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RETIREMENT BENEFIT DISTRIBUTIONS FOR CALIFORNIA EDUCATORS

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ABSTRACT

Distribution choices by individuals retiring from CalSTRS are examined for participants that retired between 2016 and 2023. Women are much more likely to select a member-only annuity while a larger proportion of men select a J&S annuity that provide survivor benefits. Being married is a dominant factor in the selection of J&S annuities. Greater final annual salary, older ages at retirement, and more years of service are associated with a greater probability of choosing a J&S annuity. We also find that benefit choices from the primary benefit plan are jointly determined with distributions chosen from the supplemental pension plan. Interestingly, about half of retirees select a lump sum distribution from the supplemental plan while receiving an annuity from their primary plan.

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For the millions of Americans who are covered by defined benefit (DB) pension plans, one of the most important lifetime economic decisions they face is how to access the benefits promised by the plan. Distribution options offered by DB plans in private retirement plans are governed by federal regulations; however, public retirement plans are not covered by the Employee Retirement Security Act (ERISA). Thus, public pension systems, such as the plan covering teachers in California (CalSTRS), are free to set most of the provisions of their retirement plans without regard to federal pension policies. As in most DB plans, the CalSTRS monthly benefit is determined by a formula based on the employee's years of service, age of retirement, and final earnings. The formula produces the monthly benefit a retiree would receive as a member-only annuity¹ with no survivor benefits. However, CalSTRS, like most DB plans, also provides a range of other payout options including a variety of joint-and-survivor annuities (J&S). The primary objective of this analysis is to determine how the choice of annuity payouts varies by individual characteristics.

CalSTRS offers a traditional final pay defined benefit to participants that covers only earnings from the standard 9-month teacher contract. CalSTRS calls this plan the Defined Benefit Program (DPB). In addition, CalSTRS provides a cash balance plan that covers additional earnings that participants may have from their employment. This plan is called the Defined Benefit Supplement Plan (DBSP). This paper examines the distribution choices of California educators who retired between 2016 and 2023 and claimed a benefit from the retirement plans offered by CalSTRS.

¹ The member-only benefit is a single life annuity in which the retirement benefit ceases with the death of the CalSTRS member.

We begin by describing the CalSTRS retirement system (Section I) and the retirement benefit formulas (Section II). In Section III, we discuss key demographic and economic characteristics that influence the type of distribution from pensions chosen by retirees and the findings of prior studies on this decision. Section IV reports mean patterns of benefit choices. Next, we estimate a Probit equation on whether CalSTRS retirees selected the member-only annuity or some type of J&S annuity from the primary retirement plan offered by CalSTRS from the DBP. In Section VI, we estimate a Probit model of the distribution choices of retirees from the supplemental plan offered by CalSTRS, the DBSP. Finally, in Section VII we examine the joint decision of benefit choices for both the DBP and the DBSP.

The most important finding is that women are much less likely to select a J&S annuity compared to men when holding final salary, years of service, marital status, and age constant. The mean difference is 23 percentage points (64% for men compared to 41% for women). Probit results holding these demographic and economic characteristics constant find a smaller gender gap of 16.3 percentage points. While earlier studies have also found similar large sex differences in distribution choices, those studies have generally not been able to hold marital status and final earnings constant in their analysis.

We also find that providing protection for spousal income is a normal good as the probability of selecting a J&S annuity increases by 1.3 percentage points for each \$10,000 increase in final annual salary. As one might expect, marital status is a major driver of the desire for retirement income that continues after the death of the member. Among CalSTRS retirees, married retirees are 66.7 percentage points more likely to select a J&S distribution compared to nonmarried retirees even though a nonmarried member can designate any individual as a beneficiary. Teachers retiring at older ages are slightly more likely to request a J&S annuity.

Finally, we explore the simultaneous decision of selecting distributions from the two plans offered by CalSTRS and find statistical support that this is in fact a joint decision. Thus, the choice of distributions from the supplemental plan is not separate from the annuity choice in the primary plan.

I. Overview of CalSTRS²

CalSTRS was established in 1913 in order to provide retirement income to public school educators working in kindergartens through community colleges.³ In 2023, CalSTRS is the largest pension fund in the world covering only educators and it is the second largest pension fund in the United States with assets of over \$300 billion. CalSTRS has over one million members and beneficiaries. The system is managed by The Teachers' Retirement Board which administers the plan and determines the policies and rules that set benefit formulas and contribution rates. In June 2022, the median retirement age was 61.5 years and the median monthly retirement for a single life annuity or a member-only benefit was \$3,583. In this section, we first describe the benefit plans offered by CalSTRS. Next, we present the formulas used to calculate retirement benefits in the various plans. Finally, we describe the distribution options available to retiring teachers and educational professionals.

Retirement Plans Provided by CalSTRS

CalSTRS covers all full-time California public school pre-kindergarten through 12th grade certificated educators, community college instructors, and public-school administrators.⁴

² The discussion in this section is based on information provided on the web pages of CalSTRS (<https://www.calstrs.com/>), especially the member handbook CalSTRS (2023), and CalSTRS (2021).

³ CalSTRS was one of the earliest state-managed public pension systems established in the United States. Clark, Craig, and Wilson (2003).

⁴ Nearly all California school districts have a teachers union affiliated with either the California Teachers Association (CTA) or the California Federation of Teachers (CFT), or both. The primary activity of a union is to represent the

The CalSTRS retirement system consists of three retirement plans available to full-time employees. The primary retirement plan provided by CalSTRS is a traditional defined benefit plan which is called the Defined Benefit Program (DBP). Participation in this program is mandatory for the groups shown above.⁵ CalSTRS also offers the Defined Benefit Supplement Program (DBSP) to members of the DBP which provides additional benefits based on earnings in excess of one school year and from other specific compensation. Participation in the DBSP is also mandatory for educational employees listed above. The DBSP is a cash balance plan which is based only on earnings above the standard compensation for one year for participants in the DBP. All employees are also eligible for CalSTRS Pension2, a voluntary defined contribution plan. It is important to note that CalSTRS members are not covered by Social Security and thus, do not pay the tax of 6.2% of covered earnings and do not accrue a Social Security retirement benefit.⁶

Defined Benefit Program. In 2012, CalSTRS substantially reduced the retirement benefits for individuals hired after January 1, 2013.⁷ Individuals hired prior to this date accrue benefits based on the terms of CalSTRS 2% at 60 while those hired after this date are covered by

teachers in negotiating the terms of employment, including retirement programs, in collective bargaining agreements. Information on union coverage is provided by Ed-Data which is a partnership of the California Department of Education, EdSource, and the Fiscal Crisis and Management Assistance Team/California School Information Services (FCMAT/CSIS) designed to offer educators, policy makers, the legislature, parents, and the public quick access to timely and comprehensive data about K-12 education in California.

⁵ Part-time employees have the choice of being covered by the DBP, a cash balance plan offered only to part-time employees, or Social Security. The present study does not include employees in the cash balance plan or Social Security.

⁶ CalSTRS members who have other earnings while members and those that have years of work with employers that are covered by Social Security will accrue a Social Security benefit from these earnings; however, their benefits may be reduced by Windfall Elimination Provision and the Government Pension Offset. CalSTRS members are covered by Medicare.

⁷ Public retirement plans across the country covering teachers and educational personnel have made a series of changes since 2000 that have reduced the value of pension benefits for newly hired employees. Abashidze, Clark, and Craig (2023) find that the mean reduction in the initial retirement benefit between 2000 and 2020 in these plans was 11.2% for workers with comparable work histories.

the rules of the CalSTRS 2% at 62. The benefit formulas and employee contribution rates differ in the two plans and these differences in each plan are described below. In both plans, educational professionals become vested in their DBP retirement benefit with five years of credited service.

The basic retirement benefit for CalSTRS members is a single life annuity and is referred to as the unmodified benefit in CalSTRS documents. In this paper we refer to this benefit as the member-only benefit. The retirement benefit formula for both plans is:

$$\textit{Benefit} = (\textit{years of service}) \textit{ times } (\textit{age factor}) \textit{ times } (\textit{final compensation})$$

The values of the benefit formula and calculation of final compensation are a function of age of claiming benefits and these factors differ between the two plans. Each plan offers several annuity options that determine the monthly retirement benefit. In addition, each member of the DBP has an individual account which is equal to the lifetime, accumulated member contributions plus credited interest.⁸ Retirees and departing employees can forfeit their claim to a retirement annuity and take a lump sum distribution equal to their account balance. Our study does not include those who chose a lump sum distribution of their account balance. CalSTRS 2% at 60 members pay 10.25% of creditable compensation to support the DBP. These members can retire at age 50 with 30 years of service or as early as 55 with five years of service. CalSTRS 2% at age 62 members pay 10.205% of creditable compensation to support the DBP. These members can

⁸ The interest rate credited on the account balance is set annually by the Teachers' Retirement Board. The interest rate approximates the rate paid on two-year Treasury notes. In June 2023, the rate was 0.43%. Lump sum payouts from public sector defined benefit plans are usually calculated in this manner. In contrast, private sector defined benefit plans typically offer a lump sum distribution equal to the present value of the retirement annuity. For a discussion of lump sum distributions and annuity pricing in public retirement plans, see Abashidze, et al (2021) and Clark, Hammond, and Vanderweide (2018).

retire at age 55 with five years of service; these retirees are not eligible for the earlier retirement age with 30 years of service.

Defined Benefit Supplement Program. Since 2001, all members of the DBP who make contributions to CalSTRS on creditable compensation also have a DBSP account. This account is in the form of a cash balance retirement plan that provides guaranteed retirement income on top of the benefit from the DBP. CalSTRS 2% at 60 members and their employer contribute 8% of earnings covered by the DBSP. Covered earnings include earnings for service in excess of one year of service credit in a school year and special limited-term payments. Many educational employees earn additional compensation from summer employment or additional assignments such as after school tasks, coaching, summer work, etc. The DBSP benefit is calculated using these earnings; base earnings for educators are not covered by the DBSP. CalSTRS 2% at 62 members and their employers contribute 9% of covered earnings. The account balance is credited with an interest rate set each fiscal year by the Teachers' Retirement Board.⁹

CalSTRS Pension2 is a voluntary defined contribution plan also called the Personal Wealth Plan (Pension2). Participants have the opportunity to invest through tax-advantaged payroll deductions into 403(b), 457(b), Roth 403(b) or Roth 457(b) plans. Yearly contributions are limited by government regulation and employees over 50 are eligible to contribute an additional “catch-up” amount each year.¹⁰ There is no employer match in this saving plan so the

⁹ The interest credited to the account balance in the cash balance plan is based on the average 30-year Treasury rate which was equal to 2.09% in June 2023.

¹⁰ Public pension systems typically offer participants the opportunity to contribute to several tax advantaged savings plans such as those offered by CalSTRS. Clark, Pathak, and Pelletier (2018) examined how teachers decide which plan to select. In most cases, these plans have multiple financial services companies competing for these contributions (Clark and Hanson,2013).

account is based solely on employee contributions and the return on the assets held in the plan.¹¹ In the following analysis, we do not examine distributions for CalSTRS Pension2 as less than 14% of retirees in our sample had an account in this plan.

II. Benefit Formulas in CalSTRS Retirement Plans

In this section, we describe the formulas that are used to determine the basic member-only benefit for retiring educators in California in both the CalSTRS 2% at 60 and CalSTRS 2% at age 62 programs. The discussion shows how the initial retirement benefit is a function of years of service, age at retirement, and final average compensation of the employee. We also present the distribution options available to retirees.

Benefits for CalSTRS 2% at 60 Members

As described above, the basic retirement benefit derived from the pension formula is a single life or member-only annuity that pays monthly benefits for the life of the member. For individuals hired prior to 2013, the formula allows a retiring worker to receive a benefit at age 60 equal to

$$\text{Benefit} = (\text{years of service}) \text{ times } (\text{age factor}) \text{ times } (\text{final compensation})$$

The age factor starts at 1.1% for members retiring at age 50 and increases with each additional year of age up to age 60 when the age factor is 2%. If the member retires after age 60, the age factor increases to a maximum of 2.4% at age 63. If the member qualifies for the 0.2% career factor (enhancement multiplier) by having at least 30 years of service credits, the member can

¹¹ Participants are eligible to take either an annuity or lump sum payment from this program. Benefits are based on the size of the saving account which reflects member contributions over the years and the return on their investments.

reach the maximum age factor of 2.4% at age 61 and six months.¹² Final compensation is equal to the highest average earnings for 36 months; however, if the retiree has 25 or more years of earnings, the final compensation is equal to the highest average earnings for any 12 consecutive months. The increasing multiplier reflects the shorter life expectancy of educators retiring at older ages. This benefit structure means that employees that continue to work will have higher benefits due to additional years of service, higher final compensation, and a higher age factor.

Retiring members can elect to provide income protection for a spouse or other beneficiary by choosing a Joint & Survivor (J&S) option. CalSTRS offers employees the following three J&S options to the DBP participants claiming benefits. The 100% beneficiary annuity provides the continuation of the same monthly benefit after the retired employee dies. Similarly, the 75% beneficiary annuity and a 50% beneficiary annuity provide lower monthly benefits after the death of the retired worker. The cost of survivor benefits is the lower monthly benefit received while the retired worker is alive. The cost of providing retirement income for spouses or other beneficiaries varies by age of member, the age of the beneficiary, and the amount of the survivor benefit. The reduction in the monthly benefit by these factors is shown in the CalSTRS Member Handbook on pages 75-76. For example, consider a member age 60 with a spouse also age 60 whose member-only monthly benefit would be \$4,000. If this retiree selected a 100% J&S benefit, the monthly benefit would be reduced to \$3,581, a reduction of \$419 per month; however, if the member had selected a 50% survivor benefit the J&S monthly benefit would have been \$3,808 or a reduction of only \$192 per month.

Benefits for CalSTRS 2% at 62 Members

¹² The age factor by age of retirement between 50 and 65 is shown in Appendix A, Table 1.

For individuals hired after January 1, 2013, the formula allows a retiring worker to receive a benefit at age 62 equal to

$$\textit{Benefit} = (\textit{years of service}) \textit{ times } (\textit{age factor}) \textit{ times } (\textit{final compensation})$$

For members of CalSTRS 2% at 62, the age factor is also a function of age. The age factor is 2.0% of salary for those retiring at age 62. Members can retire as early as 55; however, the age factor is smaller for early retirees. The age factor starts at 1.16% if you retire at age 55 and increases to a maximum of 2.4% at age 65.¹³ There is no career factor benefit or “enhancement multiplier” for members of this plan. Final compensation is equal to the highest average earnings for 36 months. The distribution options for members of CalSTRS 2% at 62 are the same as those provided to individuals hired prior to 2013.

The changes in the benefit formula for individuals hired after January 1, 2013 substantially reduced future retirement benefits for these educators. The benefit at retirement is lower because of the longer averaging period used to calculate final compensation (three years instead of one) and the lower age factor at every age of benefit claiming. For example, a pre-2013 hire with final earning of \$50,000 who retired at age 60 with 30 years of experience would qualify for an annual benefit of \$30,000. In comparison, a person hired after January 1, 2013 and also retiring at age 60 would qualify for an annual benefit of only \$26,400.

Benefits from CalSTRS DBSP

As noted earlier, the DBSP is a cash balance retirement plan funded by employee and employer contributions. The individual accounts of members are credited with interest so the account balance increases with additional member and employer contributions and accrued

¹³ Appendix A, Table 1 shows the age factors for members of this program from age 55 to 65.

interest on the balance. Retirees whose account balance is less than \$3,500 are required to take a lump sum distribution from this plan. For those with more than \$3,500 in their account, they can select a member-only annuity, a survivor annuity of 100%, 75% or 50% for a beneficiary, a period certain annuity, or a lump sum payment. The period certain annuity can be scheduled from three to ten years, in one-year increment. Retirees can also select a combination of a lump sum payment and one of the annuity options, the choice is referred to as a Combo distribution.

III. Factors Affecting the Choice of Retirement Annuities

A retiring member from CalSTRS must decide how they would like to receive their benefit from the DBP. Options include a member-only life annuity or three types of J&S annuities. Also, at retirement, the member must decide the type of benefit they wish to receive from the DBSP. Distribution options from the DBSP include a lump sum payout, a member-only annuity, one of three J&S annuities, or a period certain annuity. In this section, we examine the individual characteristics that are expected to influence the type of distribution selected by the member. We begin with a discussion of factors that influence the choice of retirement payouts and posit four hypotheses on the determination of the benefit distribution and then provide a review of studies that have examined choice between single life, or member-only, and J&S annuities.

Predictions on Factors Influencing the Choice of a J&S Annuity

The following factors are posited to be the primary determinants of retiring teachers selecting J&S annuity instead of accepting the higher monthly benefit associated with choosing the member-only annuity. We briefly review the likely impact of marital status, gender, and income on the distribution choice and provide specific testable hypotheses. These individual

characteristics will affect the distribution choice from both of the CalSTRS pension plans. The DBSP allows individuals to select a lump sum distribution along with possible annuity choices. For the DBSP, we hypothesize that a large DBP benefit will increase the likelihood that the retiree will select a lump sum distribution from the DBSP. Finally, we consider whether the distribution choices from the two plans are jointly determined or whether the choice is sequential with the retiree first deciding on the distribution from the primary plan (the DBP) and then considering how they would like to access the wealth in the supplemental plan, the DBSP.

Hypothesis 1. Married individuals will be more likely to select a J&S distribution.

The decision to select a J&S annuity instead of a member-only annuity is driven primarily by the desire to provide a lifetime benefit to a spouse in the event that the member dies first. The lower monthly J&S benefit reflects the probability that benefits will be paid over more months if the member selects a J&S. While the member can designate any individual as a beneficiary, the most frequently named individual is a spouse. Thus, one would expect that married members will be much more likely to select a J&S compared to individuals who are not married when the member retires.

Hypothesis 2. Women will be less likely to select a J&S annuity.

The member-only benefit is the monthly benefit based on the benefit formula in the retirement plan. When determining the benefit for other distribution options, plan actuaries consider the age of the member and the age of the designated beneficiary. These calculations use a unisex mortality so the monthly benefit for a J&S annuity does not reflect sex differences in life expectancy. As a result, the lower benefit associated with a J&S annuity relative to the member-only annuity is the same for a male and female retiree holding the ages of the member and the

beneficiary constant. Since women have longer life expectancies compared to men, the similar reduction of benefits tends to result in a greater reduction in the J&S benefit for women than if the cost was determined by a sex specific lifetable. Thus, we would expect that on average, women will be more likely to accept the member-only annuity and less likely to request a J&S distribution.

The preference for the member-only annuity by women may be enhanced if they are more likely to be married to men who have higher earnings and who are more likely to be covered by their own retirement plan. The retiring female teachers with these circumstances may feel a lower need to select a J&S annuity. In addition, traditional marriage patterns indicate that women are more likely to be married to men who are somewhat older and therefore, have a higher probability of dying before the retired female teacher. One would expect retirees to be more likely to choose a J&S annuity if they have fewer years of life expectancy but are married to a younger spouse with more years of life expectancy and less likely to select a J&S annuity if their spouse is older. Finally, the marriage rate for women compared to men is lower at older ages, so women will have a lower demand for providing for a beneficiary.

Hypothesis 3. The probability of selecting a J&S annuity rises with higher income as reflected by final compensation.

We anticipate that providing income protection for a spouse is a normal good. Therefore, the probability of selecting a J&S annuity is expected to increase as annual income rises. In our data, salary in the final year of employment is a proxy for annual income so higher final salary should be positively correlated with the probability of selecting a J&S benefit.

Of course, other personal and economic factors influence the decision to select a J&S annuity such as price of the J&S option. The reduction in benefits associated with the J&S annuity is based on the age of the spouse relative to the age of the teacher and the interest rate used to convert the member-only benefit to the J&S monthly benefit. As typical of administrative data, we have no information on the spouse's age, working history, or pension coverage. However, we do know the age at retirement of the teacher and the year of retirement which are included in the empirical analysis.

The variation in distributional choices over time should capture some of the effect of interest rate changes during the period as well as other changes in the economic conditions. We use the 2-year Treasury rate interest rates as an indicator of how interest rates might affect annuity choices. These rates started increasing at the beginning of our sample period, decreased through 2019, fell to almost zero during the COVID pandemic, then started increasing toward the end of 2021 (see Figure 1). Thus, the price of selecting a J&S annuity in terms of the lower monthly benefit varied over the sample period.

[Figure 1 here]

Hypothesis 4. When considering distributional choices of individuals covered by more than one pension plan, these choices should be jointly estimated.

Initially, we examine the distributional choices from both plans separately; however, we anticipate that retirees make these distributional choices jointly. The distribution choices from both the DBP and the DBSP are made at the time of retirement and both plans provide potential income in retirement. Thus, we anticipate that the decision on distributions will be

simultaneously determined. The final section tests this hypothesis of whether the distributional choices are jointly determined.

Using the information provided by CalSTRS on retiring teachers between 2016-2023, we test each of these hypotheses.

Factors Affecting the Choice of Distributions

Most of the previous studies of the choice of pension distributions focused on the choice between lump sum distributions instead of some type of annuity.¹⁴ Most of this research used survey data, often focused on defined contribution plans, and concentrated on private sector plans. This brief review focuses on recent studies that examined the annuity choices.

Clark et al (2019) examined distribution choices by retirees from the North Carolina state retirement plan for teachers and state employees. Using survey data combined with administrative records, they found that relatively few retirees select lump sum distributions and most retirees select some type of annuity. Men were 14 percentage points more likely to choose a J&S benefit than women. Other findings included results that indicated that older workers, those in good health, those that had greater life expectancy, and Blacks were less likely to choose a J&S benefit. Individuals with greater financial literacy and those whose spouse had greater life expectancy were more likely to have chosen a J&S annuity.

A recent study by Brown, Richardson, and Poterba (2022) examines the distributional choices of retirees covered by TIAA who have not taken a lump sum distribution of account balances from a defined contribution plan. Their analysis examines trends between 2000 and 2018 in the type of distributions requested including straight-life annuities, J&S annuities,

¹⁴ For example, see Banerjee (2013), Brown (2001), Benartzi, et al (2011), Butler and Teppe (2007), Clark and Mitchell (2024).

required minimum distributions, and fixed monthly payouts. They find that the average age of retirees in the sample rose by 1.3 years for women and 2.0 years for men. Among these retirees, individuals were postponing initial distributions to older ages and fewer claimants were requesting one of the annuity options offered by TIAA. Instead, they were making periodic withdrawals as mandated by the minimum distribution requirements under federal regulations. Clark and Mitchell (2024) show that participants in DC plans are much less likely to purchase annuities with their pension accounts compared to individuals covered by DB plans.

Clark, Pelletier, and Ritter (2023) examined benefit claiming from firms managed by the Pension Benefit Guarantee Corporation. They examined all individuals claiming a benefit between 2012 and 2021 and whether the retiree chose a member-only annuity or a J&S annuity. The main finding was that women were much less likely to choose a J&S than men and the difference in probability of selecting a J&S by sex was considerably higher at older ages.

IV. CalSTRS Retirees and Their Distribution Choices

In response to a Freedom of Information Request, CalSTRS provided information on all members of the defined benefit plan who retired between fiscal years 2016 and 2023. A fiscal year starts on July 1. The data was received in September 2022 and includes data for over 90,375 employees with about 12,500 educators retiring each year. The file includes information on key characteristics of retirees including age at retirement, sex of retiree, marital status, salary in final year of employment, years of service at retirement, and the type of retirement benefit distribution selected for each of their plans and their amounts. We present information on the sample of retirees and their choice of retirement benefits in the following section.

Description of CalSTRS Retirees and Their DBP Benefit Choices

In this section, we describe the demographic composition of recent retirees from CalSTRS along with their work histories and retirement benefits. These basic characteristics are discussed below and shown in Table 1. Consistent with national data on the composition of public-school teachers, participants in CalSTRS are predominantly women. Among the 90,375 retirees between 2016 and 2023, 71% are female and 29% are male. Most of the retirees (68%) are married; however, there is a notable difference in marital status, across the two genders as 75% of males are married, while only 66% of females are married. Across the sample years, the age and marital composition of retirees is fairly constant, as is the annual number of retirees, except in 2023 when the data does not include retirements from the entire year. During these years, females retired on average about 5 months earlier than males. About 20% of individuals retired before the age of 60 and 29% retired after the age of 65. Again, there is little variations in these retirement patterns across the years.

[Table 1 here]

The average number of years of service for retirees was 23.9 with males having 0.3 more years of service at retirement compared to females. The gender difference in length of service is fairly constant over time. About 0.5% of the observations do not include the salary data so the sample size goes from 90,375 to 89,890. The average final year's salary for retirees was \$93,580, with a gender gap equal to \$2,542 in favor of males or 2.7% of the male average. As expected, the average salary is increasing over time. There is an overall upward trend in the gender gap for the average salary, with a maximum gap of \$6,427 with the average salary for females being

94.5% of the final year salary of men. This difference in average salary reflects the slightly longer years of service of males.¹⁵

Examining the benefit choices of CalSTRS retirees from the DBP we find that 57% of individuals opted for the member-only annuity while 41% chose one of the J&S options. Among those selecting a J&S annuity, the 100% survivor benefit was the most popular option. Only 2% of the retirees chose the compound option. The proportion of retirees selecting each of the annuity options were relatively stable over the sample period. An important observation is the difference in annuity choice by gender. The proportion of females that chose a member-only annuity was 23 percentage points higher than for a male. This finding is consistent with Hypothesis 2 presented earlier.¹⁶ The annuity choices for males and females are relatively stable throughout the sample period.

The average initial monthly benefit of each of the different J&S options is greater than the average monthly benefit for those who chose member-only benefit. For example, the average member-only annuity was \$4,007 while the 100% J&S average benefit was \$4,229. This implies that on average, the individuals who choose J&S had a higher potential member-only benefit compared to those that actually chose the member-only annuity. As expected, males who choose a J&S distribution have, on average, higher levels of benefits than corresponding females; however, among those that selected member-only benefit, females had slightly higher monthly benefits.¹⁷ To restate this finding, the actual amount of the member-only benefit was on average

¹⁵ Appendix A, Table 2 provides annual averages on these items by gender.

¹⁶ Appendix A, Table 3 presents the proportion of retirees with each annuity by gender and by year.

¹⁷ Appendix A, Table 4 show the average benefit by distribution option selected by year and gender.

higher for those members who selected the J&S benefit option, making their reduced J&S benefit larger than the average member-only benefits taken.

Distribution Choices of Retirees from the DBSP

Virtually all of the CalSTRS DBP retirees (97%) also had account balances in the DBSP. At retirement individuals included in the supplemental plan must choose one of three types of distributions: annuity, lump sum, and combo (participant elects a portion of their defined benefit supplemental account as a lump sum and the remaining funds are used to purchase an annuity). During the sample period, 54% of the participants use the value in their supplemental account to purchase an annuity while 44% took a lump sum payment and only a few individuals chose the combo option. Compared to the large gender differences in the choice of distributions from the primary plan, the distribution pattern from the supplement plan is similar, with males opting slightly more often for an annuity compared to females (56% versus 53%), and females being slightly more likely to choose a lump sum (45% versus 41%).¹⁸

V. Estimating Benefit Choices of CalSTRS Retirees from the DBP

The DBP benefit is determined using the base compensation of the participant. In this section, we estimate the distribution choice from the DBP as if it is independent of the benefit from the DBSP. This implies that the distribution choices from the two retirement plans is sequential; the teacher first chooses their DBP benefit and then their DBSP distribution option. We model the DBP distribution choice by retirees by considering two options for each individual: the dependent variable is equal to 1 if the individual selected straight life or member-only annuity, or equal to zero if one of the J&S distributions was selected. The relatively small

¹⁸ The pattern of distribution choices from the supplemental plan is presented in Appendix A Table 5.

number of individuals (less than 2% of the sample) who selected the compound option are removed from the sample in this analysis. This leaves us with 87,877 individuals that retired between 2016 and 2023.

To model the distribution choice, we use a Probit model with the following regressors: intercept, age at retirement (measured in years), salary in the final year of employment (measured in tens of thousands of dollars), years of service (measured in years), a dichotomous variable equal to one if the individual is married (equal to zero if not), a dichotomous variable equal to one if the individual is a male (equal to zero if not), and a regressor consisting in the interaction of the married and male regressors. We also include a set of dichotomous variables for each fiscal year to capture the effects of variation in interest rates and other systematic variation across time, leaving out the first fiscal year (2016) to avoid creating perfect multicollinearity. In Table 2, we report the partial effects evaluated at the sample mean for each regressor and the corresponding standard errors. All these estimated effects are statistically significant at the 1% significance level with the exception of the dummy indicating 2017 which is only one year later than the base year of 2016.

[Table 2 here]

Perhaps the most important finding is that males are much less likely to select a member-only annuity compared to females when holding marital status, age, final salary, and years of service constant. The probit estimate indicates that unmarried males are 16.3 percentage points less likely to select a member-only annuity or 16.3 percentage points more likely to have chosen one of the J&S options. As expected, being married substantially decreases the probability of choosing a member-only annuity and the difference is even greater for married men. Together gender and marital status have extremely large impacts. Everything else being constant, if a

female is married instead of not married, the probability of selecting a member-only annuity instead of a J&S annuity decreases by 66.7 percentage points. A married male is 5.7 percentage points less likely to choose a member-only annuity than a non-married male. These findings are consistent with Hypotheses 1 and 2 described earlier.

Being one year older at retirement is associated with a lower probability of choosing a member-only annuity of 0.4 percentage points. Thus, older retirees are slightly more likely to select a J&S annuity. Consistent with Hypothesis 3 that providing income protection for one's spouse is a normal good, we find that an increase in final annual earnings of \$10,000 increases the probability of choosing a J&S annuity by 1.3 percentage points. Having one additional year of service decreases the probability of choosing a member-only annuity by 1 percentage point. Over the years covered in our review, there has been a trend of increasing probability of choosing member-only annuities from the DBP. The probit estimates indicate that the probability of choosing a member-only annuity was 9.8 percentage points higher in 2023 compared to individuals retiring in 2016.

In summary, we find large and statistically significant differences between males and females in how they access their pension wealth. Men are 16.3 percentage points more likely to select a J&S annuity that provides longevity insurance for their spouse compared to women. Being married is the primary factor leading both men and women to select a J&S annuity. Finally, we conclude that providing income protection in retirement for a spouse is a normal good as individuals with higher final earnings are more likely to choose a J&S annuity. These findings confirm the three hypotheses posed earlier.

VI. Distribution Choices from the DBSP

We first estimate the distribution choice from the DBSP as if this decision is made after the teacher has selected their DBP benefit. The benefit from the DBP examined above is based on the participants base salary; however, many educational employees also earn additional compensation from summer employment or additional assignments such as after school tasks, coaching, summer work, etc. This additional compensation is not included in the calculation of the DBP benefit. The DBSP is a separate retirement plan that covers this extra compensation. Retiring teachers must select one of the DBSP distribution options previously described when leaving the system.

We first model the option selected for the DBSP by examining whether an individual selects only a lump sum payment or purchases any of the annuity options or a combo. The dependent variable is dichotomous: equal to one if a lump sum is chosen, equal to zero if an annuity or the combo option is selected. We include all the same regressors used in Table 2 and also add the initial monthly benefit amount from the DBP (measured in hundreds of dollars). This analysis assumes that retirees first decide on their DBP benefit and then, conditional on having made that decision, they decide how to access their DBSP benefit.

In Table 3, we report the partial effects evaluated at the sample mean and their standard errors. Holding everything else constant, if the individual retiring is one year older, then the probability of selecting only a lump sum distribution instead of purchasing an annuity decreases by 0.1 percentage point. If the last year's salary increases by \$10,000, then the probability of selecting only a lump sum decreases by about one percentage point, this is consistent with protection of a spouse being a normal good. As for years of service at retirement, one more year decreases the probability for selecting lump sum by 1.2 percentage points. The amount of the retirement benefit received from the DBP is associated with an increase in the probability of

choosing a lump sum distribution. We observe that increasing the DBP benefit by \$1,000 leads to a 3 percentage points higher probability of choosing a lump sum. This is an interesting finding that indicates that the selection of the DBSP benefit is a function of the generosity of the DBP benefit.

[Table 3 here]

As for the impact of gender and marital status, we first note that they have a much smaller impact on the distribution choice of the DBSP compared to their impact on the distribution choice of the DBP. Holding everything else constant, for a female, being married decreases the probability of choosing a lump sum by 1.2 percentage points. For a male, being married decreases the probability by 2.1 percentage points. Finally, for individuals who are not married, being a male instead of a female is associated to a 2.9 percentage points lower probability of choosing a lump sum distribution. In more recent years, we see an increased probability of choosing only a lump sum distribution for the supplemental plan over purchasing an annuity, compared to years 2016 and 2017. Everything else equal, the probability of choosing a lump sum in 2021 is 8.8 percentage points higher than in 2016.

For the individuals who purchase an annuity with their supplemental plan, we investigate the type of distribution they select among the following three option: J&S (all percentages), period certain (all number of years), and member-only. The results of a multinomial Probit model are presented in Table 4. The number of observations is now reduced to 49,228. Note that by construction, the sum of the partial effects across the three options for a given regressor will be equal to zero since everyone chooses one of these distribution options.

[Table 4 here]

Holding everything else constant, if the individual is one year older at retirement, we see that it leads to a 0.7 percentage point increase in the probability of choosing a J&S distribution, while member-only decreases by 0.5 percentage point. If the individual's last year's salary increases by \$10,000, then the probability of choosing member-only decreases by 3.5 percentage points, with corresponding increases in J&S and period certain by 1.9 and 1.5 percentage points, respectively. We note the same directional impact for additional years of service at retirement, with the probability of choosing a member-only benefit decreasing by 1.7 percentage points for each year, while the probability of choosing J&S decreases by 1.2 percentage points. An increase in the DBP benefits makes the member-only option more appealing; a \$100 increase in benefits predicts a 0.6 percentage point increase in the probability of choosing a member-only benefit by 0.6.

As for the impact of the marital status and gender, we note very important impacts. For females, being married increases the probability of choosing a J&S distribution by 28.9 percentage points and decreases the probability of choosing a member-only option by 25.3 percentage points. For males, the impact of being married is even stronger, with the probability of choosing J&S increasing by 30.8 percentage points, while choosing the member-only benefit decreases by 34.1 percentage points. Unmarried males have a 4.6 percentage points higher probability of choosing J&S than unmarried females, a change fully at the expense of the member-only option. Over time, the overall pattern is a reduction in the probability of individuals choosing J&S as the distribution option in the DBSP, with a maximal decrease in fiscal year 2021 by 4.9 percentage points.

VII. Joint Determination of Retirement Benefits

Since both CalSTRS pension plans provide retirement income and the distribution choices must be made at retirement, we conclude that the best method to examine these choices is to estimate the distribution decisions for the two programs as a joint decision where the retiree considers the distribution for the DBP and the DBSP together. The first exercise simply counts the number of individuals who select each possible combination. For the DBP, we consider the member-only and J&S options. For DBSP, there are four options: lump sum, J&S, period certain, and member-only. Table 5, Panel A reports the number of retirees with each combination of benefits, while Table 5, Panel B reports the frequencies of each cell. We see that no retiree chose the combination of member-only annuity from the DBP and J&S from the DBSP, and almost no one (only 19 individuals, less than 1%) chose the combination of J&S for the DBP and member-only for the DBSP. Among the other six possible pairs, the observations are fairly balanced: member-only with lump sum is the most popular combination (with 27% of the observations), J&S for both the DBP and DBSP is the least popular (with 11% of the observations).

[Table 5 here]

The statistics in Table 5 show that with regard to modeling the joint decision for the DBP and DBSP, we do not have to consider all eight possible pairs. Knowing that an individual opted for J&S for the DBSP guarantees that she chose J&S for the DBP. Knowing that an individual opted for member-only from the DBSP (almost) guarantees that she opted for member-only from the DBP. We are left with four combinations where one element of the pair is not determined by the other: member-only or J&S for the DBP, paired with lump sum or period certain for the DBSP. Counts and frequencies are reported in Table 6 for these four pairs.

[Table 6 here]

To get an initial appreciation for potential dependence between the choice for the DBP and the choice for the DBSP, we can compute counterfactual joint probabilities equivalent to those presented in Table 6 using the marginal probabilities in Table 6, Panel B, but assuming the two choices are independent. Accordingly:

- The counterfactual probability that an individual would choose member-only for the DBP and lump sum for the DBSP is 34.2% (58% times 59%) compared to the actual 36% probability.
- The counterfactual probability that an individual would choose member-only for the DBP and period certain for the DBSP is 23.8% (58% times 41%) compared to the actual 22% probability.
- The counterfactual probability that an individual would choose J&S for the DBP and lump sum for the DBSP is 20.2% (42% times 59%) compared to the actual 23% probability.
- The counterfactual probability that an individual would choose J&S for the DBP and period certain for the DBSP is 17.2% (42% times 41%) compared to the actual 19% probability.

Small differences exist between the actual joint probabilities and the counterfactual probabilities based on independence. This is an initial indication of dependence between the choice of distribution for DBP and DBSP.

We conduct a more formal analysis of the joint selection of the distribution for the DBP and DBSP for the individuals who chose either member-only or J&S for the DBP, with lump sum or period certain for the DBSP. We employ a bivariate Probit model. As explained in Appendix B, the bivariate Probit model includes a correlation parameter linking the latent error terms in the

DBP equation and the DBSP equation. If this correlation parameter is zero, it means that the two Probit equations are independent, meaning the DBP choice is independent of the DBSP choice. A non-zero correlation means the decisions are dependent. Estimation results for the bivariate Probit model are presented in Tables 7, Panel A (parameters estimates) and Table 7, Panel B (partial effects). Note that to estimate this bivariate Probit model, we had to drop three observations with outlier values for the salary variable to avoid a local lack of identification. The sample mean of the salary variable is \$93,580, and the standard deviation is \$31,967. These three individuals that were deleted from the sample had a salary more than 25 standard deviations above the sample mean.

[Table 7 here]

Looking at the parameter estimates and standard errors in Table 7, Panel A, we can focus on the estimated correlation parameter. We see that the estimate is small (0.026), but at the 1% significance level we can reject the null hypothesis that it is zero. We can conclude that there is some dependence between the distribution choice of the DBP and the DBSP. This positive correlation increases the probability that both dependent variables take the same value, hence more likely to have individuals choose member-only combined with lump sum or J&S combined with period certain, less likely to choose member-only combined with period certain or J&S combined with lump sum.

For the remaining parameters, it is more instructive to look at the partial effects instead of the parameter estimates. Partial effects, evaluated at the sample mean, as well as their standard errors, are presented in Table 7, Panel B. Because each member will choose one of the four possible combinations for the distribution of the DBP and DBSP, the sum of the partial effects for a given regressor will mechanically sum up to zero.

If the individual is one year older at retirement, the probability of choosing the combination J&S with lump sum increases by 0.2 percentage points, while the probability of choosing member-only with period certain goes down by 0.2 percentage points. Increasing the last year's salary by \$10,000 decreases the probability of choosing the member-only with lump sum combination by 1.8 percentage points, with the corresponding largest increase being the J&S with period certain combination by 1.1 percentage points. Years of service has a similar impact as salary. One more year of service at retirement decreases the probability of choosing member-only with lump sum by 1.4 percentage points, while increasing J&S with period certain by 0.9 percentage point.

Marital status has a huge impact. For females, being married increases the two combinations with J&S for the DBP (J&S with lump sum by 39.2 percentage points, J&S with period certain by 27.3 percentage points) at the expense of the two combinations with member-only for the DBP. Being a male instead of a female further increases the impact of being married on the probability of choosing combinations with J&S for the DBP (J&S with lump sum by 41.6 percentage points, J&S with period certain by 29 percentage points). For unmarried individuals, gender has a similar impact as marital status but a lesser magnitude. Being a male increases the probability of choosing J&S with lump sum by 8.8 percentage points and J&S with period certain by 8.7 percentage points. As for variation over time, the overall pattern is an increasing trend in the probability of opting for member-only distribution from the DBP, combined with lump sum for the DBSP. For example, in fiscal year 2023, everything else being the same, the probability of choosing member-only with lump sum is 8.9 percentage points higher than in 2016.

In summary, these results indicate that retiring teachers jointly decide on the distribution options from both their primary pension plan (DBP) and their supplemental plan (DBSP); thus confirming hypothesis 4.

VIII. Conclusions

For millions of Americans, a major determinant of wellbeing in retirement is how they access their pension wealth. Workers covered by defined benefit plans typically are offered the choice between a single life annuity for the retiree or a J&S annuity that provides a benefit for the life of the retiree and a designated beneficiary. Some plans also allow for a lump sum distribution of the account balance. In general, pension participants must decide at retirement the type of benefit they prefer. While coverage by DB plans has declined in the private sector, these plans remain the primary type of retirement benefit for state and local employees.

Relatively little is known about the distribution choices made by public employees from their pension plans. This study is based on the benefit choices of individuals retiring from the CalSTRS pension plan between 2016 and 2023. CalSTRS is the largest pension fund in the world covering only educators and in 2023, it was the second largest pension fund in the United States with assets of over \$300 billion. CalSTRS has over one million members and beneficiaries. In response to a Freedom of Information Request, CalSTRS provided information on all members who retired between fiscal years 2016 and 2023, a total of 90,375 retirees.

Using the administrative data provided by CalSTRS, we examined the choices of retiring teachers in their primary pension (DBP) between a member-only annuity and a J&S annuity. The analysis indicates that being married is a major determinant of selecting a J&S benefit and providing income insurance to a spouse or other beneficiary. Another important finding is that

men are much more likely to select a J&S annuity compared to women. A third key finding is that providing a continuing benefit to the beneficiary after the death of the retiree is a normal good. While a few other studies have found these relationships, the CalSTRS information includes information that is often unavailable in prior studies including marital status, years of service, and final earnings.

Table 8 illustrates the effects on distributional choices for gender, marital status, and age. The estimated probability of married women retirees aged 55 selecting a member-only annuity is 57 percent. The proportion declines to only 42 percent at age 70 as more females select a J&S annuity. Men are over 20 percentage points less likely than women to select a member-only benefit with the difference being slightly at lower at older ages. Nonmarried retirees rarely select a J&S annuity.

[Table 8 here]

We were also given information about a supplemental pension plan covering CalSTRS participants (DBSP). Almost all of the individuals in the data file had pension accounts with both plans. An important finding from the analysis is that the distributional choices of retiring teachers from the two plans are jointly determined as the amount of the benefit from the primary plan influences how the retiree accesses their wealth in the supplemental plan.

Participants in the DBSP are allowed to select a lump sum distribution of their account balance. Table 9 shows the predicted probability of retirees selecting such a distribution by age, gender, and marital status. The predictive probability of choosing a lump sum distribution from the DBSP is between 40 and 45 percent for both sexes for all of the ages shown regardless of marital status. This implies that about half of all retirees chose an annuity from their DBP while opting for a lump sum distribution from the supplemental DBSP.

[Table 9 here]

The CalSTRS retirement plan is similar to those offered in other states for teachers and state and local employees. Thus, our findings may have broader implications for individuals throughout the economy that are covered by public defined benefit plans. In addition, we find that individuals who are covered by two retirement plans make a joint decision about their benefits from the two plans. If this result holds in other cases, it has important implications for other studies of individuals accessing retirement wealth. For example, this implies that private sector employees covered by a primary DB plan and a supplemental defined contribution or a 401(k) plan would not make independent choices on how to access their pension benefits.

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Table 1. Composition and Benefit Choices of CalSTRS Retirees

Characteristic	Full Sample	Male	Female
<i>Composition of CalSTRS Retirees</i>			
Married	68%	75%	66%
Gender		29%	71%
Mean Age	62.7 years	63.1 years	62.6 years
Years of Service	23.9 years	24.1 years	23.8 years
Final Annual Salary	\$93,580	\$95,390	\$92,848
<i>Benefit Choices from Defined Benefit Plan</i>			
Distribution Options			
Member-only	57%	41%	64%
J&S 100%	19%	31%	14%
J&S 75%	9%	13%	8%
J&S 50%	13%	12%	13%
Compound	2%	2%	2%
Monthly Benefit			
Member-only	\$4,007	\$3,798	\$4,061
J&S 100%	\$4,229	\$4,394	\$4,080
J&S 75%	\$5,037	\$5,236	\$4,901
J&S 50%	\$4,872	\$4,877	\$4,870
Compound	\$4,781	\$4,924	\$4,707
<i>Benefit Choices from the Defined Benefit Supplemental Plan</i>			
Distribution Options			
Annuity	54%	56%	53%
Lump sum	44%	41%	45%
Combo	3%	3%	2%
Annuity Types			
Member-only	26%	18%	30%
J&S 100%	12%	18%	9%
J&S 75%	3%	3%	2%
J&S 50%	6%	5%	6%
Period Certain	55%	56%	53%

The full sample contains 90,375 individuals (26,015 males and 64,360 females). The number of observations where the final annual salary is available is 89,890 (25,881 males and 64,009 females).

Table 2. Estimation Results from a Probit Model for Retirees Choosing a Member-only Annuity from the DBP

Variable	Partial Effects	Standard Errors
Age at retirement	-0.004***	0.000
Salary	-0.013***	0.001
Years of service	-0.010***	0.000
Married	-0.667***	0.006
Male	-0.163***	0.010
Married*Male	-0.057***	0.011
Year dummy 2017	0.006	0.007
Year dummy 2018	0.022***	0.007
Year dummy 2019	0.028***	0.007
Year dummy 2020	0.040***	0.007
Year dummy 2021	0.064***	0.007
Year dummy 2022	0.074***	0.007
Year dummy 2023	0.098***	0.012

The dependent variable is a dichotomous variable, equal to one if the individual selected member-only annuity or equal to zero if a J&S annuity was selected. The number of observations is 87,877. The year dummies are to be interpreted as deviations from the base year, which is 2016. Age at retirement is measured in years. Salary is measured in tens of thousands of dollars per year. Married is a dichotomous variable equal to 1 if the individual is married, equal to 0 otherwise. Years of service is measured in years. Male is a dichotomous variable equal to 1 if the individual is a male, equal to zero if a female.

The stars denote the level of statistical significance: *** for 1%.

Table 3. Estimation Results from a Probit Model for Retirees Choosing a Lump Sum from the DBSP.

Variable	Partial Effects	Standard Errors
Age at retirement	-0.001*	0.000
Salary	-0.010***	0.001
Years of service	-0.012***	0.000
Initial DB benefits	0.003***	0.000
Married	-0.012***	0.004
Male	-0.029***	0.007
Married*Male	-0.009	0.009
Year dummy 2017	0.011	0.007
Year dummy 2018	0.029***	0.006
Year dummy 2019	0.056***	0.007
Year dummy 2020	0.049***	0.007
Year dummy 2021	0.088***	0.006
Year dummy 2022	0.078***	0.007
Year dummy 2023	0.045***	0.011

The dependent variable is binary, equal to 1 if the individual selected Lump Sum for their supplemental plan (DBSP) or equal to 0 if the distribution from the supplemental plan is Annuity or Combo. The number of observations is 87,578. The year dummies are to be interpreted as deviations from the base year, i.e. 2016. Age at retirement is measured in years. Salary is measured in tens of thousands of dollars per year. Initial SR benefits is the monthly amount measured in hundreds of dollars. Married is a dichotomous variable equal to 1 if the individual is married, equal to 0 otherwise. Years of service is measured in years. Male is a dichotomous variable equal to 1 if the individual is a male, equal to zero if a female.

The stars denote the level of statistical significance: * for 10%, ** for 5%, *** for 1%.

Table 4. Estimation Results for a Multinomial Probit for the Type of Annuity Chosen by Retirees from the DBSP

Variable	Partial effect on choosing J&S	Partial effect on choosing Period Certain	Partial effect on choosing Member-only
Age at retirement	0.007*** (0.000)	-0.002*** (0.001)	-0.005*** (0.001)
Salary	0.019*** (0.001)	0.015*** (0.001)	-0.035*** (0.001)
Years of service	0.012*** (0.000)	0.005*** (0.001)	-0.017*** (0.001)
Initial DB benefits	-0.005*** (0.000)	-0.001*** (0.000)	0.006*** (0.000)
Married	0.289*** (0.006)	-0.036*** (0.006)	-0.253*** (0.005)
Male	0.046*** (0.010)	0.000 (0.010)	-0.046*** (0.008)
Married*Male	0.019* (0.011)	0.069*** (0.012)	-0.088*** (0.010)
Year dummy 2017	-0.003 (0.006)	-0.012 (0.008)	0.015** (0.008)
Year dummy 2018	-0.010 (0.006)	-0.019* (0.008)	0.029*** (0.008)
Year dummy 2019	-0.027*** (0.007)	0.016* (0.009)	0.011 (0.008)
Year dummy 2020	-0.020*** (0.007)	0.005 (0.009)	0.015* (0.008)
Year dummy 2021	-0.049*** (0.007)	0.046*** (0.009)	0.003 (0.008)
Year dummy 2022	-0.046*** (0.007)	0.023** (0.009)	0.023*** (0.008)
Year dummy 2023	-0.032*** (0.012)	0.003 (0.015)	0.030** (0.014)

Each individual who does not take their supplemental plan as a lump sum can select one of three distribution options for their supplemental plan: J&S, Period Certain, Member-only. The three options are taken as unordered. The table presents the partial effects, evaluated at the sample mean, for each regressor on the probability of choosing a given distribution option. Standard errors are between parentheses. The stars denote the level of statistical significance: * for 10%, ** for 5%, *** for 1%. The number of observations is 49,228.

Table 5, Panel A. Counts for the joint selection of the DBP and the DBSP

DBP/DBSP	Lump Sum	J&S	Period Certain	Member-only	Total (columns)
Member-only	22,860	0	14,084	12,792	49,736
J&S	14,557	9,561	11,727	19	35864
Total (rows)	37,417	9,561	25,811	12,811	85,600

The last row of the table represents the number of observations for a given DBSP distribution across the DBP options. The last column of the table represents the number of observations for a given DBP distribution across the DBSP options. The bottom right entry is the total number of observations, i.e., the sum of all observations across all combinations of DBP and DBSP distributions.

Table 5, Panel B Frequencies for the Joint Selection of the DBP and the DBSP

DBP plan/DBSP plan	Lump sum	J&S	Period Certain	Member-only	Total (columns)
Member-only	0.27	0.00	0.16	0.15	0.58
J&S	0.17	0.11	0.14	0.00	0.42
Total (rows)	0.44	0.11	0.30	0.15	1.00

The last row of the table represents the fraction of observations for a given DBSP distribution across the DBP options. The last column of the table represents the fraction of observations for a given DBP distribution across the DBSP options.

Table 6, Panel A. Counts for the Joint Selection of the DBP and a restricted set from the DBSP

DB plan/Supp plan	Lump sum	Period Certain	Total (columns)
Member-only	22860	14084	36944
J&S	14557	11727	26284
Total (rows)	37417	25811	63228

The last row of the table represents the number of observations for a given DBSP distribution across the DBP options. The last column of the table represents the number of observations for a given DBP distribution across the DBSP options. The bottom right entry is the total number of observations, i.e., the sum of all observations across all combinations of DBP and DBSP distributions.

Table 6, Panel B. Frequencies for the Joint Selection of the DBP and a Restricted Set from the DBSP

DB plan/DBSP plan	Lump sum	Period certain	Total (columns)
Member-only	0.36	0.22	0.58
Modified (J&S)	0.23	0.19	0.42
Total (rows)	0.59	0.41	1.00

The last row of the table represents the fraction of observations for a given DBSP distribution across the DBP options. The last column of the table represents the fraction of observations for a given DBP distribution across the DBSP options.

Table 7, Panel A. Bivariate Probit model for the distribution options selected from the DBP (restricted to member-only versus J&S) and the DBSP (restricted to lump sum versus period certain).

Defined benefits selection: Member-only (=1) versus J&S (=0)		
Variable	Estimates	Standard Errors
Age at retirement	-0.010***	0.001
Salary	-0.036***	0.002
Years of service	-0.027***	0.001
Married	-1.783***	0.020
Male	-0.471***	0.033
Male*Married	-0.110***	0.036
Year dummy 2017	0.018	0.022
Year dummy 2018	0.052**	0.022
Year dummy 2019	0.072***	0.022
Year dummy 2020	0.120***	0.023
Year dummy 2021	0.171***	0.022
Year dummy 2022	0.189***	0.023
Year dummy 2023	0.270***	0.039
Intercept	3.282***	0.094
Supplemental plan selection: Lump Sum (=1) versus Period Certain (=0)		
Variable	Estimates	Standard Errors
Age at retirement	0.000	0.001
Salary	-0.039***	0.003
Years of service	-0.033***	0.001
DB benefits	0.007***	0.001
Married	-0.012	0.013
Male	-0.113***	0.023
Male*Married	-0.002	0.026
Year dummy 2017	0.038*	0.020
Year dummy 2018	0.093***	0.020
Year dummy 2019	0.114***	0.020
Year dummy 2020	0.109***	0.020
Year dummy 2021	0.170***	0.019
Year dummy 2022	0.170***	0.020
Year dummy 2023	0.119***	0.034
Intercept	1.004***	0.091
Correlation	0.026***	0.007

The number of observations is 63,225. The stars denote the level of statistical significance: * for 10%, ** for 5%, *** for 1%. The correlation variable refers to the correlation between the two latent errors underpinning the two probit equations.

Table 7, Panel B. Partial effects for the bivariate Probit model for joint selection from the DBP (Member-only vs. J&S) and the DBSP (lump sum vs. period certain)

Variable	MO + LS	MO + PC	J&S + LS	J&S + PC
Age at retirement	-0.002*** (0.000)	-0.002*** (0.000)	0.002*** (0.000)	0.001*** (0.000)
Salary	-0.018*** (0.001)	0.004*** (0.001)	0.003*** (0.001)	0.011*** (0.001)
Years of service	-0.014*** (0.000)	0.004*** (0.000)	0.001*** (0.000)	0.009*** (0.000)
Married	-0.396*** (0.005)	-0.269*** (0.005)	0.392*** (0.005)	0.273*** (0.004)
Male	-0.132*** (0.009)	-0.044*** (0.007)	0.088*** (0.008)	0.087*** (0.006)
Male*Married	-0.025** (0.010)	-0.016* (0.008)	0.024*** (0.009)	0.017*** (0.007)
Initial DB benefits	0.002*** (0.000)	-0.002*** (0.000)	0.001*** (0.000)	-0.001*** (0.000)
Year dummy 2017	0.013* (0.007)	-0.007 (0.006)	0.001 (0.006)	-0.008* (0.004)
Year dummy 2018	0.035*** (0.007)	-0.015*** (0.006)	0.001 (0.006)	-0.021*** (0.004)
Year dummy 2019	0.044*** (0.007)	-0.017*** (0.006)	0.000** (0.006)	-0.027*** (0.004)
Year dummy 2020	0.053*** (0.007)	-0.009*** (0.006)	-0.011** (0.006)	-0.033*** (0.004)
Year dummy 2021	0.080*** (0.007)	-0.016** (0.006)	-0.014*** (0.006)	-0.050*** (0.004)
Year dummy 2022	0.084*** (0.007)	-0.014 (0.006)	-0.018*** (0.006)	-0.052*** (0.004)
Year dummy 2023	0.089*** (0.012)	0.012 (0.010)***	-0.043*** (0.010)	-0.058*** (0.008)

The number of observations is 63,225. Standard errors are between parentheses. The stars denote the level of statistical significance: * for 10%, ** for 5%, *** for 1%.

Table 8. Predicted Probability of Choosing a Member-Only Annuity from the DBP

Age at Retirement	Female		Male	
	Married	Not Married	Married	Not Married
55	57.0	97.5	33.9	93.7
60	52.0	96.7	29.5	92.0
65	47.0	95.6	25.3	89.9
70	42.1	94.3	21.4	87.5

Predicted probability of choosing the member-only annuity from the DBP according to the Probit model estimated in Table 2. All the regressors, other than age at retirement, sex, and marital status, are set at the mean of the sample.

Table 9. Predicted Probability of Choosing a Lump Sum from the DBSP

Age at Retirement	Female		Male	
	Married	Not Married	Married	Not Married
55	45.7	44.5	41.9	41.6
60	45.3	44.1	41.6	41.3
65	45.0	43.8	41.2	40.9
70	44.6	43.4	40.9	40.6

Predicted probability of choosing a lump sum from the DBSP according to the Probit model estimated in Table 3. All the regressors, other than age at retirement, sex, and marital status, are set at the mean of the sample.

Figure 1. U.S. Treasury Rate at 2-Year Constant Maturity.



Appendix A: CalSTRS Tables

Appendix Table 1. Age Factors for DBP Retirees

Age	2% at 60*	2% at 62
50	1.10	
51	1.16	
52	1.22	
53	1.28	
54	1.34	
55	1.40	1.16
56	1.52	1.28
57	1.64	1.40
58	1.76	1.52
59	1.88	1.64
60	2.00	1.76
61	2.133	1.88
62	2.267	2.00
63	2.40	2.133
64	2.40	2.267
65	2.40	2.40

*Retirees must have 30 or more years of service to retire between ages of 50-55.

Appendix Table 2A. DBP Retirees by Gender and Marital Status

Year	Nb. Obs.	Male (%)	Married (%)	Married (male, %)	Married (female,%)
All years	90,375	0.29	0.68	0.75	0.66
2016	11,946	0.29	0.69	0.76	0.66
2017	12,801	0.29	0.68	0.76	0.65
2018	13,436	0.29	0.68	0.74	0.65
2019	12,852	0.29	0.69	0.75	0.66
2020	12,232	0.30	0.68	0.74	0.66
2021	13,213	0.28	0.68	0.74	0.65
2022	11,506	0.28	0.70	0.76	0.67
2023	2,389	0.30	0.71	0.80	0.67

Appendix Table 2B. DBP Retirees by Age at Retirement and Gender

Year	Nb. Obs.	Age (mean)	Age (male, mean)	Age (female, mean)	Age<60 (%)	60≤Age<65 (%)	Age≥65 (%)
All years	90,375	62.73	63.11	62.57	0.20	0.51	0.29
2016	11,946	62.69	63.08	62.53	0.18	0.53	0.28
2017	12,801	62.75	63.10	62.61	0.19	0.52	0.29
2018	13,436	62.87	63.32	62.68	0.18	0.51	0.31
2019	12,852	62.81	63.11	62.69	0.20	0.50	0.30
2020	12,232	62.87	63.33	62.67	0.20	0.50	0.30
2021	13,213	62.75	63.09	62.61	0.22	0.49	0.30
2022	11,506	62.48	62.90	62.31	0.23	0.50	0.27
2023	2,389	61.94	62.02	61.91	0.27	0.51	0.22

Appendix Table 2C. DBP Retirees by Years of Service

Year	Nb. obs.	Mean	Mean (male)	Mean (female)
All years	90,375	23.86	24.07	23.77
2016	11,946	23.65	24.03	23.50
2017	12,801	23.82	24.00	23.75
2018	13,436	23.81	24.04	23.72
2019	12,852	23.65	23.78	23.59
2020	12,232	23.63	23.58	23.65
2021	13,213	24.18	24.56	24.04
2022	11,506	23.97	24.24	23.87
2023	2,389	25.27	25.55	25.14

Appendix Table 2D. DBP Retirees by Final Annual Salary

Year	Nb. obs.	Mean (all)	Mean (male)	Mean (female)
All years	89,890	93580	95390	92848
2016	11,865	86576	88109	85963
2017	12,713	88877	90754	88102
2018	13,361	91697	92896	91213
2019	12,796	93098	94051	92706
2020	12,161	93734	95269	93090
2021	13,162	97621	100264	96597
2022	11,450	100047	102729	98998
2023	2,382	112514	117022	110595

Note: The number of observations in Appendix Table 2D is slightly lower than the total number of retirees in the sample because the salary variable is missing for some individuals.

Appendix Table 3A. Distributions Chosen by DBP Retirees

Year	Nb. obs.	Member-only	J&S 100%	J&S 75%	J&S 50%	Compound
All years	90,375	0.57	0.19	0.09	0.13	0.02
2016	11,946	0.55	0.20	0.10	0.13	0.02
2017	12,801	0.55	0.20	0.10	0.13	0.02
2018	13,436	0.57	0.18	0.10	0.13	0.02
2019	12,852	0.56	0.19	0.09	0.13	0.02
2020	12,232	0.58	0.18	0.09	0.13	0.02
2021	13,213	0.59	0.18	0.09	0.12	0.02
2022	11,506	0.59	0.18	0.09	0.12	0.02
2023	2,389	0.58	0.18	0.09	0.13	0.02

Appendix Table 3B. Distributions Chosen by Male DBP Retirees

Year	Nb. obs.	Member-only	J&S 100%	J&S 75%	J&S 50%	Compound
All years	26,015	0.41	0.31	0.13	0.12	0.02
2016	3,409	0.38	0.32	0.14	0.13	0.03
2017	3,735	0.39	0.32	0.14	0.12	0.03
2018	3,864	0.41	0.30	0.14	0.12	0.03
2019	3,751	0.42	0.30	0.12	0.13	0.03
2020	3,612	0.42	0.30	0.13	0.12	0.02
2021	3,691	0.42	0.30	0.12	0.12	0.02
2022	3,240	0.43	0.31	0.13	0.11	0.02
2023	713	0.42	0.30	0.13	0.13	0.01

Appendix Table 3C. Distributions Chosen for Female DBP Retirees

Year	Nb. obs.	Member- only	J&S 100%	J&S 75%	J&S 50%	Compound
All years	64,360	0.64	0.14	0.08	0.13	0.02
2016	8,537	0.62	0.15	0.09	0.13	0.02
2017	9,066	0.62	0.15	0.08	0.13	0.02
2018	9,572	0.63	0.14	0.08	0.13	0.02
2019	9,101	0.62	0.14	0.07	0.14	0.02
2020	8,620	0.64	0.13	0.08	0.13	0.02
2021	9,522	0.66	0.13	0.07	0.12	0.02
2022	8,266	0.65	0.13	0.07	0.12	0.02
2023	1,676	0.65	0.12	0.08	0.13	0.02

Appendix Table 4A. Average Initial Monthly Benefits for DBP Retirees by Type of Annuity

Year	Member-only	J&S 100%	J&S 75%	J&S 50%	Compound
All years	4006.68	4228.88	5037.15	4872.29	4780.61
2016	3729.01	4030.66	4735.57	4614.79	4427.20
2017	3829.49	4170.03	4842.57	4604.83	4621.70
2018	3950.47	4158.54	4901.30	4666.45	4625.69
2019	3924.35	4250.22	4855.15	4806.96	4826.49
2020	4029.44	4086.19	5062.12	4830.59	4816.81
2021	4232.71	4410.78	5383.99	5138.68	4769.02
2022	4272.71	4424.30	5439.59	5351.17	5026.01
2023	4281.50	4717.51	5820.65	5725.12	6897.98

**Appendix Table 4B. Average Initial Monthly Benefit for DBP Retirees by Type of Annuity:
Males**

Year	Member-only	J&S 100%	J&S 75%	J&S 50%	Compound
All years	3797.61	4394.35	5236.00	4877.33	4923.71
2016	3460.11	4231.59	5053.64	4475.56	4781.52
2017	3520.31	4416.65	4936.88	4678.19	5208.81
2018	3737.26	4270.10	5093.60	4663.06	5068.13
2019	3702.63	4389.35	4981.96	4719.87	4393.04
2020	3800.13	4175.52	5175.47	4811.46	5058.42
2021	4113.68	4574.22	5632.13	5173.18	4664.27
2022	4137.56	4628.37	5676.96	5483.48	5267.24
2023	4190.89	4886.96	6202.97	6115.89	6069.78

**Appendix Table 4C. Average Initial Monthly Benefit for DBP Retirees by Type of Annuity:
Females**

Year	Member- only	J&S 100%	J&S 75%	J&S 50%	Compound
All years	4060.92	4080.35	4900.84	4870.31	4706.68
2016	3794.88	3855.60	4537.21	4670.85	4194.51
2017	3908.58	3944.40	4779.29	4575.74	4301.15
2018	4006.07	4060.70	4766.92	4667.74	4396.28
2019	3985.79	4130.85	4770.17	4840.87	5041.08
2020	4091.37	3998.85	4978.95	4838.38	4709.58
2021	4262.44	4269.60	5214.63	5124.69	4827.79
2022	4307.14	4238.87	5268.92	5303.32	4913.53
2023	4306.30	4540.69	5533.92	5560.97	7165.14

Appendix Table 5A. Distributions Chosen by Retirees from DBSP

Year	Nb. obs.	Annuity (%)	Combo (%)	Lump Sum (%)
All years	87,684	0.54	0.03	0.44
2016	11,546	0.58	0.03	0.40
2017	12,381	0.57	0.03	0.40
2018	13,016	0.55	0.03	0.42
2019	12,451	0.53	0.02	0.45
2020	11,851	0.53	0.02	0.44
2021	12,876	0.50	0.02	0.48
2022	11,212	0.50	0.03	0.47
2023	2,351	0.56	0.02	0.41

Appendix Table 5B. Distributions Chosen by Retirees from DBSP: Males

Year	Nb. obs.	Annuity (%)	Combo (%)	Lump Sum (%)
All years	25,266	0.56	0.03	0.41
2016	3,297	0.60	0.03	0.38
2017	3,628	0.58	0.03	0.39
2018	3,755	0.57	0.03	0.40
2019	3,634	0.56	0.03	0.42
2020	3,500	0.54	0.03	0.42
2021	3,593	0.54	0.03	0.43
2022	3,159	0.52	0.03	0.45
2023	700	0.57	0.03	0.40

Appendix Table 5C. Distributions Chosen by Retirees from DBSP: Females

Year	Nb. obs.	Annuity (%)	Combo (%)	Lump Sum (%)
All years	62,418	0.53	0.02	0.45
2016	8,249	0.57	0.03	0.41
2017	8,753	0.56	0.02	0.41
2018	9,261	0.54	0.02	0.43
2019	8,817	0.51	0.02	0.46
2020	8,351	0.53	0.02	0.45
2021	9,283	0.48	0.02	0.50
2022	8053	0.50	0.03	0.48
2023	1651	0.56	0.02	0.42

Appendix Table 6. Type of Annuity Selected from the DBSP: Only Those Who Chose Some Type of Annuity

Distribution	All individuals		Male		Female	
	Nb. Obs.	Percent	Nb. Obs.	Percent	Nb. Obs.	Percent
J&S 50%	2,841	0.06	753	0.05	2,088	0.06
J&S 75%	1,298	0.03	514	0.03	784	0.02
J&S 100%	5,799	0.12	2,639	0.18	3,160	0.09
PC 3 years	4,221	0.09	1,224	0.08	2,997	0.09
PC 4 years	1,497	0.03	443	0.03	1,054	0.03
PC 5 years	5,782	0.12	1,772	0.12	4,010	0.12
PC 6 years	1,270	0.03	410	0.03	860	0.02
PC 7 years	1,258	0.03	418	0.03	840	0.02
PC 8 years	649	0.01	221	0.01	428	0.01
PC 9 years	892	0.02	292	0.02	600	0.02
PC 10 years	10,968	0.22	3,517	0.24	7,451	0.22
Member-only	12,845	0.26	2,686	0.18	10,159	0.30

PC stands for Period Certain.

Appendix B: Overview of the Bivariate Probit Model

A common way to derive the probit model is to start with a linear model for a latent dependent y_i^* :

$$y_i^* = X_i' \beta + u_i$$

We assume that the error term u_i follows a standard normal distribution and is independent from the regressors X_i . The link between the observed binary dependent variable y_i and y_i^* is $y_i = 1$ if

$$y_i = \begin{cases} 1 & \text{if } y_i^* \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

From this structure, we can derive the probability of observing $y_i = 1$ (and $y_i = 0$):

$$\begin{aligned} Pr(y_i = 1|X_i) &= Pr(y_i^* \geq 0|X_i) \\ &= Pr(X_i' \beta + u_i \geq 0|X_i) \\ &= Pr(u_i \geq -X_i' \beta|X_i) \\ &= Pr(u_i \leq X_i' \beta|X_i) \\ &\equiv \Phi(X_i' \beta). \end{aligned}$$

The term $\Phi(x)$ represents the cdf of the standard normal density evaluated at the value x . We go from the third to the fourth line by using the fact that the standard normal density is symmetric around zero. Since y_i takes the value 1 or 0, it follows that

$$Pr(y_i = 0|X_i) = 1 - Pr(y_i = 1|X_i) = 1 - \Phi(X_i' \beta).$$

This framework can be expanded to a bivariate probit model for the case where we have two binary dependent variables, $y_{1,i}$ and $y_{2,i}$. We now have two latent variables, each with its own linear model:

$$\begin{aligned} y_{1,i}^* &= X_i' \beta + u_{1,i}, \\ y_{2,i}^* &= Z_i' \gamma + u_{2,i}. \end{aligned}$$

We assume that the two error terms are jointly normal, means equal to zero, and variances equal to one. They are potentially dependent; we denote the correlation between $u_{1,i}$ and $u_{2,i}$ by ρ . The link between the observed binary dependent variables $y_{j,i}$ and $y_{j,i}^*$ for $j = 1, 2$, is

$$y_{j,i} = \begin{cases} 1 & \text{if } y_{j,i}^* \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

From this structure, we can derive the probability of observing $(y_{1,i} = 1, y_{2,i} = 1)$, and other pairs of values for $y_{1,i}$ and $y_{2,i}$:

$$Pr(y_{1,i} = 1, y_{2,i} = 1|X_i, Z_i) = Pr(y_{1,i}^* \geq 0, y_{2,i}^* \geq 0|X_i, Z_i)$$

$$\begin{aligned}
&= \Pr(X_i'\beta + u_{1,i} \geq 0, Z_i'\gamma + u_{2,i} \geq 0 | X_i, Z_i) \\
&= \Pr(u_{1,i} \geq -X_i'\beta, u_{2,i} \geq -Z_i'\gamma | X_i, Z_i)
\end{aligned}$$

The value of this joint probability will depend on the correlation between $u_{1,i}$ and $u_{2,i}$. For example, Appendix B Figure 1 represents the joint probability $\Pr(u_{1,i} \leq 0, u_{2,i} \leq 0)$ for a range of values of the correlation ρ . From this figure, we can see that the probability will depend on the value of the correlation. When the correlation is large and negative, there is a very small probability that both variables take a negative value. As the correlation increases, the joint probability that both variables are negative increases.

Appendix B Figure 1. Probability that two standard normal random variables are negative as a function of the correlation between them.