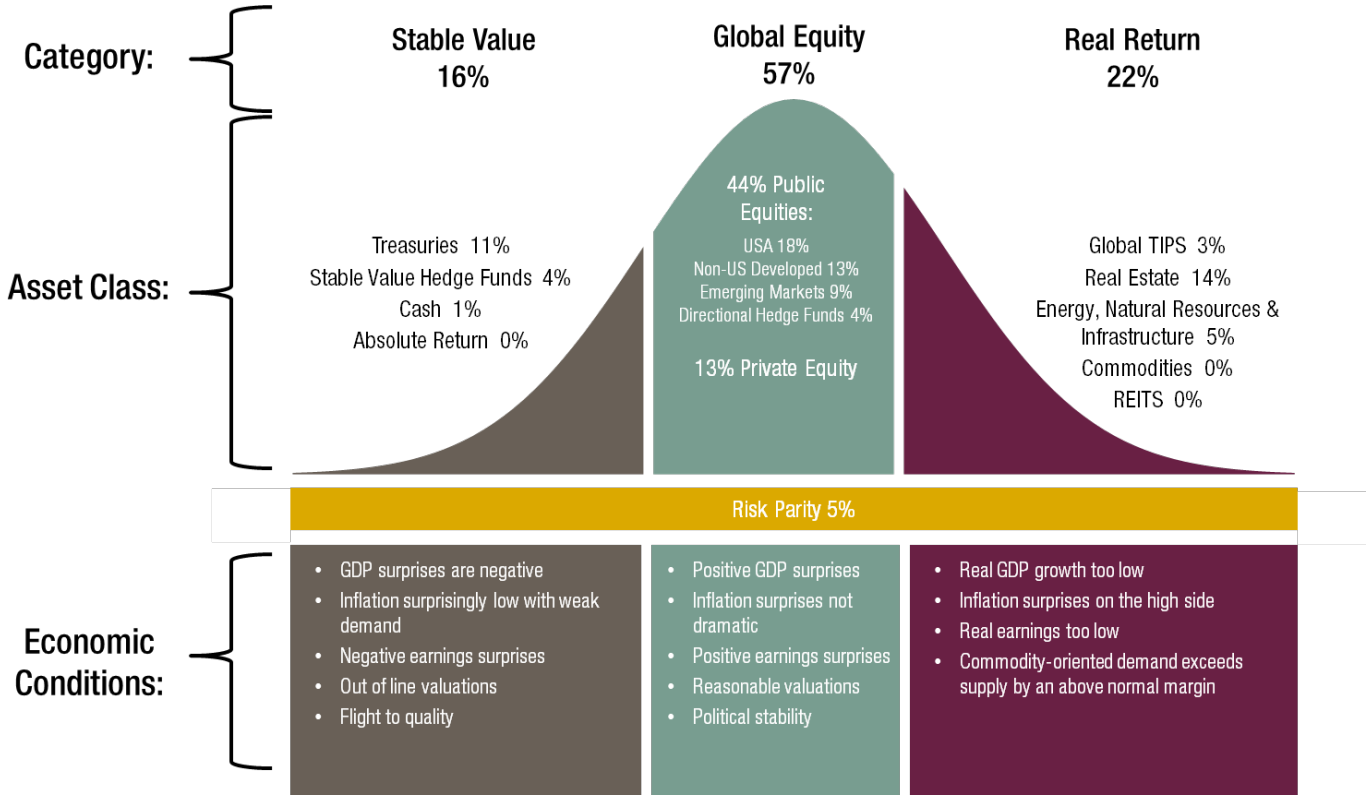
The return of the TRS trust fund over the past 25 years has been 8.0 percent[10], which is higher than the 7.25 percent assumed long-term rate of return adopted by the board in July 2018. Exceeding the 7.25 percent long-term rate of return comes from a disciplined, consistent, investment approach that is structured to control risk by diversification of asset classes. Figure 4.10 depicts the diversification framework for the trust fund. The diversification framework has helped TRS outperform its peers. For the three-year period ending June 30, 2018, TRS was ranked in the top quintile of similar public pensions on the delivery of risk-adjusted returns.[11]

FIGURE 4.9: SOURCES OF PENSION FUND REVENUE (1938-2018)



SOURCE: TRS

FIGURE 4.10: TRS DIVERSIFICATION FRAMEWORK



SOURCE: TRS

B Benefits

As previously discussed, the State, certain employers, and each member contribute to TRS during the member's working years. Upon retirement, a formula determines the amount of the member's annuity. The member then receives that annuity as a lifetime benefit. The formula is not set by the board but rather in statute.

It is important to note that TRS benefits do not include an automatic COLA for retirees, which has helped to prevent major funding issues. TRS' current standard annuity benefit formula consists of three elements – total years of service credit, average highest annual salary, and a multiplier. Figure 4.11 shows the formula used to calculate the standard annuity benefit.

FIGURE 4.11: STANDARD ANNUITY BENEFIT FORMULA

SOURCE: TRS

History of Benefits

The Texas Legislature frequently adjusts the pension benefits available to TRS members and makes changes to the TRS pension plan to control plan liabilities. While the board cannot amend the annuity formula, the board does have authority to adopt rules governing plan administration. The following table shows a history of recent pension benefit changes adopted by the legislature and the board.

FIGURE 4.12: HISTORY OF SIGNIFICANT PENSION BENEFIT CHANGES (2017 – 2005)

Year	Change
2017	*Forfeiture of Annuity*: Law requires a TRS member or annuitant to forfeit their annuity when convicted of certain crimes involving a student.
2015	*Membership*: TRS membership must be established under a single employer. *Service Credit Purchase*: Limited the amount of out-of-state service credit that may be purchased to five years.
2013	*COLA*: A 3 percent cost-of-living increase, capped at $100 per month, was provided to TRS retirees who retired on or before August 31, 2004. *Retirement Age*: Normal age retirement eligibility was increased to age 62 with the Rule of 80 for all members who did not have at least five years of service credit as of August 31, 2014.
2012	*Standard School Year*: Starting with the 2012-13 school year, all TRS members use a standardized school year of September 1 through August 31 for benefit purposes, including establishing service and compensation credit.
2011	*Service Credit*: Purchase of most types of service credit now requires payment of actuarial cost. TRS must be notified of unreported service credit within five years of when the service was rendered. *Salary Spiking*: TRS has a 10 percent or $10,000 (whichever is greater) limit on creditable compensation increases used to calculate retirement benefits, for salary increases occurring in last years before retirement. *Return to Work*: Laws are revised to eliminate exceptions that allowed certain categories of employees to return to work without loss of annuity. Service retirees who retire after January 1, 2011 are permitted to work full time for a TRS covered employer if they had a break in service of 12 full, consecutive calendar months after retirement. Retirees who had not served a 12 full, consecutive calendar month break in service after retirement could only work as substitutes or one-half time.
2008	*Disability Retirement*: Board adopts rules setting an excess compensation limit for disability retirees. Disability retirees who earn more than the limit (the greater of either (1) the highest salary in any school year before retirement or (2) $40,000) forfeit their annuity.
2007	*Supplemental Payment*: Eligible annuitants who retired by December 31, 2006 received a one-time supplemental payment in January 2008, up to a maximum of $2,400.
2005	*Retirement Age*: For members joining after August 31, 2007, the member must be at least age 60 and meet the Rule of 80 to retire without benefit reductions.

Final Average Salary (FAS): For most members, retirement benefits now are calculated using a five-year FAS instead of a three-year FAS.

Service Credit: Members may no longer purchase up to three years of service credit ("air time") to reach retirement eligibility earlier or increase benefit amount.

Partial Lump Sum Option (PLSO): Eligibility for a partial lump sum increased to a Rule of 90.

Return to Work: Enacted laws regarding returning to work after retirement. Public education employers who hire retirees must pay TRS pension and health care surcharges.

Deferred Retirement Option Plan (DROP): DROP was discontinued for new participation effective December 31, 2005.

SOURCE: TRS

Distribution of Benefit and Contribution Changes

As described above, there have been several adjustments to the plan since the 2005 legislative session. On the benefit side, the changes have primarily consisted of benefit reductions and a modest COLA. Additionally, during this time frame the contribution rate for members increased from 6.4 percent to 7.7 percent, the State contribution increased to 6.8 percent, and a new revenue stream was created so that local employers pay 1.5 percent on payroll not covered by Social Security.

The net present value from these changes has been a total concession of approximately $45 billion as of 2018, made up of $17 billion in lower projected liabilities and $28 billion in additional projected future contributions. However, the distribution of concessions varies widely across the various stakeholders. Figure 4.13 illustrates the distribution of these changes by stakeholder group.

Active employees, in general, have borne approximately 70 percent of the net reduction in value from all previous changes. More specifically, Nonvested Actives and Future Hires have borne the largest portion of the previous changes, with more than 50 percent of the total net change. The Local Employers have taken 23 percent of the net concession, while the State follows at 9 percent. The retiree group has a net opposite impact as there was a COLA and a supplemental payment during this time. While pension benefits have not been reduced for retirees, they have not received a COLA since 2013 and recent health care premiums and out-of-pocket expenses for retirees in TRS-Care have increased substantially.

FIGURE 4.13: PRESENT VALUE OF PREVIOUS CONCESSIONS (IN BILLIONS)

Group	Benefit Changes	Additional Contributions	Total Concession	Portion of Concessions
Retirees	$ (0.4)	$ 0.0	$ (0.4)	(1%)
Grandfathered Actives	-	0.1	0.1	0%
Vested as of 2014 Actives	4.0	2.6	6.6	15%
Nonvested as of 2014 Actives and Future Hires	13.3	11.0	24.3	54%
State	-	4.2	4.2	9%
Local Employers	-	10.5	10.5	23%
Total	$ 16.9	$ 28.4	$ 45.3	100%

SOURCE: GRS

TRS Benefit Compared to Peers

TRS examined the value of its members' benefits relative to the benefits provided by a variety of peer systems, including large plans in Texas and other large or regional statewide public employee and teacher systems. In order to ascertain how the level of retirement benefits provided by TRS compares to the benefits provided by other retirement systems, a Relative Benefit Index (Index) was developed that quantifies the differences. The Index, developed for this study, measures the value of retirement income provided to a prototypical career employee from the time the member retires until the member no longer receives retirement benefits. A career employee is defined as one who retires at age 62 with 32 years of service and a final salary of $60,000 annually. This is very close to the median TRS member at retirement.

An Index score of 100 means that a plan provides a benefit with a value equal to full salary replacement and a COLA consistent with Consumer Price Index-Urban (CPI-U). The Index also incorporates the impact of Social Security benefits, if applicable. Figure 4.14 shows the results of the Index comparison, which compares TRS benefits to peer retirement systems consisting of the following:

- Teacher systems from the surrounding states and the Employees Retirement System of Texas.
- Local and municipal retirement systems within Texas.
- Four very large public retirement systems in the country.

The Index compares the TRS benefit for new hires to that received by new hires in the peer systems.

The prototypical TRS career employee receives a benefit that equates to 69 percent of preretirement income when the employee initially retires. This is very comparable to the peer group when only looking at replacement income at retirement from the plan sponsor's retirement plan, as the average peer replaces 68 percent for the same member. However, members in nine of the sixteen peer systems also participate in Social Security and ten have cost-of-living increases as a provision in the system itself. As shown by the Index illustration, throughout the TRS retiree's expected lifetime, the TRS benefit only effectively

FIGURE 4.14: RELATIVE BENEFIT INDEX

SOURCE: GRS

replaces 55 percent due to a loss of purchasing power. Including COLAs and the impact from Social Security, the average value of benefit available to the same prototypical employee of the peer plans examined during their retirement years was 79 percent. A significant portion of the value difference results from all of the peer systems either providing some level of automatic COLA or participating in Social Security coverage (or both).

It should be noted that the average replacement percentage of 79 percent is down slightly from 82 percent when the study was last conducted in 2012 since a number of plans have made changes to their plan provisions through a variety of cost-saving measures such as lower benefit multipliers, lower annual COLA increases, changing the number of years included in the Final Average Compensation calculation, delaying the time frame when COLAs begin, etc.

The TRS plan is one of two in the comparison in which no amount of the member's retirement income is protected against inflation, but in the other plan the members have an option to elect an annuity pattern that incorporates a lower starting benefit and an annual increase. The peer groups and benefit provisions depicted in the Index are listed in Figure 4.15.

FIGURE 4.15: PEERS REFLECTED IN THE RELATIVE BENEFIT INDEX

Plan Name (including groups covered)	Current Cost-of-Living Adjustments	Participate in Social Security
Benchmark Retirement Plan Providing 70 Percent Replacement Income at 62/32	2.30%	N/A
Teachers Retirement System of Texas (New Members)	0.00%	No
Arkansas Teacher Retirement System	3.00%	Yes
City of Austin Employees' Retirement System (New Members)	0.00%	Yes
California Public Retirement System	2.00%	Yes
California State Teachers' Retirement System (New Members)	2.00%	No
Colorado Public Employees Retirement Association (New Members)	2.00%	No
Employees Retirement Fund of the City of Dallas (New Members)	2.30%	No
Employees Retirement System of Texas (New Members)	0.00%	Yes
Houston Municipal Employees Pension System (New Members)	0.00%	Yes

New Mexico Educational Retirement Board (New Members)	2.00%	No
New York State and Local Retirement System	2.30%	Yes
State Teachers Retirement System of Ohio	2.00%	No
Oklahoma Teachers Retirement System (New Members)	0.00%	Yes
Teachers Retirement System of Louisiana (New Members)	0.00%	No
Texas Municipal Retirement System (5% Contributions and 2/1 Match)	0.00%	Yes
Texas Municipal Retirement System (7% Contributions and 2/1 Match)	1.80%	Yes
Texas Municipal Retirement System (7% Contributions and 2/1 Match)	1.80%	No

SOURCE: GRS

TRS Benefit Compared to Social Security

In fiscal year 2018, 78 percent of TRS members, a figure that includes 96 percent of public school TRS members, did not participate in Social Security. For many TRS members, the only source of lifetime income in retirement is their TRS benefit. A lifetime benefit, such as TRS or Social Security, mitigates the risk of a retiree who — due to longevity, market volatility or failure to invest adequately — outlives his or her savings.

FOR MANY TRS MEMBERS, THE ONLY SOURCE OF LIFETIME INCOME IN RETIREMENT IS THEIR TRS BENEFIT

The original Social Security Act did not extend to state and local government workers and employers. Congress has since passed laws to allow the employers of those workers who have public pensions to elect Social Security coverage. However, state and local government workers who are covered by an adequate alternative public pension plan are not required to be covered by Social Security. Once Social Security coverage is provided, it generally cannot be terminated and all future workers are required to participate going forward. Coverage rates vary considerably across states. Across the United States, approximately 75 percent of state and local government workers are covered by Social Security. This ranges from 1 percent of public sector workers in Ohio to 99 percent in the state of New York. Texas has approximately 47 percent of its public sector workers covered by Social Security.[12] Currently, only 4 percent of public school education employees covered by the TRS plan also participate in Social Security.

In general, workers pay 6.2 percent of their salary to Social Security, and their employers match this amount, for a total contribution of 12.4 percent of salary for each covered worker. Pay deductions are made on pay up to the Social Security Wage Base. This amount is $128,400 for 2018. Benefits paid by Social Security are based on a workers' inflation-adjusted pay during their career and the benefits are also progressive (i.e. lower-

income workers receive a relatively higher benefit than higher-income workers based on their level of contributions).

Using the Index from above, Social Security as a stand-alone retirement benefit would score 33 percent compared to the 55 percent score for the prototypical TRS member currently retiring. This means that the TRS plan provides a bit more than a 65 percent greater benefit than Social Security for a contribution rate that is slightly lower (12.4 percent for Social Security vs. 11.69 percent normal cost for TRS). However, this value is partially offset by disability and death benefits provided by Social Security.

The contribution rate is not where the contrast between Social Security and the TRS plan ends. The TRS benefits can be seen as more secure than Social Security as the TRS plan is, and has been, getting prefunded through employer and employee contributions for decades, whereas Social Security is effectively "pay-as-you-go" meaning that current participant contributions are paying for current benefit payments.

Social Security is now projected to have its reserves depleted in 2034.[13] In 2012, when this study was last conducted, the Social Security "insolvency" date was projected to be 2033. In the six years that have passed, the depletion date for Social Security has moved one year and benefit reductions and/or increased contributions will need to be enacted one year sooner or just 79 percent of promised benefits could be paid in a single year. Over the same six-year time period, the TRS plan has increased plan assets from approximately $110 billion to approximately $150 billion, increased the active population in the plan from just under 830,000 to over 860,000 and does not have a depletion date.

Normal Cost

The normal cost is the annual accrual cost of providing retirement benefits for service performed in the current year. Contributions in excess of the normal cost are used to reduce the UAAL. Based on the assumption set adopted in 2018, TRS' normal cost is 11.58 percent of pay. In addition to the cost of benefits, 0.11 percent is added to the normal cost to cover annual administrative expenses for a total cost of 11.69 percent. After taking into account contributions totaling 15.41 percent, there is currently 3.72 percent remaining to amortize the UAAL. However, as more grandfathered members retire and are replaced by members in the new tier, the normal cost of the group will decline and allow more contributions to be credited towards the UAAL.

FIGURE 4.16: AVAILABLE TO AMORTIZE UAAL

	Average of Current Actives	New Hire Benefits
Members	7.70%	7.70%
State	6.80%	6.80%
Employer	0.91%	0.91%
Total Contributions	15.40%	15.40%
Normal Cost	-11.58%	-10.73%
Administrative Expenses	-0.11%	-0.11%
Total Cost	-11.69%	-10.84%
Available to Amortize UAAL	3.72%	4.51%

SOURCE: GRS

Best Practices in Financing Benefit Enhancements

As discussed throughout the report, most members of TRS do not participate in Social Security and there is no direct provision in the TRS benefit package or funding mechanism to provide retirement cost-of-living increases. The lack of purchasing power protection in the TRS plan design puts members of TRS in a very small minority compared not only to peer systems but also the general public who participate in Social Security.

During the 1980s and 1990s, strong investment performance allowed perceived surpluses to pay for increases in benefits several times. However, after the dot-com bubble and throughout the last two decades, resources to provide an increase have been scarce. In addition, the number of retirees has grown exponentially, making it increasingly more expensive to enhance the benefit.

With an annuity that does not include regular cost-of-living adjustments (COLAs), TRS retirees lose purchasing power over time to inflation. Each legislative session there are several proposals to provide an annuity increase, but the current policy for determining if an increase can be provided and the financing

policy for any increase granted is inconsistent with industry best practices and allows no margin for adverse experience.

This is a topic addressed in the CCA PPA white paper *Actuarial Funding Policies and Practices for Public Pension Plans* referenced earlier in the study. In the white paper, the authors offer the following considerations in developing a financing policy for future retiree benefit enhancements:

Goal 1: The principal goal of a funding policy is that future contributions and current plan assets should be sufficient to provide for all benefits expected to be paid to members and their beneficiaries when due.

Goal 2: The funding policy should seek a reasonable allocation of the cost of benefits and the required funding to the years of service (i.e. demographic matching). This includes the goal that annual contributions should, to the extent reasonably possible, maintain a close relationship to both the expected cost of each year of service and to variations around that expected cost.

Goal 5: The funding policy should take into consideration the nature of public sector pension plans and their governance. These governance issues include (1) agency risk issues associated with the desire of interested parties (agents) to influence the cost calculations in directions viewed as consistent with their particular interests, and (2) the need for a sustained budgeting commitment from plan sponsors.

5. For plan amendments that increase liabilities, volatility management is not an issue, only demographic matching.
   a. Use actual remaining active future service or retiree life expectancy.
   b. Could use up to 15 years as an approximation for actives.
      i. Any period that would entail negative amortization is inconsistent with general policy goals 2 (demographic matching) and 5 (nature of public plan governance).
   c. Could use up to 10 years as an approximation for inactives.
      i. Particularly for retiree benefit increases, amortization period should control for negative cash flow where additional amortization payments are less than additional benefit payments.
   d. For Early Retirement Incentive Programs use a period corresponding to the period of economic savings to the employer.
      i. Shorter than other plan amendments, typically no more than five years.
   e. For benefit improvements with accelerated payments (e.g. one time "13th check" or other lump sum payments) amortization may not be appropriate as any amortization will result in negative cash flows.

Thus, current best practice provides that advance funding would be preferable, even if it is money only earmarked for a potential increase, financing the increases while services are being provided. For increases that are provided during retirement, permanent COLAs would be financed over a 10-15 year period on a level-dollar basis and 13th checks would be financed by a lump sum. Implicit in this discussion is that a benefit increase should always have a concurrent contribution increase. These types of policies would ensure that benefit increases do not deteriorate the funding status of the plan, remove any cushion for adverse experience, or result in generational cost transfers.

A BENEFIT INCREASE SHOULD ALWAYS HAVE A CONCURRENT CONTRIBUTION INCREASE.

These recommendations are a response to one of the major contributing factors to poorly funded pension plans in the nation. Namely, the adoption of funding policies that do not align the time frames between the collection of revenue with the payment of benefits. For example, the majority of the liability associated with a specific COLA is for benefit payments being made in the next 10-15 years. Any financing arrangement that defers contributions beyond that time frame creates an imbalance in plan financing. If the liability is paid for only over its own duration, then any imbalance is small and short-lived. However, if the liability is paid for over a 20-30 year time horizon, then the funding imbalance can be significant. Moreover, if in the future, the plan has any adverse experience or another COLA is given over an extended time period, then the additional liabilities get stacked upon existing liabilities. The stacking of these scenarios would lead to multiple layers of liability and a pension system that, over time, costs more than the value provided.

Most TRS COLAs have used the stacking of liabilities by providing a COLA that increases the UAAL without a corresponding increase to the contribution rate. When COLAs are financed based on the contribution rates being paid at that time, the funding period and the expected time before the remaining UAAL is fully amortized are extended. This would be equivalent to refinancing a mortgage over a longer time period. In essence, there are no contributions being made toward the new liability until the currently existing UAAL is paid off. Therefore, any policy that does not increase contribution rates over the short-term increases the ultimate cost of the COLA by almost tenfold, pushing all of that cost to a future generation.

To illustrate this point and possible financing options, TRS estimated the impact of a 3 percent ad hoc COLA to current TRS retirees. While the current funding period is not below the statutory requirement, this analysis assumes the employer contribution has been increased to bring the funding period down to 27 years. Structured this way, a COLA can be provided and the funding period would remain under the 31-year threshold. The following table provides the additional benefit payments and the additional State contributions required under distinct funding policies over the 30 years, as well as a total contribution. For reference, a one-time 3 percent COLA to current TRS retirees would add approximately $2.8 billion in liability.

Figure 4.17 provides alternative financing options for the COLA.

Based on these results, the lump sum financing option is difficult. However, financing a COLA over the smallest time period possible results in the smallest amount of nominal employer contributions. Also shown is how the last three options contribute less in year one than the increase in benefit payments. This is undesirable and is why the CCA PPA paper advises against negative amortization and that level percentage of payroll financing is not consistent with the funding goals. The last option ends up costing by far the most, and the UAAL continues to increase at 7.25 percent per year until year 28, as no additional contributions are going toward paying off this new liability. As a result, in the last three years, when less than 20 percent of the current retirees are

FIGURE 4.17: ANNUAL CONTRIBUTION (IN BILLIONS)

	Year 1	Year 10	Year 15	Year 27	Year 30	Total Nominal Increase
Increase in Benefit Payments	$0.28	$0.22	$0.19	$0.09	$0.06	$5.83
Immediate Financing on September 1st following Legislative Session	2.80					2.80
Additional Contribution Rate to Finance the Liability over 10 Years, Level Dollar Amounts	0.41	0.41				4.07
Additional Contribution Rate to Finance the Liability over 15 Years, Level Dollar Amounts	0.32	0.32	0.32			4.73
Additional Contribution Rate to Finance the Liability over 15 Years, Level Percent of Payroll	0.26	0.35	0.40			4.91
Additional Contribution Rate to Finance the Liability over 27 Years, Level Percent of Payroll	0.18	0.24	0.27	0.39		7.36
Extend Funding Period to 30 Years					7.00	20.38

SOURCE: GRS

still collecting benefits, future significant contributions are being made.

In reality, it is unlikely the COLA would ever be financed in the last scenario because of adverse experience or another COLA (or several) stacked onto this one over time as the funding period declines. Providing a benefit enhancement without a corresponding contribution increase gives the appearance that the COLA can be granted for free, when in fact the cost is compounding annually, eroding margin for adverse experience, and causing intergenerational inequities.

To illustrate this, the following chart provides the additional amount of the UAAL at each of the given points in time.

FIGURE 4.18: ADDITIONAL UAAL BALANCE FROM A SINGLE 3 PERCENT COLA (IN BILLIONS)

	Year 1*	Year 10	Year 15	Year 27	Year 30
Immediate Financing on September 1st following Legislative Session	$0.00				
Additional Contribution Rate to Finance the Liability over 10 Years, Level Dollar Amounts	2.77	$0.39			
Additional Contribution Rate to Finance the Liability over 15 Years, Level Dollar Amounts	2.77	1.54	$0.30		
Additional Contribution Rate to Finance the Liability over 15 Years, Level Percent of Payroll	2.77	1.80	0.39		
Additional Contribution Rate to Finance the Liability over 27 Years, Level Percent of Payroll	2.77	2.97	2.73	$0.37	
Extend Funding Period to 30 Years	2.77	5.20	7.39	18.35	$6.90

*Represents the additional UAAL balance as of the valuation following the legislative session the COLA was granted.

SOURCE: GRS

In the next to last row, the additional UAAL from this COLA at year one is still essentially the same 15 years into the financing schedule. In the last row, there have been no payments made toward this additional liability and thus the UAAL continues to grow. This shows the unsustainability of this policy.

While COLAs have not been given during every legislative session, a benefit enhancement has been granted whenever possible. A review of enhancements since the 1990s shows that a benefit enhancement has been granted in every legislative session since 1993 in which the funding period was below the definition of actuarial soundness. The following table provides the last 25 years of instances when the funding period was less than the statutory definition of actuarial soundness during a legislative session.

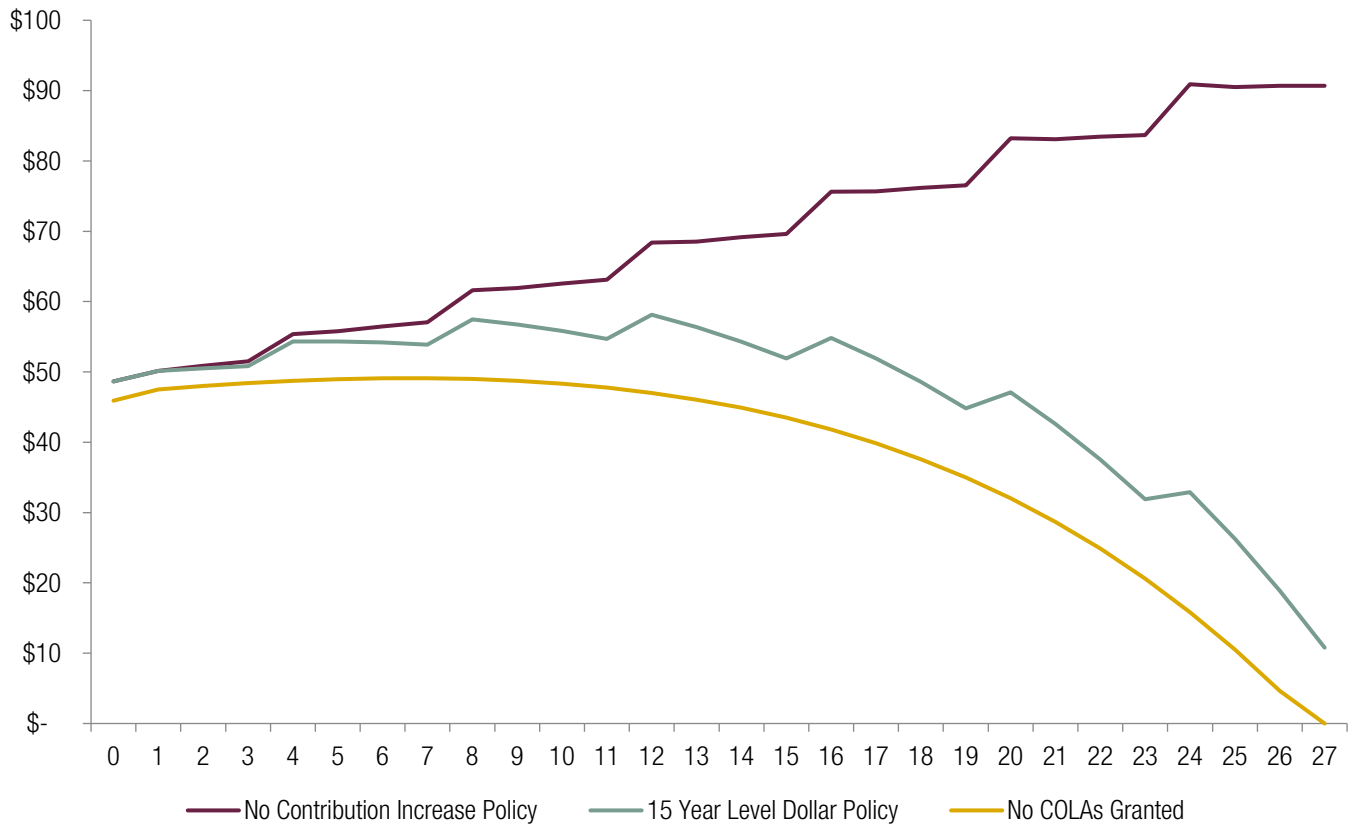
FIGURE 4.19: COLA & 13TH CHECK HISTORY (1993-2013)

Year	Funding Period	Enhancement
2013	Never as of August 31, 2012 Actuarial Valuation; Legislation increasing the State, Employer, and Member contribution rates brought the funding period down to 28.9 years; 28 years as of August 31, 2013 Actuarial Valuation	Members who retired prior to September 1, 2004 received a 3% cost-of-living adjustment (capped at $100 per month).
2007	Never as of August 31, 2006 Actuarial Valuation; State contribution increase to 6.58 percent brought the funding period down to less than 31 years; 27.4 years as of 8/31/07 Actuarial Valuation	A one-time supplemental payment (13th check), equal to the August 2007 monthly annuity, but capped at $2,400. It was paid in January 2008.
2001	Overfunded	Members who retired between September 1, 2000, and August 31, 2001, received a 4.5% increase in their annuities, which is equivalent to the multiplier increase. Members who retired prior to September 1, 2000, received a 6% inflation adjustment plus the 4.5% multiplier equivalent.
1999	Overfunded	Members who retired between September 1, 1998 and August 31, 1999 received a 10% increase in their annuities, which is equivalent to the multiplier increase. Members who retired prior to September 1, 1998 received an inflation adjustment between 2 - 7% based upon the member's retirement date and the 10% multiplier equivalent.
1997	Overfunded	Members who retired prior to September 1, 1996 received an inflation adjustment ranging from 2 - 14% based upon the member's retirement date.
1995	2.2 years as of August 31, 1994 Actuarial Valuation; 14 years as of August 31, 1995 Actuarial Valuation	Members who retired before September 1, 1993 were paid the greater of two options: o Current annuity with an inflation adjustment ranging from 2 – 17% depending on the member's retirement date; or o Recomputation of the annuity using the current minimum annual salary ($18,500) for a classroom teacher or full-time librarian if the actual average salary was less than the current minimum.
1993	28.8 years as of August 31, 1992 Actuarial Valuation; 25.1 years as of August 31, 1993 Actuarial Valuation	Members who retired prior to September 1, 1991 received an inflation adjustment ranging from 5 – 15% depending on the member's retirement date. This was the first in a series of "catch ups," for retirees whose annuity-purchasing power lagged behind the Consumer Price Index.

SOURCE: TRS

The following graph provides the projected UAAL assuming that a COLA is granted every legislative session when a COLA can be granted to move the funding period back up to 30. This amounts to a COLA every other session. The UAAL grows rapidly in perpetuity even though the funding period remains below 30 throughout. This is because the funding period at any point in time assumes there will be no further enhancements.

FIGURE 4.20: UAAL (IN BILLIONS) ASSUMING COLA GRANTED EVERY FOUR YEARS (EACH TIME 26/27 FUNDED PERIOD IS REACHED)



SOURCE: GRS

Providing COLAs that are not paid for every time the funding period allows could cause intergenerational inequities, as it does not pay for past COLAs nor provide funding for future ones. This could be mitigated if decision makers and stakeholders developed a sustainable policy that can provide COLAs over time through prefunding with increased contributions or adding a funding source that is earmarked for future COLAs.

RECENT FACTORS IMPACTING THE PLAN

RECENT FACTORS IMPACTING THE PLAN

2013 Legislation

In 2012, the trust fund had an UAAL of $26.1 billion, a funded ratio of 81.9 percent, an amortization period of never with a projected depletion date of 2065. During the 2013 legislative session, the legislature made significant changes to the defined benefit plan with the goal of improving the financial condition of the fund.

These changes included increasing contribution rates for active members and the State, authorizing a new revenue stream from certain employers, and changing benefit provisions relating to normal-age retirement.[14] The combination of these changes reversed the position of having a projected depletion date to instead having a projected date on which the UAAL was expected to be fully amortized and provided a modest cost-of-living adjustment for certain retirees. As of August 31, 2013, the system had a 28-year funding period on a smoothed basis and slightly over 37 years on a market basis. Even though the 28 years was still outside of industry best practices, it was a stark improvement. However, based on deferred investment losses, it was still anticipated the funding period would increase before beginning to decline.

A detailed description of the legislative changes can be found in Appendix D.

Plan Experience

From 2013 through 2017, experience unfolded almost exactly as anticipated, if not slightly outperforming expectations. Investment returns were strong, the active population increased, and liabilities grew slightly slower than anticipated based on salary increases being lower than expected; however, retiree life expectancy grew faster than anticipated in the assumption set. When the mortality assumptions were adopted in 2011, they contained significant margin for possible future mortality improvement. Nevertheless, by the end of fiscal year 2014, there was significant erosion of this margin to the point that the margin was eliminated and the 2011 expectations of mortality were no longer reasonable.

In 2014, TRS' actuary recommended an initial change to the mortality assumption to increase the assumed longevity of retirees with a commitment to examine mortality more deeply during the 2015 experience study.

With the 2015 experience study, the board adopted the actuary's recommendation to move from static mortality to generational mortality. With generational mortality, future mortality improvement is built in rather than just assuming one improvement number over a set number of years. As a strategy, adopting generational mortality has greatly increased the sustainability of the fund because it significantly reduces the probabilities of having to materially change the mortality assumption again in the future.

By the end of fiscal year 2017, the fund was nearing the statutory definition of being actuarially sound, with a funding period of 32 years. The statutory definition of actuarial soundness is to have a funding period of less than 31 years. If actual experience had met assumptions, then the contribution policy would have continued to push the funding period down annually. However, based on the impact of negative amortization, the UAAL grew to $35 billion and was expected to continue to increase for another decade before beginning to decline.

2018 Experience Study

TRS is required to conduct an experience study at least once every five years.[15] Due to anticipated changes in the global economic outlook and upon the advice of TRS' investment advisors and actuary, TRS conducted an experience study in late 2017 — two years earlier than required.

Across the pension industry and the financial industry at large, expectations of future investment returns have steadily declined. The median assumption used to project future investment returns

dropped from 8 percent in 2011 to below 7.5 percent in 2018. Additionally, other retirement systems that were in the process of examining these expectations were choosing assumptions at 7.25 percent or below. At the beginning of 2018, TRS was still assuming returns would be close to 8 percent, an assumption that had been in place for 33 years.

These industry expectations had been declining for several reasons, but most notably because of the current market conditions which include low inflation expectations and bond yields. TRS' investment consultant, Aon Hewitt, published their best estimate for the TRS portfolio to be 7.14 percent over the next decade and 7.34 percent over a longer time frame.[16] Additionally, a survey by TRS' actuary of other investment firms produced similar expectations at 7.07 percent for the next decade and 7.32 percent over a longer term.[17] These data points led TRS' actuary to recommend an investment return assumption of 7.25 percent.

In summer 2018, the board adopted a new assumption set, which included lowering the assumed rate of return from 8.0 percent to 7.25 percent. As a result of this vote, the 2018 UAAL increased by over $10 billion to $46.2 billion. Having an UAAL at a specific point in time is not necessarily a bad thing, since the actual benefit payments are not all due immediately. Instead, benefit payments will be paid out over the remaining lifetimes of the current members. The UAAL must be financed before the benefits are due in order to meet current obligations and avoid intergenerational inequity. A 20-year history of the source of growth in the UAAL can be found in Appendix D.

The adoption of a new assumption set also impacted the funding period which increased from 33 years to 87 years. To bring the funding period down to less than 31 years, an immediate and permanent contribution increase of 1.76 percent would be needed in addition to all assumptions being met in perpetuity.

Figure 5.1 shows how the above-mentioned factors have impacted the plan's key financial indicators.

FIGURE 5.1: FINANCIAL INDICATORS

Actuarial Valuation	UAAL (in Billions)	Funded Ratio	Funding Period (in Years)	Percent ADC Funded
8/31/2012	$26.10	81.9%	Never	74%
8/31/2013	$28.94	80.8%	28	78%
8/31/2014	$31.64	80.2%	29.8	93%
8/31/2015	$32.97	80.2%	33.3	97%
8/31/2016	$35.45	79.7%	33.6	97%
8/31/2017	$35.47	80.5%	32.2	98%
8/31/2018	$46.17	76.9%	87	81%

SOURCE: GRS

Legislative Appropriations Request

The 2018 actuarial valuation incorporates the new assumption set and assumes existing contribution rates. Based on this scenario, the funding period is approximately 87 years. As plan fiduciaries, TRS has requested a contribution increase because the longer it takes to begin to pay off the UAAL the more expensive addressing the problem becomes.

To get the fund back on a path to full funding and begin to address negative amortization, TRS requested a contribution rate increase of between 1.5 percent and 2.0 percent in its Legislative Appropriations Request (1.82 percent). While TRS did not address who should pay for the contribution increase, possible revenue sources include the State, local employers, active members, or any combination of these.

CONSIDERATIONS IN PLAN DESIGN

CONSIDERATIONS IN PLAN DESIGN

Before analyzing different types of retirement plans, it is useful to review the important metrics in plan design as well as resulting behaviors.

- Replacement Income
- Efficiency
- Risk
- Workforce Management
- Portability
- Fees
- Access to Fewer Asset Classes
- Demonstrated Behavioral Tendencies
- Social Security Factor

Replacement Income

If the primary goal of a pension plan is to provide self-sufficiency in retirement that helps to mitigate against the risk of elder poverty, then the amount of retirement income received by a retiree under a particular plan is of critical importance. The most common measure for replacement income is the replacement ratio. In general, the replacement ratio is defined as the percentage of an employee's preretirement income received in retirement. For example, if an employee earns an annual preretirement income of $60,000 and receives an annual retirement benefit of $42,000, then the replacement ratio is 70 percent.

Experts generally provide that a replacement ratio of around 70 to 90 percent is considered sufficient to maintain the standard of living prior to retirement, but it varies depending on income level.[18] An adequate ratio is generally recognized as one that allows retirees to maintain the same standard of living after retirement and accounts for the fact that some major expenses are eliminated in retirement, such as saving for retirement, commuting, and certain taxes.

TRS determined that the current defined benefit plan replaces approximately 69 percent of a career employee's preretirement income. As used in this study, a career employee is defined as one who retires at age 62 with 32 years of service. The 69 percent replacement ratio applies only to replacement income at initial retirement, and — as demonstrated in the Relative Benefit Index in Section IV — the lack of post-retirement increases will lower the replacement ratio to 55 percent due to a loss of purchasing power over time. The 69 percent replacement ratio is slightly below the bottom end of the 70 to 90 percent range mentioned above, but it will immediately begin to descend further from that bottom threshold of 70 percent every year as the costs of goods and services increase due to inflation but the annuity payment to the participant does not.

A retiree's replacement income does not have to come all from one source, such as a single employer-sponsored plan. Rather, savings through all types of saving vehicles, including personal savings and IRA type plans, should be encouraged. Therefore, regardless of plan structure, knowledge of the replacement ratio necessary for a particular employee to maintain a preretirement standard of living into retirement and the amount of replacement ratio provided by an employee's retirement plan is of considerable interest. Such information is critical for sound savings and investment decisions that impact an employee's future.

Efficiency

The term "value" means different things to different plan stakeholders. To TRS employers, a valuable plan is one that helps them to attract, retain, and predictably retire quality public school and higher education employees, with the most effective plan design and cost. Taxpayers want an efficiently run plan that balances the needs of the members and the State. Members will find value in a retirement plan that fairly compensates them in retirement given the amount of compensation contributed to the plan and the amount of time spent working for their employer.

For the study, TRS defined value as the amount of replacement ratio generated for a particular contribution rate (as a percent of payroll). In other words, which plan provides the most return for the dollars contributed? This metric is also most likely to meet the previously mentioned goals of the employer, taxpayers, and members. It is easy to switch from a defined benefit structure to a defined contribution structure and tout the savings, but what is often lost in the conversation is that the plan is no longer supplying its members with adequate benefits. A new plan design may be saving the employer 30 percent but giving members a benefit that is 50 percent (or likely more) lower than before. This will have an

impact on retention, retirement patterns, spending patterns of retirees, and other social programs retired members may qualify for. That is where the efficiency of plan design enters the discussion.

An important component in assessing value and efficiency is the amount of investment earnings generated under a given plan design. The level of investment earnings generated by a trust is the biggest source of value because lower investment earnings necessitate higher contribution rates to provide a given level of benefits. A second component is the ability of the plan design to absorb longevity risk over the entire group covered.

At the lower end of the efficiency scale would be plans that are, or effectively operate as, pay-as-you-go plans. Any plan in which the monies coming in are immediately used to pay benefits going out is unable to convert those contributions into investable income which can help reduce future contribution requirements. Social Security is an example of a plan that is currently operating in this manner. The plan provides much-needed benefits, but at a relatively high cost compared to alternatives.

Further up on the spectrum of efficiency are defined contribution plans. In the defined contribution arena, there are both self-directed situations, in which the participant directs the investment of the assets in the account, and also structures that remove the individual from investment decisions. These are called "Target Date," "Ideal" or "Optimal/Optimized" plans. These funds can remove behavioral effects and tendencies that individual investors tend to show, such as under-diversified portfolios and the "disposition effect" (selling shares that are increasing while holding ones that are falling in value).

At the higher end of the efficiency spectrum are defined benefit plans which will have professionally managed investments and are pooled across the lifecycle of all members. Cash Balance plans have a similar, if not identical setup, where the assets are pooled and the money is managed by investment professionals. But by their nature, Cash Balance plans are designed to have more portability than defined benefit plans, which adds to the overall expense of those plans, leaving defined benefit plans the most efficient vehicle for participants who work until retirement. Defined contribution and cash balance plans also have a more difficult time providing ancillary benefits such as disability or active death benefits which many defined benefit plans provide.

As a collaborating source to the findings in this study, a 2014 study by the National Institute on Retirement Security[19] showed that the cost to fund a given target retirement benefit under a defined benefit plan was 16.3 percent of payroll. Under an individually-directed defined contribution plan, that same target retirement benefit required 31.3 percent of payroll — a 92 percent increase. Ideal (or optimized) defined contribution plans that benefited from more beneficial investment return assumptions required 23 percent of payroll — still a 41 percent increase over defined benefit plans. The efficiency of defined benefit plans that benefit from pooling longevity risks, investment advantages and lower fees cannot be underestimated. Defined contribution plans can be implemented at the same cost as current defined benefit plans, but those plans will almost certainly be leaving the members with less benefits.

THE EFFICIENCY OF DEFINED BENEFIT PLANS THAT BENEFIT FROM POOLING LONGEVITY RISKS, INVESTMENT ADVANTAGES, AND LOWER FEES CANNOT BE UNDERESTIMATED.

Risk

There are varieties of risk in pension plan design, but the most prominent risks are investment and longevity. Investment risk is the risk of actual investment returns falling short of assumptions, which includes the impact of market volatility, while longevity risk is the danger that a retiree will outlive his or her retirement savings and end up relying on public services. These risks vary by the type of retirement plan.

A traditional defined benefit arrangement places the majority of investment and longevity risk on the plan sponsor. This is because a defined benefit plan provides a lifetime benefit that is, generally, based on a formula designed to provide a livable benefit to retirees. Alternatively, a defined contribution arrangement transitions the majority of risk to the member, who must manage the plan contributions, investment strategy, and post-retirement withdrawals to ensure adequate retirement income and withstand market volatility throughout the life of the member.

In a defined benefit plan, the plan sponsor bears the investment risk and is responsible for ensuring that, either through

contributions or investment returns, there are sufficient funds to provide a retiree's lifetime benefit. Longevity risk is mitigated for the member because longevity risks are pooled (i.e., spread out) over all the plan members (employees, retirees, and their beneficiaries). Some retiring participants will live a long time, whereas other individuals may only receive pension benefits for a handful of years.

Alternatively, a defined contribution arrangement transitions the majority of risk to the member who must invest the plan contributions to generate adequate retirement savings that will last the member's lifetime (as opposed to average life expectancy). At retirement, an individual relying on a defined contribution account balance may live a very long life in retirement, in which case the account balance could run out, even if optimally managed. The timing of retirement is also an important factor, as retiring in a down market can result in less income over the course of retirement.

THE MOST PROMINENT RISKS IN PENSION PLAN DESIGN ARE INVESTMENT RISKS AND LONGEVITY RISKS.

In addition to investment and longevity risks are other risks in defined benefit plans that are not as clearly defined. These include the risk that increased employer pension contributions could be passed through to the members in the form of lower salary increases, higher member contributions into the pension plan, and changes to prospective benefit accruals. The risk that individuals who retire with inadequate retirement savings could lack retirement self-sufficiency and place a strain on governmental social services. This is especially true for groups not covered by Social Security. And finally, the risk that reduced pension benefits might cause changes in mid-career retention, predictable retirement patterns, and negatively impacting younger employee recruitment.

Ultimately, there are overlapping complexities of risk that should be considered when contemplating plan design changes. Alternative structures that fall in between the traditional defined benefit plan and the traditional defined contribution plan share these risks between the State and the members in different ways. For example, in a typical defined benefit/defined contribution hybrid plan, all of the risks continue to exist, they are just smaller versions of either stand-alone plan. For example, investment and longevity risks are borne by the *plan sponsor* on the defined benefit portion of the plan while investment and longevity risks are borne by the *member* on the defined contribution portion of the plan.

In practice, however, neither the employer nor the member can completely avoid the risks associated with ensuring retirement security. For example, with defined benefit plans, increases in employer pension contributions are often either directly shared with members in the form of higher member contributions or lower prospective benefits or indirectly passed to the active members by decreases in other forms of compensation. Either way, difficult times for the employer can result in some risk shifting to the member. Generally, when risks are shifted, they are not equitably distributed among the member population.

The last decade for the TRS population is an example of this. As shown in Figure 4.13, of the pension reforms that have occurred since 2005, active members have borne approximately 70 percent of the additional cost either in the form of lower benefits or higher member contributions, whereas, the State has borne less than 10 percent of the cost.

Another, more subtle, risk is the negative economic impact to both the individual and the State from diminished retirement income. While defined contribution plan structures may initially shift risk away from the plan sponsor by limiting the sponsor's financial exposure only to the contributions made during the member's career, there is latent risk of retirees potentially spending less on the economy or even utilizing social services to make ends meet. Research suggests that, on their own, many people struggle to accumulate and manage adequate retirement savings. They either draw account balances down too quickly and run out of money, or hold funds for too long and thus lower their standard of living.

For a small private sector employer whose members are covered by Social Security, this risk could be transferred away from the plan sponsor in a defined contribution plan. However, for a plan sponsor such as the State covering TRS members who are not covered by Social Security and make up approximately 5 percent of the state's population, a diminished retirement income will have some level of diminishing impact on the economic activity in

the state and more importantly, will increase retiree use of social services post-retirement due to a lack of retirement self-sufficiency.

Section VII of this study analyzes a defined contribution plan with a 7.7 percent member contribution and the same State contribution toward new benefits as the current program. Under a defined contribution plan with these contribution rates, the median career member would have a 30 percent replacement ratio at retirement. Based on recent retirees, that would be an average annuity of $18,000 in today's dollars. However, 30 percent of members would have annual replacement incomes less than $16,000 which is the current marker for poverty for a household of two. In addition, since the current provisions of TRS do not allow for a dependable increase to the benefit after retirement, the purchasing power of the retirees will diminish over time. Based on the analysis, it is estimated that 80 percent of future career TRS retirees would be under the poverty threshold at some point during their retirement.

The fiscal and social costs resulting from retirees who lack retirement self-sufficiency are beyond the scope of this study to assess but could be significant. Therefore, while changing to an alternative plan could shift direct investment and longevity risk away from the State, it is important to consider the potential impacts that could come from shifting these risks.

Workforce Management

Another policy issue worth considering when designing a retirement plan is the impact of pension plan design on employee recruitment and retention. Attracting and retaining quality public and higher education employees has long been an issue of importance to Texas lawmakers, and the ultimate goal of any retirement plan is to attract and retain qualified employees and facilitate consistent and predictable retirement patterns. This includes factors such as:

- Hiring and retaining qualified employees lowers employer search and training costs.
- High-quality education makes our children, and therefore the state, more economically competitive.
- Retaining qualified employees improves the quality of service and reduces errors.
- Retirement benefits are an essential part of total compensation.
- Retirement security is an important consideration in accepting long-term employment.
- Predictable retirement benefits allow individuals to plan for and manage toward retirement on their own time frame and allow employers to engage in employee transitional planning.

Studies show that defined benefit plans play a major role in recruitment and retention and are on the forefront of the workers' minds. A 2017 public opinion by the National Institute on Retirement Security[20] found that 88 percent of Public Sector Employees stated that retirement benefits are "Extremely or very important." By contrast, 57 percent of the same group said that salary was "Extremely or very important". Private sector polling showed nearly the opposite result with 65 percent stating that retirement benefits were "Extremely or very important" and 82 percent saying the same about salary.

Defined benefit plans have also become one of the main issues for employees who are considering job changes. A 2017 Gallup[21] poll indicate that 51 percent of employees sampled would change jobs to have a retirement plan with a defined benefit pension. This exceeded people who said they would change jobs to participate in profit sharing plan, which registered at 40 percent.

Yet, other studies offer that mobility, including mobility of retirement benefits for teachers in the form of a defined contribution plan, positively influences recruitment and retention. A study by the State Higher Education Executive Officers (SHEEO) asserts that recruitment and retention of accomplished teachers involves facilitating their mobility across districts and states, which includes personnel policies that give teachers freedom of movement enjoyed by other high-status professions.[22] In light of the SHEEO study, it is useful to note that TRS members have portability within the state and across school district lines. Additionally, TRS has reciprocity with the Employees Retirement System of Texas (ERS) and proportionate retirement with some other Texas public pension systems. This is described in more detail in the following section.

One additional fact to note, however, is that if a plan structure encourages workers to stay past their normal-age retirement then there can be difficulty transitioning the workforce. For example, for the 12 months following the 2008 financial crisis, the number of private sector employees who retired from defined contribution plans decreased dramatically as the individuals lost significant amounts of wealth very quickly. This caused transition issues

inside the specific companies and added to the employment problems facing young individuals in the general workforce for a number of years. Therefore, TRS concludes that while there are divergent viewpoints as to which pension plan structure attracts and retains the most qualified workforce, a structure that offers more predictability and less annual volatility in wealth created leads to greater predictability in retirement patterns.

Portability

One important consideration in plan design is the degree of "portability," or the ability to allow retirement benefits to travel with members as they switch employers. A strong appeal of defined contribution plans is their degree of portability. Since a participant is accumulating an account balance, that participant can take those benefits with them should they choose to seek employment elsewhere. Moreover, these plans do not have early-retirement reductions as defined benefit plans typically do.

There is no mistaking that defined benefit pension plans become increasingly more valuable the more service a person has attained. This design is logical given that these are retirement plans and not termination plans. The goal is to help (and reward) the participants that work for an employer for many years, devoting years of service to that employer, with the understanding that they will continue to be paid in retirement for their time. It is true that many retirement plans have a much-reduced benefit amount for participants who only worked a short time. Those individuals indeed do not receive unreduced benefits like retirement-eligible participants can receive.

THE TRS PLAN ALLOWS PARTICIPANTS TO EASILY MOVE AROUND THE LARGEST STATE IN THE CONTIGUOUS 48 STATES, EVEN CHANGE VOCATIONS, WHILE STILL ACCRUING SERVICE.

While employers may not be looking to necessarily reward participants who move from job to job, they also do not want to hold participants captive by only giving benefits to the people who stay for their entire careers. This is where the TRS plan has certain advantages regarding portability that other defined benefits may not have. A teacher working in one school district in Texas may have reason to move from one city to another. Whereas a person in a standard retirement plan may have to exit that plan if they move across the state, teachers can move school districts and their service and eligibility in the TRS plan will be unchanged.

Being able to move within the teaching profession while retaining and accruing service toward benefits and benefit eligibilities is certainly appealing, but TRS also has reciprocity agreements with a number of retirement systems in the state of Texas unrelated to the teaching profession. These provisions can even help people who change careers built upon service obtained in another industry. Agreement with ERS allows for service transfers for eligible employees. Additionally, the ability to combine service for purposes of benefit eligibility exists with a number of systems beyond ERS including the Texas Municipal Retirement System, the Texas County and District Retirement System, as well as city systems in Austin and El Paso (both the Employees' and Police funds in both cities).

TRS MEMBERS HAVE PORTABILITY WITHIN THE STATE AND ACROSS SCHOOL DISTRICT LINES.

In addition to having the ability to continue (or move) service from one system to another, certain participants in the TRS plan may also have the ability to purchase certain service credits. Prior to retirement, eligible participants can purchase service for a number of time periods in their life including, but not limited to, military service, substitute service, membership waiting period service, out-of-state service credit and state sick and/or personal leave service.

Portability of defined contribution plans is often pointed to as a way to give workers the ability to change jobs or locales since they can typically vest in those plans more quickly than defined benefit plans and easily take their account balance with them. But, as discussed above, the TRS plan allows participants to easily move around the largest state in the contiguous 48 states, even change vocations, while still accruing service. What is forgotten in the portability discussion for defined contribution plans is that members have to accumulate vesting service from zero in the new

plan they have entered. The TRS design prevents this for a number of members.

Fees

Pooled trusts will generally have lower costs than individual trust plans. The costs for defined contribution plans include recordkeeping, administration, and investment management. One important point is that fees are typically covered by the members in defined contribution plans, while the costs are shared, or paid by the sponsor, in defined benefit plans. In 2017, pension administration costs at TRS were $35 per active member and annuitant, $61 below the peer average of $96.[23]

Access to Fewer Asset Classes

One reason an institutionally managed system, like TRS, is anticipated to outperform individual investors is access to asset classes that are offered to qualified institutional investors. These asset classes include private equity and private real estate, which provide essential diversification and return enhancement to the TRS portfolio. As shown in Figure 6.1, two of the nation's largest lifecycle fund families, Fidelity and Vanguard, lack exposure to certain TRS asset classes in their lifecycle funds[24]:

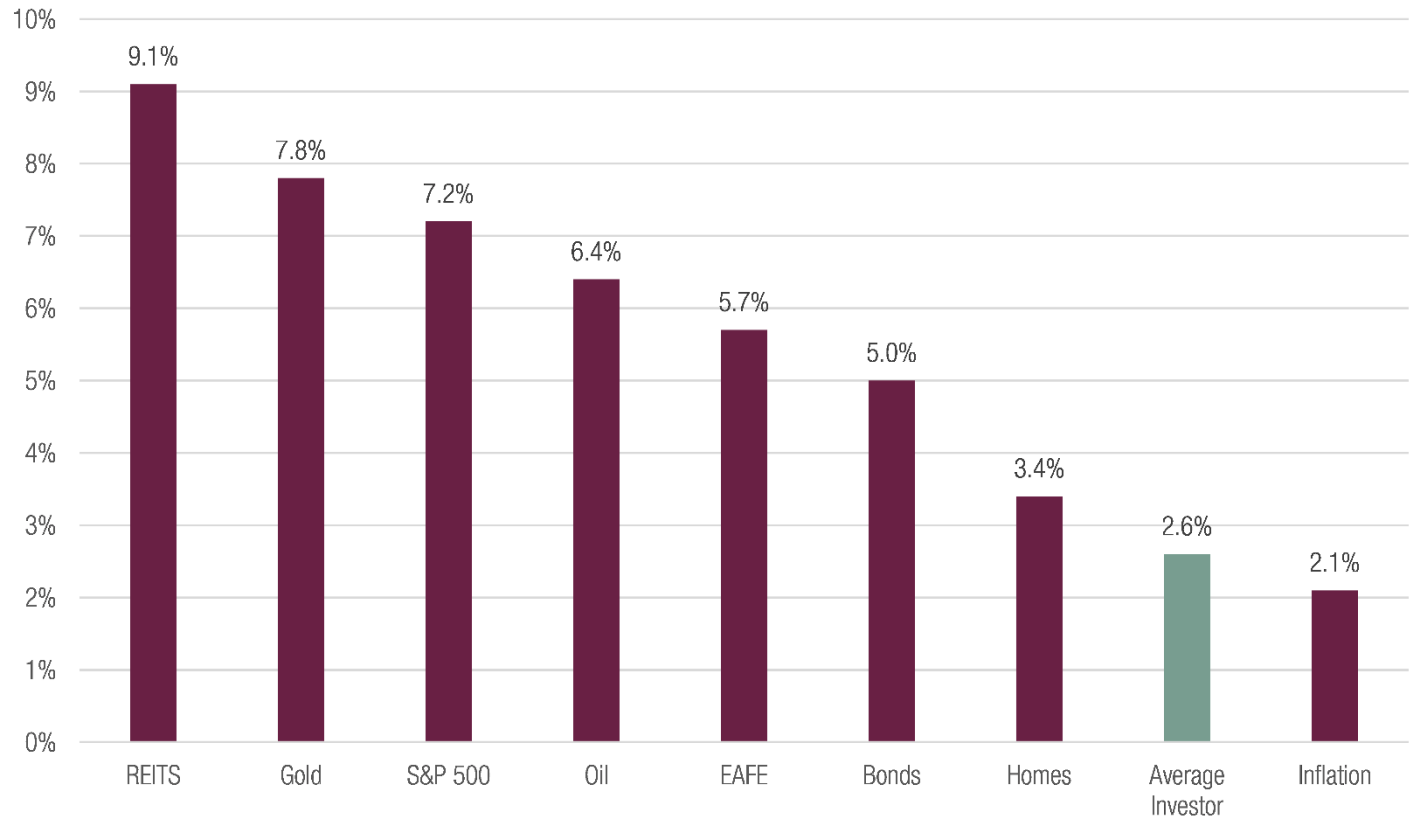
TRS and other defined benefit plans capture additional return, increased diversification, and enhanced risk management by investing in less liquid assets such as private equity and private real estate. For instance, over three years to March 31, 2018, TRS earned an annualized 12.79 percent return on its investments in private equity, compared to a 7.64 percent return on its investments in public equities.

FIGURE 6.1: ASSET CLASS ACCESS COMPARISON

Asset Class	TRS	Fidelity Freedom Funds	Vanguard Target Retirement Funds
Large Cap Value Equity	Yes	Yes	Yes
Large Cap Growth Equity	Yes	Yes	Yes
Small Cap Equity	Yes	Yes	Yes
EAFE Equity	Yes	Yes	Yes
Emerging Markets Equity	Yes	Yes	Yes
Directional Hedge Funds	Yes	No	No
Private Equity	Yes	No	No
Stable Value Hedge Funds	Yes	No	No
Long Treasuries	Yes	Yes	Yes
Cash	Yes	Yes	Yes
US Aggregate	Yes	Yes	Yes
US Tips	Yes	Yes	Yes
REITS	Yes	Yes	Yes
Commodities	Yes	Yes	Yes
Real Assets	Yes	No	No

SOURCE: TRS

FIGURE 6.2: 20-YEAR ANNUALIZED RETURNS BY ASSET CLASS (1998-2017)



SOURCE: JPM Guide to the Markets, Q3 2018

Demonstrated Behavioral Tendencies

Figure 6.2 is J.P. Morgan's recent report on returns earned by individuals (as a group) relative to asset class returns over a 20-year period.[25] The chart demonstrates that individual investors have generated lower returns over the last 20-year period than if they had invested consistently in any of the asset classes shown on the figure.

Social Security Factor

Historically, Social Security was not extended to state or local governmental employees, such as teachers. Initially, when Social Security coverage was extended to state and local employees, the state or local government employer had discretion in choosing whether to elect participation. Beginning in 1991 through today, state and local government employees are subject to mandatory Social Security coverage if they are not members of a "qualified replacement plan," such as TRS.

Many TRS employers have opted-out of Social Security participation and rely on TRS as a qualified replacement plan. Currently, only 4 percent of public school employees in TRS and 22 percent of all active TRS members participate in Social Security. The availability of TRS as a qualified replacement plan saves Texas public school employers an estimated $1.65 billion annually.

For the 96 percent of public school employees in Texas who do not participate in Social Security, TRS may be their only lifetime annuity benefit. Structural changes that convert TRS to a defined contribution plan could severely impact public school employees who do not contribute to Social Security, as those employees would face retirement without a lifetime benefit.

Therefore, TRS finds the following are important considerations for the State when contemplating potential changes to the plan:

- A total of 96 percent of public school employees who are TRS members do not participate in Social Security, leaving the TRS benefit as their only lifetime annuity.

- If benefit changes trigger mandatory Social Security participation, the 12.4 percent Social Security contribution could be required in addition to the minimum 6 percent member and minimum 6 percent State constitutionally-mandated contributions to the TRS plan.

It is also important to note that, for a state or local government employee to continue to be exempt from Social Security coverage, the employee must participate in a qualified replacement plan. As currently structured, TRS is a public retirement system that meets the requirements of a qualified replacement plan. Any major plan design changes should be evaluated to determine whether they would impact TRS' qualified replacement plan status. An in-depth discussion of the requirements for a retirement plan to be considered a qualified replacement plan is beyond the scope of this study. However, federal law generally provides[26]:

If the proposed replacement plan is a defined contribution plan, it must:

- Provide for a mandatory minimum allocation to the employee's account of at least 7.5 percent of the employee's compensation. The 7.5 percent may be made up of employer only, employee only, or both employer and employee contributions; and
- Credit employees' accounts with a reasonable interest rate or hold the funds in a separate trust subject to fiduciary standards and credited with actual earnings.

If the plan is a defined benefit plan, it generally meets the safe harbor if:

- The benefit is at least 1.5 percent of average compensation during an employee's last three years of employment, multiplied by the employee's number of years of service;
- For a plan that uses a five-year salary average, the benefit is based on a multiplier of at least 1.6 percent;
- The normal retirement age is not greater than age 65; and
- The benefit payment on which the benefit calculation must be based is a single life annuity payable beginning no later than age 65.

If structural changes or benefit reductions cause the TRS benefits to fail to meet the requirements of a qualified replacement plan, then Texas public education employers might be subject to mandatory Social Security, which would require employer contributions of 6.2 percent and employee contributions of 6.2 percent. This contribution might have to be made in addition to member and State contributions to the TRS plan, given that the TRS plan is constitutionally mandated.

The study does not attempt to determine whether the State constitutionally could opt for Social Security coverage instead of maintaining the TRS plan. Rather, TRS simply raises the policy consideration that the State could find itself contributing to the TRS plan and addressing the fact that school districts might also have to cover their employees under Social Security coverage, if TRS benefits were to no longer meet the requirements of a qualified replacement plan.

DIFFERENT TYPES OF RETIREMENT PLANS

DIFFERENT TYPES OF RETIREMENT PLANS

A defined benefit retirement plan, like TRS, delivers a lifetime stream of payments derived from a formula based on years of service, salary, and a multiplier factor. In a self-directed defined contribution plan, the employee directs the investment of an individual account and must manage the assets to ensure adequate retirement income. Between these two plan structures are a variety of plans that contain both defined benefit and defined contribution elements. Below is a general description of the plan structures that TRS analyzed as potential alternatives to the traditional defined benefit plan.

Trust Structure

The first distinguishing factor between the various plan structures is whether the investments, contributions, and benefits are managed on a pooled basis or on an individual member basis. A pooled trust structure will have comingled assets from employers and members in one account with one portfolio and investment strategy, with longevity risk management provided by the trust. An individual trust structure would have individual investment portfolios for each member based on their life factors and the longevity risk for that member is the sole responsibility of the individual's account. The defined benefit and cash balance plans will both be managed in a pooled trust basis, while the defined contribution plans will be on an Individual Trust Basis.

Modeling

In addition to the current defined benefit plan, TRS modeled and analyzed the actuarial and fiscal impacts of three alternative plans – cash balance, self-directed, and optimized. TRS used a number of assumptions in modeling the alternative plans. An overview of the structure specific assumptions are provided in Appendix F and G and a more detailed discussion of the investment assumptions is provided in Appendix H.

TRS compared the plans using two different approaches – Targeted Benefit and Targeted Contribution. The Targeted Benefit Approach keeps the ultimate level of plan benefits constant and lets the contribution amounts vary while the Targeted Contribution Approach keeps the level of contributions constant and lets the ultimate level of benefits vary.

MODEL CAREER EMPLOYEE
HIRED AT AGE 30
RETIRED AT AGE 62
FINAL AVERAGE SALARY
$60,000

The TRS alternative plan models demonstrate the actuarial and fiscal impacts of plan design changes on a career employee hired at age 30 and retiring at age 62, with a final salary during the last year of employment of approximately $60,000. This member matches very closely to a median member of TRS.

The plan designs are as follows:

Current Defined Benefit Plan

- A pooled trust structure.
- A 2.3 percent benefit multiplier applied per year of service based on a final average salary period of five years.
- A 69.4 percent replacement ratio for the hypothetical career employee.
- The cost to provide this benefit in aggregate to 30-year-old new hires is 10.3 percent of payroll based on current assumptions.
- Using these baseline values, the Targeted Benefit Approach of the modeled plans targets a 69-70 percent replacement ratio for a career employee, and the Targeted Contribution Approach targets a combined 10.3 percent contribution rate consisting of 7.7 percent from the member and 2.6 percent from the sponsor.
- The approach targets a 10.3 percent contribution rate as opposed to the 15.6 percent contribution rate currently being received because the cost to provide the existing TRS benefit is 10.3 percent with the remaining 5.3 percent of the State and Employer contribution going toward paying down the UAAL.

Cash Balance

- A pooled trust structure.
- Members have a "virtual" account to which both the employer and the member credit a set percentage of wages (pay credits).

- Pay credits then earn interest at an amount specified in the plan (interest credits).
- Interest credits can be handled in various ways. For example, a set rate of interest credit, such as 5 percent; an interest credit tied to a yield index at a specific point in time (treasury yields, corporate bonds, etc.); or a credit based on the actual performance of the trust fund. Minimums and maximums can be applied along with applying a factor to the credit. For example, the credit could be 2 percent plus 50 percent of the actual return of the fund. How the investment credit is formulated dictates how much risk is shared between the active member and the State.
- For the study, TRS modeled a "100 percent pass through cash balance plan" where the member's virtual account is credited with the actual investment return on the underlying assets in the pension trust, determined by a five-year smoothed basis. Therefore, the member holds the majority of investment performance risk during active employment. However, using the five-year average return versus the annual return provides more stability in the interest credits and lowers the likelihood of a bad outcome for a member a year before retirement.
- As modeled, the virtual account balance is annuitized into the trust fund based on a 4.5 percent discount rate and plan mortality. Annuitizing the plan in this manner means that the State continues to be exposed to the longevity risk and to the investment risk post-employment.
- Other retirement systems using a cash balance plan are the Texas Municipal Retirement System, Texas County and District Retirement System, and the Nebraska Public Employees Retirement System.

Self-Directed

- An individual trust structure.
- Traditional defined contribution plan design (401(k) or IRA, for example).
- Member and/or employer contribute money to the account.
- Member selects the investments from a list of options provided by the plan.
- Member assumes, or is responsible for managing, virtually all of the investment and longevity risk.
- Besides providing the framework, the employers or plan sponsors would have no involvement in investing or administering the plan.
- For the study, TRS assumed that the member would direct investment of the contributions, which includes an assumption for fees and behavioral investment tax, and annuitize the balance with a private insurance company at retirement.

Optimized (Target Date Funds)

- This is the same structure as the Self-Directed Defined Contribution plan, but members would have no discretion over investment decisions while employed and would be invested in a retirement target date mutual fund. This program is expected to perform better for the average member as it eliminates the behavioral investment tax.
- There is an assumption for fees and the annuitization of the balance with a private insurance company.

Distinguishing Features Between Plans

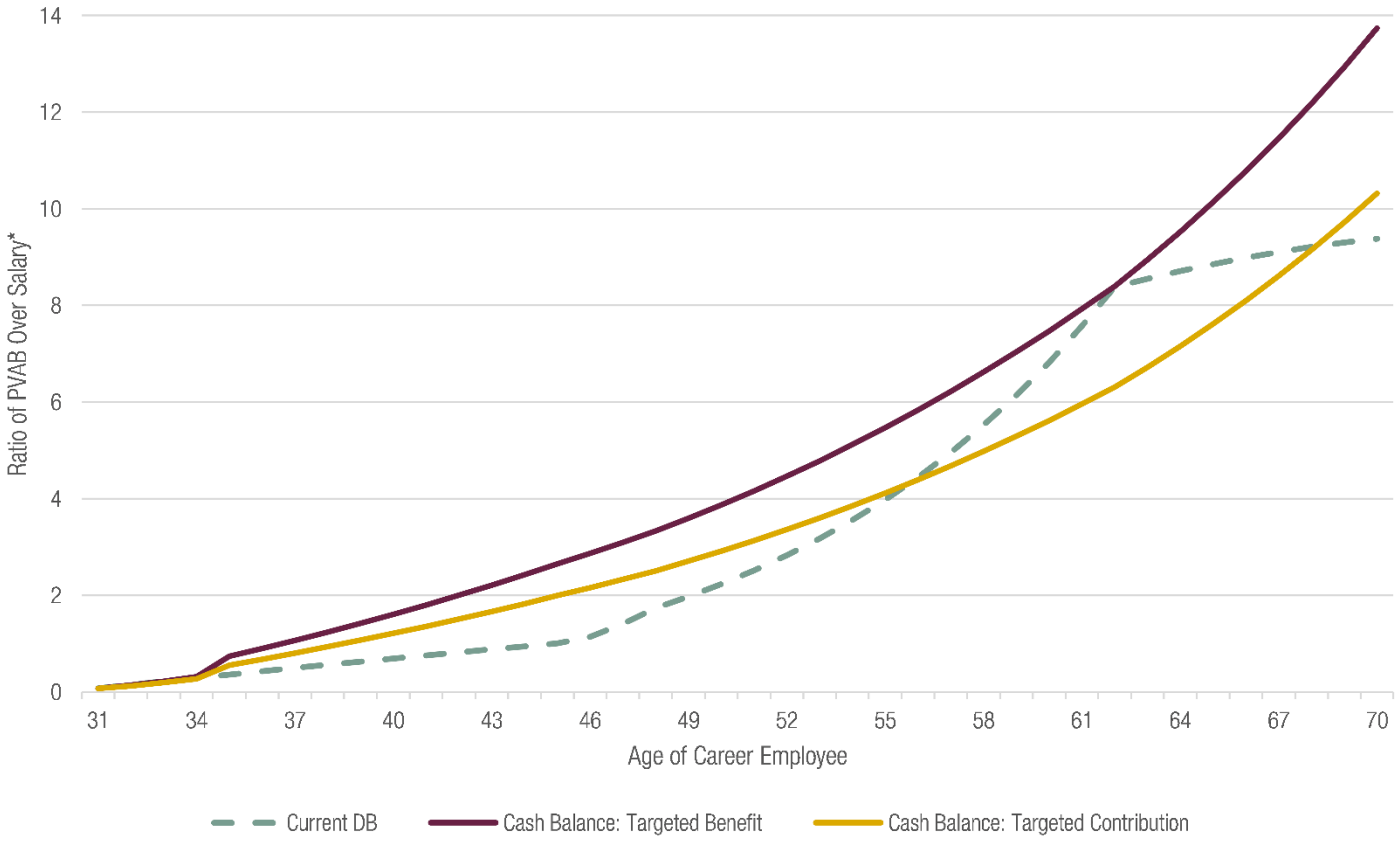
FIGURE 7.1: COMPARISON OF PLAN FEATURES

<table>
<tr><th>Retirement Plan</th><th>Investment Management (Pre-Retirement)</th><th>Investment Management (Post-Retirement)</th><th>Benefit Accrual Pattern</th><th>Longevity Protection</th></tr>
<tr><td>Current TRS Plan</td><td colspan="2" rowspan="2">Professionally managed in TRS trust fund, aggregate with all members</td><td>More valuable benefits to career employees</td><td rowspan="2">Risk aggregated across TRS retirees</td></tr>
<tr><td>Cash Balance</td><td rowspan="3">More valuable benefits to partial career or mobile employees</td></tr>
<tr><td>Optimized</td><td>Target date index funds</td><td rowspan="2">Either annuitized with insurance company or self managed through a withdrawal strategy</td><td rowspan="2">Either annuitized with insurance company or fund to considerable margin in life expectancy, leave balance to estate</td></tr>
<tr><td>Self-Directed</td><td>Member chooses asset allocation, typically mutual funds; or annuity products</td></tr>
</table>

SOURCE: GRS

Replacement ratio and cost across the structures show the difference in value between the plan designs. It is important to point out that there are basically two causes in the differences in efficiency: differences in economic efficiencies in delivering benefits to a specific individual and the efficiency of delivering the most value to career employees. The defined benefit and cash balance plans can both maximize the economic efficiency due to the pooled trust structure, but one of the features of the traditional defined benefit plan is that it maximizes the reward to career employees over short-term employees. Defined contribution plans and cash balance plans, on the other hand, provide a more even reward to all employees over the course of their employment. Figure 7.2 provides a graphical illustration of these patterns.

FIGURE 7.2: BENEFIT ACCRUAL PATTERNS OF ALTERNATIVE PLANS



*PVAB: Present Value of Accrued Benefits

SOURCE: GRS

As shown, the cash balance plan has an accrual pattern that is higher earlier, and a more even growth rate throughout the career. The current defined benefit plan remains very low for approximately 15 years, then begins to accelerate higher as the member approaches retirement. Based on this pattern, when comparing the current defined benefit and the cash balance plans, it takes more contributions in the cash balance plan across all employees to provide the same benefit to the career employee in the defined benefit plan. This is not because the career employee is individually more expensive, but because the value of benefit provided to non-career members is larger.

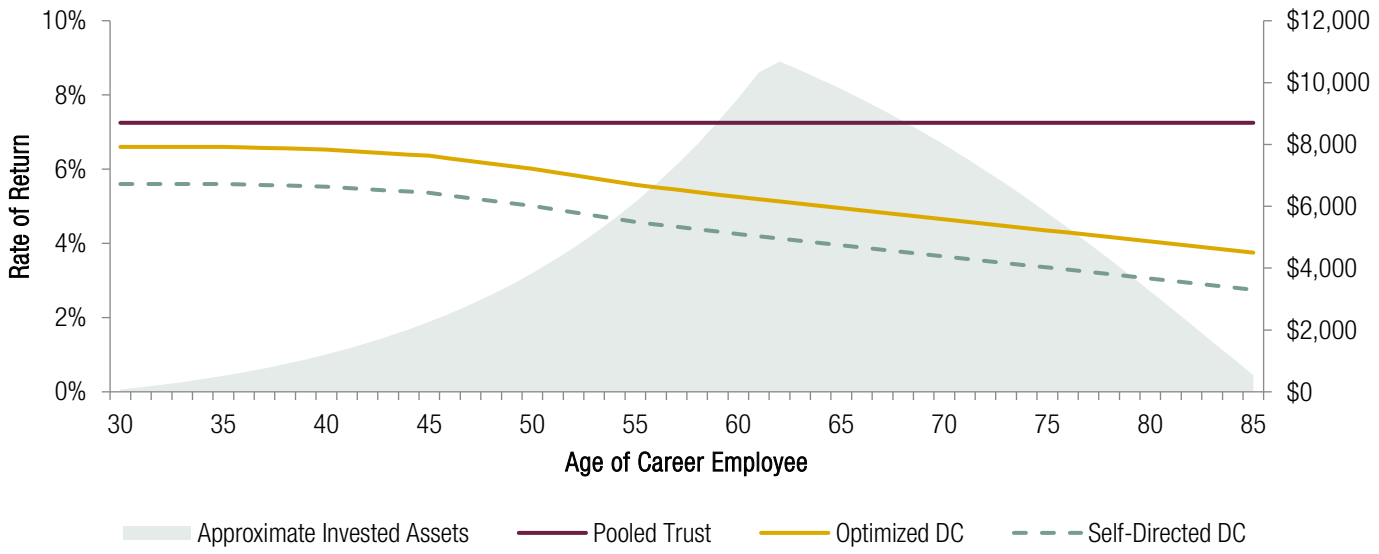
Economic Advantages of Pooled Trust Structures

Pooled trust structures will provide more efficiency (provide more benefit per unit of cost) compared to individual trust structures based on three main differences:

1. Ability to generate more investment earnings over the life cycle of the member
2. Lower administrative and investment-related expenses
3. Pooling of longevity risk

The National Institute on Retirement Security detailed these three advantages in their 2014 report "Still a Better Bang for the Buck." This study confirms their findings. The following is a brief explanation of these advantages.

FIGURE 7.3: PORTFOLIO DIVERSIFICATION THROUGHOUT LIFE CYCLE



SOURCE: GRS

Ability to Generate More Investment Earnings Over the Life Cycle of the Member

History has shown that investment earnings have provided the majority of the assets available to pay benefits from defined benefit plans. The more investment earnings that can be generated, the less contributions are needed to provide a specific benefit, or, the more benefit that can be provided from a specific contribution level. It is important to distinguish between investment *rates of returns* and investment *earnings*. While *rates of returns* are the headline number and easier to compare situation to situation, the benefits are actually paid with *investment earnings*, which are the dollar amounts generated from those returns over time. The earnings are a function of two variables, the rate of return and the amount of assets generating the return. A larger portfolio will generate more investment earnings.

Most financial advisors recommend individuals begin to reduce their investment risk exposure as they approach retirement age as demonstrated in the portfolios of the retirement target date mutual funds. Also, based on the longevity management section that follows, an individual not in Social Security should be annuitizing their account balance at retirement with an insurance company. This means that while the average median return from the pension trust versus the optimized defined contribution plan during the working career is somewhat modest (7.25 percent versus 6.60 percent), the pension trust is earning 7.25 percent per year from age 55 onward, when the asset levels are the highest, while the individual has begun to significantly reduce their risk exposure during those periods and thus is generating 2 percent to 3 percent less per year. Figure 7.3 shows the expected return for each of the portfolios during the lifecycle of the member along with the shape of the hypothetical asset balance for each age.

As shown, while the expected return on the individual's portfolio is not significantly less than the pension trust through age 50, the difference from age 55 onward is substantial, and that is when the assets are highest. The rate of return on the portfolio when the member is 34 will have an immaterial impact on the retirement security of the member, but the rate of return (or loss) at age 60 and 61 will have a dramatic impact on the amount of benefit.

Lower Administrative and Investment-Related Expenses

As discussed in Appendix H, the pooled trust, due to its size, ability to dictate terms in contracts, and less daily account requirements would likely have lower expenses.

Longevity Management

Longevity risk is defined as the uncertainty a retiree must manage in respect to their own lifespan. Actuarial tables may suggest a retiree currently age 62 should live about 26 more years to 88. In truth, for 1,000 62 year olds, the distribution will range from one month to 40 more years. Figure 7.4 represents how many of 1,000 age 62 female teachers would be alive at each prospective age based on the current valuation assumptions.

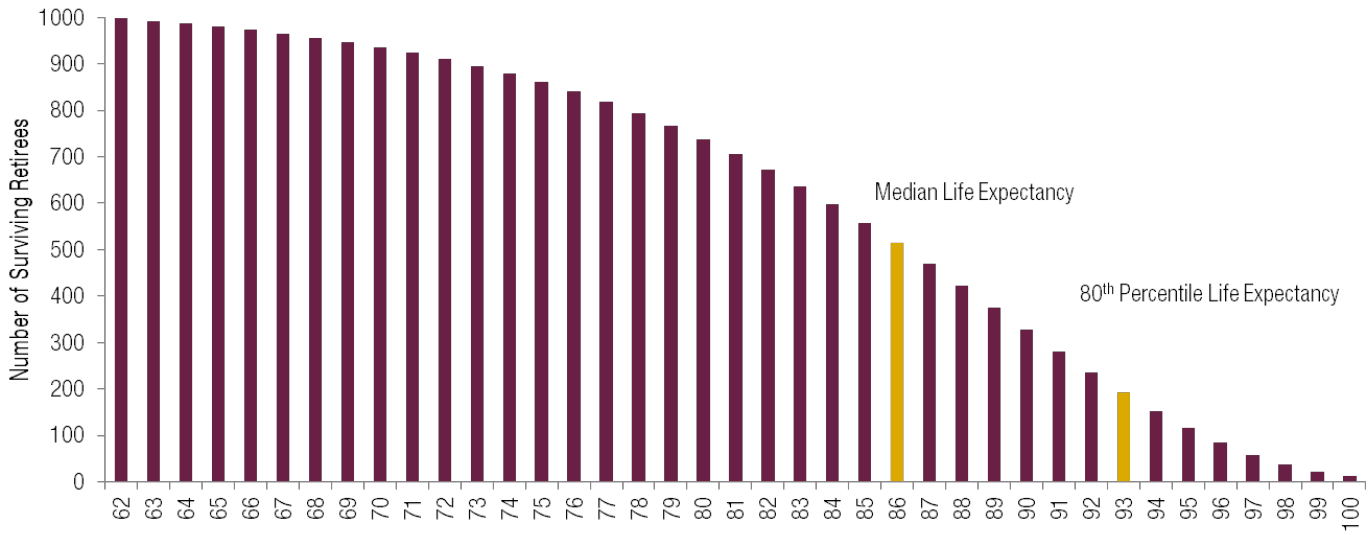
At retirement, the retiree does not know which end of the spectrum they will be on. Even if the retiree decided to be conservative and save enough to be in the 80th percentile (which would take approximately 12 percent more in contributions throughout the working career), there is still a 20 percent probability the member will outlive their money. A pooled trust can manage this by pooling the 1,000 teachers together so that funding to the 50th percentile is producing the maximal value without "over saving."

State Intrinsic Risk

If new teachers were put into a defined contribution plan and then all decided to attempt to manage their own money in retirement by funding to the 80th percentile, 20 percent of them would run out of money. Stochastic modeling would actually anticipate as many as 35 percent running out of money at some point, as once a member runs out of funds, they cannot recover. Without Social Security, these members would have no assets or income and thus would qualify for every social program available to retirees, for example Medicaid.

Given that one in 20 people in the state are members of TRS, there is substantial risk to the State if these retirees do not have benefit security. Advance funding the benefit through TRS, with professional money management, is far more efficient and less costly than paying other benefits later. For these reasons, account balances at retirement have been annuitized to provide benefit security to the member and less potential future risk to the State.

FIGURE 7.4: AVERAGE LIFE EXPECTANCY

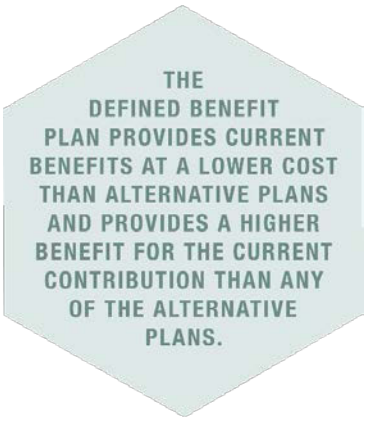


SOURCE: GRS

Plan Comparison

Alternative Plans Compared to Current Defined Benefit Plan

In examining replacement income for the career employee, TRS finds that the defined benefit plan provides current benefits at a lower cost than alternative plans and provides a higher benefit for the current contribution than any of the alternative plans.



Therefore, if the State desires to provide the same levels of benefits under any alternative plan, then higher contribution rates would be necessary. Figure 7.5 demonstrates this finding.

Targeted Benefit Approach

The TRS benefit, as currently designed, replaces roughly 69 percent of a career employee's preretirement income when the employee initially retires. Therefore, TRS modeled the plans in the Targeted Benefit Approach to provide the same level of benefit as the current plan regardless of cost. TRS set the cost of the current defined benefit plan at 100 and measured the relative cost of the alternative plans assuming the goal is to provide the same benefit level to a career employee as provided under the current plan.

As shown below, TRS determined that the alternative plans would be 30 percent to 124 percent more expensive than the current defined benefit plan to provide the same level of benefit when the employee initially retires. Note, this estimate does not include costs associated with paying off any unfunded liability.

Notables:

- The Targeted Benefit Approach, is designed so that all of the structures create a 69-70 percent replacement income at age 62 for a member hired at age 30.
- The relative cost always refers back to the current benefit structure. So the 224 score on a self-directed defined contribution plan means that it costs 124 percent more across all members to provide the same benefit at retirement to career employees, if all assumptions are met.
- The stated expected costs are based on all assumptions being met. Variance will begin to emerge as the experience differs from the assumptions. This is illustrated in the investment return sensitivity analysis of Appendix I.
- Again, the perceived higher cost when comparing the cash balance program to the current defined benefit program is not derived from less efficiency overall, but is due to the higher benefits provided to members who do not work entire careers. Defined benefit programs maximize the benefit provided to the career employee while cash balance programs spread the value out between career and partial

FIGURE 7.5: COMPARISON OF ALTERNATIVE PLANS – TARGETED BENEFIT APPROACH

Illustrated Structure	State Contribution	Member Contribution	Relative Cost	Replacement Ratio at Age		
				60	62	65
Current Defined Benefit Plan	2.59%	7.70%	100	58.3%	69.4%	76.3%
Cash Balance Plan	5.72%	7.70%	130	59.7%	69.4%	86.8%
Optimized Defined Contribution Plan	11.86%	7.70%	190	60.4%	69.4%	90.5%
Self-Directed Defined Contribution Plan	15.35%	7.70%	224	61.2%	69.4%	88.9%

SOURCE: TRS and GRS

career employees. The Targeted Benefit Approach would require an employer contribution of 5.7 percent of payroll, compared to the 2.6 percent of payroll in the current defined benefit program. The Targeted Contribution Approach would replace approximately 56 percent of final salary for the career employee, versus the 69 percent in the current program.

Figure 7.6 is a graphical representation of the Targeted Benefit Approach. The figure shows the contribution rate (relative cost) necessary under each plan structure when the benefit level is kept the same and the contribution rate varies.

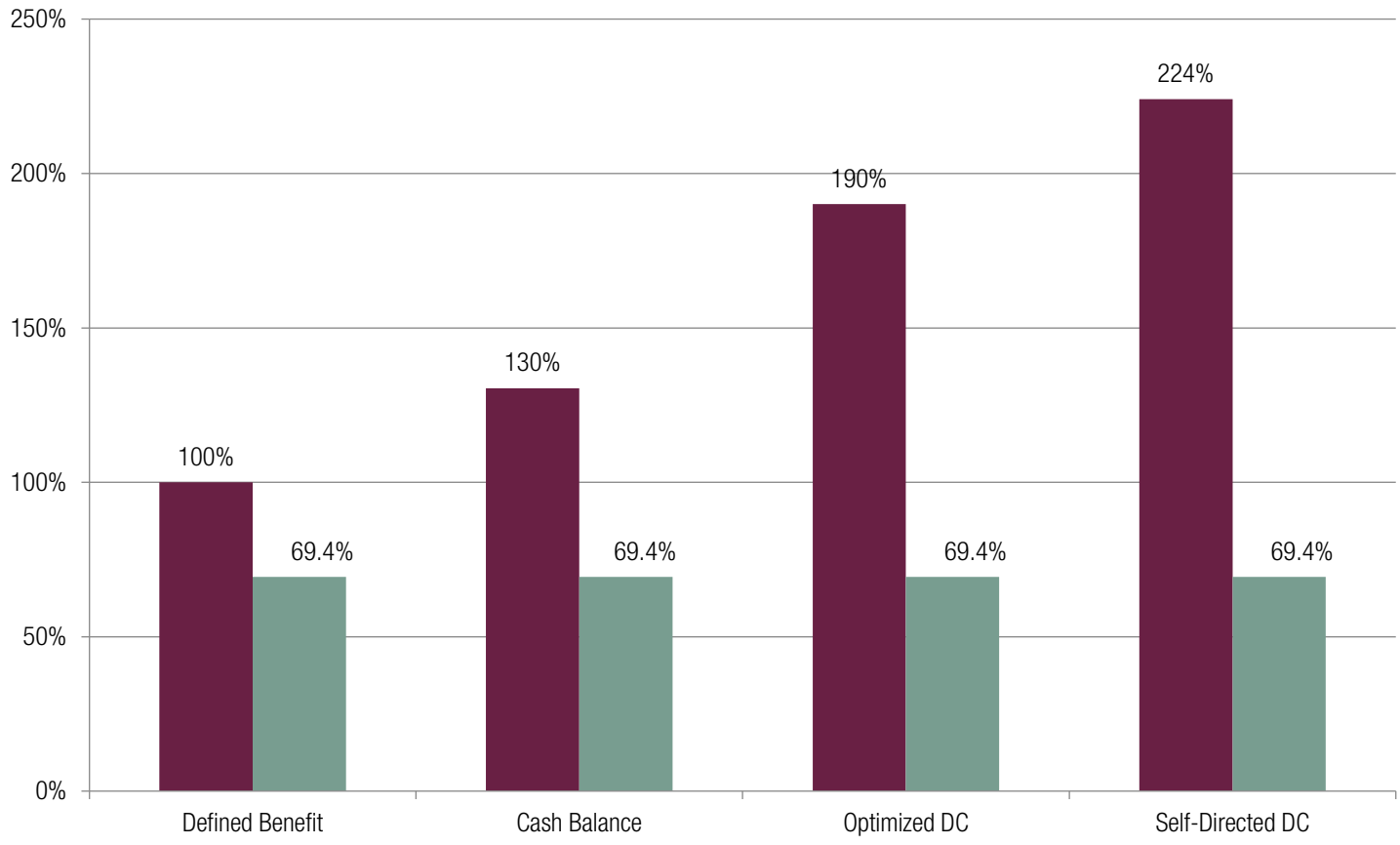
Targeted Contribution Approach

Conversely, under the Targeted Contribution Approach, TRS modeled the alternative plans to cost the same as the current plan and the resulting replacement ratios are allowed to vary. Under this approach, TRS determined that the alternative plans would replace 29.9 percent to 56.1 percent of preretirement income for a career employee retiring at age 62. Figure 7.7 shows the replacement income results of the alternative plans as modeled under the Targeted Contribution Approach. The result of the Targeted Contribution Approach shows that the current defined benefit plan provides a higher benefit for the current cost than any of the alternative plans.

Notables:

- Using the Targeted Contribution Approach, all of the structures create a 100 percent relative cost.

FIGURE 7.6: TARGETED BENEFIT APPROACH



SOURCE: GRS

FIGURE 7.7: COMPARISON OF ALTERNATIVE PLANS – TARGETED CONTRIBUTION APPROACH

Illustrated Structure	State Contribution	Member Contribution	Relative Cost	Replacement Ratio at Age		
				60	62	65
Current Defined Benefit Plan	2.59%	7.70%	100	58.3%	69.4%	76.3%
Cash Balance Plan	2.59%	7.70%	100	48.3%	56.1%	70.2%
Optimized Defined Contribution Plan	2.59%	7.70%	100	30.8%	35.4%	46.2%
Self-Directed Defined Contribution Plan	2.59%	7.70%	100	26.3%	29.9%	38.3%

SOURCE: GRS

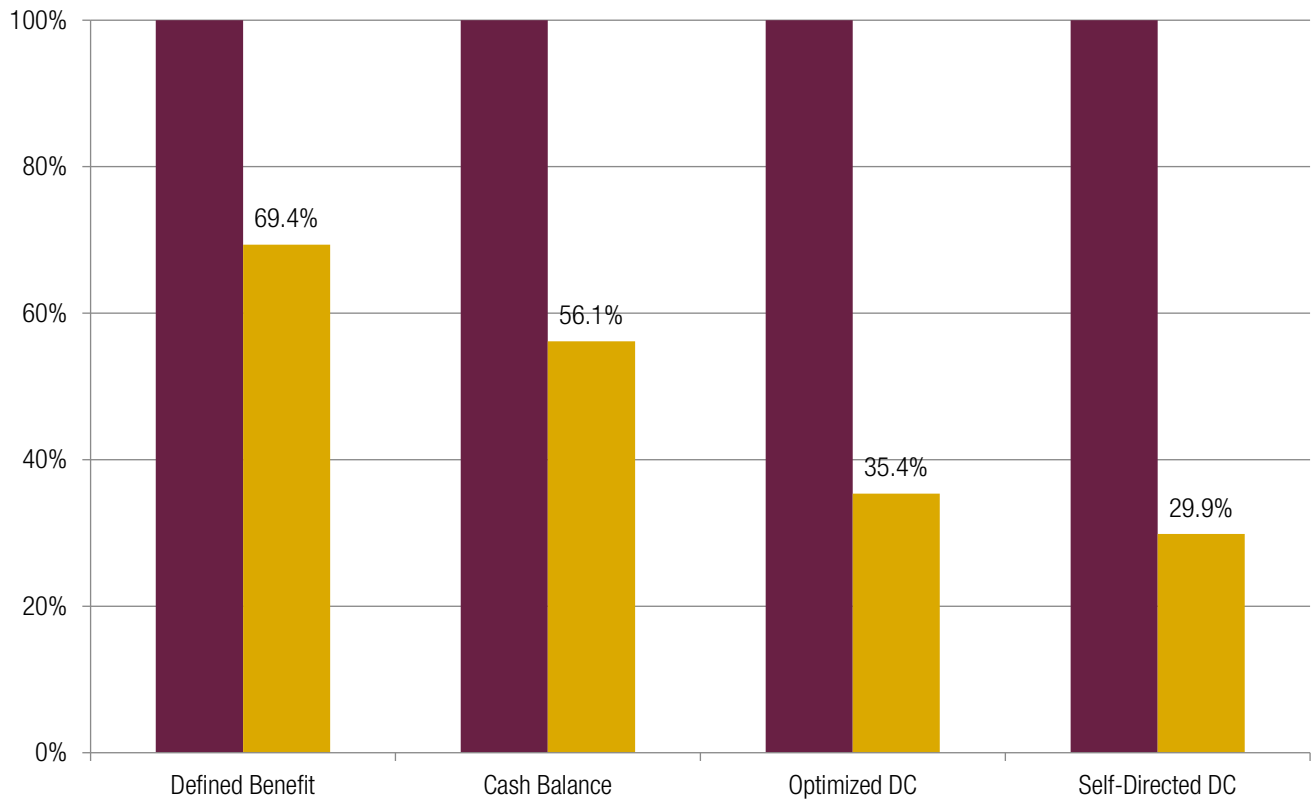
- As modeled, the cash balance plan offers the closest replacement ratio to the current plan at age 62, but still quite a bit lower for the career employee.

- The 29.9 percent expected replacement ratio for the self-directed defined contribution plan at age 62 equates to an $18,000 annual benefit for the career employee, with no anticipated cost-of-living adjustments and no Social Security benefits. For reference, the poverty guideline in 2018 for a household of two was $16,460.[27]

It is important to note that required contribution amounts and resulting replacement ratios of the alternative plan models will vary depending on the investment experience of the plan. Appendix I demonstrates the sensitivity of the alternative plans to differing rates of investment returns.

Figure 7.8 is a graphical representation of the Targeted Contribution Approach. This figure shows the resulting replacement ratio under each plan structure when the contribution rate is kept the same and the benefit varies.

FIGURE 7.8: TARGETED CONTRIBUTION APPROACH



SOURCE: GRS

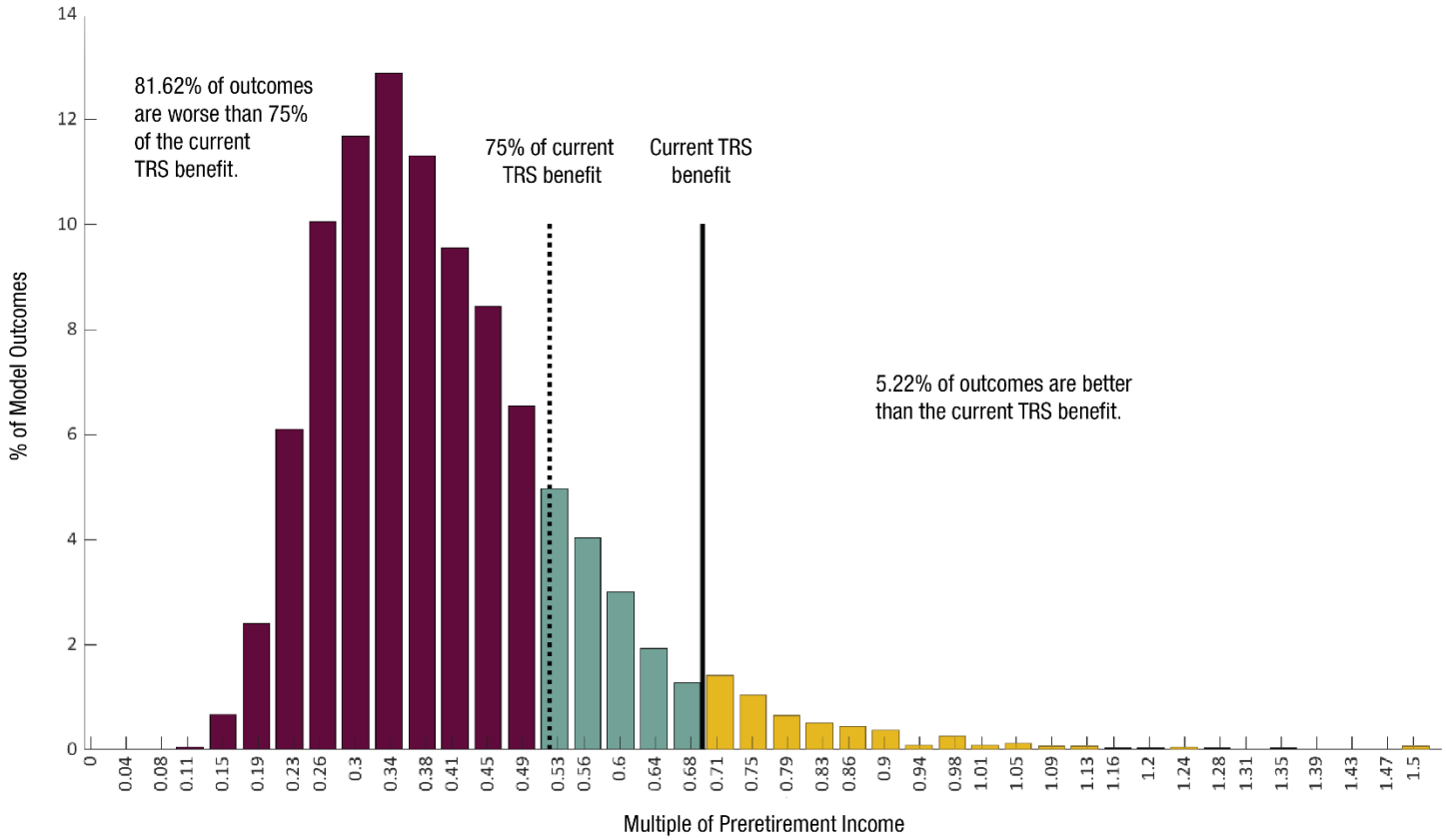
Individual Self-Directed Retirement Income

The majority of TRS members will do significantly worse investing on their own in a plan with a defined-contribution component. In any plan with a self-directed defined-contribution component, TRS members would make their own investment decisions. The resulting difference between individual returns would likely be very wide.

Figure 7.9 illustrates the range of potential retirement outcomes that might occur for an individual with a self-directed defined contribution plan to which the member contributes the same 7.7 percent as the current plan and the State contributes 6.0 percent.

This analysis uses target date funds from Fidelity and Vanguard as the asset allocation and the capital market assumptions provided by Aon Hewitt to simulate 5,000 possible investment experiences for a hypothetical career employee. This process produces estimates of the amount an average employee could accrue by the age of 62. The solid black line shows the current TRS benefit as a multiple of preretirement income, which is approximately 69 percent. Only a handful of outcomes (5.22 percent) provide a level of benefit that exceeds the current defined benefit. The vast majority of outcomes provide a level of benefit that is less than three-quarters of the current defined benefit level.

FIGURE 7.9: INDIVIDUAL SELF-DIRECTED RETIREMENT INCOME COMPARED TO TRS BENEFIT



SOURCE: TRS

The estimated underperformance is attributable to lower investment returns from a shorter investment period, access to fewer asset classes, less-disciplined investment approaches, and potentially higher fees. Appendix H provides detailed assumptions for this analysis.

Notables:

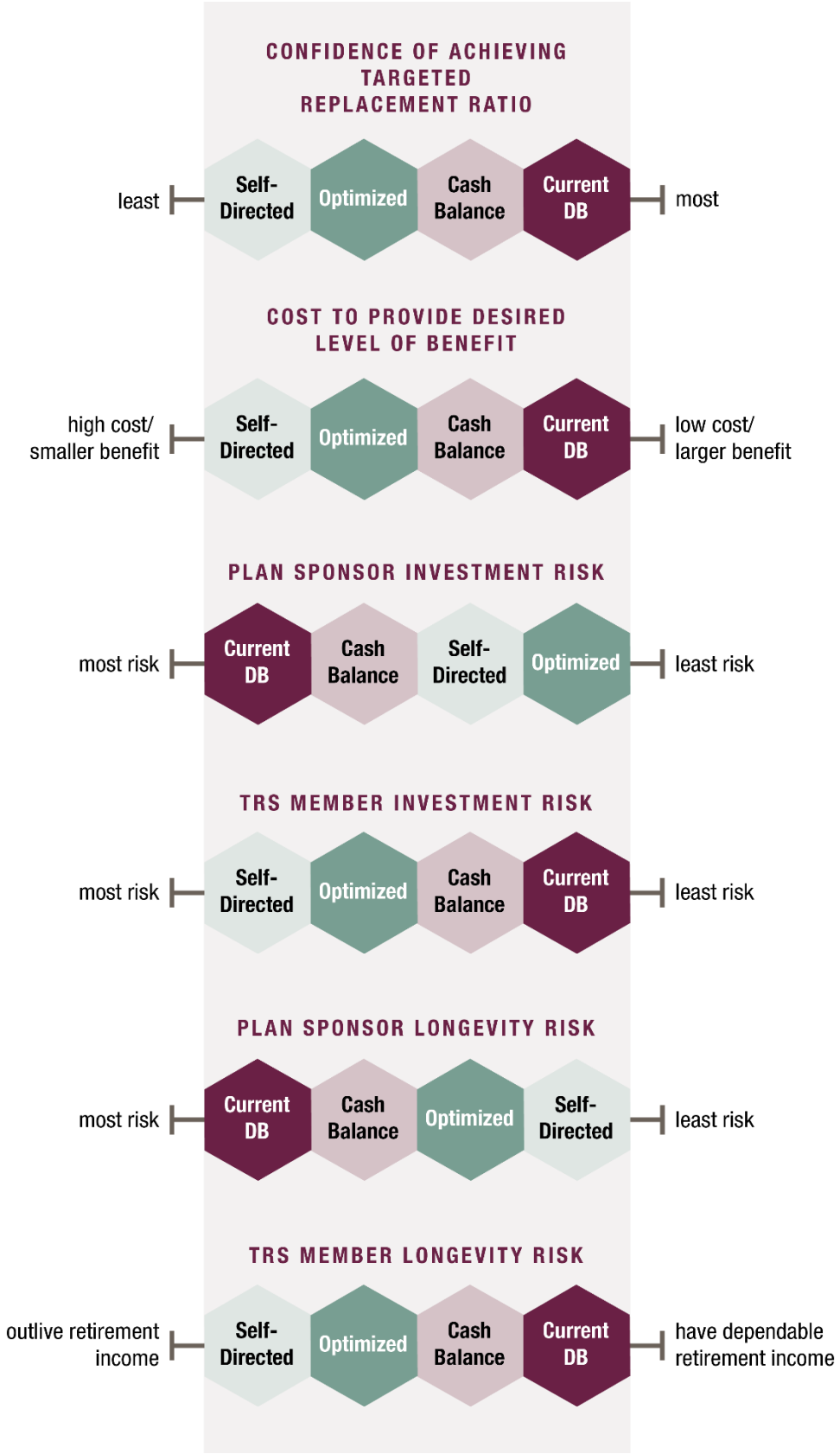
- Assumes an employee begins working at age 30 and retires at age 62.
- Contribution rates are fixed at their current levels of 7.7 percent for the member and 6.0 percent for the State.
- Converts the 5,000 lump sum outcomes accrued by retirement at the age of 62 into a fixed lifetime payment stream.

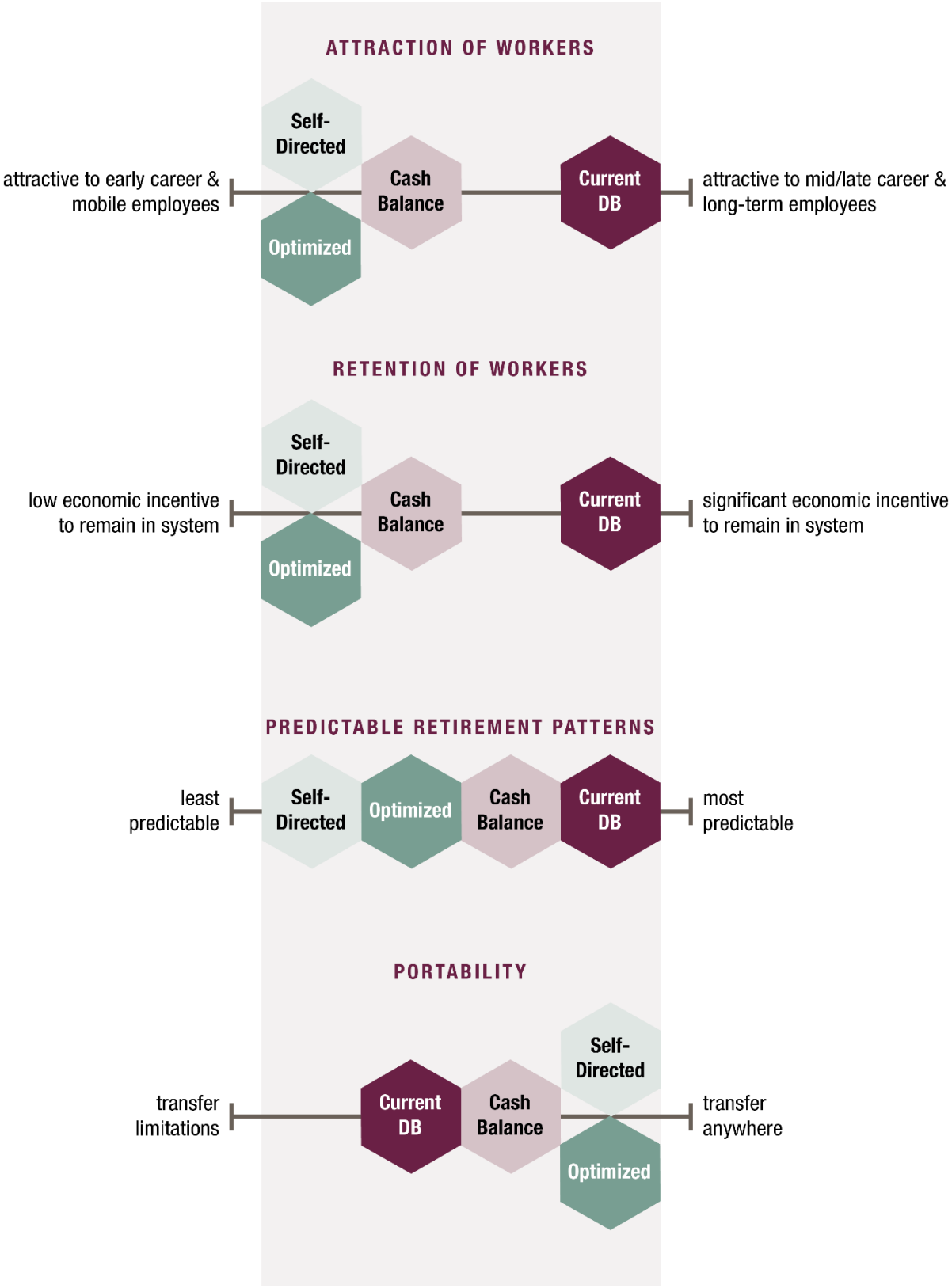
All Plans Compared to Considerations in Plan Design

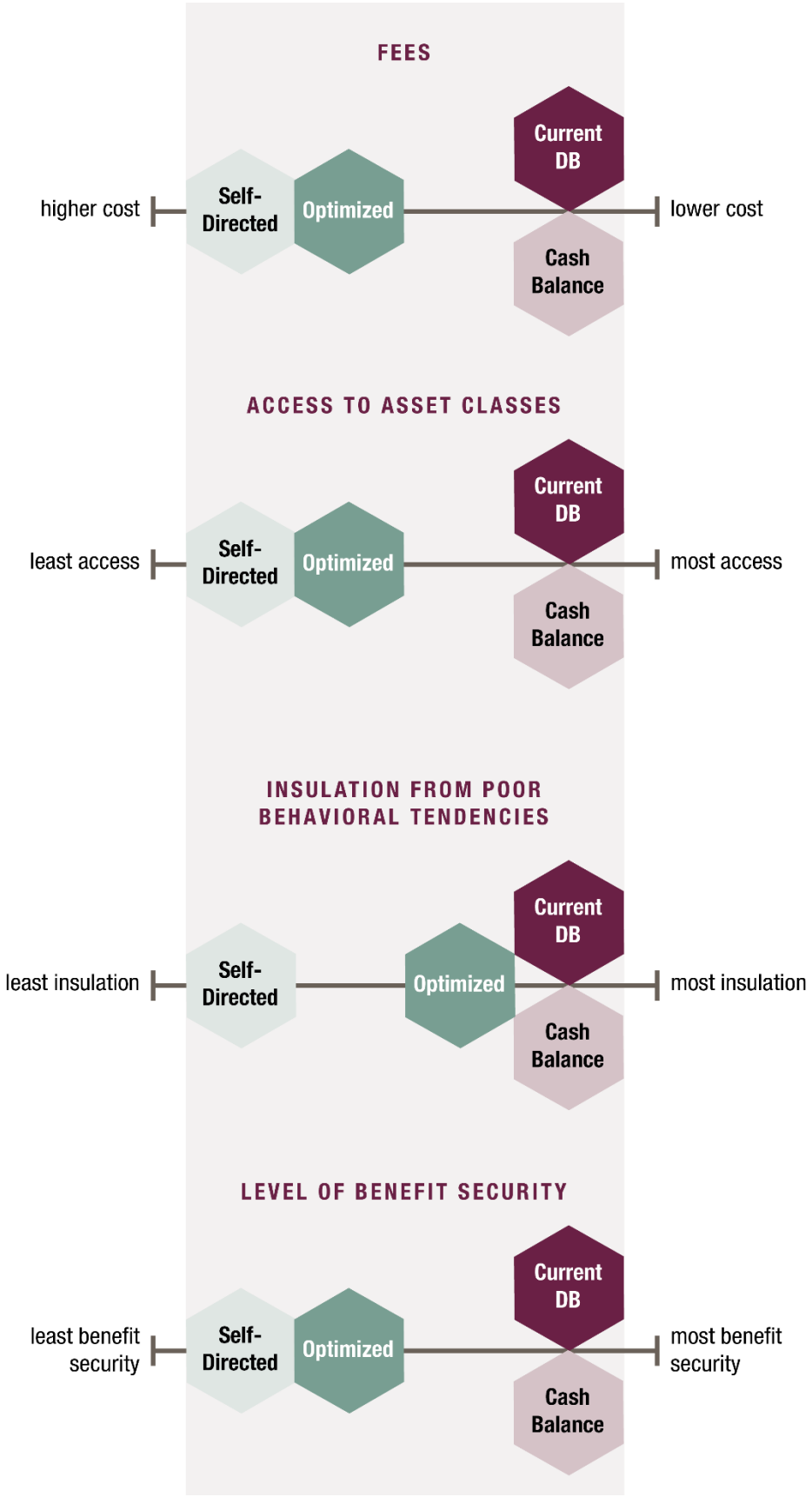
When examining the most important aspects of pension plan design, the current defined benefit plan generally provides more favorable outcomes for TRS members. These plan design metrics include replacement income, efficiency, investment and longevity risk, workforce management, portability, fees, access to asset classes, insulation from poor behavioral tendencies, and Social Security.

Figure 7.10 provides a brief summary of each of the modeled plans in the context of the various considerations in plan design. The four plans (Current Defined Benefit, Cash Balance, Optimized, and Self-Directed) are placed on a scale from least to most desirable outcome depending on plan design consideration. Placement on the scale represents order only, not magnitude.

FIGURE 7.10: ALL PLANS COMPARED TO CONSIDERATIONS IN PLAN DESIGN




ATTRACTION OF WORKERS
attractive to early career & mobile employees
Self-Directed
Optimized
Cash Balance
Current DB
attractive to mid/late career & long-term employees
RETENTION OF WORKERS
low economic incentive to remain in system
Self-Directed
Optimized
Cash Balance
Current DB
significant economic incentive to remain in system
PREDICTABLE RETIREMENT PATTERNS
least predictable
Self-Directed
Optimized
Cash Balance
Current DB
most predictable
PORTABILITY
transfer limitations
Current DB
Cash Balance
Self-Directed
Optimized
transfer anywhere


FEES
higher cost
Self-Directed
Optimized
Current DB
Cash Balance
lower cost
ACCESS TO ASSET CLASSES
least access
Self-Directed
Optimized
Current DB
Cash Balance
most access
INSULATION FROM POOR BEHAVIORAL TENDENCIES
least insulation
Self-Directed
Optimized
Current DB
Cash Balance
most insulation
LEVEL OF BENEFIT SECURITY
least benefit security
Self-Directed
Optimized
Current DB
Cash Balance
most benefit security

SOURCE: TRS

TOTAL COST IMPACT FROM IMPLEMENTING A NEW STRUCTURE

TOTAL COST IMPACT FROM IMPLEMENTING A NEW STRUCTURE

To fully examine the cost of implementing a new plan, the appropriate comparison is between the anticipated cost of the current program, assuming new hires are added over time, and the sum of the anticipated cost of the current program once closed, including any impact closing the current plan would have on the existing unfunded liability, and the cost of the new program.

Liabilities for Current and Future Members in the Current Program

The 2018 UAAL of $46.2 billion represents benefits accrued by current active members and retirees. It does not represent any prospective liability for current active members or anticipated new hires that have not yet joined the system. Current members are also anticipated to accrue approximately $12.5 billion in employer provided new benefits before they have all retired. The sum of the $46.2 unfunded liability and the $12.5 billion in projected new benefits is $58.7 billion in total present value of expected employer contributions to pay for benefits for current members.

For future members, while the total plan sponsor contribution rate of 7.71 percent (6.8 percent State and 0.91 percent Employer) is being made on all of their payroll, only approximately 3.14 percent of pay is going towards providing benefit accruals for members. The remaining 4.57 percent of pay is allocated toward amortizing the UAAL for current members, and thus is represented in the $46.2 billion UAAL value above. Assuming a stable active population where current members are replaced as they leave active service and a 3 percent wage inflation assumption, to provide 3.14 percent benefit accruals to all future members is a present value of future contributions equal to $22.1 billion. To put this number in context, the total present value of salaries projected to be paid to future members is $704 billion.

Liabilities Assuming the Current Plan is Closed and Future Members in the New Program

To assess the economic impacts of closing the plan, TRS examined two elements — the present value of providing benefits to current members under a closed plan and the present value to provide benefits to new members under a defined contribution plan. Assessing these costs together is designed to give a complete picture of the total present value of defined benefit and defined contribution plan costs if the current plan were closed.

First, placing new hires into a different program will not reduce the liabilities of the current plan. Therefore, the $58.7 billion described above, which consists of $46.2 in unfunded liabilities and $12.5 billion in future benefits for current members, remain regardless of plan design. Moreover, modeling shows that closing the plan will increase the cost of providing benefits to current members due to lower investment returns.

When new members are placed into a new plan, the contributions for those members no longer flow into the original pension trust. This limits the ability to invest in illiquid asset classes that often have higher returns, such as private equity and impacts the fund's ability to generate investment earnings. To reflect this, TRS has assumed the fund would slowly transition from the current asset allocation to a more liquid asset allocation with similar risk characteristics over 20 years and then remain in the new allocation. This change to investment policy decreases the expected investment earnings generated to assist in financing the benefits for current members by approximately $15.5 billion. This $15.5 billion loss in future investment earnings directly increases the UAAL for current members and will have to be made up with future contributions. Thus the total present value of projected plan sponsor contributions to pay for benefits for current members, if the plan is closed, increases from $58.7 billion to $74.2 billion. The State would have options when determining how to finance these costs, whether through a combination of direct payment schedules, lump sums, and/or percentage of payroll contributions.

The second cost element TRS examined under a closed plan is the cost to provide benefits for new members under an alternative plan design. Currently, the plan sponsor contribution is 3.14 percent of pay in benefit accruals. This is reflected in the $22.1 billion discussed above. If the current plan is closed and new hires participate in a defined contribution plan, the State will necessarily

make decisions regarding the amount of plan sponsor contributions going into the new plan. If the plan sponsor contribution is the current 3.14 percent of pay in benefit accruals for new hires, then the cost of that contribution will be $22.1 billion regardless of plan design.

However, putting new hires into a defined contribution plan with a contribution of 3.14 percent of pay could be inconsistent with both the Texas Constitution that requires a minimum 6 percent of pay contribution from the State and federal requirements to provide a meaningful alternative to Social Security. It is beyond the scope of this study to address any legal questions surrounding the amount of State or plan sponsor contributions. Rather, TRS has modeled the total present value of plan sponsor contributions with both a contribution of 3.14 percent of pay and with a contribution of 6 percent of pay.

Putting new hires into a defined contribution plan with a plan sponsor contribution of 6 percent of pay for new members would result in a net present value of plan sponsor contributions of $42.2 billion, or an increase of approximately $20.1 billion. This $42.2 billion consists of the $22.1 billion to contribute 3.14 percent of pay toward benefit accruals plus an increase of $20.1 if the State raised the plan sponsor contribution to 6 percent of pay toward benefit accruals.

Thus, the total cost from closing the plan and providing a 6 percent contribution to a defined contribution plan for future hires would be the sum of the $74.2 billion in present value of contributions made for providing benefits to current members with lower expected investment earnings and the $42.2 billion in present value of contributions into the new program, or $116.4 billion. More information on assumptions for the alternative structure and impact on closing the plan is in Appendix J.

This analysis has been modeled four ways. The term “State” represents all employers and plan sponsors collectively.

Model 1 - A true apples-to-apples scenario where the investment policy is left unchanged and the State contribution into the defined contribution plan is equal to the defined benefit plan sponsor contribution of 3.14 percent of pay toward benefit accruals for new members.

Model 2 - The investment policy is changed over time and the State contribution into the defined contribution plan is equal to the defined benefit plan sponsor contribution of 3.14 percent of pay toward benefit accruals.

Model 3 - The investment policy is left unchanged and the State contribution into the defined contribution plan is equal to 6.00 percent of pay toward benefit accruals.

Model 4 - The investment policy is changed over time and the State contribution into the defined contribution plan is equal to 6.00 percent of pay toward benefit accruals.

The fourth scenario, in which the investment policy is changed over time to reflect the liquidity constraints and the impact of volatility on trust asset values along with a 6 percent plan sponsor contribution into the defined contribution plan, is the most realistic scenario and thus represents the estimated cost impact of implementing the new program. It is assumed the new defined contribution plan would be based on the “Optimized” version discussed in the previous sections.

Impact

To analyze the impact of the combined new program, TRS has determined the median change in the present value of future employer contributions before and after the closure. The model used a stochastic process to generate return scenarios over the next 100 years. The same economic scenarios were run through each model, with variances only from portfolio construction and cash flows. Figure 8.1 provides the result of the analysis.

The most likely scenario, Model 4, is expected to increase the present value of State contributions by approximately $36 billion. A majority of this comes from the increased contribution for new benefits as the contribution rate on behalf of new hires would increase from the current 3.14 percent to 6.00 percent. Even at that level, the defined contribution plan would only be expected to provide approximately two thirds of the benefit provided by the current defined benefit program. Thus, the State would be paying 44 percent more to provide significantly less in benefits to a career member.

If the System earned exactly 7.25 percent each year, all of the other assumptions are exactly met, and the State contribution into the defined contribution plan were equal to the value of the benefit currently being provided in the defined benefit plan, the total State contribution amounts should be the same over the projection horizon, whether the System is closed or not. Models for the open and closed plan bear this out. If 7.25 percent is assumed to be achieved each year and the State contributed 3.14 percent to the new program, the two models compute basically the same total employer contributions.

Investment Risk

THE STATE WOULD BE PAYING 44% MORE TO PROVIDE SIGNIFICANTLY LESS IN BENEFITS TO A CAREER MEMBER.

One of the arguments for moving to a defined contribution plan is shifting risk away from the State. The median results above clearly show the new plan will cost more than the current plan, but how does the relationship hold up in an adverse scenario? Using the same stochastic model, TRS performed the same comparison using the 25th percentile adverse experience outcome. For reference, that would be about 0.75 percent less than expected, or an approximate 6.50 percent return over the long term versus the currently assumed 7.25 percent for the current portfolio.

FIGURE 8.1: Comparison of Expected Future Employer Contributions

Model	Current	1	2	3	4
Asset Allocation	Current	Current	Liquid 60/40**	Current	Liquid 60/40**
State Contribution*	3.14%	3.14%	3.14%	6.00%	6.00%
Present Value of State Contributions (in billions)					
Current Members	$58.7	$58.7	$58.7	$58.7	$58.7
Loss of Expected Investment Earnings	$0.0	$0.0	$15.5	$0.0	$15.5
Future Members	$22.1	$22.1	$22.1	$42.2	$42.2
Total PV State Contributions	$80.8	$80.8	$96.3	$100.9	$116.4
Increase in State PV	$0.0	$0.0	$15.5	$20.1	$35.6
Estimated Replacement Income for Career Member	69%	35%	35%	46%	46%

* Average employer normal cost for current defined benefit, employer matching contribution into DC plan

** The trust would slowly transition from the current asset allocation to a more liquid asset allocation with similar risk characteristics over 20 years and then remain in the new allocation.

SOURCE: GRS

FIGURE 8.2: Comparison of Expected Future Employer Contributions: Adverse Scenario

Model	Current	1	2	3	4
Asset Allocation	Current	Current	Liquid 60/40**	Current	Liquid 60/40**
State Contribution*	3.14%	3.14%	3.14%	6.00%	6.00%
Present Value of State Contributions (in billions)					
Current Members	$58.7	$58.7	$58.7	$58.7	$58.7
Loss of Expected Investment Earnings	$0.0	$0.0	$15.5	$0.0	$15.5
Future Members	$22.1	$22.1	$22.1	$42.2	$42.2
Adverse Investment Performance	$35.8	$29.2	$23.1	$29.2	$23.1
Total PV State Contributions	$116.6	$110.0	$119.4	$130.1	$139.5
Increase in State PV	$0.0	$(6.6)	$2.8	$13.5	$22.9
Estimated Replacement Income for Career Member	69%	29%	29%	36%	36%

* Average employer normal cost for current defined benefit, employer matching contribution into DC plan

** The trust would slowly transition from the current asset allocation to a more liquid asset allocation with similar risk characteristics over 20 years and then remain in the new allocation.

SOURCE: GRS

If the investment returns are actually lower than currently assumed, the difference will have to be made up with increased contributions. Thus, in the current program, if the returns are closer to 6.50 percent, it will create approximately $35.8 billion in investment losses over time which in turn will require an additional $35.8 billion in present value of contributions to keep the current benefit package. However, even in Scenario 1 where new members are not in the trust (and thus there can be no losses on their assets), the increase in the present value of contributions is still $29.2 billion. In the more liquid portfolios, the potential for less earnings is reduced, but this is because that portfolio is expected to return less in general. Based on the most realistic Scenario 4, even in an adverse scenario, the State would be paying 20 percent more to provide half the benefit when compared to the current program.

How poor do the actual returns have to be for the alternative program to cost less than the current one? The model estimates less than 1 percent of potential scenarios would produce a lower present value of State contributions than the current program. Specifically, these are the scenarios in which the current portfolio is generating returns less than 4.5 percent over the long term. It is important to also point out that the same market performance that is generating lower returns in the current trust would also impact the members in the defined contribution plans. In this scenario where the current trust earns less than 4.5 percent over time, the average expected replacement ratio of the career member in the defined contribution plan would decline to 21 percent of final salary, or approximately $12,500 per year in today's dollars.

LEGAL CONSIDERATIONS

LEGAL CONSIDERATIONS

This study does not present a detailed analysis of the legal questions that could arise from consideration of various types of plan changes since it is not known what changes, if any, the legislature may decide to pursue. However, this section briefly addresses the major legal considerations that could arise, depending on the nature of potential changes.

Major Legal Considerations

The major legal considerations in a plan design change can be summarized as follows:

- Whether, and to what extent, TRS members and retirees have a contractual right to their TRS benefits.
- Whether proposed changes would create plan qualification issues under the Internal Revenue Code.
- Whether, and to what extent, federal constitutional protections could prohibit a diminishment of benefits.
- Whether the proposed changes jeopardize the plan's status as a Social Security replacement plan and, if so, how such changes will impact school districts.[28]
- How the Texas constitutional funding requirements in Article 16, Section 67 would apply to different plan designs.
- Whether TRS can receive approval from the IRS on the new plan design.

Article 16, Section 67

Section 67 directed the legislature to create a Teacher Retirement System of Texas and established the basic operational and funding requirements. Section 67 requires, for example, that financing of TRS benefits be based on sound actuarial principles and that the board invest the funds in accordance with its fiduciary duty. Additionally, the Texas Constitution sets the funding requirements for the current plan, including a State contribution rate not less than 6 percent nor more than 10 percent of the "aggregate compensation paid to individuals participating in the system." Section 67(a)(4) provides that general laws in effect at the time of adoption of the section "remain in effect, subject to the general powers of the legislature established in this subsection."

Current Texas Law Relating to Non-Impairment of Pension Benefits

It has been over 80 years since the Texas Supreme Court has addressed the question of whether current TRS members have contractual protection of their benefits and the extent of any such protections. The relevant portion of the Texas Constitution, Article 16, Section 67 (Section 67), does not contain an explicit non-impairment clause which would prohibit the impairment or diminishment of benefits for statewide retirement systems. This is in contrast to Article 16, Section 66 (Section 66), which applies to certain local retirement systems and does contain a non-impairment clause. Section 66 was approved by the electorate and became effective in 2003. The apparent divergent treatment of benefits for a statewide plan as compared to a local plan has not been challenged in court. If benefits of a statewide retirement system are reduced in a way that would violate Section 66, had the plan been local, then the divergent treatment could be the subject of litigation.

Prior to 2003, it was generally assumed that Texas follows the "gratuity model" for statewide pension benefits.[29] This assumption arose from the *Dallas v. Trammell* decision rendered by the Texas Supreme Court in 1937.

The *Trammell* case, a depression-era ruling, has not yet been revisited by the Texas Supreme Court. In the years since *Trammell*, and especially in the last 15 years, there have been numerous cases across the country addressing whether each state's laws provide protection against various types of legislative efforts to diminish public pension benefits. At this point, Texas, Arkansas and Indiana are the only states that have continued to follow a "gratuity model" for pension benefits. The other 47 states have recognized some form of a "contractual theory," recognizing that a public pension annuitant has vested rights in his or her pension benefits that are not subject to reduction or elimination.

Since 2003, there has been one Texas Attorney General Opinion[30] and at least three court cases[31] litigating Section 66, its impact

on *Trammell*, and the ability it gives local retirement systems to reduce benefits. As of the date of this study, the *Eddington* case is currently pending at the Texas Supreme Court. It is reasonable to anticipate that if and when the Texas Supreme Court revisits the *Trammell* decision, which it has an opportunity to do with *Eddington*, that it will update its position on what constitutional protections Texas law provides public pension benefits (if any).

Federal Law Considerations

TRS is a qualified plan under the Internal Revenue Code (IRC) Section 401(a), and a governmental plan within the meaning of IRC 414(d). To maintain status as a qualified governmental plan, there are certain legal requirements found in the IRC that TRS must comply with and these requirements should be taken into consideration when considering plan design changes.

TRS IS A QUALIFIED PLAN UNDER THE INTERNAL REVENUE CODE SECTION 401(a).

For example, there are vesting provisions set forth in the IRC and related IRS guidance that apply to TRS benefits. These vesting provisions require that, at a minimum, a qualified plan must provide 100 percent vesting of a participant's interest when a participant reaches normal retirement age.[32] The normal retirement age in a pension is generally the lowest age specified in the plan at which the employee has the right to retire without the consent of the employer and receive retirement benefits based on the amount of the employee's service on the date of retirement at the full rate (unreduced) set forth in the plan.[33]

To the extent that the legislature is considering a defined contribution component or providing active members the option to voluntarily switch to an alternative retirement plan, the plan should be designed to prevent an improper cash or deferred arrangement (CODA) under the IRC.

In addition to potential IRC impacts, there may be protections under the United States Constitution that should be taken into consideration. In particular, the Contracts Clause, the Takings Clause and/or Due Process Clause each raise legal considerations that would need to be evaluated in the context of the specific plan design changes under consideration.

As more extensively discussed in Section VI, any proposed plan design changes should consider the potential impact on the Social Security status of current TRS members and new hires. For those TRS members who do not participate in Social Security coverage, their exclusion from Social Security is conditioned on being covered by a public retirement plan that provides a minimum level of benefit to qualify as a replacement to Social Security. Accordingly, any reduction in the benefit structure of the TRS pension plan must be carefully reviewed against the minimum standards set by regulation and IRS guidance to determine whether it continues to serve as a qualified replacement plan for all TRS members.

Summary

In summary, any proposal that may emerge will need to navigate state and federal laws that are complex and subject to differing interpretations. It is unclear what amount of protection from legislative diminishment the TRS pension benefits would receive from the Texas Supreme Court. However, based on the experience observed in many states across the country in response to attempts to significantly diminish public pension benefits for active members, wide-spread litigation is almost a certainty. Even under the seemingly low protection provided to pension benefits by Texas law, any attempt to diminish vested benefits by the legislature could be struck down by the courts or jeopardize TRS' qualified plan status under 401(a) of the IRC.

CONCLUSION

CONCLUSION

While the TRS plan is better funded than the average public pension plan, with a modest benefit structure and lower contribution rates, the plan has long-term funding challenges that must eventually be addressed by the legislature. In conducting this study, TRS' goal has been to provide information on the respective values of the current defined benefit plan, a cash balance plan, and different types of defined contribution plans. TRS stands ready to educate and inform lawmakers as they address the very important issue of retirement benefits for the over 1.5 million members of TRS.

APPENDIX A–J

APPENDIX A – GLOSSARY

Actuarially Sound – A funding period less than 31 years; per Government Code Sec. 821.006, a new monetary benefit increase may not be established if the time required to amortize the unfunded actuarial actuarial liability would be increased to a period that exceeds 30 years by one or more years.

Actuarial Standards of Practice (ASOP) – Governing guidance that describes procedures an Actuary should follow when conducting actuarial services and defines what items should be disclosed when communicating actuarial results. The standards serve to assure the public that actuaries are professionally accountable.

Actuarial Valuation – An analysis done by the actuary as of a valuation date (typically annually or biennially) used to assess the current financial health of a pension system and to determine the adequacy of statutory contribution rates by comparing the fund's liabilities to its actuarial value and analyzing changes in the fund's condition.

Annuity – An annual monthly pension amount payable for the lifetime of a plan participant. Depending on optional forms of payment selected, the payment may also continue on for the life of a beneficiary.

Annuitize – The process of converting a one-time payment into an annuity, or lifetime stream of payments, of the same actuarial equivalent value.

Actuarially Determined Contribution (ADC) or Actuarially Determined Employer Contribution (ADEC) – A calculated contribution into a pension plan for the reporting year, most often determined based on the funding policy of the plan. Typically, the ADC (or ADEC) has a normal cost payment component and an amortization of the Unfunded Actuarial Accrued Liability. The ADC/ADEC replaced the ARC (Actuarially Required Contribution) beginning in 2015.

Assumption Set – The set of decrements and predicted economic parameters (such as probability of retirement, termination, mortality, assumed investment return, etc.). This set attempts to predict future events and is examined periodically and adopted by the TRS Board of Trustees as part of an experience study.

Benefit Enhancements – Increases to benefits such as cost-of-living adjustments, 13th checks, and increases in the benefit multiplier as a percentage of payroll. Reducing or easing benefit eligibility can also be viewed as a benefit enhancement.

Benefits Equation – Contributions + Investments = Benefits or C + I = B.

Benefit Formula – Found in Government Code § 824.203; for a standard service retirement annuity, computed based on a member's average annual compensation for the three or five years of service (depending on eligibility and hire date) in which the member received the highest annual compensation multiplied by 2.3 percent for each year of service credit in the retirement system.

Closed Ladder – An amortization method resulting in losses being amortized over set amortization periods and gains can be offset against losses (and amortized over the same period as the largest outstanding loss bases).

Contribution Policy – A policy that defines the annual contribution to a pension plan. This can be either a fixed-amount policy or one that adjusts year-to-year for changes in the normal cost and Unfunded Actuarial Accrued Liability. Typically set as a percentage of payroll.

Cost-of-Living Adjustment (COLA) – The increase given to pension payments being received by retirees. This is typically tied to a Consumer Price Index (CPI) and may have thresholds set on certain metrics before being granted. Can only be considered when the system's funding period is less than 31 years; see Government Code Sec. 821.006.

Defined Benefit Plan – A type of retirement plan in which the amount of the monthly benefit paid at retirement is determined under a formula established by law. The monthly benefit is defined by the formula and is not limited to the amount of accumulated contributions in a member's account.

Defined Contribution Plan – A type of retirement plan in which both the employee and employer make contributions on a regular basis. The amount of contributions into the plan are defined and the total value of the benefit at retirement is not known.

Demographic Assumptions – Certain components of the assumption set adopted by the board as part of the experience study which consists of the probability of certain events happening at each age or service, such as rates of termination, retirement, and mortality.

Depletion Date – The date that the retirement system no longer has enough assets to pay for benefit payments that have come due.

Economic Assumptions – The components of the assumption set adopted by the board as part of the experience study which consists of the year-to-year change in certain items such as payroll growth, wage growth, rate of return on investments, and inflation.

Employer Normal Cost – The total normal cost less the member contribution rate.

Experience Study – A periodic review and analysis of the actual experience of the retirement system. Experience studies determine if actual behavior, plan provisions, and investment returns have matched assumptions, or if adjustments are necessary. The study also examines whether certain assumptions match anticipated future experience and observable economic data. TRS is required to conduct an experience study at least once every five years.

Floating Amortization – The amortization period that results from a plan having a level contribution rate, as a percentage of payroll. As experience unfolds each year, the amortization period is calculated based on updated information. A floating amortization policy sets a minimum contribution rate based on the required amortization period, but does not let the rate decrease until the Unfunded Actuarial Accrued Liability is completely financed as long as the actual contribution rate is higher than the minimum.

Funding Holiday – A plan sponsor either not contributing or not contributing an actuarially appropriate amount to a pension fund.

Funding Period – The number of years required to pay off or eliminate the Unfunded Actuarial Accrued Liability.

Funding Policy – The plan for determining annual contributions by the plan sponsor (and employees, if applicable) to provide for the secure funding of plan benefits over time.

Generational Mortality – Mortality decrements that adjust annually to build in anticipated future mortality improvement rather than assuming the same mortality improvement for given ages for all future years.

Government Code Sec. 821.006. ACTION INCREASING AMORTIZATION PERIOD – (a) A rate of member or state contributions to or a rate of interest or the rate of a fee required for the establishment of credit in the retirement system may not be reduced or eliminated, a type of service may not be made creditable in the retirement system, a limit on the maximum permissible amount of a type of creditable service may not be removed or raised, a new monetary benefit payable by the retirement system may not be established, and the determination of

the amount of a monetary benefit from the system may not be increased, if, as a result of the particular action, the time, as determined by an actuarial valuation, required to amortize the unfunded actuarial liabilities of the retirement system would be increased to a period that exceeds 30 years by one or more years. (b) If the amortization period for the unfunded actuarial liabilities of the retirement system exceeds 30 years by one or more years at the time an action described by Subsection (a) is proposed, the proposal may not be adopted if, as a result of the adoption, the amortization period would be increased, as determined by an actuarial valuation.

Government Code § 824.203. Standard Service Retirement Benefits – (a) Except as provided by Subsections (c) and (d), the standard service retirement annuity is an amount computed on the basis of the member's average annual compensation for the five years of service, whether or not consecutive, in which the member received the highest annual compensation, times 2.3 percent for each year of service credit in the retirement system.

Gratuity Model – Instead of pensions being viewed as a contractual or statutory right, pension benefits are viewed as relatively unprotected from reduction or elimination.

Individual Retirement Arrangements (IRAs) – A retirement vehicle for making tax-deferred investments.

Intergenerational Inequity – The concept of pushing the costs applied to benefits in one age group (or time period) on to future workers who will likely be receiving lower benefits, comparatively.

Multiplier – One of the factors in the benefit formula; 2.3 percent of payroll.

Negative Amortization – Occurs when the Unfunded Actuarial Accrued Liability increases from one year to the next because the interest charges on the Unfunded Actuarial Accrued Liability are larger than the amortization payments contributed against that liability.

Normal Cost – The annual accrual cost of providing retirement benefits for service performed in the current year.

Open Amortization – A non-closed amortization period set for making payment on the Unfunded Actuarial Accrued Liability, typically reset every year.

Plan Sponsor – The entity that implements and maintains a retirement plan, including determining contributions, defining the benefit package, amending the plan, etc.

Qualified Plan – A retirement plan defined under Section 401(a) of the IRS tax code that give tax advantages for contributions employers make to the plan.

Replacement Income – The amount of pension money received in retirement compared to the final salary while active.

Rolling Amortization – Utilizing an amortization period that is reset every year. In effect, an open amortization policy.

Standard Annuity – A monthly pension payment payable for the life of the participant only. Typically it is the highest monthly amount available since there is no adjustment to accommodate payments beyond the participant's lifetime.

Static Mortality – Mortality decrement improvements that stay the same for each given age over time.

Stochastic Model – A predictive model that, instead of selecting one unique value for each assumption variable, runs many (often thousands) of projections using random variations on the assumption variables. The results can be refined into different expected percentile groupings to offer likelihoods of future outcomes.

Target Date Funds – Retirement funds designed to automatically adjust asset mixes to grow more conservative the closer a participant gets to retirement. The speed with which the fund derisks is known as the "glide path."

Unfunded Actuarially Accrued Liability (UAAL) – The excess of the Actuarial Accrued Liability over the plan assets.

401(k) – A defined contribution tax-advantaged retirement plan in which participants defer income until retirement. Employers typically match a certain percentage of the participant contributions.

403(b) – A defined contribution tax-advantaged retirement plan in which participants defer income until retirement. Employers typically match a certain percentage of the participant contributions. Often used by non-profit organizations.

APPENDIX B – 2016 MEMBER SATISFACTION SURVEY RESULTS ON FINANCIAL PREPAREDNESS

Q41. Are you saving for retirement outside of your TRS pension plan in a private savings vehicle such as a 403(b) or IRA? (N=828)

	Yes	No	Don't Know
All Respondents	55.9	43.5	0.7
Gender			
Male	55.8	43.7	0.5
Female	55.9	43.4	0.7
Age			
36 and under	50.0	50.0	0
37 to 45	57.7	41.0	1.3
46 to 51	71.1	27.8	1.1
52 and over	61.3	37.6	1.2
Institution Type			
Public School	56.6	43.1	0.3
Higher Education	52.5	45.0	2.5

Q41a. If yes, what type of account? [Respondents could check all that apply so percentages won't add to 100.] (N=514)

Type of Account	Percent of Active Members Saving Outside of TRS Retirement
403(b)	39.6
IRA	40.2
Cash	11.8
Stock	7.5
Other	12.6

Q41b. If no, then do any of the following reasons apply as to why you are not saving for retirement outside of your TRS pension plan? (N=304)

	Percent of Active Members NOT Saving for Retirement Outside of TRS
I do not think I need to save extra outside of my TRS pension plan.	2.3
It seems too far away to save for now.	8.1
I do not have enough after my expenses are paid to save for retirement outside of my TRS pension plan.	62.9

I don't know how to save for retirement outside of my TRS pension plan.	8.1
None of those are the reason.	19.9

Q42. Have you estimated how much income you will need in retirement? (N=828)

	Yes	No	Don't Know
All Respondents	34.7	64.3	1.0
Gender			
Male	39.7	57.8	2.6
Female	33.1	66.5	0.5
Age			
36 and under	22.7	75.9	1.4
37 to 45	37.2	62.4	0.4
46 to 51	44.5	55.3	0.3
52 and over	58.8	39.9	1.3
Institution Type			
Public School	33.9	65.1	1.0
Higher Education	38.4	60.5	1.1

Q42a. If no, do any of the following reasons apply as to why you have not estimated how much income you will need in retirement? (N=425)

	Percent of Active Members Who Have Not Estimated Income Needed for Retirement
I think my TRS pension will give me the income I need in retirement; so, I don't need to estimate anything else.	1.5
It seems too far away to think about estimating how much income I will need in retirement.	34.5
I don't know how to estimate how much I need in retirement.	42.6
None of those are the reason.	25.4

Q43. How knowledgeable do you feel about ways to save for retirement outside of your TRS pension plan? (N=828)

	Very Knowledgeable	Knowledgeable	Somewhat Knowledgeable	Not at all Knowledgeable	Don't Know
All Respondents	10.5	31.3	36.5	21.6	0.2
Gender					
Male	18.7	33.7	33.2	14.4	0.0
Female	7.7	30.5	37.6	24.1	0.2
Age					
36 and under	6.7	28.3	38.7	26.3	0.0
37 to 45	12.1	34.8	29.5	23.1	0.4
46 to 51	16.2	31.8	36.6	15.2	0.2
52 and over	15.0	33.2	42.1	9.5	0.2

Institution Type					
Public School	10.8	31.2	35.7	22.3	0.0
Higher Education	9.2	31.6	39.8	18.5	0.9

Q44. If you have gathered information on ways to save for retirement outside of your TRS pension plan, where have you gotten most of your information? (N=828)

	Financial Planner	Financial Web Sites	Social Media	Books/ Magazines	Friends/ Family	Other	Don't Know
All Respondents	32.1	11.6	0.5	7.0	32.3	12.3	4.2
Gender							
Male	35.6	21.9	0.1	5.2	23.8	8.5	5.0
Female	30.8	8.1	0.7	7.7	35.2	13.6	3.9
Age							
36 and under	28.5	10.5	0.8	4.2	42.4	9.1	4.5
37 to 45	33.7	14.4	0.0	11.8	21.7	13.0	5.5
46 to 51	39.2	14.1	1.1	4.9	29.7	9.4	1.5
52 and over	35.3	8.4	0.5	8.1	23.8	21.7	2.3
Institution Type							
Public School	32.7	10.0	0.1	6.9	34.7	12.4	3.3
Higher Education	29.2	19.0	2.4	7.7	21.6	12.2	7.9

APPENDIX C – OTHER FUNDING SCENARIOS

In all scenarios, the member rate increases would begin in fiscal year 2020 and would always be 0.25 percent increases per year until reaching the ultimate rate shown. Increases for the sponsor would always be uniform over the period. In other words, if it requires 0.50 percent increases per year that would be true for all years, and likewise for the 0.25 percent scenarios. More consideration should be given to a higher ultimate contribution rate for smaller increases over a longer phase in period. In addition, as discussed in previous sections, much stronger consideration should be given to scenarios that achieve funding periods of less than 31 years (in **bold**).

FIGURE C.1: OTHER ALTERNATIVE SCENARIOS

	Ultimate Increase: Sponsor	Ultimate Increase: Member	Increase Begin FY	Number of Increases: Sponsor	Funding Period as of 2019 Valuation	FY20 Impact: State (in millions)	Biennium Impact (in millions)	UAAL Peak (in billions)
1a	1.50%	0.50%	20	3 (0.50%)	**29**	$232	$709	$52.8 in 2030
1b	1.00%	1.00%	20	2 (0.50%)	**29**	$232	$709	$53.5 in 2030
1c	1.50%	0.50%	20	6 (0.25%)	**30**	$116	$354	$54.7 in 2030
1d	1.00%	1.00%	20	4 (0.25%)	**30**	$116	$354	$54.4 in 2031
1e	1.50%	1.00%	20	3 (0.50%)	**26**	$232	$709	$51.3 in 2027
1f	1.50%	1.00%	20	6 (0.25%)	**27**	$116	$354	$52.9 in 2028
1g	2.00%	0.50%	20	4 (0.50%)	**26**	$232	$709	$51.3 in 2026
1h	2.00%	1.00%	20	4 (0.50%)	**24**	$232	$709	$50.6 in 2025
2a	1.50%	0.50%	21	3 (0.50%)	**30**		$238	$54.4 in 2030
2b	1.00%	1.00%	21	2 (0.50%)	**30**		$238	$55.2 in 2031
2c	1.50%	0.50%	21	6 (0.25%)	31		$119	$56.3 in 2032
2d	1.00%	1.00%	21	4 (0.25%)	31		$119	$56.1 in 2032
2e	1.50%	1.00%	21	3 (0.50%)	**27**		$238	$53.0 in 2028
2f	1.50%	1.00%	21	6 (0.25%)	**28**		$119	$55.2 in 2027
2g	2.00%	0.50%	21	4 (0.50%)	**27**		$238	$52.9 in 2027
2h	2.00%	1.00%	21	4 (0.50%)	**25**		$238	$52.3 in 2025
3a	2.00%	0.50%	21	4 (0.50%)	**27**		$238	$52.9 in 2027
3b	1.50%	1.00%	21	3 (0.50%)	**27**		$238	$53.0 in 2028
3c	2.00%	0.50%	21	8 (0.25%)	**28**		$119	$56.4 in 2029
3d	1.50%	1.00%	21	6 (0.25%)	**28**		$119	$54.5 in 2029
3e	2.00%	1.00%	21	4 (0.50%)	**25**		$238	$52.3 in 2025
3f	2.00%	1.00%	21	8 (0.25%)	**27**		$119	$53.8 in 2026
3g	2.50%	0.50%	21	5 (0.50%)	**25**		$238	$52.6 in 2025
3h	2.50%	1.00%	21	5 (0.50%)	**23**		$238	$52.3 in 2025

SOURCE: GRS

APPENDIX D – 2013 PENSION FUND LEGISLATION

Senate Bill 1458

- Increased the member contribution rate incrementally from 6.4 percent to 6.7 percent in fiscal year 2015, to 7.2 percent in fiscal year 2016, and 7.7 percent in fiscal year 2017.
- Authorized a new 1.5 percent payroll contribution for school districts and charter schools whose employees do not participate in Social Security beginning in fiscal year 2015. Applies to employees whose positions are subject to the State statutory minimum salary schedule (MSS). For employees whose positions are not subject to the MSS, the employer will contribute 1.5 percent on the employees' total salary.
- Tied any future reductions in the State contribution rate to the member and school district rate by a corresponding tenth.
- Changed normal retirement eligibility to age 65 with 5 years of service or Rule of 80 with a minimum age of 62 for members not vested as of August 31, 2014 (was Rule of 80 with a minimum age of 60).
- Imposed a penalty of 5 percent per year for each year of retirement before age 62 (was age 60).
- Sets a minimum age of 62 for participation in TRS-Care 2 and TRS-Care 3 for individuals who retire on or after September 1, 2014. Members who meet the Rule of 70 or greater or have 25 years of service as of August 31, 2014 were exempted from this new requirement.
- Provided a 3 percent one-time cost-of-living adjustment, capped at no more than $100 per month, for annuitants who retired on August 31, 2004 or earlier.
- Reduced the interest on withdrawn service from 5 percent to 2 percent prospectively.

Senate Bill 1

- Provided that contingent on passage of Senate Bill 1458, any excess general revenue funds available through the annual fiscal year 2013 settle-up be used to increase the State contribution rate in fiscal year 2014 up to 6.8 percent. Sufficient funds were available to increase the State contribution rate to 6.8 percent in fiscal year 2014.

Senate Bill 1812

- Addressed community college proportionality by providing that the State fund 50 percent of the State contribution for public community college employees.

APPENDIX E – SOURCE OF GROWTH IN UAAL 2011-2018

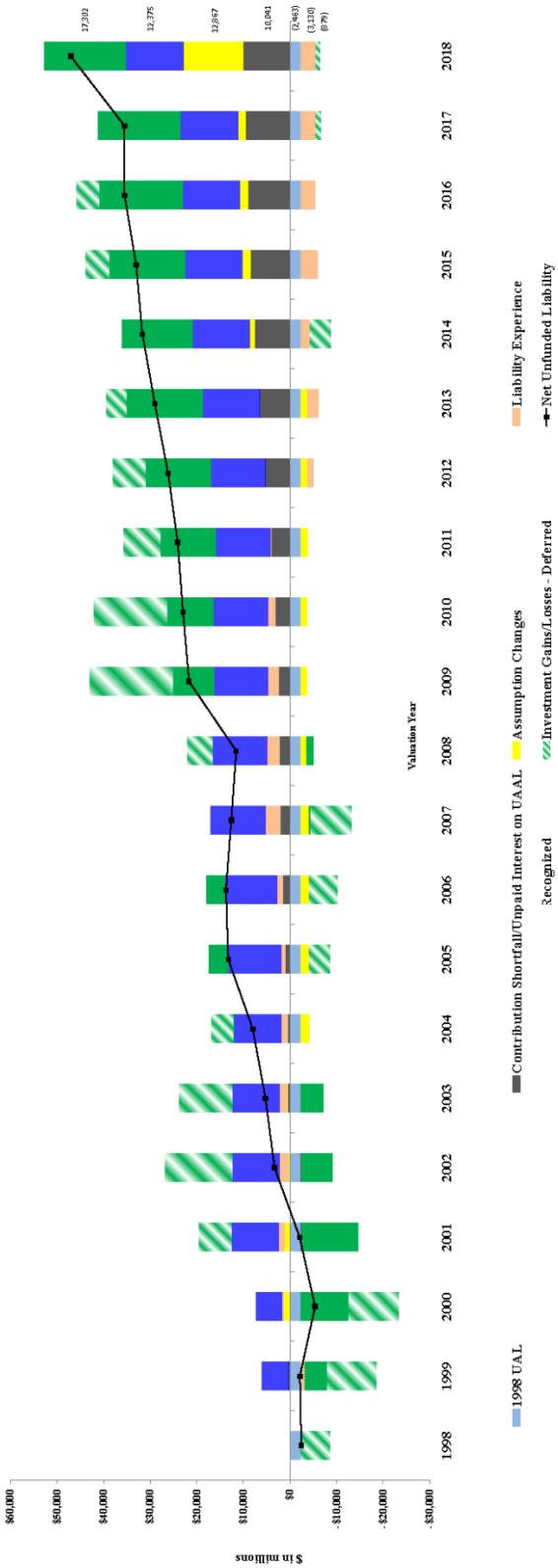


FIGURE E.1: SOURCE OF GROWTH IN UAAL 2011-2018

SOURCE: GRS

APPENDIX F – ASSUMPTIONS FOR RETIREMENT PLAN MODELING

Desired Outcome

A number of assumptions were necessary to perform the requisite modeling. However, one key issue for which TRS was unable to make an assumption was the State's desired outcome in plan design. TRS does not know if the State desires the plan to continue providing the same level of benefits regardless of the cost or if the State aims to keep contribution rates the same and let the benefits vary. Therefore, TRS modeled the alternative plans using two different approaches: (1) The Targeted Benefit Approach assumes that the State wants to keep the ultimate level of expected benefits constant and let the contribution amounts vary; and (2) the Targeted Contribution Approach assumes that the State wants to keep the level of contributions constant and let the ultimate level of benefits vary.

Using two different approaches helps ensure the modeling provides an "apples to apples comparison." Often, when alternative plans are examined, items portrayed as cost differences based on plan design are, in fact, differences based on the level of benefits provided. In other words, a model that allows both the benefits and the contributions to vary at the same time creates an "apples to oranges" comparison. By using two different approaches, TRS' modeling holds constant either the level of benefits or the level of contributions and allows for a true comparison of the efficiency of providing benefits under each alterative plan.

Demographics

The analysis was performed using the profile of a member hired at age 30 and retiring at age 62. Members are expected to receive salary increases consistent with the current salary scale assumptions used in the actuarial valuation, which are based on historical trends of TRS members. The same is true for termination assumptions, retirement patterns, and mortality expectations. The contributions required under the Targeted Benefit Approach were developed to provide the same benefit to this hypothetical member, not necessarily the group as a whole. As the different structures have different accrual patterns, it is not possible to provide the same benefit to all members under all structures. Some members would receive more benefits and others less, depending on age at hire and length of service.

Benefit Provisions

In order to single out the desired metric of either employer contribution or level of benefit, TRS has fixed a set of benefit provisions that will apply across all structures. These are: Rule of 80 retirement eligibility with minimum age 62, a 7.7 percent member contribution rate, five-year cliff vesting, and no post-retirement benefit increases.

In assuming a 7.7 percent member rate, TRS is not suggesting that members should only contribute 7.7 percent to the plan and the State should make up the difference. Rather, TRS kept the member rate fixed and allowed the State contribution to increase under the Targeted Benefit Approach because the goal of this approach is consistency with the current level of benefits. Increasing the member contribution under this approach would be inconsistent with that goal because requiring members to contribute more to receive the same replacement ratio would amount to a benefit reduction. However, as seen in Figure 7.6, several of the structures require a higher overall contribution rate to reach the targeted level of benefits, and TRS notes that the State could structure any of these plans to increase the member contribution, thus requiring the members to share in the additional cost. Given that TRS performed the analysis based on the total contributions required, the ultimate findings of the analysis (i.e. the total plan cost to keep the current level of benefits) would not be considerably different if the member rate was increased or decreased across all structures (i.e. the member rate increased to 8 percent and the State contribution decreased accordingly).

The five-year cliff vesting mimics the current provisions. Varying this provision can have a pronounced impact on the results, especially for defined contribution structures.

Investment Return

It has been assumed that the TRS trust fund would generate 7.25 percent annual investment returns, net of expenses. This would be true under the defined benefit or the cash balance plan. Optimized defined contribution accounts were modeled based on target date allocations shown in Appendix H, Figure H.5 with the same expected return and volatility parameters by asset class used to model the pension trust. This process produced an approximate ROI of 6.16 percent for the optimized and 5.16 percent for the self-directed defined contribution plans during the member's accumulation period. The difference in the returns for the two defined contribution plans is based on the behavioral tax of 1 percent applied to the self-directed model.

Annuitization

To model the replacement ratios across all plans, TRS assumed that all defined contribution accounts would annuitize the balance with an insurance company at retirement. To estimate the cost of an annuity over time, TRS used a 4.5 percent discount rate with a 10 percent load on mortality for margin, administration, commission, and profit. Even though a member could not currently annuitize at a 4.5 percent discount rate, this analysis is directed at what an average participant would receive at a random point in time.

FIGURE G.1: ALTERNATIVE PLAN MODELS

Structure	Features	Modeled to Provide Same Level of Benefits as Current Plan			Modeled to Cost the Same as Current Plan			Unfunded Liability***	Explicit Risk
		Contributions		Percent of Income Replaced**	Contributions*		Percent of Income Replaced		
		State	Member		State	Member			
Current Defined Benefit Plan	Maintain current benefit	2.6%	7.7%	69.4%	2.6%	7.7%	69.4%	$45.9 B	State
Cash Balance Plan	Interest credited on 5-year actual investment earnings	5.7%	7.7%	69.4%	2.6%	7.7%	56.1%	$45.9 B	Shared
Optimized Defined Contribution Plan	Member-invested in target date funds	11.9%	7.7%	69.4%	2.6%	7.7%	35.4%	$61.4 B	Member
Self-Directed Defined Contribution Plan	Member-invested contributions	15.4%	7.7%	69.4%	2.6%	7.7%	29.9%	$61.4 B	Member

*Contribution under this model targets a 10.3% contribution rate as opposed to the 15.4% current contribution received because the cost to provide the accrual of benefits under the current plan is 10.3% with remaining 5.0% going toward paying down the unfunded liability.
**Assumes member hired at age 30, retires at age 62 with 32 years of service and 5 year cliff vesting across all plans.
***Assumes that only new TRS members will be placed in to the alternative plan and active members will stay in current defined benefit plan.

SOURCE: GRS

APPENDIX H – METHODOLOGIES AND ASSUMPTIONS PROJECTED INVESTMENT RETURNS

In order to objectively compare the alternative retirement plans outlined in the TRS study, specific assumptions about potential investment returns must be made. Appendix H explains those assumptions and the methodologies employed to calculate the returns of the different plan alternatives and is structured into the following two sections:

- Defined Benefit Analysis - discusses the expected investment returns for the current defined benefit plan and the expected returns of the current defined benefit plan if new TRS members are placed into an alternative plan (thus closing the current plan).
- Defined Contribution Analysis - describes the expected investment returns for TRS members in either the optimized or the self-directed defined contribution plan.

First, it is useful to note the following regarding investment forecasting:

- It is virtually impossible to project with any real certainty what will happen over a single year. It is reasonably possible to estimate what will happen over a five to seven year period, based on current market valuations, which will ultimately be transitory.
- It is much more certain to forecast what will happen over a 10-30 year period, regardless of the near-term market environment, assuming that normal desired market conditions will prove to have been most common, despite shorter-term volatility.
- Over longer periods it is reasonable to assume that various cycles will occur and that inflation and interest rates will vary.

As mentioned in the study, TRS has, on average, 22 years to invest until the average benefit payment comes due. As such, TRS can invest for the "long-term"; therefore, TRS designs its long-term policy allocation using long-term expectations and that particular time frame.

Specifically, for the study, TRS defines "long-term" as at least as long as the average amount of time TRS has to invest contributions until a benefit payment becomes due (22 years). To approximate these long term returns, TRS primarily used Aon Hewitt's 10-year horizon market assumptions as of September 2018.[34] The expected return using those long-term assumptions for the current TRS asset allocation is 7.14 percent.

Aon Hewitt, a financial consulting firm, uses a "building block" approach to arrive at their long-term asset-class return forecasts. The major views underlying their assumptions are as follows:

- Fixed income returns are built by forecasting expected future yields to determine the necessary change in bond prices.
- Equity returns are based on inflation expectations plus forecast real earnings growth and dividend yield adjusting for the impact of valuation changes.
- Volatility and correlations
    - Forward-looking view when setting volatility assumptions as opposed to using purely historic averages. Implied volatilities priced into option contracts
    - Historical volatility levels
    - The broad economic/market environment
    - Aon assumes that volatilities are not constant over time.
    - Correlation assumptions are formulated with reference to historic experience over different time periods and during different economic conditions.

- Inflation assumption is based on consensus forecasts supplemented with other sources.

Defined Benefit Component Analysis

Time Horizon

- The analysis began with an examination of the duration of the expected liabilities. The duration of a financial asset or liability consisting of fixed cash flows is the weighted average of the time until those fixed cash flows are received. The longer the duration, the longer the investment horizon that can be employed.
- The cash flows for the liabilities in this study were provided by TRS' actuary, Gabriel, Roeder, Smith & Company (GRS), for the open and closed plans.
- For the current defined benefit plan or the cash balance plan, the duration of the liabilities is sufficiently long (22 years or more) to maintain the long-term investment strategy currently employed by TRS.
- Calculating the expected return of the plan requires an asset allocation and a complete set of return (and covariance) forecasts for each asset in the allocation.
- Aon was selected as the primary source for volatility assumptions and "long-term" asset class forecasts.

Figure H.1 displays the asset allocation, forecasts, and resulting gross return estimates used for the defined benefit plan.

FIGURE H.1: CURRENT POLICY ALLOCATION AND FORECAST USED FOR MOST DEFINED BENEFIT RETURNS IN STUDY

	Current TRS Policy Allocation	10-Year Horizon	
		Forecast[1]	Volatility[1]
US Large Cap	16%	6.40%	17.90%
US Small Cap	2%	6.40%	17.90%
EAFE + Canada	13%	7.20%	20.00%
EM	9%	7.60%	27.00%
Directional Hedge Funds[4]	4%	5.20%	11.20%
Private Equity[4]	13%	9.10%	26.00%
Treasuries	11%	3.00%	9.00%
Stable Value Hedge Funds[4]	4%	5.10%	7.60%
Cash	1%	2.00%	1.00%
Inflation Linked Bonds	3%	2.90%	4.50%
Real Assets[4]	14%	6.40%	14.90%
ENRI[3,4]	5%	8.50%	16.00%
Risk Parity[3]	5%	5.50%	10.00%
Total	100%		
Expected Annualized Return[2]		7.14%	

Notes:

[1] Expected Asset Returns and Volatility Estimates are from Aon (2018).

[2] Expected Portfolio Returns are Geometric with a zero alpha assumption.

[3] ENRI and Risk Parity are a blend of sub-strategies.

[4] Private Asset Classes are net of fees.

SOURCE: TRS

The Expected Annualized Return reflects both the forecast returns of the individual asset classes and the compounding effects of the portfolio's volatility or variance over time.

In order to calculate the expected variance of the portfolio, TRS used volatility estimates from Aon and correlation estimates from JP Morgan.

FIGURE H.2: CORRELATION ASSUMPTIONS

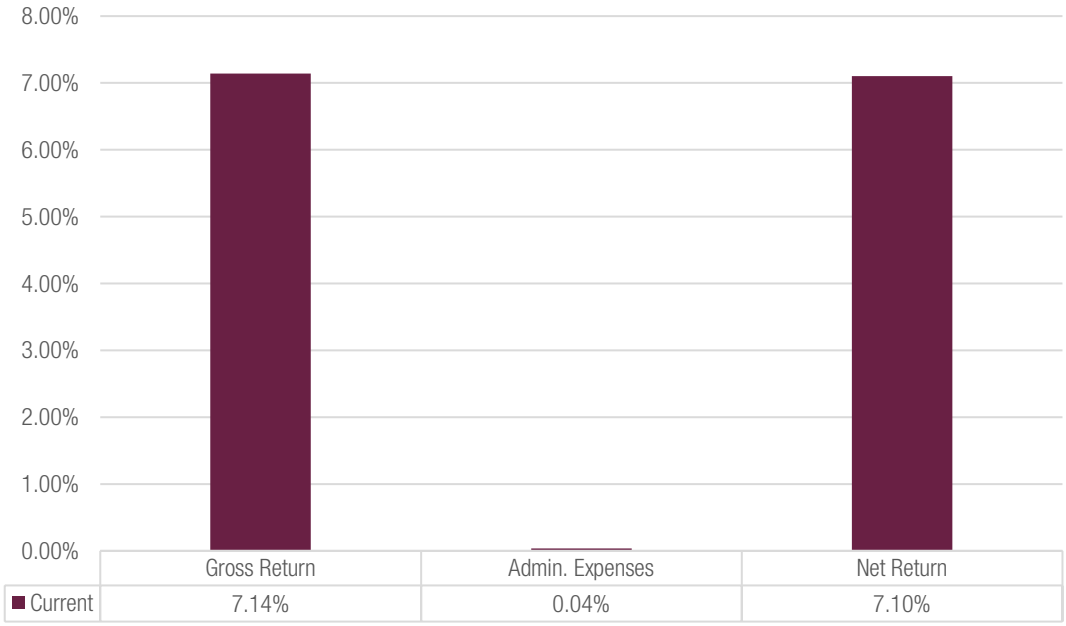
	U.S. Cash	U.S. Long Treasuries	TIPS	U.S. Large Cap	U.S. Small Cap	EAFE Equity	Emerging Markets Equity	Private Equity	Real Assets	Directional Hedge Funds	Stable Value Hedge Funds	ENRI	Risk Parity
U.S. Cash	1.00	0.04	0.07	-0.06	-0.08	0.00	0.08	-0.03	-0.03	-0.01	-0.02	-0.03	0.03
U.S. Long Treasuries	0.04	1.00	0.51	-0.35	-0.38	-0.30	-0.26	-0.30	-0.06	-0.47	-0.42	-0.22	-0.01
TIPS	0.07	0.51	1.00	0.06	-0.02	0.16	0.25	0.10	0.04	0.08	0.16	0.08	0.30
U.S. Large Cap	-0.06	-0.35	0.06	1.00	0.90	0.88	0.76	0.82	0.33	0.86	0.68	0.68	0.43
U.S. Small Cap	-0.08	-0.38	-0.02	0.90	1.00	0.76	0.68	0.76	0.33	0.81	0.62	0.64	0.37
EAFE Equity	0.00	-0.30	0.16	0.88	0.76	1.00	0.87	0.82	0.28	0.89	0.75	0.66	0.48
Emerging Markets Equity	0.08	-0.26	0.25	0.76	0.68	0.87	1.00	0.72	0.23	0.89	0.75	0.57	0.48
Private Equity	-0.03	-0.30	0.10	0.82	0.76	0.82	0.72	1.00	0.27	0.78	0.64	0.77	0.40
Real Assets	-0.03	-0.06	0.04	0.33	0.33	0.28	0.23	0.27	1.00	0.24	0.18	0.61	0.14
Directional Hedge Funds	-0.01	-0.47	0.08	0.86	0.81	0.89	0.89	0.78	0.24	1.00	0.86	0.61	0.45
Stable Value Hedge Funds	-0.02	-0.42	0.16	0.68	0.62	0.75	0.75	0.64	0.18	0.86	1.00	0.50	0.40
ENRI[2]	-0.03	-0.22	0.08	0.68	0.64	0.66	0.57	0.77	0.61	0.61	0.50	1.00	0.32
Risk Parity[2]	0.03	-0.01	0.30	0.43	0.37	0.48	0.48	0.40	0.14	0.45	0.40	0.32	1.00

Notes:
1. Correlation values are JP Morgan estimates.
2. For these asset classes each pairwise correlation was calculated by decomposing the asset class into their sub components.

SOURCE: TRS

In summary, as shown in Figure H.3, for the current defined benefit plan or a cash balance plan, the net expected geometric long-term return is expected to be 7.10 percent.

FIGURE H.3: PROJECTED DEFINED BENEFIT INVESTMENT RETURNS



SOURCE: TRS

Defined Benefit Returns Assuming a More Liquid Allocation is Needed Due to a Closing the Plan Analysis

TRS determined that if the legislature decided to place new TRS members in a defined contribution plan rather than the current defined benefit plan, the current defined benefit plan would require a more liquid asset allocation because of increased net outflows.[35]

The impact would result in expected returns that are 103 basis points lower than the current allocation over time. To adjust the current TRS policy asset allocation for this analysis, TRS would gradually eliminate Private Equity, ENRI, and Real Assets since continuing to invest in those long-lived, illiquid vehicles would no longer be feasible given the anticipated liquidity requirements of the remaining plan. It is important to note that it would likely take between ten and twenty years to completely implement the new allocation. The following table, Figure H.4, displays the asset allocation, forecasts, and resulting return estimates, after adjusting for a more liquid asset allocation.

FIGURE H.4: POLICY ALLOCATIONS AND FORECASTS USED FOR CLOSED DEFINED BENEFIT PLAN

	Modified More Liquid Policy Allocation	10-Year Horizon	
		Forecast[1]	Volatility[1]
US Large Cap	24%	6.40%	17.90%
US Small Cap	2%	6.40%	17.90%
EAFE + Canada	20%	7.20%	20.00%
EM	10%	7.60%	27.00%
Directional Hedge Funds[4]	4%	5.20%	11.20%
Private Equity[4]	0%	9.10%	26.00%
Treasuries	25%	3.00%	9.00%
Stable Value Hedge Funds[4]	4%	5.10%	7.60%
Cash	1%	2.00%	1.00%
Inflation Linked Bonds	10%	2.90%	4.50%
Real Assets[4]	0%	6.40%	14.90%
ENRI[3,4]	0%	8.50%	16.00%
Risk Parity[3]	0%	5.50%	10.00%
Total	100%		
Expected Annualized Return[2]		6.11%	

Notes:

[1] Expected Asset Returns and Volatility Estimates are from Aon (2018).

[2] Expected Portfolio Returns are Geometric with a zero alpha assumption.

[3] ENRI and Risk Parity are a blend of sub-strategies.

[4] Private Asset Classes are net of fees.

SOURCE: TRS

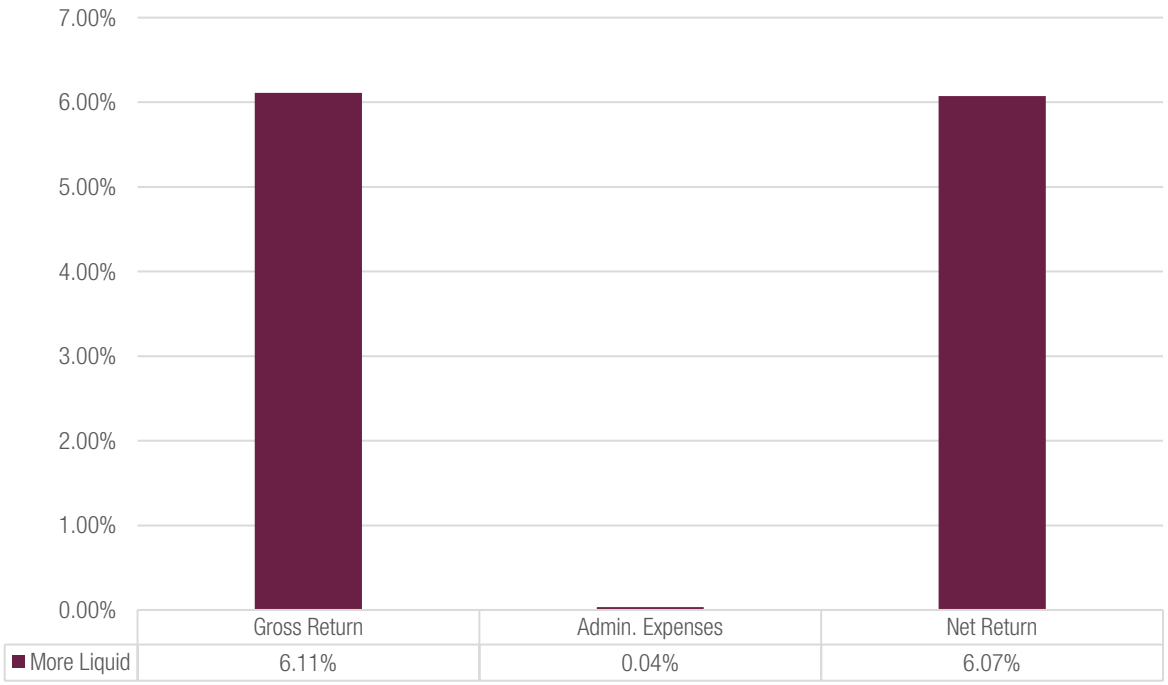
Defined Benefit Expenses

For private asset classes, the capital market assumptions are net of management fees. For public asset classes, which are typically very liquid and easy to replicate, a fee assumption of zero is appropriate for a passive implementation of benchmark asset classes. The expected return numbers presented in figures H.1 and H.4 include a "zero-alpha" assumption and therefore more closely reflect the returns of a passively managed benchmark. These expected return numbers are net of all expenses, with the exception of investment related administrative expenses. In order to make these numbers fully comparable to the defined contribution returns presented below, investment related administrative expenses are subtracted.[36]

If the legislature were to place new TRS members into a defined contribution plan, and the asset allocations were made as discussed above, the current plan would require a more liquid allocation. A more liquid allocation would result in lower expected returns in both an absolute and risk adjusted sense. However, the analysis uses the same expenses in both of these scenarios for the reasons listed above.

Thus, as shown in Figure H.5, if new TRS members were placed into a defined contribution plan, the net expected geometric return on the remaining defined benefit plan is expected to be 6.07 percent.

FIGURE H.5: EXPECTED DEFINED BENEFIT RETURNS IF MORE LIQUID ALLOCATION NEEDED



SOURCE: TRS

Self-Directed Defined Contribution Analysis

To generate the expected return for the defined contribution plans, TRS applied the same long-term asset return and covariance estimates used for defined benefit plans. However, TRS also had to choose an appropriate asset allocation that is representative of a defined contribution plan. To create the asset allocation, TRS examined the two largest lifecycle fund families in the world, Fidelity and Vanguard[37], to examine the asset allocation typically offered to individual investors over various time horizons to retirement.

TRS used the average asset allocation of Fidelity and Vanguard funds to approximate an individual investor shifting their allocation over time, moving to more fixed income securities as retirement approaches. Figure H.6 shows the defined contribution allocations for Fidelity and Vanguard funds.[38] The shaded sections highlight asset classes available to the TRS defined benefit plan that are not offered in these plans.

FIGURE H.6: AVERAGE OF FIDELITY AND VANGUARD TARGET DATE FUNDS USED FOR DEFINED CONTRIBUTION ANALYSIS

	Age 30-34	Age 35-39	Age 40-44	Age 45-49	Age 50-54	Age 55-59	Age 60-62
U.S. Cash	0.95%	0.95%	0.94%	0.94%	0.91%	3.98%	5.36%
U.S. Intermediate Treasuries	0.23%	0.23%	0.23%	1.44%	7.47%	10.55%	12.27%
U.S. Long Treasuries	4.85%	4.85%	6.44%	9.09%	11.72%	14.30%	15.48%
TIPS	0.40%	0.40%	0.40%	0.40%	0.39%	0.41%	2.93%
U.S. High Yield Bonds	0.75%	0.75%	0.75%	0.75%	0.76%	0.78%	0.79%
World ex-U.S. Government Bonds	1.51%	1.51%	2.16%	3.31%	4.41%	5.56%	6.21%
Emerging Markets Sovereign Debt	0.32%	0.32%	0.32%	0.32%	0.33%	0.34%	0.35%
U.S. Large Cap	46.68%	46.68%	45.59%	43.06%	37.79%	32.24%	28.37%
U.S. Small Cap	10.52%	10.52%	10.26%	9.67%	8.53%	7.30%	6.42%
EAFE Equity	24.16%	24.16%	23.48%	22.07%	19.54%	17.09%	15.02%
Emerging Markets Equity	8.59%	8.59%	8.38%	7.92%	7.09%	6.29%	5.63%
Private Equity	-	-	-	-	-	-	-
Real Assets	-	-	-	-	-	-	-
Directional Hedge Funds	-	-	-	-	-	-	-
Stable Value Hedge Funds	-	-	-	-	-	-	-
Commodities	1.09%	1.09%	1.09%	1.06%	1.09%	1.16%	1.16%
ENRI	-	-	-	-	-	-	-
Risk Parity	-	-	-	-	-	-	-
Total	100%	100%	100%	100%	100%	100%	100%

SOURCE: TRS

Using the averages of the dynamic asset allocation schedules from both Fidelity and Vanguard, TRS calculated the expected return of a typical investor for each of the six, 5-year periods and the one 3-year period during the saving horizon (i.e., working lifetime). Once this was done, the accumulated asset value for the member at age 62 was generated stochastically to calculate a distribution of outcomes and a median balance.

Defined Contribution Fees

To estimate the fees that would be charged to a hypothetical defined contribution plan participant, TRS used outside sources for market data, considering the amount of assets under management and the number of participants as criteria when selecting inputs. TRS used 0.61 percent for an estimated annual expense, as displayed below. For active investment management fees, TRS used fees that correspond to the bottom 10th percentile for a conservative fee estimate.

FIGURE H.7: FEE ESTIMATE FOR SELF-DIRECTED DEFINED CONTRIBUTION PARTICIPANT

Type of Fee	Cost	Source
Active Investment Management Fees	0.36%	Investment Company Institute (ICI)
Recordkeeping and Admin Fees	0.15%	General Accounting Office (GAO)
Oversight Custodial and Other	0.03%	TRS Actual Cost
Consulting and Advisory Fees	0.07%	General Accounting Office (GAO)
"All In" Defined Contribution Fee Estimate	0.61%	

SOURCE: TRS

In addition to management fees, TRS applied a reasonably well documented and conservative estimate of the impact of behavioral biases on individual investors. These demonstrated behavioral tendencies often severely impact individual investor performance and often reflect ineffective risk management, sub-optimal asset allocation, performance chasing, and loss aversion. To quantify the impact of these biases on a self-directed defined contribution plan participant, TRS surveyed the available academic research and assumed a conservative impact estimate of 1 percent, which is below the average effect surveyed in the literature. The range of projected returns in an individual investor format will vary widely.

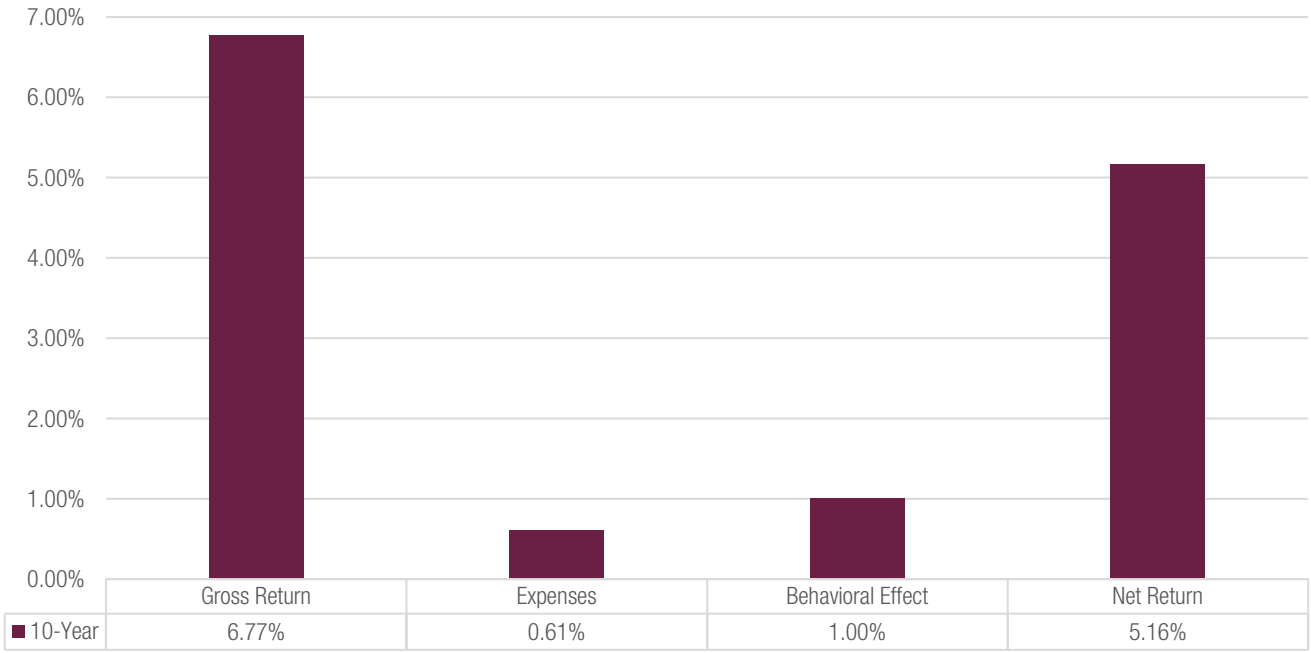
FIGURE H.8: ESTIMATE OF BEHAVIORAL EFFECTS FOR SELF-DIRECTED DEFINED CONTRIBUTION PARTICIPANT

Analysis of Underperformance	Observed Underperformance	Source
Mutual Fund Investors vs. Underlying Funds	1.56%	Friesen and Sapp
Mutual Fund Investors vs. Market Returns	2.69%	DalBar
Active Brokerage Investors vs. Market Returns	6.50%	Barber and Odean
Self-Directed 401(k) vs Optimal 401(k)	0.98%	Tang et al.
Average	2.93%	
Behavioral Effect Selected	1.00%	

SOURCE: TRS

In summary, for a self-directed defined contribution plan, the net expected long-term geometric return is expected to be 5.16 percent.

FIGURE H.9: EXPECTED SELF-DIRECTED DEFINED CONTRIBUTION RETURNS



SOURCE: TRS

Range of Defined Contribution Outcomes Compared to the Current Defined Benefit Plan

To illustrate the range of potential retirement outcomes that might occur for an individual with a self-directed defined contribution plan or component, TRS used the defined contribution allocation and the long-term return estimates to simulate 5,000 possible investment experiences for a hypothetical career employee. The process produces estimates of the amount an average employee could accrue by a retirement age of 62.

The inputs included the following assumptions:

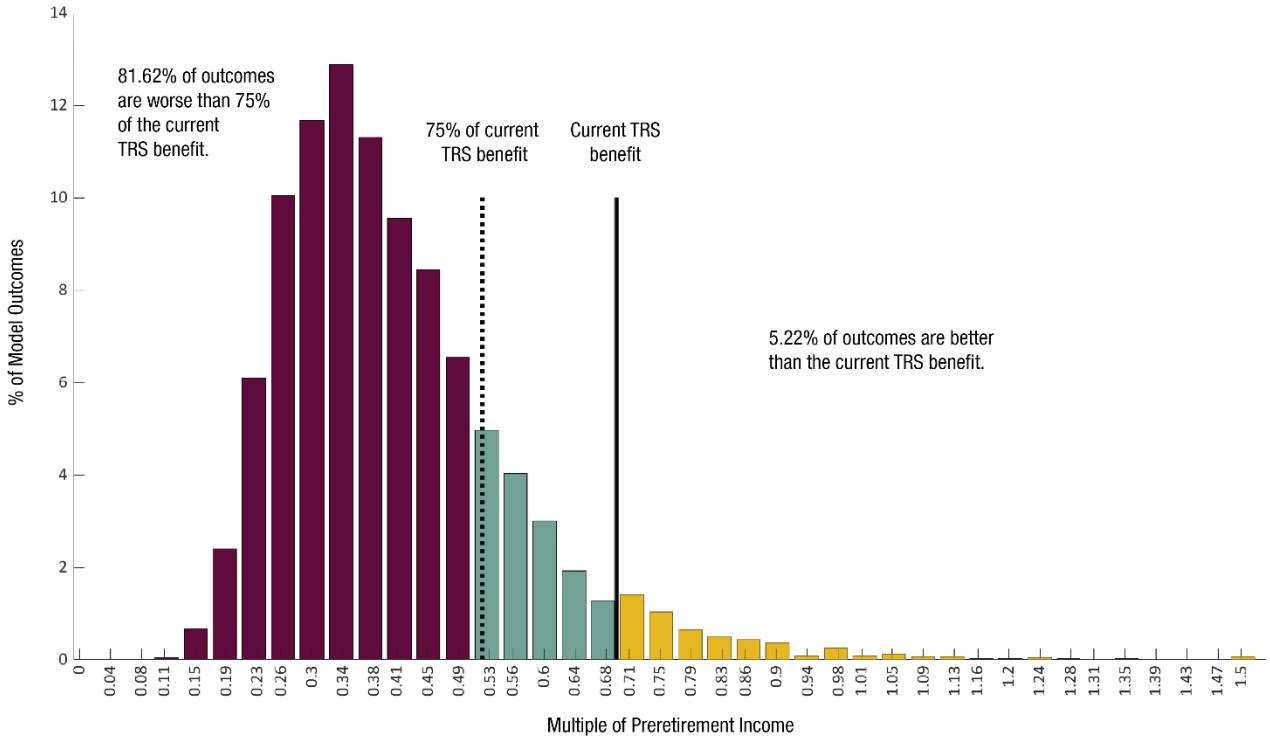
- The employee begins working in 2018 at the age of 30 and retires at the age of 62.
- A 7.7 percent annual contribution rate for the member (the same as the current defined benefit plan).
- A 6.0 percent annual contribution rate for the State (the constitutional minimum).
- For salary growth, TRS used assumptions GRS provided for projected member salary over the next 33 years.
- Projected defined contribution fees annually are 0.61 percent for management and a 1 percent behavioral effect.
- TRS converted the 5,000 lump sum outcomes accrued by retirement at the age of 62 into a lifetime annuity figure using an annuitization factor provided by GRS.[39]

In order to make relevant comparisons between defined benefit and defined contribution outcomes, TRS calculated a "defined benefit" using the highest five years of salary that the hypothetical employee achieved, consistent with the current TRS benefit formula for new employees.[40]

TRS compared this calculation to the annuity calculation in the self-directed defined contribution and found that for 94.78 percent of possible outcomes, the annuity to a current defined benefit retiree exceeds the potential annuity in the defined contribution plan. As illustrated below, modeling showed that more than four-fifths of the members would receive no more than 75 percent of the current benefit. Only a handful

— about 5.22 percent — of the members would receive more than the current defined benefit. The estimated underperformance is attributable to lower investment returns from a shorter investment period, access to fewer asset classes, less-disciplined investment approaches that lead to poor behavior tendencies, and potentially higher fees.

FIGURE H.10: INDIVIDUAL SELF-DIRECTED RETIREMENT INCOME COMPARED TO TRS BENEFIT



SOURCE: TRS

FIGURE H.11: FIDELITY PORTFOLIO COMPOSITIONS

Fund	Ticker	2050 30-34	2045 35-39	2040 40-44	2035 45-49	2030 50-54	2025 55-59	2020 60-62
Intrinsic Opportunities Fund	FDMLX	9.84%	9.85%	9.89%	9.60%	8.18%	6.71%	6.08%
Growth & Income Fund	FGLGX	8.87%	8.87%	8.86%	8.61%	7.34%	6.15%	5.51%
Growth Company Fund	FCGSX	8.38%	8.38%	8.38%	8.14%	6.97%	5.74%	5.14%
Stock Selector Large Cap Value Fund	FBLEX	6.69%	6.68%	6.67%	6.43%	5.49%	4.55%	4.09%
Value Discovery Fund	FNKLX	4.78%	4.77%	4.77%	4.63%	3.96%	3.26%	2.91%
Opportunistic Insights Fund	FVWSX	4.52%	4.52%	4.52%	4.40%	3.75%	3.08%	2.74%
Blue Chip Growth Fund	FSBDX	4.28%	4.27%	4.27%	4.16%	3.55%	2.92%	2.61%
All-Sector Equity Fund	FSAEX	3.91%	3.91%	3.90%	3.80%	3.24%	2.66%	2.38%
Small Cap Opportunities Fund	FSOPX	3.73%	3.73%	3.73%	3.64%	3.12%	2.56%	2.28%
Large Cap Value Index Fund	FIOOX	2.46%	2.46%	2.45%	2.40%	2.05%	1.68%	1.49%
100 Index Fund	FOHIX	1.74%	1.75%	1.77%	1.41%	1.00%	0.82%	0.73%
Small Cap Discovery Fund	FJACX	1.18%	1.18%	1.18%	1.16%	0.89%	0.40%	0.09%
Commodity Strategy Fund	FCSSX	2.21%	2.21%	2.21%	2.19%	2.19%	2.25%	2.25%
International Growth Fund	FINVX	8.71%	8.71%	8.71%	8.47%	7.36%	6.24%	5.67%
International Value Fund	FIGSX	8.59%	8.59%	8.59%	8.37%	7.24%	6.09%	5.55%
International small Cap Fund	FSTSX	2.11%	2.11%	2.11%	2.04%	1.78%	1.51%	1.32%
Canada Fund	FCNSX	0.90%	0.90%	0.90%	0.88%	0.76%	0.64%	0.58%
Emerging Markets Opportunities Fund	FEMSX	8.34%	8.36%	8.37%	7.94%	7.01%	6.19%	5.72%
Long-Term Treasury Bond Index Fund	FTLTX	2.92%	2.92%	2.92%	3.16%	3.32%	3.51%	2.96%
Investment Grade Bond Fund	FSIGX	0.45%	0.45%	0.45%	3.07%	15.24%	20.83%	24.26%
Inflation-Protected Bond Index Fund	FSIPX	0.80%	0.80%	0.80%	0.80%	0.80%	1.80%	2.37%
High Income Fund	FSHNX	1.31%	1.31%	1.32%	1.34%	1.36%	1.39%	1.41%
Floating Rate High Income Fund	FFHCX	0.22%	0.22%	0.22%	0.22%	0.22%	0.23%	0.23%
International Credit Fund	FCDSX	0.04%	0.04%	0.04%	0.04%	0.05%	0.06%	0.06%
Emerging Markets Debt Fund	FEDCX	0.60%	0.60%	0.61%	0.61%	0.62%	0.64%	0.66%
Real Estate Income Fund	FSREX	0.43%	0.43%	0.44%	0.44%	0.45%	0.46%	0.46%
Government Money Market Fund	FGNXX	1.64%	1.63%	1.62%	1.69%	1.69%	6.10%	8.39%
Short-Term Credit Fund	FYBTX	0.30%	0.30%	0.29%	0.29%	0.28%	1.45%	1.95%
Cash Central Fund	-	0.02%	0.02%	-0.02%	0.05%	0.06%	0.03%	0.05%
NET OTHER ASSETS	-	0.03%	0.03%	0.03%	0.02%	0.03%	0.05%	0.06%
Total		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

SOURCE: TRS

FIGURE H.12: VANGUARD PORTFOLIO COMPOSITIONS

Fund	Ticker	2050 30-34	2045 35-39	2040 40-44	2035 45-49	2030 50-54	2025 55-59	2020 60-62
Vanguard Total Stock Market Index	VTSMX	54.00%	54.10%	51.20%	46.70%	42.20%	37.70%	32.30%
Vanguard Total International Stock Index	VGTSX	35.90%	35.90%	33.90%	31.00%	28.00%	26.10%	28.90%
Vanguard Total Bond Market II Index	VBMFX	7.10%	7.10%	10.50%	15.70%	20.90%	25.10%	21.50%
Vanguard Total International Bond Index	VTIBX	3.00%	2.90%	4.40%	6.60%	8.90%	11.10%	12.30%
Vanguard Inflation-Protected Securities	VIPSX	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	5.00%
Total		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

SOURCE: TRS

APPENDIX I – ALTERNATIVE PLAN MODELS SENSITIVITY TO INVESTMENT EXPERIENCE

Actuarial assumptions supply the inputs for a starting point in expectations for projecting future contributions and benefits. Over time, the actual experience will drive the true cost (or benefit). However, the actual benefits available to members will be based on what returns the members actually achieve.

In the defined benefit plan, the over- or underperformance compared to the assumptions will drive the cost requirements over time. Several of the alternative structures share the risk/rewards generated from experience. The following exhibit provides an estimate of how the cost and benefit will change based on the investment returns being 1 percent higher or lower than the expectation.

FIGURE I.1: SENSITIVITY TO INVESTMENT EXPERIENCE

Structure	Relative Cost			Replacement Ratio at Age 62			Percent Change from 1 Percent Decrease in Investment Return		Comments
	8.25%	7.25%	6.25%	8.25%	7.25%	6.25%	Cost	Benefit	
Current Defined Benefit Plan	79%	100%	129%	69%	69%	69%	29%	0%	Adverse experience absorbed by contribution increases.
Cash Balance Plan	119%	130%	144%	83%	69%	59%	11%	-14%	Adverse experience "shared" by cost and benefit. The first years of experience are absorbed by the active member's account balance. After retirement, the adverse experience is absorbed by contributions.
Optimized Defined Contribution Plan	190%	190%	190%	82%	69%	59%	0%	-14%	All adverse experience absorbed by benefit.
Self-Directed Defined Contribution Plan	224%	224%	224%	82%	69%	59%	0%	-14%	All adverse experience absorbed by benefit.

SOURCE: GRS

APPENDIX J – ASSUMPTIONS FOR ALTERNATIVE STRUCTURE AND IMPACT ON CLOSED PLAN

For this type of analysis, there is a need to make several new assumptions, or modify old assumptions to reflect the proposed new reality. In particular, an assumption has to be made for the following:

- What are the member and employer contribution rates to the new defined contribution plan?
- Is there going to be a change to the funding policy for the legacy, closed defined benefit plan?
- Is there going to be a change to the investment policy for the legacy, closed defined benefit plan? If so, when?

For this analysis, TRS attempted to keep the study as close to an "apples-to-apples" comparison as possible. Much of the time, when a plan closure study or large reform analysis is performed, there are large variations in the ultimate benefit levels or funding policy that skew the impact of the analysis. For example, if members are put into a defined contribution plan with a substantially lower employer contribution rate than the legacy defined benefit plan, there will likely be a cost savings generated from the analysis. However, was the savings from the change in structure or the reduction in benefits? Could the same savings be generated from a reduction in the benefit provided in the defined benefit plan? Or, was the savings due to changes in the funding policy? Typically, when a plan is closed, the funding policy for the legacy plan may be modified to be more conservative. Was any stated increase in cost due to the closing of the plan or the changing of the funding policy?

For these reasons, the following assumptions were made to try to keep the analysis truly focused on the impact of closing the plan to new entrants and not a change in funding policy or benefit levels:

- Members will annually contribute the same 7.70 percent of salary to the new defined contribution plan.
- In Scenario 1, the State will contribute 3.14 percent of payroll to the new defined contribution plan on payroll for those members, which is equal to the average employer normal cost from the current plan.
- The State will contribute the average employer normal cost as a percentage of payroll into the legacy defined benefit plan for the closed group of current members.
- The State will contribute amortization payments as dollar amounts into the legacy defined benefit plan based on a level percentage of pay – floating amortization policy. A floating amortization policy sets a minimum contribution rate based on the required amortization period, but does not let the rate decrease until the UAAL is completely financed as long as the actual contribution rate is higher than the minimum. Once the UAAL was fully amortized, the contribution is reduced to the normal cost, or $0 if no members remained.
- The amortization period used to determine if contributions needed to increase was a 30 year policy for all years in the open scenario, and 30 years to begin with in the closed scenario, lowering as the remaining expected lifetime of the covered group decreased below 30 years.
- If the scenario produces an asset value lower than the anticipated benefit payments for the following year, the contribution policy reverts to "pay as you go."

General Impact of Closing a Defined Benefit Plan to New Entrants

A pension plan is a series of cash flows. Each year, there are contributions made into the retirement system and benefit payments paid out. The following is the general funding formula:

Contributions + Investment Earnings = Benefit Payments + Expenses

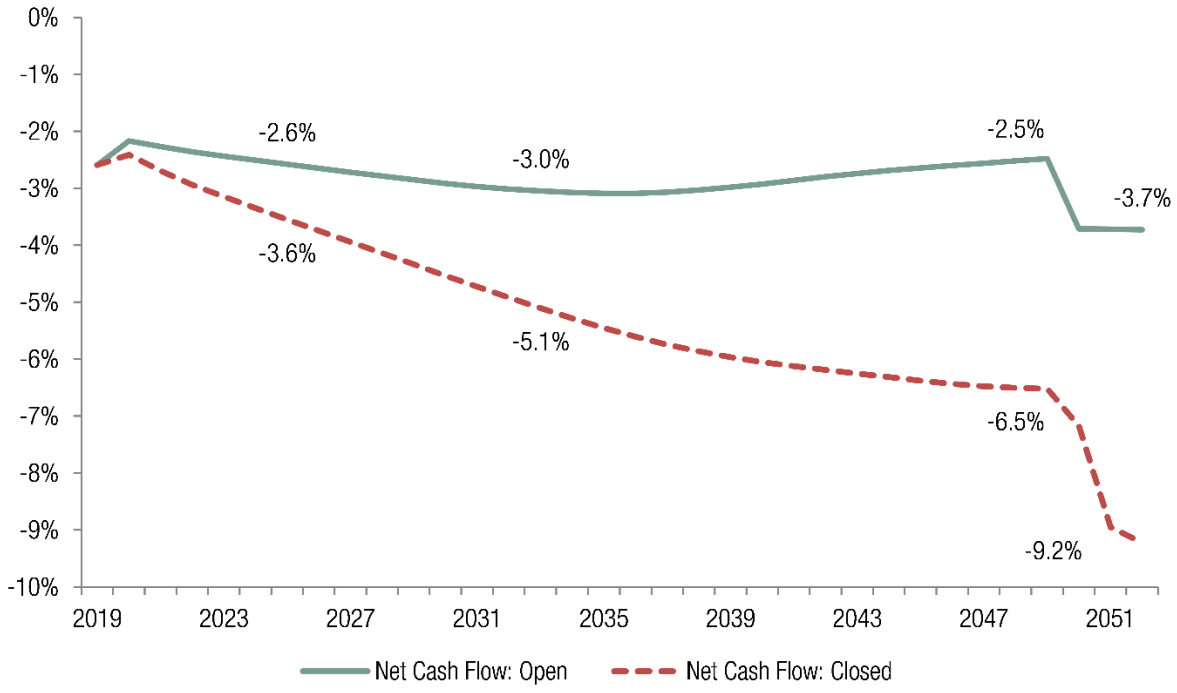
This formula will always hold true over the long term. There can never be more money paid out than there was either (1) contributed or (2) earned through investments. This is true for all financial systems, including defined contribution plans. Please note this formula is not based on actuarial assumptions. This formula is based on the long-term actual experience of the system.

Therefore, when a retirement system is closed to new entrants without any change to the benefits for current members, it is true that the overall benefit obligations have been decreased over the very long term, but the benefits for current members have not changed. So, holding the formula constant, to meet the benefit obligations of the current members, the system needs the same total of contributions and investment earnings as it did before. If there are any factors that decrease the amount of actual investment earnings being generated to help pay the benefits for current members, then the contributions will have to increase. There are at least two factors that can cause the actual earnings in future years to decrease: (1) the returns are lower, perhaps based on changes in the asset allocation, or (2) the pool of trust assets available to generate the earnings is lower. It is important to emphasize the differentiation between rates of return, which are a percentage, and investment earnings which are the actual dollars generated.

This formula also holds true at the individual level. Consequently, when the first new hire enrolls into the defined contribution plan instead of the current defined benefit plan, it is true that the total discounted liabilities of the system and the total discounted future contributions of the system are both decreased by the same amount. Does this mean there is no impact? To assume so, one must mistakenly look at a retirement system as a one dimensional balance sheet as of a given valuation date. In reality, a pension plan is a series of cash flows. And while the overall present value of contributions will decrease the same amount as the present value of benefits, the annual contributions will decrease well before the annual benefits decrease. This is a timing issue.

The following is a graph of the net cash outflows from TRS as a percentage of the assets available each year in the future. A negative percentage means that more monies are leaving the system through benefits than coming in through contributions.

FIGURE J.1: NET CASH OUTFLOWS AS A PERCENTAGE OF PLAN ASSETS



SOURCE: GRS

From the above graph, notice that by the year 2035, the negative cash flows as a percentage of assets are substantially lower for the closed plan – eventually exceeding double digits once fully funded, compared to 3 - 4 percent for the open plan. Also note that both scenarios fully amortize the UAAL at the same time and have a corresponding decrease in contributions (and increase in negative cash flow).

Impact of negative cash flow and volatility on liquidity requirements

When pension plans are setting their asset allocation, most use an asset/liability modeling process, and one of the, if not the, main factors of that process is assessing liquidity needs. The financial crisis exposed the risks of treating illiquid assets in the context of a traditional mean/correlation optimization when making asset allocation decisions. It is important to point out that liquidity management and risk tolerance are not synonymous, but are a factor in the ability to take on risk context.

High negative cash flow generally means the system will be selling assets monthly to meet its obligations, and can force the system to be a seller in very unfavorable market conditions. Pension plans attempt to manage this is several ways, including increased contributions, increased investments that produce a cash yield, and/or strictly managing overall portfolio illiquidity. All three of these actions increase the required contributions into the trust fund.

This negative cash flow represents the percentage of the current trust assets that must be paid out of the trust fund monthly from interest, dividends, or selling current asset positions to meet the obligations. During these times of volatility, the amount of dollars the trust must pay out remains the same, meaning the trust will be required to sell assets at times of distress. The higher the payout, the higher the potential exposure to having to sell at times at distress. TRS determined that if the legislature decided to place new TRS members in a defined contribution plan rather than the current defined benefit plan, the current plan would eventually require a more liquid asset allocation because of these increased outflows.

The analysis attempts to not use arguments that do not have consensus agreement, and thus even though as discussed below, it is very likely a future board would choose to also derisk the portfolio as the cash flow requirements accelerate, the model has not assumed they would do so . However, the liquidity reality is not as discretionary, and it has been assumed the board will begin to move away from illiquid asset classes (ones that have long redemption time horizons, large redemption penalties, or long-term maturities) over 20 years. Thus, the new asset allocation from year 20 onward is a 60 percent equity portfolio that has similar risk characteristics as the current portfolio (the current portfolio is 57 percent equity), but limits the use of illiquid asset classes. This change alone decreases the median expected return of the portfolio by over 1 percent in the current environment.

The impact would result in a lower plan expected return than the current allocation over time. To adjust the current TRS policy asset allocation for this analysis, TRS would gradually eliminate Private Equity and Real Assets since continuing to invest in those long-lived, illiquid vehicles would no longer be feasible given the anticipated liquidity requirements of the remaining plan.

Impact of negative cash flow and volatility on magnification of downside risk and asset accumulation

The next step is to illustrate the impact that volatility can have on asset accumulation and how negative cash flow amplifies downside risk. For example, starting at an amount of $100 at time zero, a 10 percent decline in investments followed by a 10 percent increase does not return the value to $100; it returns the value to $99. However, this math example assumes that all of the $90 was available at time 1 to earn the 10 percent in year 2. Most pension plans have negative cash flow, meaning more money is being paid out of the trust than is being received on an annual (and probably monthly) basis. When that occurs, every dollar that is paid is 100 percent funded and decreases the amount of money left in the corpus. Negative cash flow in a mature pension plan is actually an expected occurrence, as this is a reason why

employers prefund the benefit promise. Many studies have shown that roughly two-thirds of benefit payments paid from a pension plan come from investment earnings, not contributions.

Back to the simple example above, if at the end of time 1, $5 is paid out, then only $85 is left to earn the 10 percent in year 2, so the ending value is $93.50. The liabilities would have been expected to earn $0 in both years, so the liabilities would be $100-$5=$95. Therefore, the investment volatility cost the fund $1 and the negative cash flow cost the fund $0.50.

The following is a bit more complicated, but realistic example of this concept. Figure J.2 shows two identical $100,000 trust funds, one with a 80 percent/20 percent portfolio of stocks and bonds with the other with a 60 percent/40 percent blend, have the following investment return scenario occur.

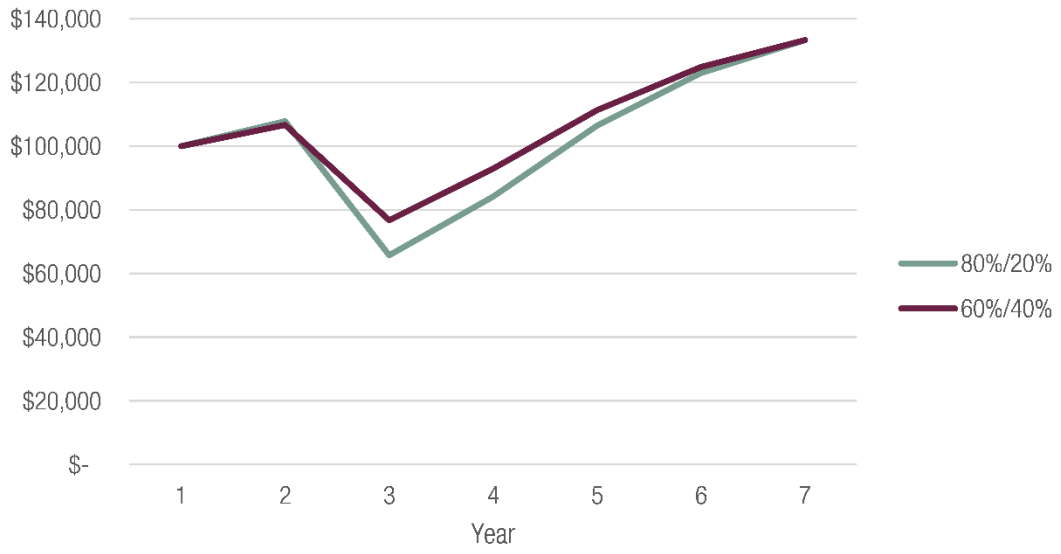
FIGURE J.2: ILLUSTRATED SCENARIOS

Year	Stocks	Bonds	A: 80%/20%	B: 60%/40%
1	9%	3%	7.8%	6.6%
2	-50%	5%	-39.0%	-28.0%
3	35%	0%	28.0%	21.1%
4	33%	0%	26.4%	19.8%
5	19%	2%	15.6%	12.2%
6	10%	2%	8.4%	6.8%
Average Compound Return	4.2%	2.0%	4.9%	4.9%

SOURCE: GRS

Notice the above two portfolios have the same average compound return over the six-year period. A comparison of the growth of the $100,000 for the two funds is displayed in Figure J.3.

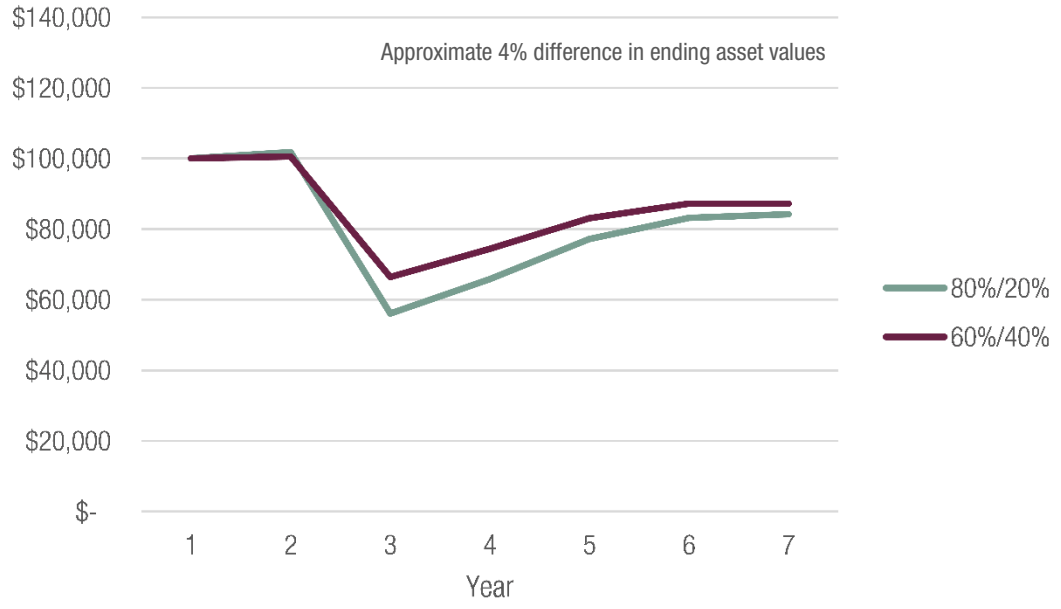
FIGURE J.3: NO CASH OUTFLOWS



SOURCE: GRS

Generating the same compound return yields the same ending value, as expected. However, if both portfolios are paying out $6,000 per year in net cash outflows, the graph becomes the following:

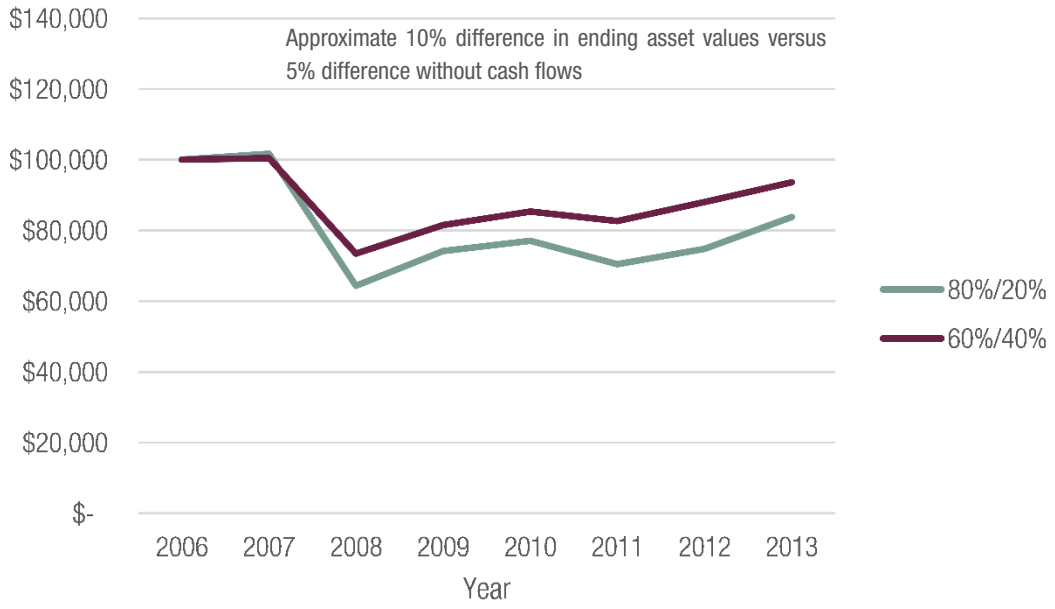
FIGURE J.4: $6,000 ANNUAL CASH OUTFLOWS



SOURCE: GRS

Thus, these two programs could each state that they earned 4.9 percent over the period, but one would have a funding ratio 4 percent higher than the other. This illustrates why higher payout ratios and higher volatility are not optimal and must be managed against each other. And, while the example above was purposefully created to force the returns to be exactly equal, this does occur in the real world. Figure J.5 is the same example but using actual returns from 2007 through 2013.

FIGURE J.5: $6,000 ANNUAL CASH OUTFLOWS (ACTUAL RETURNS)



Notes:
This scenario uses actual returns from 2007 – 2013.
Stocks returned 3.8 percent during the period, Bonds 6.6 percent, the 80/20 would have returned 5.1 percent, and the 60/40 6.0 percent.

SOURCE: GRS

As shown, the negative cash flow made it more difficult for the more volatile portfolio to make up the 2008 loss. The 2008 market crash has led many plans to rethink their portfolio strategies to derisk against this type of loss, even if it means lower long-term "expected" rates of return. This becomes more pronounced for a closed mature plan because of shorter investment horizons, higher required returns to make up a shortfall due to the loss of corpus, and a higher probability of ruin (reverting to pay-as-you-go).

Potential Impact on Risk Tolerance

The board sets the asset allocation for the system. Investment consultants for public sector retirement systems often argue that the asset allocation is the most important decision a board can make for generating returns. The asset allocation attempts to balance risk versus reward by adjusting the portfolio according to the investor's risk tolerance, goals and investment time frame. The current portfolio was constructed assuming the system is an ongoing institution, using current funding and benefit provisions, based on current liquidity needs, and based on the risk tolerance of the board. Some may argue that the risk tolerance of the plan sponsor should also be considered.

Risk tolerance is a measure of the combination of willingness, ability, and need to take on risk. Willingness to take risk is a subjective measure for how much an investor can withstand or be comfortable with losing money. Ability to take risk is much more quantitative. For

pension plans, this may be certain funded ratios that trigger certain events, or perhaps limitations on the amount or volatility in contribution amounts.

As the closed system becomes more mature, it is possible that the risk tolerance of the board, and possibly the State, will change. If so, then a future asset allocation will have different risk/reward characteristics than the current one. Considering what is happening to the cash flows and the time horizon of the closed system, from an actuarial perspective it is reasonable to expect that the portfolio will become more liquid, more income-producing and less risky; and thus be expected to generate less return.

It is possible that the State would be willing to take the same level of investment risk whether the plan is closed or not, or, have the same "risk tolerance." This idea likely views risk tolerance from the willingness perspective, such as a wealthy individual investor context which is the degree of variability in investment returns that an investor is willing to withstand or the extent to which an investor is comfortable with the risk of losing money on an investment. The argument may be that the government is an ongoing concern whether the system is or not, and thus the relative size of the drawdown can be managed either way.

First, risk tolerance is not the only factor considered when choosing the asset allocation. Liquidity management, the difference in time horizon, and the goal of the investment are also considered.

Second, what is missing from this definition of risk tolerance and the conclusion that the asset allocation would not need to eventually change, is the *consequences* of the loss.

Risk tolerance should not be viewed as the event, it should be viewed as the impact, or effect, of the event. It may be true that whether the plan is open or closed, the probabilities of a market crash are the same, and perhaps the increase in the size of the UAAL is the same, and thus the sponsor can have the same "risk tolerance". But, the outcome of the event can be very different.

Thus, asset allocation studies often define risk tolerance as a maximum contribution amount, or maximum amount of change in contribution amount. This is looking at the effect of the event.

In the closed TRS model, as the plan gets more mature, the ability to make up a given loss is decreased based on the impact from negative cash flow and the time horizon to fund the loss is shorter as the monies must be in the trust before the benefits can be paid. This is another big difference between a closed pension plan and an individual investor — there is a liability that does not go away in a pension plan. An individual investor, especially one that is investing surplus assets, takes the loss and the money may not have to be made up. The pension plan is not in a surplus position and has to pay the benefit, when it is due, regardless.

TRS modeled the actual investment returns from the 2007-13 time period in both models based on a 70/30 portfolio assuming 2007 occurs in 2048, 2008 occurs in 2049, etc. Because the assets of the closed plan are smaller by this time, the nominal value of the loss is smaller as well. But, the impact on the employer contribution requirement is 33 percent larger, or approximately 1 percent of payroll more.

The biggest difference between the two is the period used to amortize the loss and the smaller amount of corpus to ride the rebound after 2008.

Two asset allocation studies (open and closed) performed in 2045 look at the possible outcomes and the impact of the outcomes. If the plan sponsor in the open plan is willing to take a maximum change of up to 2 percent of payroll increase in its annual contribution, they can choose the 70/30 percent portfolio. The 2 percent becomes an objective measure of the risk tolerance. If the risk tolerance stays the same at the 2 percent in the closed plan scenario, the same portfolio cannot satisfy the risk tolerance if it increases the contribution rate by 3 percent, even if it has the same normal parameters of risk, for example standard deviation. Maintaining this risk tolerance would require a

less risky portfolio that had a maximum one-year increase of 2 percent, and that portfolio would be expected to generate less returns based on standard portfolio theory.

Thus, if using a more specific definition of "risk tolerance," it is unlikely that future asset allocation and asset liability studies will continue to result in the same asset allocations as the contribution risk of the program continues to increase. However, as this is a point of contention, and the liquidity and cost of the new program arguments alone create substantially higher contributions, there have not been any adjustments to the risk exposure of the portfolio. TRS has estimated that if the portfolio were derisked to a portfolio of approximately 40 percent equities and 60 percent bonds over the ten years following the jump in negative cash flow in 2050, it would increase the present value of employer contributions by another $2 billion.

[1] TRS 2018 Comprehensive Annual Financial Report
[2] *Pensions & Investments* as of September 30, 2017
[3] As of October 2018
[4] TRS Actuarial Valuation as of August 31, 2018.
[5] TRS 2018 Comprehensive Annual Financial Report
[6] "The Impact of Annuity Payments by the Teacher Retirement System on Texas and Local Areas Within the State" (The Perryman Group, January 2017)
[7] 2018 Comprehensive Annual Financial Report.
[8] Actuarial Standards Board Exposure Draft. Proposed Revision of Actuarial Standard of Practice No. 4 – Measuring Pension Obligations and Determining Pension Plan Costs or Contributions. (March 2018)
[9] Conference of Consulting Actuaries Public Plans Community. Actuarial Funding Policies and Practices for Public Pension Plans. (October 2014)
[10] As of August 31, 2018.
[11] Aon Hewitt analysis presented to TRS Board of Trustees as of June 30, 2018.
[12] PublicPlansData.org
[13] The 2018 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds. June 5, 2018.
[14] Senate Bill 1458, Senate Bill 1, and Senate Bill 1812
[15] Government Code § 825.206
[16] Aon Hewitt Presentation to the TRS Board of Trustees. (February 2018). Long-Term Portfolio Risk/Return Expectations.
[17] Actuarial Experience Study as of August 31, 2017. (July 2018).
[18] *The Impact of Tax Reform on Wage Replacement Ratios*. Bruce A. Palmer, Ph.D Center for Risk Management and Insurance Research Georgia State University Atlanta, GA Research Report NO. 88-7 March 1988 and 2008 GSU/Aon Retire Project Report. Bruce A. Palmer Ph.D. Center for Risk Management and Insurance Research, Georgia State University Atlanta, GA Research Report NO. 08-1, June 2008.
[19] *Still a Better Bang for the Buck.* December 2014. National Institute on Retirement Security.
[20] Decisions, Decisions: An Update on Retirement Plan Choices for Public Employees and Employers. August 2017. National Institute on Retirement Security.
[21] State of the American Workplace. 2017. Gallup.
[22] Enhancing the Teaching Profession: The Importance of Mobility to Recruitment and Retention. State Higher Education Executive Officers. February 2001.
[23] 2017 CEM Benchmarking Analysis for Teacher Retirement System of Texas
[24] Vanguard and Fidelity offer broad asset diversification and represent a combined $84 billion in assets across all their lifecycle funds as of June 26, 2011.
[25] JPM Guide to the Markets, Q3 2018 Indexes used are as follows: REITS: NAREIT Equity REIT Index, EAFE: MSCI EAFE, Oil: WTI Index, Bonds: Barclays Capital U.S. Aggregate Index, Homes: median sale price of existing single-family homes, Gold: USD/troy oz, Inflation: CPI Average asset allocation investor return is based on an analysis by Dalbar Inc., which utilizes the net of aggregate mutual fund sales, redemptions and exchanges each month as a measure of investor behavior. Returns are annualized (and total return where applicable) and represent the 20-year period ending 12/31/17 to match Dalbar's most recent analysis.
[26] Internal Revenue Code Section 3121(b)(7)(F); Treasury Regulation 31.3121(b)(7)-2(e); and Revenue Procedure 91-40.
[27] U.S. Department of Health & Human Services
[28] Discussed in Considerations in Plan Design.
[29] Under the gratuity model, there is no contractual obligation to pay the pension and the State is free to make changes to the pension.
[30] Tex. Att'y Gen. Op. No. GA-0615.
[31] *Eddington v. Dallas Police & Fire Pension Sys.*, 508 S.W.3d 774 (Tex. App. – Dallas, 2016, pet. granted); *Van Houten v. City of Fort Worth*, 827 F.3d 530 (5th Cir. 2016); *Tate v. City of Fort Worth*, 2015 U.S. Dist. LEXIS 95649.
[32] *See* Rev. Rul. 68-302, 1968-1 C.B.163, Rev. Rul. 66-11, 1966-1 C.B. 71. Revenue Ruling 68-302 specifically states "[a] plan will not be held to qualify if it fails to provide that an employee who has reached the normal retirement age (in the case of a pension or annuity plan) . . . and has satisfied any reasonable and uniformly applicable requirements as to length of service or participation is vested in the contributions made or benefits payable under the plan."
[33] Rev. Rul. 71-147, 1971-1 C.B. 116
[34] Aon Hewitt. (September 2018). *Capital Market Assumptions.*
[35] It is important to note that this determination would require detailed analysis and a decision by the TRS Board of Trustees before changing policy allocations.
[36] TRS Comprehensive Annual Financial Report, 2018.
[37] Defined contribution money managers in balanced/asset allocation reported by Pensions and Investments as of December 31, 2017. Retrieved September 20, 2018 from http://researchcenter.pionline.com/rankings/dc-money-manager/datatable
[38] See Additional Information for detail on funds used in analysis.
[39] The annuitization factor provided by GRS is 15.8 and reflects a 10 percent annuity load.
[40] The formula is 2.3 percent times the years of service (33) times the average of highest five years of salary.

TEACHER RETIREMENT SYSTEM OF TEXAS
1000 Red River Street
Austin, TX 78701
www.trs.texas.gov
1-800-223-8778