How Much Do Public Employees Value Defined Benefit versus Defined Contribution Retirement Benefits?*

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Abstract

We survey public employees across the United States about their preferences regarding retirement plan options, and in particular at what employer contribution rate public employees would agree to switch to a defined contribution (DC) plan on a forward-looking basis. Overall, 89.2% of respondents are willing to accept a hard freeze of their defined benefit (DB) plan and the introduction of a DC plan at some contribution level. Conditional on acceptance, the median minimum contribution rate that respondents would require—if no additional retirement benefits would accumulate under their existing plan—is 10.0% of payroll, while the mean is 18.2% of payroll. The perceived and actual financial generosity of the pension plan relates negatively to the acceptance rate and positively to the minimum required contribution. More senior employees are somewhat less likely to accept the DC option, but there is over 80% acceptance even among long-tenured employees. Consistent with typical DB accrual patterns in the presence of early retirement options, employees with around 20 years of service require the largest DC contributions to switch. Employees who perceive the financial stability of their current plan as weaker are, on average, more likely to accept a DC plan and at lower contribution levels. We find no statistically significant heterogeneity with respect to educational attainment or financial literacy, making an explanation of the results based on cognitive ability less likely. In comparison to the economic cost of prevailing DB plans, introducing DC options that are acceptable to employees could potentially improve the sustainability of pension systems across the United States without compromising employees' satisfaction with their pension plan options.

Keywords: Public pensions, state and local governments, retirement policies, pension cost, government debt, pension preferences, defined benefit plans, defined contribution plans, pension sustainability.
JEL codes: H55, H75, J26, J45

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1 Introduction

In the United States, state and local governments predominantly offer their employees defined benefit (DB) pension plans. While only 16 percent of employees in the private sector had access to a DB plan in 2020 (Bureau of Labor Statistics, 2020), about 83 percent (Bureau of Labor Statistics, 2020; NASRA, 2021) of public sector employees are enrolled in a DB plan. This is largely because new private sector US firms have for decades generally offered individual account DC plans instead of DB plan, and older firms have in large number frozen their DB plans (Rauh, Stefanescu, and Zeldes, 2020) and introduced DC plans, either for new hires only (a "soft freeze") or for all employees (a "hard freeze"). Even the US federal government has, since 1987, offered a DC option, the Thrift Savings Plan, alongside a less generous DB plan than was previously in place.

Current public sector pension plans require substantial resources from the budgets of state and local governments. In 2021 reported government contributions were 8.4% of own source revenue or 12.5% of tax revenues. However, economically required contributions are closer to 14.2% of own source revenue or 21.1% of total tax revenue in 2021 (Giesecke and Rauh, 2022). With regards to the balance sheet of state and local governments, unfunded pension obligations constitute the largest liability of sub-national US government entities, exceeding even fixed-income obligations in the municipal bond market (Giesecke, Mateen, and Jardim Sena, 2022). As of fiscal year 2021, the total reported unfunded liabilities of these plans under governmental accounting standards is $1.076 trillion.[1] In contrast, the market value of the unfunded liability is approximately $6.501 trillion (Giesecke and Rauh, 2022). The market values reflect the fact that accrued pension promises are a form of government debt with strong rights, and should thus be measured using default-free discount rates (Brown and Wilcox, 2009; Brown and Pennacchi, 2016; Novy-Marx and Rauh, 2011). Furthermore, between 2014 and 2021, despite strong stock market performance, the aggregate unfunded liability increased steadily from $4.349 trillion to $6.501 trillion, due both to declines in market discount rates and to the steady accrual of promised benefits.[2]

In light of the growing liabilities originating from DB plans, we survey public sector

[1] 2021 is the latest year for which complete accounts are available for all cities and states.

[2] Complete data are not yet available for 2022. We predict that while the increase in bond yields during 2022 will have reduced the market value of liabilities through 2022, the decline in assets will have offset this improvement to some extent, and unfunded liabilities are likely to fall in the range of $5-$6 trillion for fiscal year 2022. For a time series of total liabilities, assets and the net pension liability see Appendix Figure A.2.

employees about their retirement plan preferences. In particular, we ask respondents a series of questions to elicit the value they place on continuing to accrue benefits in their DB plan, relative to the freezing of DB benefits and introduction of a DC plan. In a DB plan, the employer guarantees the retirement benefits and makes investment decisions regarding retirement assets on behalf of their employees. Importantly, any shortfall in investment returns has to be offset by the employer, since the employer has guaranteed the benefit. In contrast, in a DC plan, the employer makes fixed contributions into an investment account and employees invest the assets at their discretion. Ex-ante it is unclear what employees would prefer, as the decision involves multiple trade-offs (Bodie, Marcus, and Merton, 1988). On the one hand, DB plans provide the employee with a large degree of certainty about future benefit payments, at least in the absence of the default of their employer, and generally provide an automatic annuity benefit.[3] On the other hand, DB plans take away any discretion in the investment decision from employees.[4] Given different preferences for deferred and annuitized income, and different levels of background wealth and background risks for individuals, the decision between DB plans and DC plans is a question of the employer contribution rate into the DC plan at which employees would feel equally well off. Specifically, we ask at what minimum contribution rate to a new hypothetical DC plan employees are indifferent between that new DC plan or a continuation of their existing, predominantly DB, plan.

We survey public employees of school districts, local and state governments in the United States. We contacted approximately 396,948 public employees across 16 states.[5] We received a total of 7,674 responses which amounts to an overall response rate of 2.1% after adjusting for inactive or inaccurate e-mail addresses.[6]

[3]In Detroit, MI, retirees had to accept a 4.5% reduction in pension benefits for most employees, excluding police and fire retirees, as part of the bankruptcy chapter 9 proceedings. San Bernardino paid CalPERS in full despite its bankruptcy chapter 9 proceedings, reaffirming the statutory protections in the state of California (Dick, 2018). In Central Falls, RI, pension payments were reduced by approximately 55% and cost of living adjustments (COLAs) were eliminated (Hylton, 2013) as part of the bankruptcy chapter 9 proceedings.

[4]Jang and Wu (2021) show that among a large sample of private pension plans in the United Stats, DB plans underperform size-matched DC in terms of investment returns. Further, the majority of DC and DB underperform investable passive benchmarks

[5]We have surveyed AR, CA, CO, CT, DE, IA, ID, KS, MD, MN, MT, NC, NE, PA, VA and VT. The total invitations consist of 325,473 public state employees, 65,493 in state higher education institutions, and 5,982 K-12 teachers and administrators.

[6]We adjust for a 10% "bounce-back" rate due inactive or inaccurate e-mail addresses. Thus, we estimate the number of received invitations to be 357,253. In a study on investment beliefs of clients of the major investment firm Vanguard, sent under Vanguard cover, Giglio, Maggiori, Stroebel, and Utkus (2021) obtain a response rate of 2.5-4 percent across multiple survey waves. Our response rate of 2.1% compares well given

We find that 89.2% of respondents would accept a DC plan in lieu of their existing plan for future accruals at some contribution level. Conditional on acceptance, the median respondent is willing to forgo future accruals under their existing plan in exchange for a DC plan with a contribution rate of 10.0% of payroll and a mean of 18.2% of payroll. We find a variety of heterogeneous responses. First, with respect to years of service, more senior employees are somewhat less likely to accept the DC option, but there is over 80% acceptance even among long-tenured employees. Consistent with typical DB accrual patterns in the presence of early retirement options (Stock and Wise, 1990), employees with around 20 years of service require the largest DC contributions to switch. Employees that perceive the financial stability of their current plan as weaker are, on average, more likely to accept a DC plan and at significantly lower contribution levels. The perceived and actual financial generosity of the pension plan relate negatively to the acceptance rate and positively with the minimum required contribution rate. We find no statistically significant heterogeneity of the minimum required contribution rate with respect to educational attainment and financial literacy, making an explanation of the results based on cognitive ability less likely.

We compare the respondents' minimum required contribution rate to the economic cost of their existing DB plans.[7] The economic cost for DC retirement plans is straightforward: the employer contributes a percentage of payroll to the employee's investment account, often consisting of base percentage plus a matched contribution up to a specified percentage of pay. There is no additional liability for the employer, so that the total cost in any given time period is simply whatever the employer contributes in that time period. In contrast, the employer cost for DB plans is more complex and consists of two components. The first component is the service ("normal") cost which reflects the cost of newly accrued benefits during the year. The second component is any payment related to the unfunded portion of liabilities already accrued. The service cost is the present value of newly-accrued benefits at some risk-appropriate discount rate, and the cost of carrying an unfunded liability is simply the interest on that unfunded liability, at a risk-appropriate discount rate (Novy-Marx and Rauh, 2014a). The risk-appropriate discount rate would reflect the fact that the benefit is guaranteed. Contributions at this level would result in no risk-adjusted expected

that no prior contact or relationship had been established.

[7]In our survey, we ask respondents about a hypothetical DC plan that involves no matching, only an unconditional employer contribution specified as a percent of pay. Thus, the employer contribution of the respondent's required minimum rate would be the cost of the new DC plan.

increase in the unfunded liability (Giesecke and Rauh, 2022).

In a transition from a DB plan to a DC plan that does not impair any already-accrued annuity benefits under the DB plan, the employer effectively eliminates the service cost and instead pays DC contributions into the new plan. This, however, does not change the unfunded liability and the costs of servicing it (Rauh, Stefanescu, and Zeldes, 2020). Many companies have undertaken this type of shift (Rauh and Stefanescu, 2009), often referred to as a "hard freeze". Thus, the DB service cost measured at a discount rate appropriate for guaranteed benefits would be the cost of continuing the DB plan, and that cost is the appropriate comparison to the DC employer contribution in the new plan. The cost of carrying the unfunded accrued liability is invariant to whether participants are continuing to accrue new DB pension rights.

In a comparison of the required contribution to the economic pension cost, we find that a substantial share of public employees demand a minimum required contribution rate from the employer that is below the economic cost of the pension plan that they are currently enrolled in. Concretely, in 2021 the payroll-weighted average service cost under market valuation was 26.7%, and 20.7% after subtracting off member contributions, with substantial variation across plans (Giesecke and Rauh, 2022). Thus, the required contribution rate as a percent of payroll in our survey, with a median of 10.0%, a mean of 18.2%, and a 75th percentile of 25.0% tends be lower than the average economic cost of continuing the DB plan for much of the distribution. However, the aggregated summary statistics conceal substantial heterogeneity in the cross-section. Thus, we conduct a plan-by-plan analysis. We find that for the predominant share of pension plans the median of the respondents' required DC contributions is below the economic cost of the current DB pension plan. For most plans even the mean of respondents' required DC contributions are below the economic cost of the current DB plan. To take full individual heterogeneity into account, we model each respondent's individual pension cost and compare it with the required contribution rate. For close to 80% of the respondents, we find that the required DC contribution rate is below the market value of the employer service cost. We find a strong gradient with respect to years of service; younger employees more often willing to accept less than the employer cost relative to older employees. The results suggest that, especially young, public sector employees value other dimensions of their compensation package than solely the magnitude of their retirement benefit promises—a finding that is corroborated by two in-

dependently conducted studies that survey employees' satisfaction with their DB pension plans (MissionSquare Research Institute, 2022; Fuchsman, McGee, and Zamarro, 2023).

The majority of employees seem to value the apparent flexibility and portability of DC plans, making them willing to accept a contribution that is below the current economic cost of their pension plan. This finding also suggests that there might be substantial savings for pension sponsors of more expensive DB plans by switching to a DC plan that is agreeable to the great majority of employees.

Literature Pension promises are a form of government debt with strong statutory and contractual rights. As pension promises are made for future periods, liability measurement requires to discounting promised benefits to today's value. The principles of financial economics require that the discount rate should reflect the riskiness of the associated cash flow stream. Thus future benefits for which employees have accrued pension rights as of the present time should measured using default-free discount rates (Lucas and Zeldes, 2006; Brown and Wilcox, 2009; Novy-Marx and Rauh, 2009, 2011; Novy-Marx, 2013; Brown and Pennacchi, 2016). The choice of the discount rate not only affects the value of the pension liability but also impacts the costs that a government ascribes to an employee working an additional year. The fact that an employee works for an additional year raises the pension that an employee is due to receive when they retire. The additional cost of providing that pension is a compensation cost that governments must take into account. The higher the discount rate, the lower the deferred compensation cost will appear to be. Giesecke and Rauh (2022) show that, under governmental accounting, state and local governments cover newly accruing pension benefit and, for the most part, interest cost as well as some amortization of the unfunded liability. However, considering the true cost under financial economics, employers barely fund the economic cost of newly accrued benefits, let alone any servicing of the unfunded liability.[8]

There is a long-standing literature on the choice between DB vs. DC plans, dating back at least to Bodie, Marcus, and Merton (1988). Cocco and Lopes (2011) show that the optimal choice between DC and DB plans depends on the expected earning growth and risk of the individual. Individuals who expect a higher growth rates of earnings are more likely to choose DB plans, whereas individuals with higher risk prefer DC plans. Brown and

[8]See also Novy-Marx and Rauh (2014a).

Weisbenner (2014) study the choice between defined contribution (DC) and defined benefit (DB) retirement plans empirically. The paper finds that the probability of choosing the DC plan decreases with the relative financial generosity of the DB plan, a finding that is confirmed in our survey study. Similarly, we also find a positive gradient with respect to income after accounting for factors constant within states. In contrast to Brown and Weisbenner (2014) we do not find a statistically significant effect with respect to education. Brown and Weisbenner (2014) further find that other individual characteristics and beliefs, such as, risk/return trade-offs, financial literacy, return expectations, and political risk are important for the explanatory power. Brown, Ivković, and Weisbenner (2015) study the choice between a more immediate payment and a larger deferred payment. The paper finds that individuals prefer the long-term payment if they have higher incomes and are not liquidity constrained; better health and longer life expectancy lead them to consider longer horizons in financial decision-making, whereas individuals who expect higher risk are more likely to take the earlier income stream.

There is a small but growing literature on the conversion of pension benefits. Chalmers, Johnson, and Reuter (2014) use administrative data from Oregon's Public Employees Retirement System and quasi-exogenous variation to estimate how pension incentives affect members' retirement behavior. Rauh, Stefanescu, and Zeldes (2020) study the freezing of corporate defined benefit pension plans. The paper finds that companies save the equivalent of 13.5% of the long-horizon payroll of current employees. Further, the paper finds evidence consistent with firms' reneging on implicit contracts of high pension accruals in the later stage of employees' career.

Surveys have been an important tool in social science research. Stantcheva (2022) emphasizes the use of surveys for capturing perceptions, knowledge, beliefs, attitudes, and reasoning. In our specific setting, we also elicit preferences. While economics has a long history of capturing preferences via "revealed preference" approach by observing choice, in our setting observational data is very limited and conducting experiments are politically costly if not unfeasible. Beshears, Choi, Laibson, Madrian, and Zeldes (2014) survey participants about hypothetical annuitization choices. The paper finds that individuals are more like to annuitize if they are allowed to annuitize a fraction of their wealth. If individuals are exposed to frames that highlight flexibility, control, and investment, it reduces likelihood of annuitization. Cole and Taska (2022) uses an online survey to evaluate the relative valu-

ation between total pay and a non-matching employer sponsored 401(k). The paper finds that a provision of retirement benefits is valued more than additional pay, in particular for employees with high salary.

In Section 2 we discuss the economics of pension plans. Section 3 describes the design choices of the survey and provides information on the conduct of the survey. Section 4 provides summary statistics for the most important variables of the survey. Section 5 discusses the results and Section 6 compares the results relative to the economic cost of current pension plans. Section 8 concludes.

2 Economics of Pension Plans

In this section, we illustrate the the main differences in the economics of defined benefit and defined contribution plans from the perspective of employer cost.

The economic cost of a DB plan consists of two components. The first is the service (or "normal") cost which is the present value of newly accrued benefits during the year, at some risk-appropriate discount rate. The second us the interest cost on the unfunded liability at a risk-appropriate discount rate, which is the servicing of the unfunded liability required to prevent it from growing. From the employer perspective, these costs may also be offset by any employee (member) contributions. In this sense, the true economic cost of a DB plan to an employer is clear: it is the present value of new benefit accruals (the service cost) at a bond-like discount rate, plus the interest on the unfunded liability at a similar rate, minus any contributions the employer collects from employees to offset the costs (Novy-Marx and Rauh, 2011, 2014a). The appropriate discount rate to measure such costs is a default-free rate that reflects the bond-like characteristics of the pension promise (Brown and Wilcox, 2009; Novy-Marx and Rauh, 2011; Brown and Pennacchi, 2016).

State and local government budgeting reflects costs in a slightly different fashion. The expected return in government budgeting serves as the discount rate both for the service cost and for the accrued liability. Furthermore, recognizing the fact that any shortfall in investment returns must be offset by the employer, since it guaranteed benefit instead of the contributions, most state and local governments calculate amortizing payments on the unfunded liability instead of mere interest payments, albeit under inflated rate assumptions. Thus, the cost by governments is conceptually more aggressive relative to the true

economic cost, in that it targets paydown of the unfunded liability rather than just holding it at a level that does not increase government debt. However, this more conservative cost concept is offset in large part by the fact that much higher discount rates are used for both components (Novy-Marx and Rauh, 2014a; Giesecke and Rauh, 2022).

For the purposes of our survey, the key cost comparison for the employer is the cost of continuing the DB plan versus the cost of introducing the DC plan for a given employee or group of employees, while preserving any accrued DB benefits. A key observation here is that regardless of whether the DB to DC switch is made, if accrued pension promises are honored then the servicing of the unfunded liability must happen regardless (Rauh, Stefanescu, and Zeldes, 2020). Therefore, the true cost of continuing the DB plan relative to the hard-freeze introduction of the DC plan is the service cost calculated at a risk-appropriate discount rate, minus any employee (member) contributions.

For example, the California State Teachers Retirement System (CalSTRS) benefit formula is [2% x Years of Service x Final Average Pay] with full retirement eligibility at 60 or 62. The reported normal cost is 19.6% of payroll (calculated at 7.1% discount rate) and the system calculates an amortization rate of 15.1% of payroll to get to full funding by 2046 (at same discount rate) as of 2021. Members contribute 10.2% of payroll. Thus the total employer "cost" is 24.5% of payroll. However, the cost of continuing to run the DB plan is really the normal cost at a correct discount rate. CalSTRS true normal cost as a percentage of payroll using Treasury yield curve is 44.3% for fiscal year ending 2021. Subtracting the employee contribution yields an employer cost of 34.1% of payroll, which is the key cost comparison for a DC plan. A DC plan that in 2021 required the employer to contribute anything less than 34.1% of pay in that year would be cost saving for the employer. This does not necessarily mean that an entity sponsoring such a DB plan would necessarily save money for any retirement plan with less than a 34.1% of pay employer contribution. For example, there could be planned reductions in service costs due to the introduction of new pension tiers or changing employee demographics, although Giesecke and Rauh (2022) find service costs as a percent of payroll remarkable stable at between 12.9% and 13.6% between 2014 and 2021 with no directional pattern.

In the sample of 647 pension plans studied in Giesecke and Rauh (2022), covering around 90% of the public pension universe, the mean stated service cost is 13.3% of payroll, or 6.6% of payroll after member contributions, while the mean service cost under market

valuation is 26.7% of payroll or 20.7% after subtracting off member contributions in 2021. In other words, public employers contribute on average around $0.07 out of every $1 in payroll in order to fund newly accruing pension benefits, but in fact they would have to contribute about $0.21 out of every $1 in payroll to fund those newly accruing pension benefits on a market basis.[9] As explained above, if a plan implemented a hard freeze, the interest cost and the amortization payment for the unfunded liability would remain unchanged (Rauh, Stefanescu, and Zeldes, 2020). Thus, the share of the service cost that the employer pays is the relevant opportunity cost when thinking about a conversion to a DC plan.

The employer cost for DC retirement plans is relatively straightforward. Typically the employer contributes a basic (unconditional) percent of payroll (which in some cases is 0%), and makes an additional employer match to voluntary employee contributions as a percent of payroll. Thus, the total cost in any given year is simply the employer's contribution in the that year. There is no additional liability for the employer regarding retirement (abstracting from health care benefits which are independent of a DC or DB pension program). The Stanford Contributory Retirement Plan provides one example. The basic contribution equals min{5,your years of service}% of earnings up to limit. Additionally there is a matching contribution of up to 5% of earnings, for employee contribution of 4% of earnings (less if you contribute less), up to a limit. Thus, the total cost is up to 10% of earnings as contribution, up to a statutory limit.

3 Survey Design and Conduct

Survey Population and Sample In principle every public employee working for a school district, local or state government that has a pension plan other than a DC plan only is a candidate for our pension survey. As of this version of our study, we have surveyed public employees in 16 states. Concretely, we surveyed employees from AR, CA, CO, CT, DE, IA, ID, KS, MD, MN, MT, NC, NE, PA, VA and VT. The selection of states is based on where we are able to obtain e-mail addresses from completely public sources, and ex-

[9] An alternative interpretation of the service cost under market valuation is that it represents the economic cost of offering pension benefits under the current contractual terms if pension plans were fully funded.

cluding states where reforms or the introduction of tiers added excessive complexity.[10] We collected 396,948 publicly available e-mail addresses of public employees. Our list consists of 325,473 public state employees, 65,493 employees in state higher education institutions, and 5,982 K-12 teachers and administrators.

Design The survey is designed to capture the employment status, the current pension status, perceptions about the DB and DC plan indifference point, financial literacy and a rich set of demographic and socioeconomic characteristics. In particular, the employment status asks about the current employer, the current position, age, years of service, years until retirement, and income. The section on the pension status asks about the type of the pension plan that the employee is currently enrolled in, as well as, both currently accrued benefits (the pension the respondent would be entitled to at retirement if they left employment today) and expected benefits under the respondent's planned employment trajectory. In the financial literacy section, we ask a total of six questions that cover basic household finance knowledge. Demographic and socioeconomic characteristics cover sex, marital status, and household circumstances.

The key question regarding the perception of DB and DC plan equivalence asks:

> *If your employer offered to contribute an amount equal to X% of your income each year into an investment account, would you enroll in this hypothetical plan if it meant you would stop earning additional benefits under your current plan?*

where X takes on an ascending sequence of the following values $2.5\%, 5\%, 7.5\%, 10\%, 15\%, 20\%, 25\%, 30\%, 40\%, 50\%, 60\%$ until the respondent accepts. If the respondent passes 60% we ask for the required contribution rate as of payroll or provide the option that indicates a rejection of the DC plan under any contribution. The question is preceded by a more detailed explanation that the selection into the new plan would mean that retirement benefits would stop accruing under the current plan of the employee, essentially constituting a hard freeze. For a complete list of the questions confer Appendix Tables A.1 and A.2.

[10] An example of a state we excluded is Oregon, which calculates pension benefits using retirement benefit using up to three different DB, DC, and hybrid formulas (Chalmers, Johnson, and Reuter, 2014). Another is Wisconsin, whose main plan is generally characterized as a DB plan but one in which the benefit is in some respects linked to investment performance and thus may be seen as having elements of a pooled DC plan (Novy-Marx and Rauh, 2014b).

Invitation and Follow-up We invite our survey candidates via email from the Stanford University e-mail address, pensionstudy@stanford.edu, with an invitation that emphasizes anonymity of the survey. The full invitation e-mail can be found in Appendix Figure A.6. We send a follow-up e-mail that encourages candidates to participate if they have not already done so about 10-14 days after the initial invitation was sent. The full content of this follow-up e-mail is available in Appendix Figure A.7. In addition, we have setup a website dedicated to our survey, https://pensionsurvey.stanford.edu, providing additional information on the survey and general information on retirement systems across the United States.

4 Summary Statistics

We first provide summary statistics on the response rate of the survey and the breakdown of the response rate by state. Second, we tabulate the summary statistic of our survey responses. This encompasses a subset of the variables that we collect in our survey, as well as, observable characteristics from the pension plans in which our current survey sample is enrolled. In addition, we perform an analysis that assesses the representativeness of our survey sample. The actuarial valuation reports of pension plans provide a detailed tabulation of the years of service, age, and often income of the active plan members. In principle, the distribution of employees' characteristics represents the distribution of our survey population. Thus, we compare the distribution of employees' characteristics in our pension survey with that of the actuarial reports to assess the representativeness along years of service, age, and income. Obviously, one of the limitations is that we cannot ensure a full match along other observed and unobserved characteristics.

Response Rate We received a total of 7,674 responses. Thus, our overall adjusted response rate is about 2.1%.[11] Figure 1 shows the response rate visually for each state in our sample. Out of all respondents, approximately 2/3 completed the full survey; the remainder provided partial responses.

[11]The number of total invitations sent includes "bounce-backs" due to inaccurate or out-dated e-mail addresses in our email list. Adjusting for a 10% "bounce-back" rate yields an adjusted number of invitations of 357,253. We only record responses if the questions about age and years of service have been completed. We use these two basic questions to compute cross-sectional attrition rates to check for potential bias and

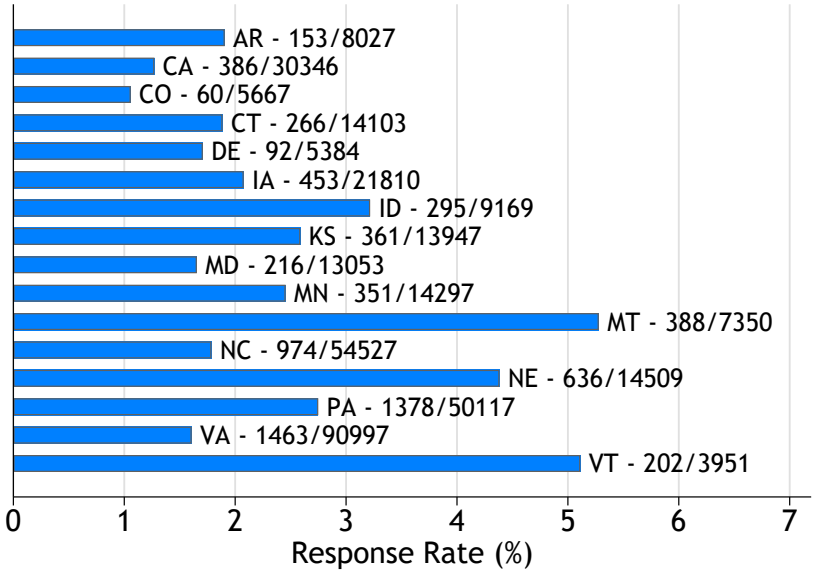


Figure 1: Response Rate

Notes: The figure shows the response rate for each state in our sample. The response rate is calculated by adjusting the total invitations sent by a common bounce back rate of 10%.

Attrition Rate Attrition rates that vary across different sets of the sub-population can reflect selection and potentially bias our estimates (Stantcheva, 2022). We find an overall attrition rate of 19.8% with regards to our key question. Our survey asks for most of the individual characteristics, including age, years of service, and the employer type at the beginning. We use this information to evaluate the attrition rates among different sub-samples. We find no differential completion rate of the main survey questions along the dimensions of age and years of service as Appendix Figure A.1 shows. Even in a more granular split of our sample into both age and years of service subsamples, we find that only 7.6% of the 66 age-service bins with over ten respondents had an average completion rate which was significantly different, at the 5% confidence level, from the remainder of the sample. These bins represented less than 5.0% of the overall sample observations.

Summary Statistics We tabulate summary statistics for the most important variables in Table 1. The median age in our survey sample is 50.0, and the median years of service is 11.0. The inter-quartile range for years of services ranges from 4.0 to 21.0. The median

comparison with the survey population.

income from the public employment job is $65,000, with a 25th percentile of $45,000 and a 75th percentile of $85,000. The total household income is higher with a median of $112,500 and a 25th percentile of $65,000 and a 75th percentile of $162,500. Thus, public service income constitutes more then half of the households' income. The summary statistics on the plan cost are as follows: The median reported service cost as of payroll is 11.9%, with a 25th percentile of 9.5% and a 75th percentile of 14.5%; under market valuation the median service cost as of payroll is 24.3%, with a 25th percentile of 20.7% and a 75th percentile of 24.7%. Contributions as a percent of payroll have a median of 14.8%, with a 25th percentile of 12.3% and a 75th percentile of 45.0%.

	Mean	p25	p50	p75	Count
I. Survey Responses:					
Public Service Income (USD)	75,375	45,000	65,000	85,000	7,458
Household Income (USD)	118,205	65,000	112,500	162,500	7,243
Financial Literacy (% Correct)	65.7	50.0	66.7	83.3	6,735
Age	49.2	40.0	50.0	59.0	7,674
Retirement Age	63.6	60.0	65.0	67.0	7,660
Years of Service	13.5	4.0	11.0	21.0	7,674
Remaining Years of Service	11.4	4.0	9.0	17.0	7,309
Hours Worked	40.5	40.0	40.0	40.0	7,674
Current DB Annuity (USD)	34,279	15,000	25,000	45,000	3,441
Expected DB Annuity (USD)	50,803	25,000	45,000	65,000	3,526
Current DC Balance (USD)	220,498	28,000	80,000	236,250	1,532
Acceptance of DC Plan (%)	89.2	100.0	100.0	100.0	5,524
Minimum Required DC Rate (%)	18.2	5.0	10.0	25.0	4,930
II. Matched Pension Plans:					
Reported Service Cost as % of Payroll	12.6	9.5	11.9	14.5	5,127
Market Value Service Cost as % of Payroll	24.1	20.4	24.3	24.7	4,819
Reported Service + Interest Cost as % of Payroll	58.2	47.9	52.5	70.8	5,127
MV Service + Interest Cost as % of Payroll	68.4	56.8	63.9	81.0	4,819
Contributions as % of Payroll	22.9	12.3	14.8	45.0	5,113

Table 1: Summary Statistics

Notes: The table tabulates the summary statistics for a subset of variables in our survey. The survey provides pre-defined brackets of income level as response options for public service income and household income, with brackets of 10k until an income level of 100k and 25k thereafter. Income above 250k is subsumed in one category. Similarly, for current and expected DB benefits brackets of 10k are given, with two final categories of 100k-150k and above 150k. We assign the midpoint of the bracket for the summary statistics and the analysis. The first panel tabulates the summary statistics of the responses to the survey questions. The second panel tabulates the summary statistics of the financial indicators of matched pension plans. Reported financial indicators are collected from the ACFRs, financial indicators under market values come from Giesecke and Rauh (2022). The variation in the number of observations among variables originates from missing responses or small variations in the set of questions across our survey waves.

Additional summary statistics for the categorical variables, which include the perception of the financial stability of the pension plan, the self-declared health status, race and

ethnicity, educational attainment, marital status, and sex are in Table 6.

We match the survey respondents to public pension plans based on their answers unless they indicate that their main plan is a DC plan or a plan of "other" type, which includes the relatively rare guaranteed return or cash balance plans. Excluding the previously mentioned categories, we are able to match about 82.5% of the responses to a public pension plan. For the remainder, the respondent provided insufficient information to establish a high confidence match. In total, we identify 52 public pension plans across the 16 states. We list every plan for which we identified more than 5 responses and the corresponding summary statistics in Tables 8 and 9.

Survey Representativeness The actuarial valuation reports of pension plans provide detailed information about its active members. Specifically, the reports provide a distribution of age and years of service, and often income, for plan participants. We consider the distribution of active employees' characteristics as the relevant survey population to which we compare our survey sample.[12]

Variable	Mean	p25	p50	p75	Count
Actuarial Age	45.3	37.0	47.0	57.0	2,149,303
Survey Age	49.2	40.0	50.0	59.0	7,671
Actuarial Years of Service	10.6	2.0	7.0	17.0	2,149,356
Survey Years of Service	13.5	4.0	11.0	21.0	7,671
Actuarial Income (in USD)	57,004	45,073	57,065	65,756	2,120,481
Survey Income (in USD)	75,384	45,000	65,000	85,000	7,456

Table 2: Summary Statistics Age and Years of Service

Notes: The table tabulates summary statistics for age and years of service for the full sample of 16 states. The summary statistics for income excludes Kansas because the actuarial valuation reports do not contain information about the income distribution of active pension plan members.

In terms of the summary statistics, we find that the median age in the active member distribution of the actuarial valuation report is 47.0 years across all plans and years, while it is slightly higher in our survey sample with 50.0 years. We observe a similar pattern for the median years of service. In the actuarial valuation reports, the median years of service is 7.0 years, while it is 11.0 years in the survey. This difference in seniority is also reflected in the median income. In the population the median income is $57,065 and it is $65,000

[12]We use the actuarial valuation reports of pension plans for which we have survey responses. The full list of plans and tiers that we include is tabulated in Appendix Tables A.4, A.5, and A.6.

in the survey. Other moments of the distribution for age, years of service and income are tabulated in Table 2.

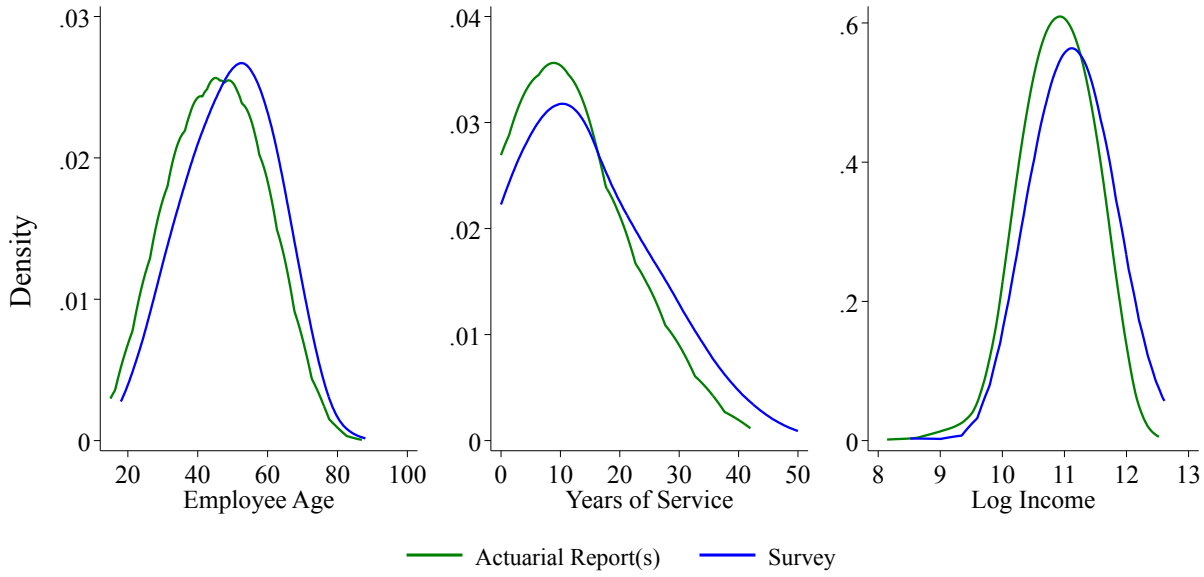


Figure 2: Covariate Densities

Notes: Density plots for age and years of service are for the full sample of 16 states. The density plot for log income excludes Kansas because the actuarial valuation report does not contain information about the income distribution of active pension plan members.

The density plot shown in Figure 2 provides a more granular understanding about the distribution of the sample and population characteristics. For age and log income, we observe an overall rightward shift of the sample distribution in comparison to the population distribution, while for years of service, we find that the sample distribution has disproportional mass in the right tail vis-à-vis the corresponding population distribution. More details on the densities for each state are reported in Appendix Figures A.3, A.4 and A.5.

5 Results

We first present the results of the nationwide analysis in Section 5.1. We then show bivariate relationships between the respondents characteristics, e.g. age and years of service, and the main outcome of interest in section 5.2. Next, we evaluate bivariate relationship between the pension plans' characteristics and the responses in Section 5.3. We show het-

erogeneity at the state level in Section 5.4. In Section 5.5 we conduct multivariate regression analysis.

We present the relationship between quantitative variables and the outcome in binscatters and categorical variables with their corresponding mean and inter-quartile range in outcomes. We use binscatters with 20 bins, which display the mean of the outcome variable for each of the quantiles, by default. If the explanatory variable does not allow for enough granularity the number of bins is reduced accordingly.

5.1 Nationwide Results

Our nationwide sample currently encompass 16 states.[13] Some of the key questions in our survey elicit the employer DC contribution level, if any, under which public employees would switch to a DC plan if it meant that benefits under the current pension plan would stop accruing. Among all our respondents the overall acceptance rate of such a new plan is 89.2%. Acceptance is defined as the respondents' willingness to accept a DC plan with a minimum required contribution rate of less or equal to 30% of their salary. Respondents that either require more than 30% or state that they would not accept "under any conditions" are categorized under non-acceptance.

Conditional on acceptance, we find that the median minimum required contribution is 10.0% of payroll. The mean is slightly higher at 18.2% of payroll because of the right skew of the response distribution. The distribution can further characterized by a 25th percentile of 5.0% and a 75th percentile of 25.0% of payroll. The full distribution of the minimum required contribution as of payroll is tabulated in Figure 3, with the last vertical bar being the relative response share of non-acceptance.

[13] Concretely, we surveyed employees from AR, CA, CO, CT, DE, IA, ID, KS, MD, MN, MT, NC, NE, PA, VA and VT.

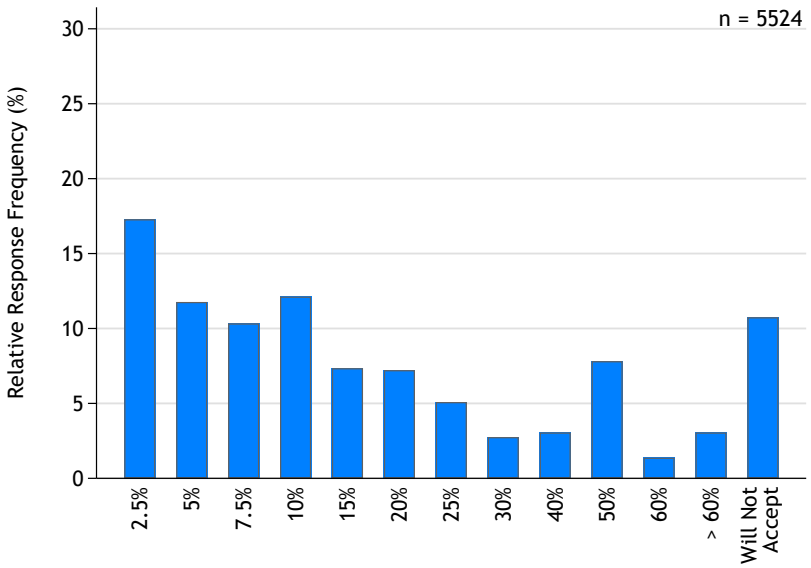


Figure 3: Acceptance and Minimum Required Contribution Rate

Notes: The figure plots the relative frequency of responses to the minimum contribution rate question. Write in answers above 60% are aggregated in the ">60%" category. "Will Not Accept" consolidates all responses with a contribution rate of above or equal 100% and answers that state that the respondent would not enroll in a defined contribution plan "under any conditions".

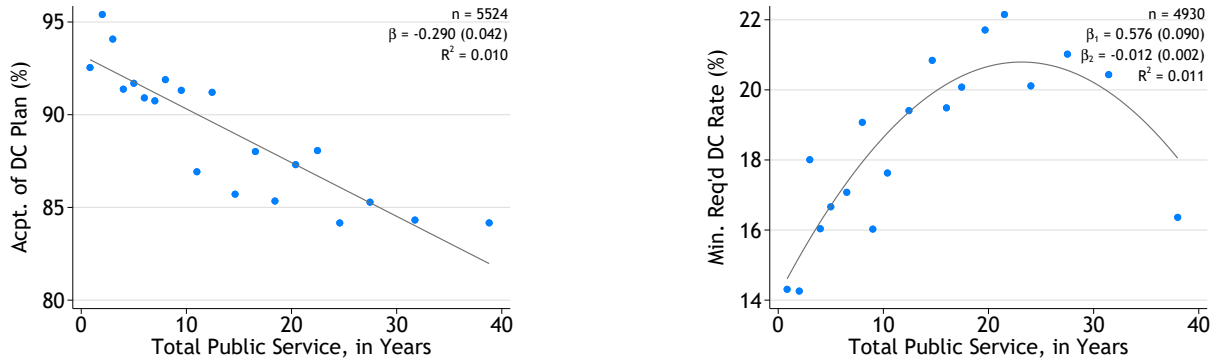
5.2 Heterogeneity by Respondents' Characteristics

How does the acceptance and the minimum required contribution vary with self-expressed characteristics and observable characteristics? In the following we show bivariate relationships between acceptance rates and the minimum required contribution rate and some salient characteristics.

Years of Service We find a negative gradient between the total years of public service and the acceptance of a DC plan. The relationship is sufficiently precisely estimated to reject the null hypothesis of a zero gradient. Concretely, public employees that have about 35 years of service are on average 5% less likely to accept the new hypothetical defined contribution plan in our survey. However, we note that average acceptance among long-tenured employees such as those with 30 or more years of service, are nonetheless quite high, at over 80%.

A similar and consistent message can be derived from the estimates between the years of service and the minimum required DC contribution rate, at least until we get to very

long-tenured employees with time in service beyond around 25 or 30 years. For short- and medium-tenured employees, we find a robust positive relationship which means that public employees with more years of service on average require higher contributions. While for a public employee the average required contribution rate is about 18% of payroll, it rises to about 21% of payroll for a public employee with 20 years of service, flattens out, and then turns downward back to 16% for employees with over 35 years of service.



(a) Acceptance of Defined Contribution Plan

(b) Minimum Required Contribution Rate

Figure 4: Acceptance and Minimum Required Contribution by Years of Service

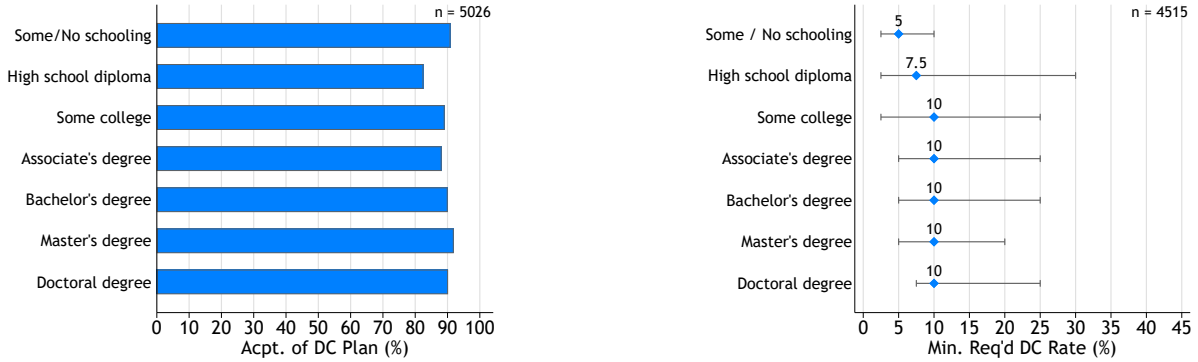
Notes: The left panel shows the relationship between the acceptance of a DC plan and years of service in a binscatter. All responses with a contribution rate of above or equal 100% and answers that state that the respondent would not enroll in a defined contribution plan "under any conditions" are classified as non acceptance. The right panel shows a binscatter and the model fit of the following estimated quadratic relationship: $Rate_i = \beta_0 + \beta_1 service_i + \beta_2 service_i^2 + \epsilon_i$, between the minimum required contribution rate into a DC plan as of payroll and the years of service.

The willingness of long-career employees to accept DC plans, and some downward slope to the acceptance rate for very long-tenured workers, may at first glance seem puzzling, given the generally convex accrual pattern of DB pension plans with accrual formulas like those described in Section 2. However, long-career employees may already be at a point in their pension accrual trajectory where they have early retirement options under which the pension will be reduced by an amount that would be less than actuarially neutral. In these circumstances, DB accruals with continued work for long-career workers eligible for early retirement is often negative (Stock and Wise, 1990).

The bivariate relationship with respect to age reflects this phenomenon. Respondents in their 40s require considerably higher compensation in the form of employer contributions to the DC plan than employees in their 20s and 30s. Employees in their 50s and 60s,

however, show similar minimum required DC contribution rates to the youngest group of employees, resulting in an overall U-shape of minimum required DC contributions with respect to age. These relationships are shown in Appendix Figure 16. The bivariate correlation shown in Appendix Figure 17 between minimum required contribution and years of remaining service also reflects the fact that those very close to retirement perceive their expected DB accruals as relatively small.

Educational Attainment We find very little heterogeneity with respect to education. It should be noted that the category "some/no schooling" only accounts for 0.3% of our sample and the category "high school diploma" for 5.5% (see summary statistics in Appendix Table 6). For the other educational attainment categories the acceptance rate and the median minimum required contribution hovers around the average acceptance rate and the median of the full survey sample.



(a) Acceptance of DC Plan

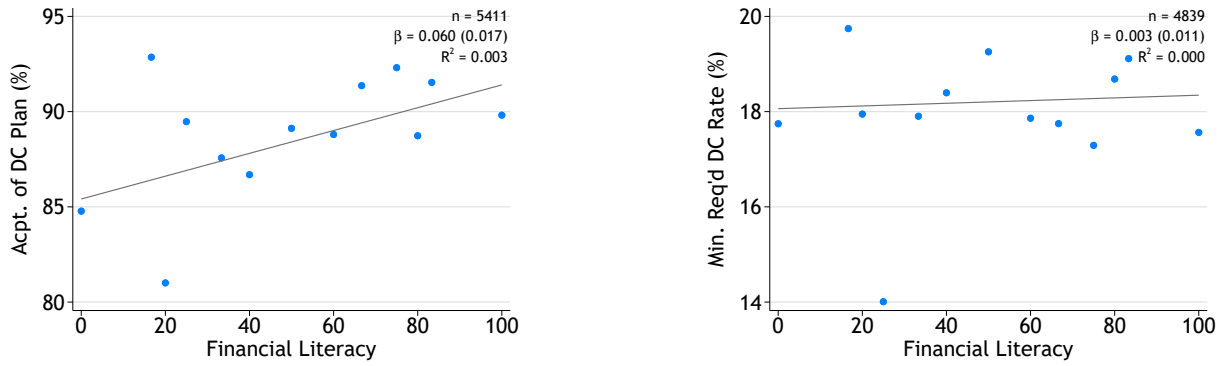
(b) Minimum Required Contribution Rate

Figure 5: Acceptance and Minimum Required Contribution by Education

Notes: The left panel shows acceptance percentage of a defined contribution plan by educational attainment. All responses with a contribution rate of above or equal 100% and answers that state that the respondent would not enroll in a defined contribution plan "under any conditions" are classified as non acceptance. The right panel plots the median (blue diamond) and the inter-quartile range (whisker plot) of the minimum required contribution as of payroll by educational attainment.

Financial Literacy The lack of a gradient in the responses with respect to educational attainment is also mirrored in the responses with regard to financial literacy. Financial literacy is measured by six questions about personal finances. The questions cover the understanding of compounding interest, real rates, dynamics of fixed income instruments,

portfolio diversification, and the time value of money.[14] We then define the financial literacy score as the percentage of questions that are answered correctly and ranges between 0 and 100. We find a small positive gradient between financial literacy and the acceptance rate, with higher literacy generally showing the tendency to accept the DC at a higher rate. The relationship between the financial literacy and the minimum required contribution is essentially flat suggesting a very weak or no relationship. Once again, this mirrors the findings for educational attainment.



(a) Acceptance of DC Plan

(b) Minimum Required Contribution Rate

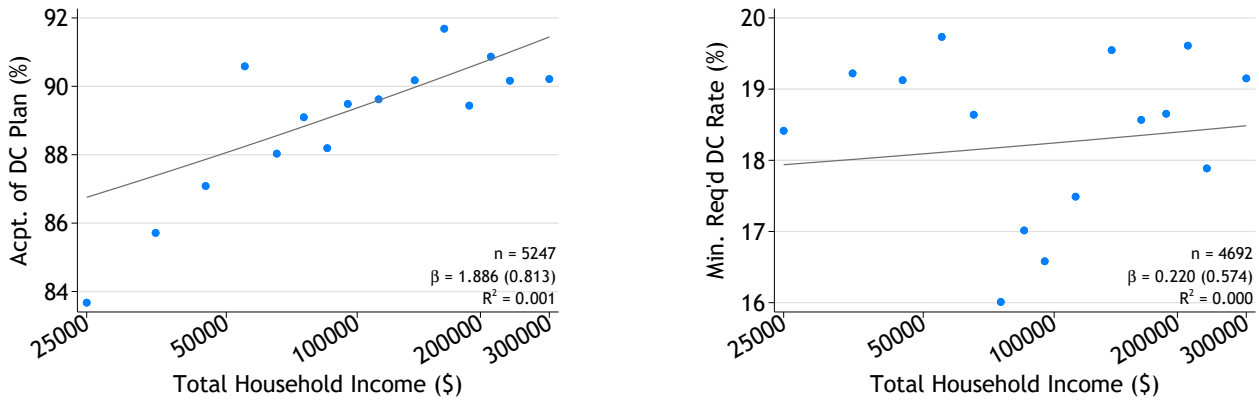
Figure 6: Acceptance and Minimum Required Contribution by Financial Literacy

Notes: The left panel shows the relationship between the acceptance of a DC plan and the financial literacy score in a binscatter. All responses with a contribution rate of above or equal 100% and answers that state that the respondent would not enroll in a defined contribution plan "under any conditions" are classified as non acceptance. The right panel shows the relationship between the minimum required contribution rate into a DC plan as of payroll and the financial literacy score in a binscatter. Financial literacy is measured by six questions about personal finances (Q34-Q40). The financial literacy score is the percentage of questions that are answered correctly and ranges between 0 and 100.

Household Income We find a positive and statistical significant relationship between household income and the acceptance rate. The relationship between household income and the required contribution rates shows an unclear relationship. The estimate for the association is measured with imprecision, so that we cannot reject the hypothesis of no relationship.[15]

[14]Financial literacy question are Q34-Q40 and the exact question can be found in Appendix Tables A.1 and A.2.

[15]Note that there is no mechanical relationship between income and the contribution rate as we specifically ask for the minimum contribution percentage as of payroll. Hence a higher minimum contribution percentage means a higher relative and absolute payment.



(a) Acceptance of DC Plan

(b) Minimum Required Contribution Rate

Figure 7: Acceptance and Minimum Required Contribution by Household Income

Notes: The left panel shows the relationship between acceptance of a DC plan and household income in a binscatter. All responses with a contribution rate of above or equal 100% and answers that state that the respondent would not enroll in a defined contribution plan "under any conditions" are classified as non acceptance. The right panel shows the relationship between the minimum required contribution rate into a DC plan as of payroll and household in a binscatter.

Additional Analysis We conduct additional heterogeneity analysis with respect to sex (Appendix Figure 18), with respect to health status (Appendix Figure 19), with respect to race (Appendix Figure 20), with respect to marital status (Appendix Figure 21), and with respect to hours worked (Appendix Figure 22).

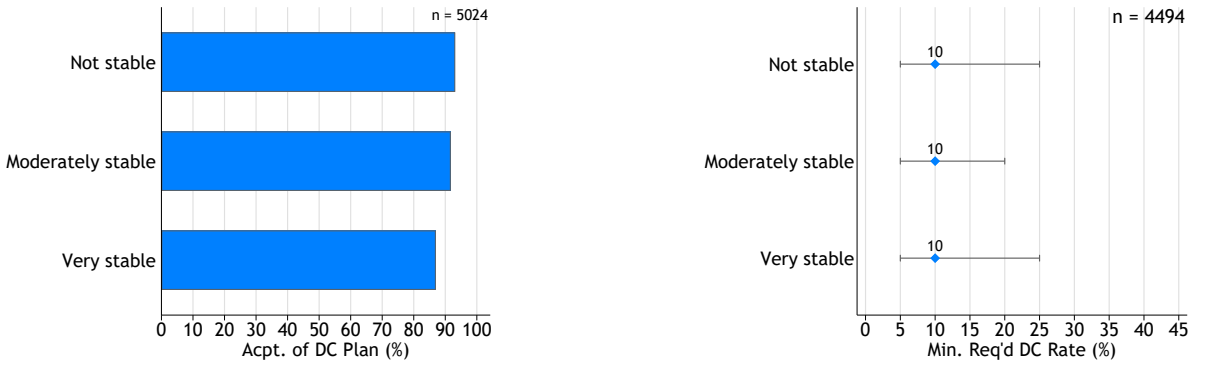
5.3 Heterogeneity by Plans' Characteristics

We further evaluate the response of public employees with respect to perceived plan and observed plan characteristics. In the survey we ask public employees about their perception about the financial stability and the financial generosity of their pension plan. In addition, we obtain information about the financial generosity of pension plans from the financial disclosures to assess heterogeneities in responses along this dimension.[16]

[16]We are matching the survey respondents to public pension plans based on their answers unless they indicate that their main plan is a DC plan or a plan of "other" type, which includes e.g. guaranteed return plans. Excluding the previously mentioned categories, we are able to match about 82.5% of the responses to a pension plan. For the remainder, the respondent provided insufficient information to establish a high confidence match. We match employees at the plan level. This ignores potential differences among different tiers of a plan. The information loss in this context is limited because financial information is only reported at the plan level.

Financial Stability Public employees perceive their plan with varying degrees of financial stability. 7.7% of respondents consider their plan to be "not stable", 44.9% perceive their plan as "moderately stable" and 45.9% think of their plan as "very stable". Interestingly, the assessment generally aligns well with the funding ratio of those plans; thus, providing some evidence that employees pay attention to the overall state of the pension system. The full summary statistics of the responses about financial stability are tabulated in Appendix Table 6.

The risk assessment of public employees is also reflected in their willingness to switch from a DB plan to a DC plan. While in a DB plan the benefit payment will depend on the solvency of the pension sponsor, this is not the case for a DC plan. Thus, the hypothesis is that the less stable employees perceive their plan the higher the willingness is to switch to a DC plan. Indeed this is what we find. We find a negative gradient between the stability and the willingness to accept a defined contribution plan as shown in Figure 8a. The hypothesis about the minimum required contribution is more difficult. In principle, the plan's financial stability should be unrelated the employees' required contribution conditional on acceptance. The responses are in line with this conjecture. We find no robust relationship between financial stability and the expressed minimum required contribution rate as shown in Figure 8b.



(a) Acceptance of DC Plan

(b) Minimum Required Contribution Rate

Figure 8: Acceptance and Minimum Required Contribution by Stability

Notes: The left panel shows acceptance percentage of a defined contribution plan by perceived retirement system stability. All responses with a contribution rate of above or equal 100% and answers that state that the respondent would not enroll in a defined contribution plan "under any conditions" are classified as non acceptance. The right panel plots the median (blue diamond) and the inter-quartile range (whisker plot) of the minimum required contribution rate as of payroll by perceived retirement system stability.

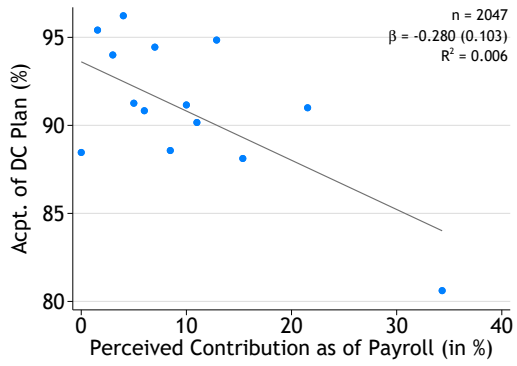
Pension Plan Generosity We further evaluate how public employees' preferences vary with pension plans' financial generosity. We measure plans' financial generosity with two different measures. First, we use the employees' perception about the employer's contribution relative to their salary. As employees' answers are relative to their subjective reference point, the perceived financial generosity provides a direct measure about the subjective status quo. Obviously, the individual perception may deviate from the actual financial generosity. Thus, we use the employer service cost as percentage of payroll which we obtain from the financial disclosures of pension plans from Giesecke and Rauh (2022).[17] The key hypotheses are that public employees that are part of a more generous plan are less likely to switch to a DC plan, and if they do, they request a higher minimum contribution rate.

Our estimates confirm both of the hypotheses. Figure 9a shows the relationship between the perceived employer contribution and the acceptance rate of the DC plan. Plans with higher perceived contribution rate have, on average, a lower acceptance rate. The estimate is sufficiently precisely estimated to reject the null hypothesis of no relationship. Second, we find a positive relationship between the perceived generosity of the plan and the minimum required contribution rate; thus, providing evidence in support of our second hypothesis as shown in Figure 9b. Once, again the estimates are sufficiently tightly estimated to reject the null hypothesis.

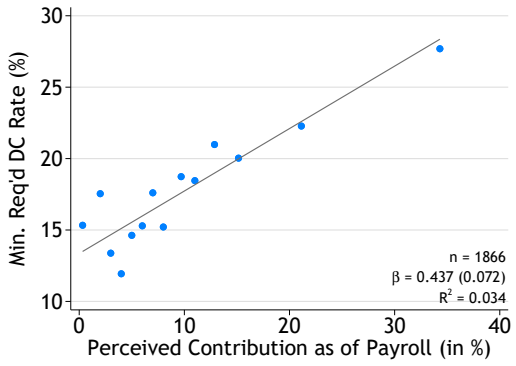
Similarly, we find support for the hypotheses when we evaluate the responses with respect to the employer service cost—a more objective measure of financial generosity. Once again, we find that more generous plans have, on average, a lower acceptance rate as shown in Figure 10a and more generous plans have, on average, responses that require a higher minimum contribution rate as shown in Figure 10b.

In a regression analysis, tabulated in Table 3, we confirm that this relationship is not driven by the individual characteristics or demographic characteristics that also affect the acceptance and the minimum contribution rate. Both relationships remain qualitatively,

[17]We define the employer service cost as the reported service cost after subtracting the member contributions. It measures the employer's pension cost for accruing pension benefits for the service of current employees after accounting for the employees' contribution share to the overall pension cost. Relying on financial disclosures comes with at least two shortcomings. First, financial disclosures are only made at the plan level. Thus, we ignore the potential differences among different tiers of a plan (if available). Thus, the employer service cost as percentage of payroll should be considered as the average financial generosity of the plan rather than the employee specific financial generosity. Second, using the plan level employer service cost ignores the convex accrual pattern of benefits over the course of an employee's career.



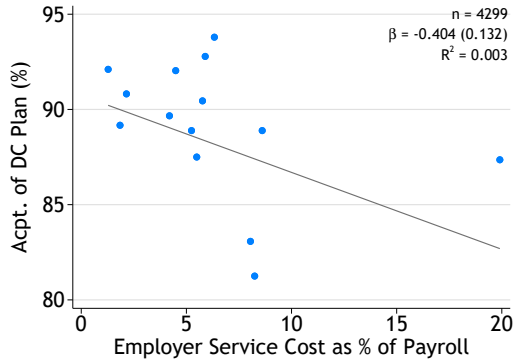
(a) Acceptance of DC Plan



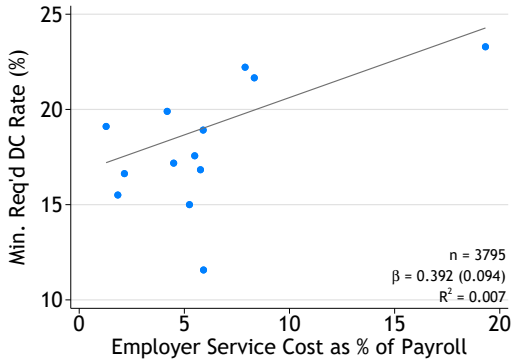
(b) Minimum Required Contribution Rate

Figure 9: Acceptance and Required Contribution and Perceived Employer Contribution

Notes: The left panel shows the relationship between the acceptance of a DC plan and the perceived employer contribution in a binscatter. All responses with a contribution rate of above or equal 100% and answers that state that the respondent would not enroll in a defined contribution plan "under any conditions" are classified as non acceptance. The right panel shows the relationship between the minimum required contribution rate into a DC plan as of payroll and the the perceived employer contribution in a binscatter.



(a) Acceptance of DC Plan



(b) Minimum Required Contribution Rate

Figure 10: Acceptance and Required Contribution by Employer Service Cost

Notes: The left panel shows the relationship between the acceptance of a DC plan and the employer service cost as percentage of payroll in a binscatter. All responses with a contribution rate of above or equal 100% and answers that state that the respondent would not enroll in a defined contribution plan "under any conditions" are classified as non acceptance. The right panel shows the relationship between the minimum required contribution rate into a DC plan as of payroll and the employer service cost as percentage of payroll in a binscatter. The employer service cost as percentage of payroll is defined as the reported service cost after subtracting the member contributions expressed as a percentage of payroll.

and for the most part, qualitatively unchanged after saturating the specification with individual and demographic characteristics. Concretely, a 1¢ increase in the employer service

cost (perceived contribution) per $1 of payroll is associated with a 0.35¢ (0.45¢) increase in the required contribution.

	Acceptance DC		Minimum Required Contribution DC	
	(1)	(2)	(3)	(4)
Perceived Employer Contr. as % of Payroll	-0.270***		0.449***	
	(0.0888)		(0.0580)	
Employer Service Cost. as % of Payroll		-0.317***		0.347***
		(0.112)		(0.0773)
R^2	0.030	0.026	0.060	0.034
Ind. Characteristic	✓	✓	✓	✓
Race/Ethnicity	✓	✓	✓	✓
Marital Status	✓	✓	✓	✓
Education	✓	✓	✓	✓
Sex	✓	✓	✓	✓
Observations	1816	3683	1657	3271

Table 3: Pension Plan Generosity, Acceptance and Minimum Required Contribution Rate

Notes: Column (1) and column (2) estimate the relationship between acceptance of a DC plan and the perceived employer contribution as percentage of payroll and employer service cost as percentage of payroll, respectively. All responses with a contribution rate of above or equal 100% and answers that state that the respondent would not enroll in a defined contribution plan "under any conditions" are classified as non acceptance. Column (3) and column (4) estimate the relationship between the minimum required contribution rate into a DC plan and the perceived employer contribution as percentage of payroll and employer service cost as percentage of payroll, respectively. Individual characteristics include age, years of service, and log income from the public sector job. The employer service cost as percentage of payroll is defined as the reported service cost after subtracting the member contributions expressed as a percentage of payroll. Standard errors are robust to heteroskedasticity. *,**, *** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

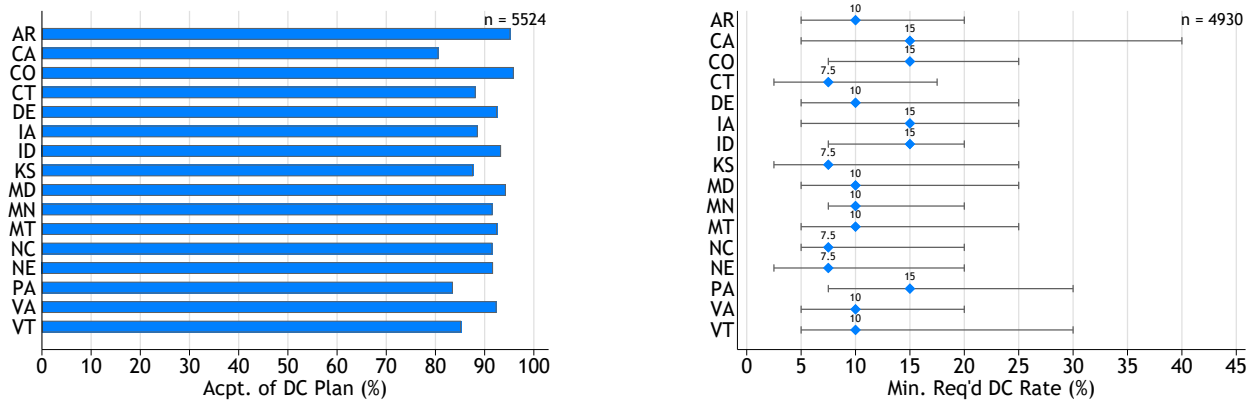
The employer service cost as percentage of payroll is one measure to capture the financial generosity of the plan. As an alternative we also conduct the analysis with respect to actual contribution as of payroll. This measure is potentially confounded by the funding decision of the employer but it measures the actual cash that the employer contributes to the plan and as such may affect employees' perception about the generosity of the plan. The results are shown in Figure 15. We obtain qualitatively similar results.

5.4 Heterogeneity by State

In this subsection we evaluate the results for each state individually. We tabulate the survey responses for the acceptance rate and the minimum required contribution rate. At this point we do not take a stance where the inter-state differences originate from. States may

show different degrees of financial generosity or difference in the employee composition that could influence the results.

Acceptance and Minimum Required Contribution The acceptance rate ranges from 80.6% (California) to 95.9% (Colorado). And the median minimum required contribution as of payroll ranges from 7.5% to 15.0%. The size of the inter-quartile range also shows some variation. In California, the inter-quartile range is 35% whereas in Minnesota it is only 12.5%.



(a) Acceptance of DC Plan

(b) Minimum Required Contribution Rate

Figure 11: Acceptance and Minimum Required Contribution by State

Notes: The left panel shows acceptance percentage of a defined contribution plan by state. All responses with a contribution rate of above or equal 100% and answers that state that the respondent would not enroll in a defined contribution plan "under any conditions" are classified as non acceptance. The right panel plots the median (blue diamond) and the inter-quartile range (whisker plot) of the minimum required contribution as of payroll by state.

The acceptance rate and the minimum required contribution for each pension plan for which we have more than five responses in our sample is tabulated in the Appendix Table 8 and 9.

5.5 Multivariate Analysis

Thus far, with the exception of Table 3, we have shown bivariate relationships. Obviously, many variables are highly correlated with each other which makes an attribution of the differences in acceptance rate and minimum required contribution rates difficult. Thus,

in the following we perform multivariate regression analysis for better attribution of the difference to individual variables.

Table 4 conducts the regression analysis with the acceptance rate as the outcome variable in a linear probability model specification. Table 5 shows the estimates with the minimum required contribution rate as percentage of payroll as the outcome variable. For both outcome variables we estimate specifications with and without state fixed effects. We use state fixed effects to partial out effects due to cultural or other unobserved characteristics that are constant within states. For the most part, the estimation results remain qualitatively unaffected by the inclusion of the state fixed effects. In column (1) of Table 4 we estimate a specification that includes log household income, years of service, age, financial literacy and educational attainment. In this specification, we find a statistically significant negative relationship between years of service and the acceptance rate. This finding mirrors our conclusion from the bivariate analysis that we discussed above. Interestingly, the association between age and the acceptance rate is muted once we also consider the effect of years of service. Once we include state fixed effects in the specification that is shown in column (2) we find that higher household income generally relates robustly to a higher acceptance rate of the DC plan option. A likely explanation for the increase of the estimate is that the generosity level varies substantially across states but less within—a hypothesis that we will test below. In column (3) and column (4) we control for the employer service cost to account for the financial generosity of the plan. The estimates for the other variables of interest remain large unchanged in comparison to column (1) and column (2) except that we generally find a stronger income effect, reaffirming the hypothesis about important inter-state differences in generosity.

	Acceptance (dummy)			
	(1)	(2)	(3)	(4)
Log HH Income	0.893	1.589*	2.101**	2.266**
	(0.842)	(0.869)	(1.034)	(1.063)
Age	0.00689	0.00149	-0.00271	-0.0169
	(0.0406)	(0.0410)	(0.0496)	(0.0503)
Years of Service	-0.289***	-0.277***	-0.295***	-0.296***
	(0.0508)	(0.0523)	(0.0603)	(0.0624)
Financial Literacy	4.947**	5.064***	6.799***	7.230***
	(1.947)	(1.955)	(2.389)	(2.409)
Education	0.648*	0.330	0.557	0.201
	(0.376)	(0.379)	(0.445)	(0.450)
Employer Service Cost % Payroll			-0.342**	-0.0123
			(0.137)	(0.154)
R^2	0.013	0.030	0.018	0.032
State-FE		✓		✓
Observations	4826	4826	3813	3813

Table 4: Estimates of DC Plan Acceptance

Notes: All responses with a contribution rate of above or equal 100% and answers that state that the respondent would not enroll in a defined contribution plan "under any conditions" are classified as non acceptance. The employer service cost as percentage of payroll is defined as the reported service cost after subtracting the member contributions expressed as a percentage of payroll. Standard errors are robust to heteroskedasticity. *,**, *** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

Table 5 uses the minimum required contribution rate as the outcome variable. In column (1) we estimate a specification that includes log household income, age, years of service, financial literacy and educational attainment. In this specification, we find a statistically significant positive relationship between years of service, a negative relationship with regards to age, and a weak negative relationship with respect to education. The estimate of education is not robust to the inclusion of state fixed effects as column (2) shows. In columns (3) and (4) we add the employer service cost into the specification. While the employer service cost is itself positively and statistically robustly related to the minimum required contribution rate, as we discussed in Section 5.3, it has little effect on the magnitude of the remaining estimates. Interpreting the economic magnitude of our preferred specifications, we find that for 10 additional years of service employees demand, on average, a 1.6%-2.0% higher minimum required contribution rate. This is consistent with the convex and increasing accrual pattern of defined benefit pensions over the course of an employees career. Interestingly, we also find that conditional on years of service, age is negatively related to the minimum required contribution rate. In other words, older employees, with the same number of years of service, require lower contribution rates in comparison to their younger colleagues. This finding is consistent with the theory because

older employees are closer to their early retirement threshold.

	Minimum Required Contribution Rate (in %)			
	(1)	(2)	(3)	(4)
Log HH Income	0.239	-0.0230	0.147	-0.0759
	(0.623)	(0.627)	(0.730)	(0.740)
Age	-0.110***	-0.110***	-0.131***	-0.126***
	(0.0289)	(0.0290)	(0.0341)	(0.0345)
Years of Service	0.192***	0.203***	0.163***	0.188***
	(0.0342)	(0.0350)	(0.0379)	(0.0386)
Financial Literacy	0.407	0.292	0.789	0.481
	(1.314)	(1.318)	(1.529)	(1.541)
Education	-0.486*	-0.188	-0.519*	-0.206
	(0.263)	(0.266)	(0.295)	(0.300)
Employer Service Cost % Payroll			0.354***	0.210*
			(0.0966)	(0.110)
R^2	0.009	0.027	0.014	0.030
State-FE		✓		✓
Observations	4339	4339	3380	3380

Table 5: Determinants of Minimum Required Contribution Rate

Notes: The employer service cost as percentage of payroll is defined as the reported service cost after subtracting the member contributions expressed as a percentage of payroll. Standard errors are robust to heteroskedasticity. *,**, *** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

6 Economic Cost and Pension Preferences

This section analyzes the required contribution rate relative to the economic pension cost. In the aggregate, the payroll-weighted average service cost under market valuation was 26.7%, and 20.7% after subtracting off member contributions in 2021. Thus, the required contribution rate as a percent of payroll in our survey, with a median of 10.0%, a mean of 18.2%, and a 75th percentile of 25.0% tends be lower than the average economic cost of continuing the DB plan for much of the distribution. However, the aggregated summary statistics conceal substantial heterogeneity in the cross-section. Thus, we conduct a plan-by-plan analysis in Section 6.1 and a comparison of the individual specific service cost with the required contribution rate in Section 6.2.

6.1 Plan Level Analysis

In this section we contrast the required contribution rates as collected in response to the survey to the actual pension cost on a plan-by-plan analysis. As discussed above, the ser-

vice cost represents the overall economic pension cost. Part of the pension cost is covered by contributions of pension plans' active members. Thus, the employer service cost is the service cost after subtracting the member contributions. As our previous analysis of Section 5.3 has shown, the required contribution rate varies across plans and is positively related to the financial generosity of the plan. Thus, in Figure 12 we compare several moments of the required contribution rate distribution with the economically relevant employer pension cost plan-by-plan.

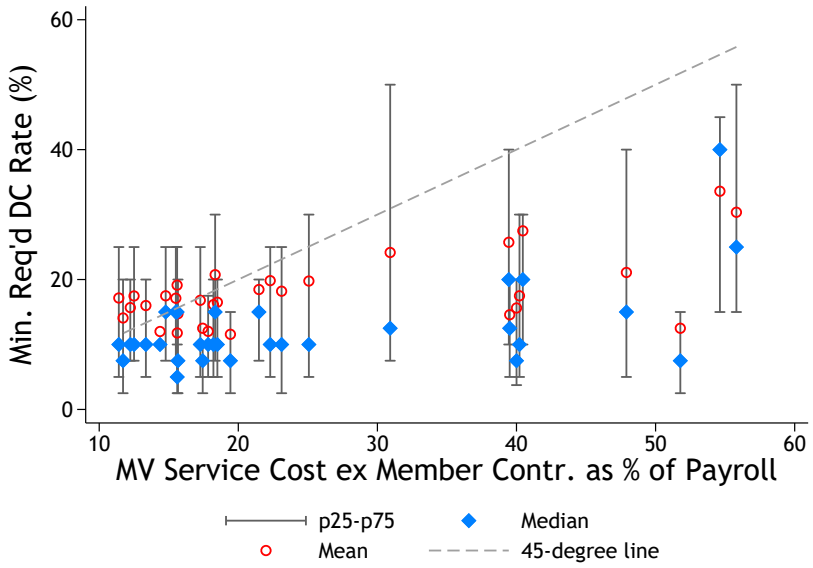


Figure 12: Economic Cost vs. Required Contributions

Notes: The figure compares the service cost minus member contributions as percentage of payroll under market valuations and different moments of the minimum required contribution rate distribution. The 45-degree line denotes the minimum required contribution level at which the fiscal cost for the pension sponsor would be identical under the existing and the new hypothetical DC pension plan. The analysis includes all plans for which we obtained a minimum of five responses. The full list of plans and values is shown in Appendix Tables 8 and 9.

We find a positive gradient between the employer pension cost and the required minimum contribution rate. This mirrors the results for financial generosity as shown in Figure 10b but this time at the plan level. We find that the median is consistently below the current employer pension cost, often substantially below. Even the mean which tends to be higher than the median due to the right skew of the minimum required rate distribution is below the employer cost for the predominant share of plans.[18]

[18]The plan based service cost and the member contributions are the average across all employees that are

6.2 Individual Level Analysis

As discussed in the previous section, pension plans disclose the service cost of their members typically at the plan level. As such it represents the average service cost among all plan members and conceals potential variation across members. There are at least two factors that contribute to the heterogeneity of service cost among members. First, pension plans have gradually introduced new tiers that have often made benefits less generous over time. Second, individuals differ in their years of service and their expected retirement age. These differences in tenure and remaining years of service affect the economic cost for the employer. Concretely, we calculate the forward-looking employer pension cost of projected benefits expressed as a fixed percent of payroll between employees' year of entry and their expected date of retirement.[19] Thus, for two people of a given age, we can imagine one who expects to work just until the minimum retirement age vs another employee that expects to work post minimum retirement age. As a result of the difference in the remaining years of service, the prospective service cost is smaller for the first person relative to the latter person.

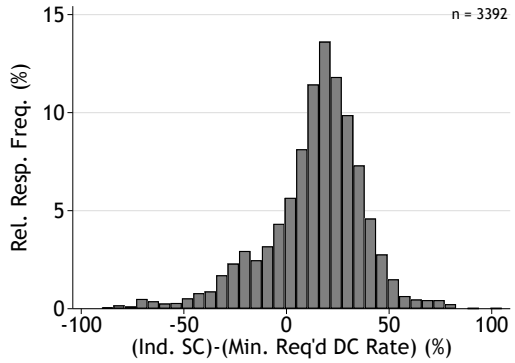
We calculate the individual service cost for each plan member using the individuals' age, years of service, and expected remaining years of service, as well as, plan and tier attributes. More details about the modelling of the service cost can be found in Appendix Section A.8. We verify that the weighted individual service cost is consistent with the overall service cost and find reasonable alignment between the reported and the individually calculated service cost at the plan level.

With this more granular measure of the service cost, we first evaluate the respondent's required contribution rate vis-a-vis the market value of the individual employer service cost. The histogram in Figure 13a shows the full distribution of the difference between the market value of the individual employer service cost and the respondent's required contribution rate (in the following referred as *delta*). A positive delta means that the employee is willing to accept a DC plan that is less expensive to the employer than the current DB plan. We find that 78.2% of respondent's required contribution rate is below the market value

enrolled in the plan. Some states have taken measures to reduce pension cost by introducing "tiers", that is, some employees receive less generous pension promises. As plans are only required to report financial information at the plan level, we are unable to account for these intra-plan differences. However, we perform an extensive modeling of the individual service cost in Section 6.2.

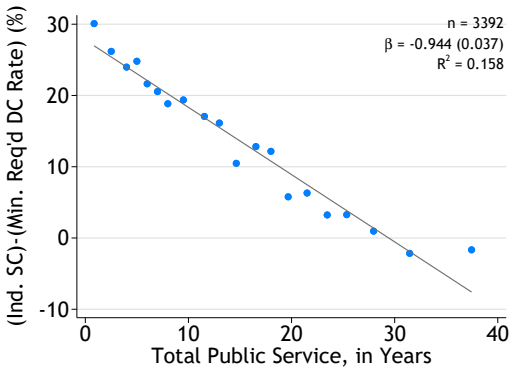
[19] In actuarial lingo, this is referred to as the entry age normal, level-percent of payroll service cost.

of the individual employer service cost. The 25th percentile of this delta is 3.3% and the 75th percentile is 28.9% of payroll. One could argue that individuals that are willing to accept a DC plan with a positive delta make a financially irrational decision. This argument, however, takes a uni-dimensional perspective as we discuss in detail in Section 7. In addition, we analyse how this delta relates to other observable characteristics. We find a strong negative relationship with respect to years of service. That is, employees with only a few years of service are often willing to accept a DC plan with substantially lower employer contribution rate than the current economic cost to their employer. This decreases with the number of years of service and the delta turns, on average, negative for employees that have 30 years of service or above.[20]



(a) Histogram of Difference Between Individual SC and Required Contribution Rate

Notes: This figure displays the distribution of the differences between the market value of the employer's proportion of the calculated service cost less the minimum required contribution rate and the respondent's required contribution rate.



(b) Individual SC - Required Contribution Rate vs. Years of Service

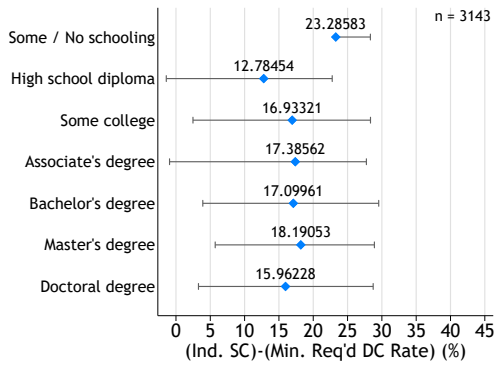
Notes: This figure displays the relationship between the employer's portion of the calculated market value of the individual service cost and the years of service of the employee

Figure 13: Comparison with Individual Service Cost

One of the natural criticism to our analysis is that respondents may not understand the full extent of the trade-off between the DB and DC options. While there is no ultimate proof to contradict this claim, we can evaluate the extent to which this delta is related to observable characteristics that measure cognitive ability. In our survey, we both ask

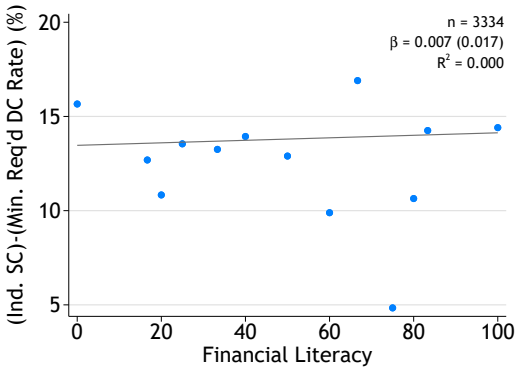
[20]The market value of the individual employer service cost is increasing for employees that have many years of service left as discussed in detail in Appendix Section A.8. Thus, for robustness we repeat the analysis with the plan specific service cost adjustment factor instead of the individual specific service cost adjustment factor. The results are shown in Appendix Figure 25. The use of the alternative adjustment factor leaves the main results qualitatively unchanged but reduces the slope in Panel B as a consequence.

for educational attainment and ask several questions to test the financial literacy of the respondent. Figure 14a shows the mean delta for each education category and Figure 14b shows the relationship with our constructed financial literacy variable. We do not find a strong relationship for either educational attainment or financial literacy; thus, making the hypothesis of misunderstanding less plausible.



(a) Individual SC - Required Contribution Rate vs. Education Level

Notes: This figure displays the relationship between the employer's portion of the calculated individual market value service cost and education level of the employee



(b) Individual SC - Required Contribution Rate vs. Financial Literacy

Notes: This figure displays the relationship between the employer's portion of the calculated individual market value service cost and the financial literacy score of the employee.

Figure 14: Comparison with Individual Service Cost

Similarly, there is little relation between the delta and investment stability, state of residence, marital status, education, race, gender, health, discount rate, financial literacy, hour worked per week, or retirement age, or income (untabulated).

7 Discussion of Rational Choice by Employees

There are several reasons why public employees prefer a DC plan over a conventional DB plan—even if the employer contributes less to the DB plan than the economic cost of the DB plan.

First, DC plans offer employees the ability to re-balance pension benefits and take-home pay. DB plans are highly prescriptive as the employer makes a fixed contribution and often requires the employee to make an additional pre-determined contribution. Thus, employees have little choice than to accept the fixed division between take-home pay and

retirement benefits. This division may not align with individuals' preferences. Fuchsman, McGee, and Zamarro (2023) find, in a nationally representative survey of teachers, that teachers value traditional DB pensions less than other dimensions of the compensation package such as greater salary growth or other benefits such as health insurance or social security. A similar conclusion follows from the pension survey of MissionSquare Research Institute (2022). The survey is conducted among overwhelmingly young public sector employees and finds that 83% of respondents find public-sector benefits to be overall competitive, but only 32% found public-sector salaries to be competitive in comparison to the private sector. The fixed division of compensation is particularly burdensome for young employees who are liquidity constraint. A significant fraction of their income is annuitized despite their need for immediate investments. Brown, Ivković, and Weisbenner (2015) finds empirical evidence for this. The paper finds that individuals prefer the annuitization payment if they have higher incomes and are not liquidity constrained, whereas individuals who expect higher risk are more likely to take the earlier income stream. Cole and Taska (2022) also finds that retirement benefits are valued more among employees with high salary. Overall, with an appropriately designed DC plan public employees can re-balance pension benefits and take-home pay.

Second, DB plans typically offer no discretion about investment decisions. Employees that value flexibility with regard to their investment decision may accept lower contributions in exchange for the ability to allocate their assets based on their preferences. Relatedly, Beshears, Choi, Laibson, Madrian, and Zeldes (2014) finds, in a survey about hypothetical annuitization choices, that individuals are less likely to annuitize if they are exposed to frames that highlight flexibility, control, and investment.

Third, portability of pension benefits is important for employees that prefer a more flexible career path. DB plans often have significant vesting periods—the minimum year of service to be eligible for retirement benefits—and convex accrual patterns. This makes a switch of the employer costly and unattractive. Cocco and Lopes (2011) finds that employees in the UK that show higher job mobility are more likely to chose a transferable, less generous state pension plan than to contribute to the occupational, more generous, pension plan offered by their employer.

8 Conclusion

As the liabilities associated with DB plans continue to grow, alternative pension plan options are becoming of increased interest. An important input in the consideration of alternative options are the preferences of beneficiaries, that is, public employees of school districts, local or state governments. Under the status quo, public employees are predominantly enrolled in DB plans, which absolve the employee of the need to make financial decisions and bear financial risk, but do so at the cost of a lack of flexibility and discretion regarding their retirement investments.

Our survey aims to elicit the preferences of public employees about retirement benefits in a sample that is representative of the age and service composition of their pension systems as a whole. It is important to acknowledge that there is substantial heterogeneity across public employees. If anything, our sample respondents are somewhat older and somewhat longer-tenured than average, and we find that more senior employees are overall less likely to accept the DC option and generally at higher contribution rates. While the relationship between service and acceptance is overall positive, public employees who have age and service profiles that put them already in an eligibility range for retirement generally accept a lower contribution rate than those whose profiles give them the very highest DB accruals. We find that employees factor the generosity of their current plan into their current expression of preferences. We estimate the effect for both perceived and actual financial generosity and find a lower acceptance rate and, conditional on acceptance, higher minimum required contribution rates for more generous plans.

Interestingly, we find no robust heterogeneity with respect to educational attainment or financial literacy, making an explanation of the results based on cognitive ability less likely. If anything, employees who answer a higher share of the financial literacy questions correctly accept the DC option at a higher rate, perhaps reflecting the possibility that they believe they are more able to manage their retirement money themselves, but even in the lowest categories of financial literacy that we measure, acceptance rates are over 80%.

The results of the study demonstrate that many public employees would accept a DC plan that would both preserve the satisfaction with the retirement plan option and potentially offer substantial savings for the plan sponsor for the majority of plans represented in our survey. Especially given the fact that DB under governmental funding standards tend

towards becoming underfunded, such changes could positively impact long-term stability of public sector retirement plans in the United States while also meeting the expressed preferences of employees. Overall, we consider the results to this survey as valuable input into the academic and public policy discussions of sustainable retirement options for public employees across the United States.

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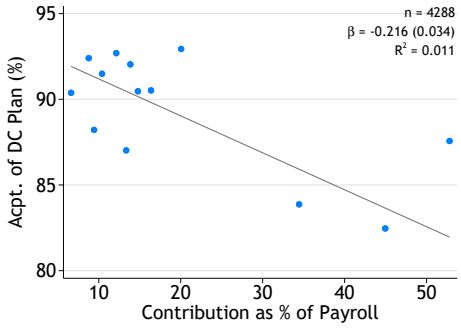
Additional Tables and Figures

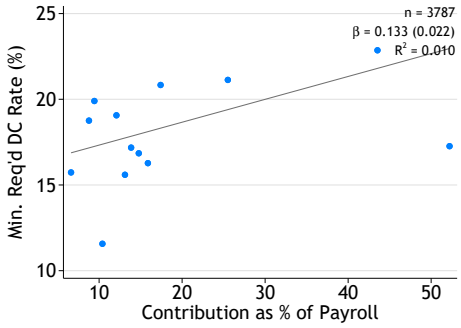
	N	Rel. Resp. Freq.
I. Plan Stability:		
Not stable	475	7.7%
Moderately stable	2,773	44.9%
Very stable	2,926	47.4%
II. Health Status:		
Poor	82	1.1%
Fair	2,766	36.9%
Excellent	4,653	62.0%
III. Race:		
Asian	131	2.1%
Black	458	7.2%
Native	27	0.4%
Other	466	7.4%
Pacific Islander	21	0.3%
Two or More	90	1.4%
White	5,141	81.2%
IV. Educational Attainment:		
Some/No Schooling	17	0.3%
High School Diploma	345	5.5%
Some College	655	10.5%
Associate's Degree / Credential	631	10.1%
Bachelor's Degree	2,090	33.6%
Master's Degree	1,520	24.4%
Doctoral Degree	971	15.6%
V. Marital Status:		
Divorced	795	12.6%
Living with a partner	91	1.4%
Married	3,995	63.1%
Never married	1,017	16.1%
Prefer not to say	224	3.5%
Separated	80	1.3%
Widowed	132	2.1%
VI. Sex:		
Female	3,078	49.9%
Male	3,042	49.3%
Non-binary / Other	47	0.8%

Table 6: Summary Statistics Categorical Variables

Notes: The table tabulates summary statistics for the categorical variables in our pension survey. The variation in total counts indicates unanswered questions and slight variations in questions asked across the survey waves.



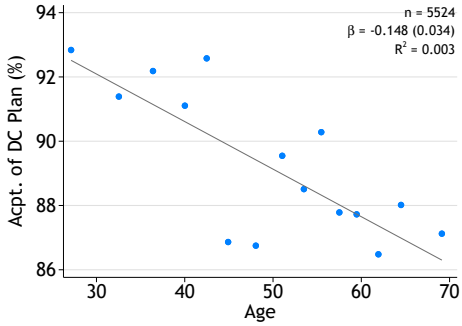
(a) Acceptance of DC Plan



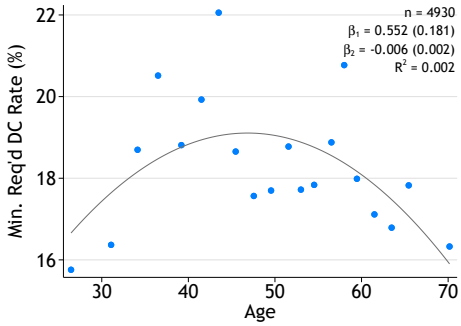
(b) Minimum Required Contribution Rate

Figure 15: Acceptance and Minimum Required Contribution by Actual Contribution as of Payroll

Notes: The left panel shows the relationship between the acceptance of a DC plan and the actual contribution as of payroll in a binscatter. All responses with a contribution rate of above or equal 100% and answers that state that the respondent would not enroll in a defined contribution plan "under any conditions" are classified as non acceptance. The right panel shows the relationship between the minimum required contribution rate into a DC plan as of payroll and the actual contribution as of payroll in a binscatter.



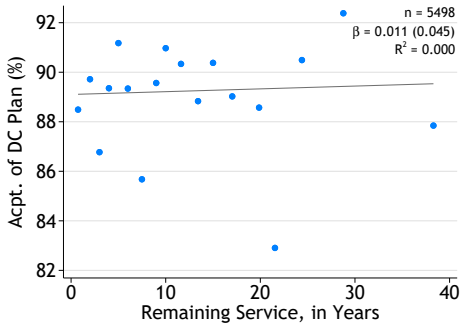
(a) Acceptance of DC Plan



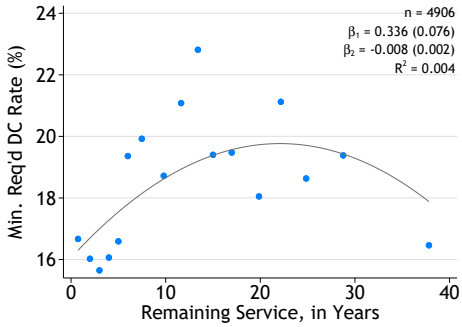
(b) Minimum Required Contribution Rate

Figure 16: Acceptance and Minimum Required Contribution by Age

Notes: The left panel shows the relationship between the acceptance of a DC plan and age (in years) in a binscatter. All responses with a contribution rate of above or equal 100% and answers that state that the respondent would not enroll in a defined contribution plan "under any conditions" are classified as non acceptance. The right panel shows the quadratic relationship, $Rate_i = \beta_0 + \beta_1 Age_i + \beta_2 Age_i^2 + \epsilon_i$, between the minimum required contribution rate into a DC plan as of payroll and age (in years) in a binscatter.



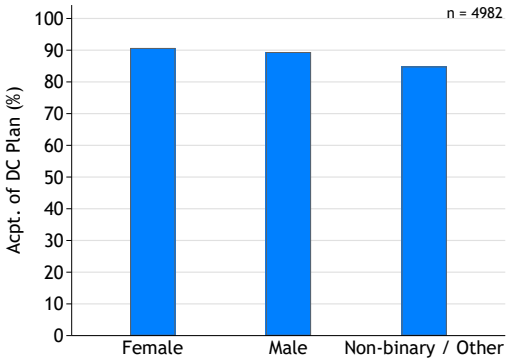
(a) Acceptance of DC Plan



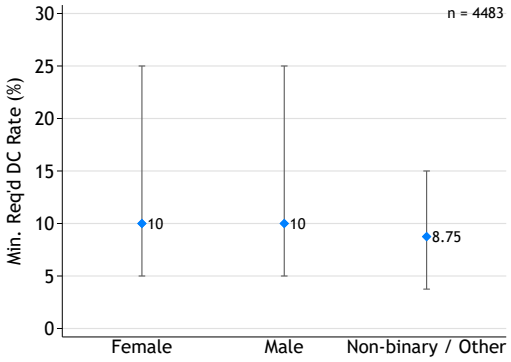
(b) Minimum Required Contribution Rate

Figure 17: Acceptance and Minimum Required Contribution by Remaining Years of Service

Notes: The left panel shows the relationship between acceptance of a DC plan and remaining years of service in a binscatter. All responses with a contribution rate of above or equal 100% and answers that state that the respondent would not enroll in a defined contribution plan "under any conditions" are classified as non acceptance. The right panel shows the quadratic relationship, $Rate_i = \beta_0 + \beta_1 Remaining\ Years\ of\ Service_i + \beta_2 Remaining\ Years\ of\ Service_i^2 + \epsilon_i$, between the minimum required contribution rate into a DC plan as of payroll and remaining years of service in a binscatter.



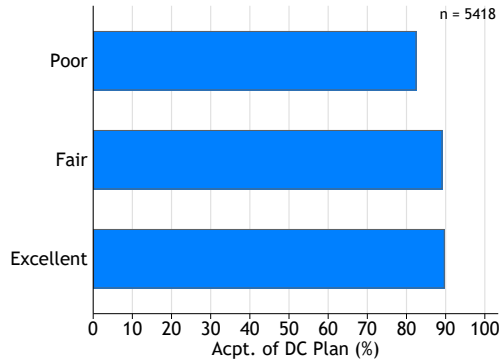
(a) Acceptance of DC Plan



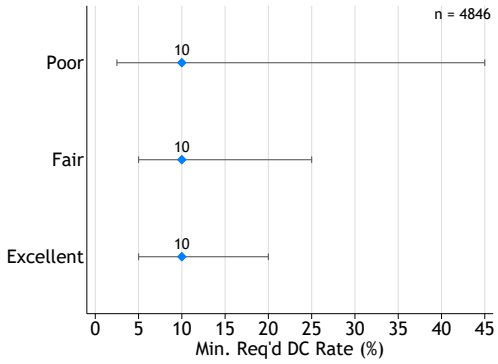
(b) Minimum Required Contribution Rate

Figure 18: Acceptance and Minimum Required Contribution by Sex

Notes: The left panel shows acceptance percentage of a defined contribution plan by sex. All responses with a contribution rate of above or equal 100% and answers that state that the respondent would not enroll in a defined contribution plan "under any conditions" are classified as non acceptance. The right panel plots the median (blue diamond) and the inter-quartile range (whisker plot) of the minimum required contribution as of payroll by sex.



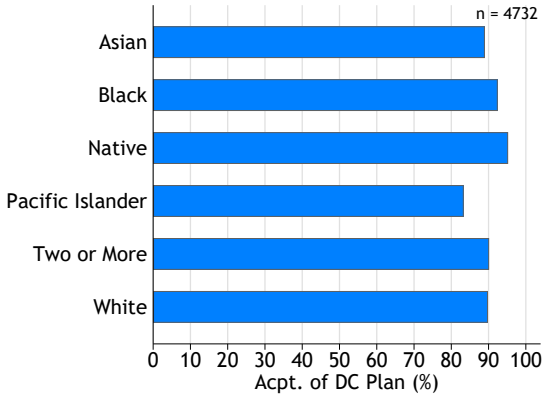
(a) Acceptance of DC Plan



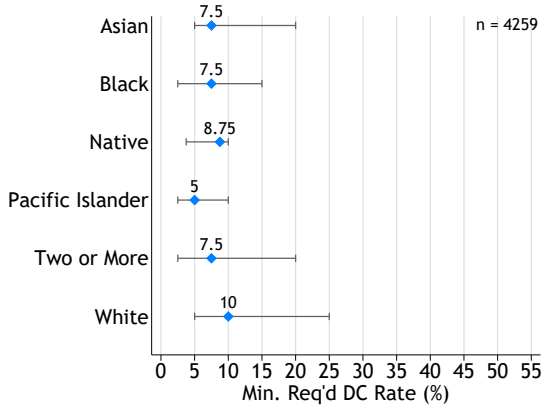
(b) Minimum Required Contribution Rate

Figure 19: Acceptance and Minimum Required Contribution by Health Status

Notes: The left panel shows acceptance percentage of a defined contribution plan by health status. All responses with a contribution rate of above or equal 100% and answers that state that the respondent would not enroll in a defined contribution plan "under any conditions" are classified as non acceptance. The right panel plots the median (blue diamond) and the inter-quartile range (whisker plot) of the minimum required contribution as of payroll by health status.



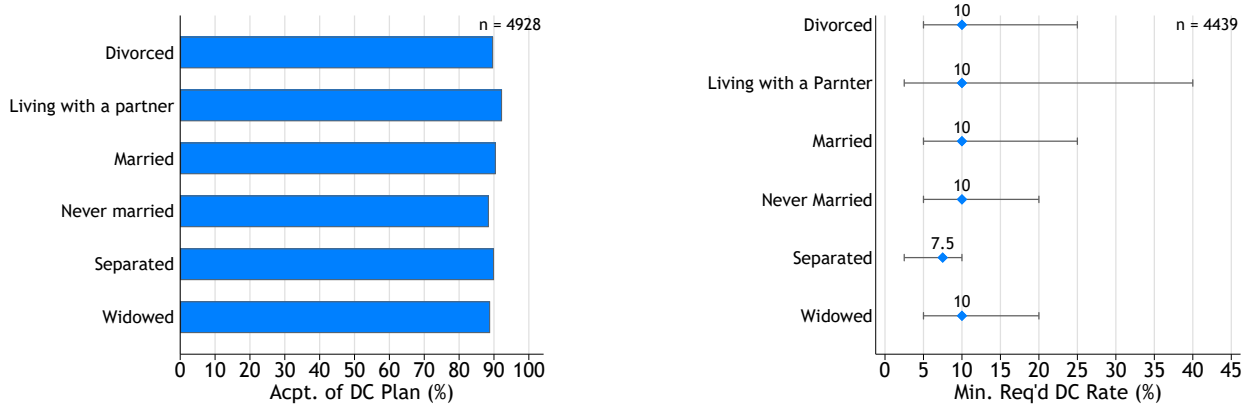
(a) Acceptance of DC Plan



(b) Minimum Required Contribution Rate

Figure 20: Acceptance and Minimum Required Contribution by Race

Notes: The left panel shows acceptance percentage of a defined contribution plan by race. All responses with a contribution rate of above or equal 100% and answers that state that the respondent would not enroll in a defined contribution plan "under any conditions" are classified as non acceptance. The right panel plots the median (blue diamond) and the inter-quartile range (whisker plot) of the minimum required contribution as of payroll by race.

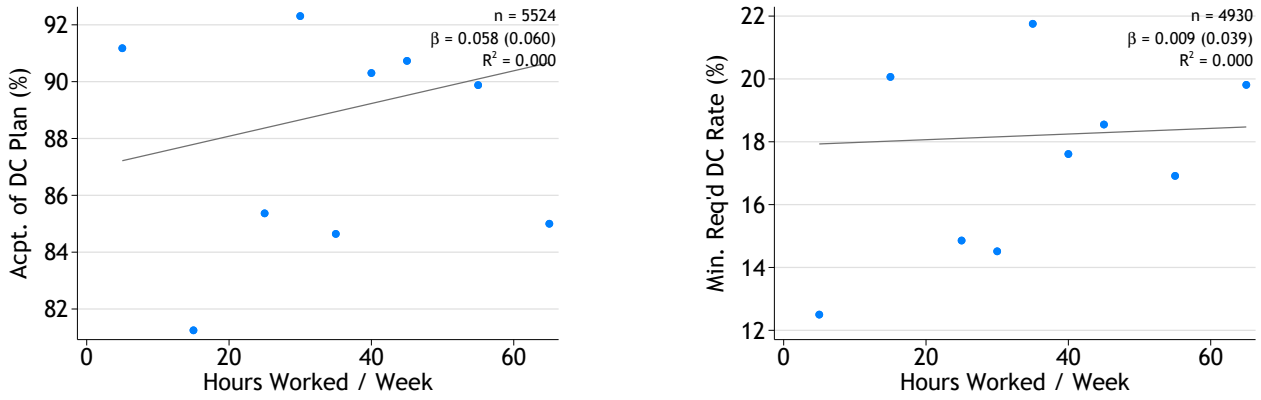


(a) Acceptance of DC Plan

(b) Minimum Required Contribution Rate

Figure 21: Acceptance and Minimum Required Contribution by Marital Status

Notes: The left panel shows acceptance percentage of a defined contribution plan by marital status. All responses with a contribution rate of above or equal 100% and answers that state that the respondent would not enroll in a defined contribution plan "under any conditions" are classified as non acceptance. The right panel plots the median (blue diamond) and the inter-quartile range (whisker plot) of the minimum required contribution as of payroll by marital status.

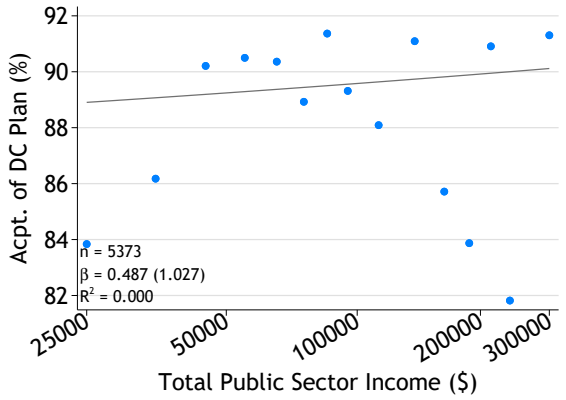


(a) Acceptance of DC Plan

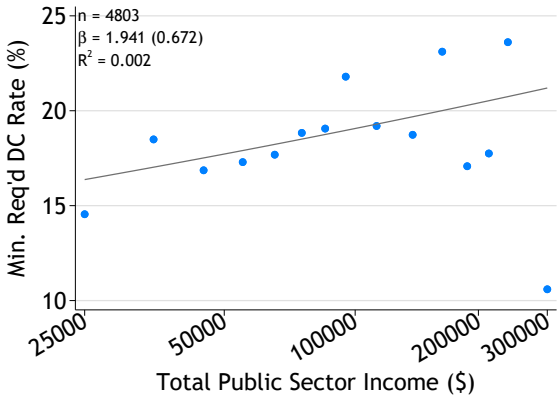
(b) Minimum Required Contribution Rate

Figure 22: Acceptance and Minimum Required Contribution by Hours Worked

Notes: The left panel shows the relationship between acceptance of a DC plan and hours worked per week in a binscatter. All responses with a contribution rate of above or equal 100% and answers that state that the respondent would not enroll in a defined contribution plan "under any conditions" are classified as non acceptance. The right panel shows the relationship between the minimum required contribution rate into a DC plan as of payroll and hours worked per week in a binscatter.



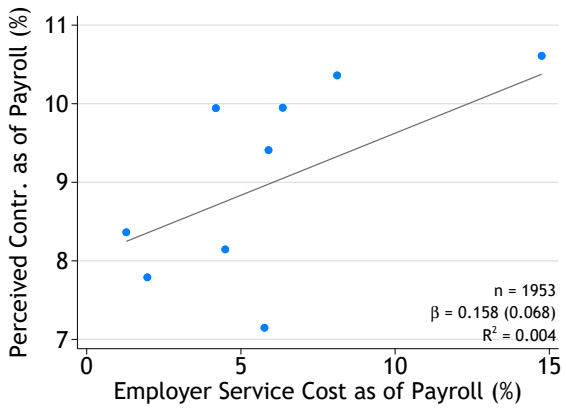
(a) Acceptance of DC Plan



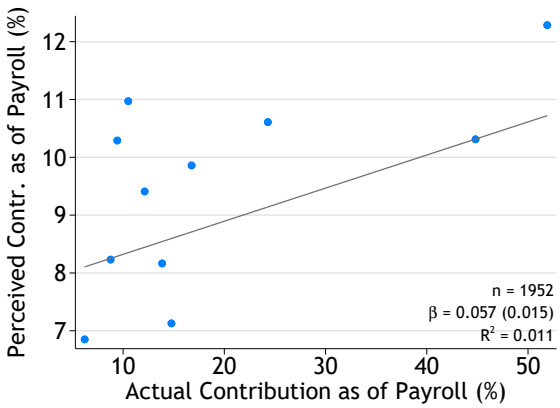
(b) Minimum Required Contribution Rate

Figure 23: Acceptance and Minimum Required Contribution by Public Sector Income

Notes: The left panel shows the relationship between acceptance of a DC plan and public sector income in a binscatter. All responses with a contribution rate of above or equal 100% and answers that state that the respondent would not enroll in a defined contribution plan "under any conditions" are classified as non acceptance. The right panel shows the relationship between the minimum required contribution rate into a DC plan as of payroll and public sector income in a binscatter.



(a) Perceived Contribution and Employer Service Cost



(b) Perceived Contribution and Actual Contribution)

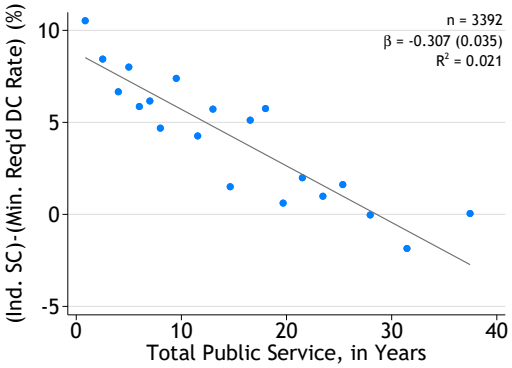
Figure 24: Pension Plan Generosity

Notes: The left panel shows the employees perceived contribution of the employer as a percentage of payroll in relationship to the employer service cost as percentage of payroll of the employee's pension plan. The right panel shows the relationship between the employees perceived contribution of the employer as a percentage of payroll and the employers' actual contribution as a percentage of payroll. The employer service cost as percentage of payroll is defined as the reported service cost after subtracting the member contributions expressed as a percentage of payroll. Both panels are binscatters. Reported standard errors of the slope coefficients are robust to heteroskedasticity.

	Acceptance (dummy)		Minimum Req'd Contribution Rate (in %)	
	(1)	(2)	(3)	(4)
Dummy Hybrid Plan	5.474***	4.437***	-2.978***	-2.513***
	(1.104)	(1.131)	(0.733)	(0.767)
Dummy Other Plan	-0.654	3.795	-4.331**	-4.176**
	(2.690)	(3.021)	(1.835)	(2.057)
Constant	87.66***	61.32***	19.42***	1.817
	(0.529)	(14.50)	(0.360)	(9.995)
R^2	0.024	0.034	0.027	0.032
Gender FE		✓		✓
Ind. Characteristic		✓		✓
State FE	✓	✓	✓	✓
Observations	4814	4300	4280	3856

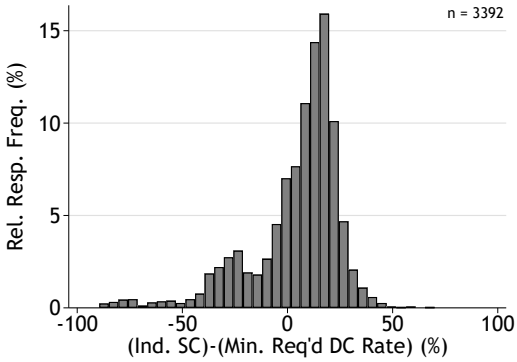
Table 7: Acceptance Rate and Minimum Contribution by Plan Type

Notes: The table present the estimates of a specification with the acceptance rate (columns 1 and 2) and the minimum required contribution rate (columns 3 and 4) as the outcome variables. Each plan type is included as a dummy variable with defined benefit plans being the base category. Individual characteristics are included as controls and encompass log income, years of service, financial literacy. Standard errors are robust to heteroskedasticity. *,**, *** indicates significance at the 0.1, 0.05, 0.01 level, respectively.



(a) Individual SC - Required Contribution Rate vs. Years of Service

Notes: This figure displays the relationship between the employer's portion of the calculated individual market value service cost, using the methodology of Giesecke and Rauh (2022), less the minimum required contribution rate and the years of service of the employee



(b) Histogram of Difference Between Individual SC and Required Contribution Rate

Notes: This figure displays the distribution of the differences between the market value of the employer's proportion of the calculated service cost, using the methodology of Giesecke and Rauh (2022), and the respondent's required contribution rate.

Figure 25: Comparison with Alternate Individual Service Cost

State	Plan Name	N	Stability Score	Share Acceptance	p50 Req'd DC Rate	Mean Req'd DC Rate	p25 Req'd DC Rate	p75 Req'd DC Rate
AR	Arkansas Public Employees Retirement System (APERS)	84	1.43	96.4%	10.0%	17.5%	5.0%	20.0%
CA	California Public Employee Retirement System (CalPERS) - Judges I	10	1.80	70.0%	25.0%	32.9%	11.2%	50.0%
CA	California Public Employee Retirement System (CalPERS) - Judges II	19	1.44	84.2%	40.0%	33.6%	17.5%	42.5%
CA	California Public Employee Retirement System (CalPERS) - State Miscellaneous	208	1.70	81.2%	10.0%	21.7%	5.0%	30.0%
CA	California Public Employee Retirement System (CalPERS) - State Peace Officers and Firefighters	31	1.63	77.4%	17.5%	24.4%	6.9%	40.0%
CO	Public Employees' Retirement Association of Colorado (PERA) - State Division	41	1.10	97.6%	15.0%	17.1%	7.5%	25.0%
CT	Connecticut State Employee Retirement System (SERS)	149	1.46	89.3%	7.5%	14.8%	2.5%	20.0%
DE	Delaware Public Employee Retirement System (DPERS) - State Employees	58	1.59	93.1%	10.0%	16.8%	5.0%	23.8%
IA	Iowa Judicial Retirement System (JRS)	30	1.54	90.0%	20.0%	25.7%	12.5%	40.0%
IA	Iowa Public Employees' Retirement System (IPERS) - Regular Membership	267	1.50	88.0%	15.0%	20.2%	5.0%	25.0%
IA	Peace Officers' Retirement, Accident and Disability System (PORS)	7	1.86	100.0%	25.0%	30.4%	15.0%	50.0%
ID	Public Employee Retirement System of Idaho (PERSI)	193	1.69	92.7%	15.0%	19.0%	8.8%	20.0%
KS	Kansas Public Employees Retirement System (KPERS)	207	1.37	87.0%	7.5%	15.0%	2.5%	20.0%
MD	Maryland Employees' Retirement and Pension Systems (ECS)	72	1.50	94.4%	15.0%	21.1%	7.5%	25.0%

Table 8: Summary Statistics by Plan

Notes: The table lists all pension plans for which we have more than five responses in our survey sample. The stability score ranges from 0 to 2, where 0 stands for "not stable", 1 for "moderately stable" and 2 for "very stable". All responses with a contribution rate of above or equal 100% and answers that state that the respondent would not enroll in a defined contribution plan "under any conditions" are classified as non acceptance. The median required contribution is the minimum required contribution at which the responded would accept a DC plan and benefits would not longer accrue under the previous plan.

State	Plan Name	N	Stability Score	Share Acceptance	p50 Req'd DC Rate	Mean Req'd DC Rate	p25 Req'd DC Rate	p75 Req'd DC Rate
MD	Maryland Teachers' Retirement and Pension Systems (TCS)	17	1.53	94.1%	10.0%	12.0%	5.0%	16.2%
MN	Public Employees Retirement Association (PERA) - General Employees Fund	23	1.38	91.3%	10.0%	17.6%	5.0%	25.0%
MN	State Retirement System (SRS) - Correctional Employees Retirement Fund	7	1.57	85.7%	12.5%	24.2%	8.1%	41.2%
MN	State Retirement System (SRS) - General Employees Retirement Fund	195	1.57	90.8%	10.0%	16.7%	7.5%	20.0%
MN	State Retirement System (SRS) - State Patrol Retirement Fund	7	1.83	85.7%	20.0%	27.5%	10.0%	30.0%
MT	Public Employees' Retirement System (PERA) - Game Wardens' and Peace Officers' Retirement System	13	1.38	92.3%	12.5%	14.6%	5.0%	20.0%
MT	Public Employees' Retirement System (PERA) - Public Employees Retirement System	221	1.41	92.3%	10.0%	19.1%	7.5%	25.0%
NC	North Carolina Consolidated Judicial Retirement System (CJRS)	17	1.35	94.1%	7.5%	15.6%	4.4%	20.0%
NC	North Carolina Local Governmental Employees' Retirement System (LGERS)	47	1.42	91.5%	7.5%	11.6%	2.5%	15.0%
NC	North Carolina Teachers and State Employees' Retirement System (TSERS)	534	1.54	90.4%	10.0%	16.8%	5.0%	20.0%
NE	Nebraska Public Employees Retirement System (NPERS) - State Employees	95	1.45	89.5%	5.0%	13.9%	2.5%	10.0%
NE	Nebraska Public Employees Retirement System (NPERS) - State Patrol	20	1.50	90.0%	7.5%	17.4%	2.5%	18.8%
PA	Pennsylvania State Employees Retirement System (SERS)	956	1.46	82.4%	15.0%	23.2%	7.5%	30.0%
VA	Virginia Law Officers' Retirement System (VaLORS)	54	1.12	88.9%	10.0%	21.6%	4.4%	26.2%
VA	Virginia Retirement System (VRS) - State Employees	538	1.44	92.0%	10.0%	17.2%	5.0%	20.0%
VA	Virginia Retirement System (VRS) - Teachers	10	1.70	90.0%	7.5%	12.5%	2.5%	10.0%
VT	Vermont State Employee Retirement System (VSERS)	120	0.97	86.7%	10.0%	20.6%	5.0%	26.2%

Table 9: Summary Statistics by Plan (cont'd)

Notes: The table lists all pension plans for which we have more than five responses in our survey sample. The stability score ranges from 0 to 2, where 0 stands for "not stable", 1 for "moderately stable" and 2 for "very stable". All responses with a contribution rate of above or equal 100% and answers that state that the respondent would not enroll in a defined contribution plan "under any conditions" are classified as non acceptance. The median required contribution is the minimum required contribution at which the responded would accept a DC plan and benefits would not longer accrue under the previous plan.

Appendix

A.1 Pension Survey Questions

Index	Question
Q1	Which of the following best describes your current employer?
Q2	Who is your current primary employer?
Q3	Which of the following best describes your current job?
Q4	How many years have you worked for your employer?
Q5	How many hours per week do you work in your job on average?
Q6	What was the estimated income from your job in the past 12 months?
Q7	Considering your entire household (which includes you, your spouse / partner) now, what was your estimated total household income (including income from all jobs as well as rent, dividends, interest, and other money received) in the past 12 months?
Q8	What is your age?
Q9	At what age do you plan to retire?
Q10	How would you describe your current health?
Q11	Which of the following, if any, best describes the retirement plans in which you are enrolled through your employer?
Q12	What is the name of the hybrid plan in which you are enrolled?
Q13	What is the name of the defined benefit pension plan in which you are enrolled?
Q14	(To the best of your knowledge,) how much do you expect to receive per year from your defined benefit pension plan after your retirement if you were to leave your job today?
Q15	For about how many more years do you expect to continue to work for your current employer?
Q16	(To the best of your knowledge,) how much do you expect to receive per year from your defined benefit pension plan after your retirement if you continued to work for the number of years specified in the previous question?
Q17	To the nearest $10,000, what is the estimated balance of your current defined contribution plan (e.g. 401(k), 403(b), etc.)?
Q18	How much do you think your employer pays into your defined benefit pension plan, defined contribution plan, guaranteed return plan and/or hybrid plan combined, as a percentage of your income (before taxes)?
Q19	How much does your household expect to receive annually in retirement benefits after retirement (including all defined benefit plans, 401(k), 403(b), social security benefits, military retired pay and veteran's pensions)?
Q20	If your employer offered to contribute an amount equal to 2.5% of your income each year into an investment account, would you enroll in this hypothetical plan if it meant you would stop earning additional benefits under your current plan?
Q21	If your employer offered to contribute an amount equal to 5% of your income each year into an investment account, would you enroll in this hypothetical plan if it meant you would stop earning additional benefits under your current plan?
Q22	If your employer offered to contribute an amount equal to 7.5% of your income each year into an investment account, would you enroll in this hypothetical plan if it meant you would stop earning additional benefits under your current plan?
Q23	If your employer offered to contribute an amount equal to 10% of your income each year into an investment account, would you enroll in this hypothetical plan if it meant you would stop earning additional benefits under your current plan?

Table A.1: Pension Survey Questions

Index	Question
Q24	If your employer offered to contribute an amount equal to 15% of your income each year into an investment account, would you enroll in this hypothetical plan if it meant you would stop earning additional benefits under your current plan?
Q25	If your employer offered to contribute an amount equal to 20% of your income each year into an investment account, would you enroll in this hypothetical plan if it meant you would stop earning additional benefits under your current plan?
Q26	If your employer offered to contribute an amount equal to 25% of your income each year into an investment account, would you enroll in this hypothetical plan if it meant you would stop earning additional benefits under your current plan?
Q27	If your employer offered to contribute an amount equal to 30% of your income each year into an investment account, would you enroll in this hypothetical plan if it meant you would stop earning additional benefits under your current plan?
Q28	If your employer offered to contribute an amount equal to 40% of your income each year into an investment account, would you enroll in this hypothetical plan if it meant you would stop earning additional benefits under your current plan?
Q29	If your employer offered to contribute an amount equal to 50% of your income each year into an investment account, would you enroll in this hypothetical plan if it meant you would stop earning additional benefits under your current plan?
Q30	If your employer offered to contribute an amount equal to 60% of your income each year into an investment account, would you enroll in this hypothetical plan if it meant you would stop earning additional benefits under your current plan?
Q31	Ok, if your employer offered to contribute an amount equal to any percentage of your income each year into an investment account, what is the smallest percentage you would accept to enroll in this hypothetical plan?
Q32	What healthcare benefits do you expect to receive upon retirement?
Q33	How would you describe the stability of your current retirement plan?
Q34	Suppose you have $100 in an account with an interest rate of 2% per year. If you left your money in the account for 5 years, how much money do you think would be in the account?
Q35	Again, suppose you have $100 in an account with an interest rate of 2% per year. If you left your money in the account for 5 years, how much money do you think would be in the account?
Q36	Suppose you have some money in an account with an interest rate of 2% per year. If inflation is 3%, after one year, will you be able to buy less, more, or exactly the same with the money in your account than you could today?
Q37	What typically happens to the value of investment in bonds if interest rates rise?
Q38	Buying a single company's stock usually provides a safer return than a stock mutual fund
Q39	Suppose you have the option between a secure, guaranteed one-time payment of $10,000 cash in ten years, or a one-time immediate cash payment today. What is the minimum amount that the immediate cash payment would have to be for you to choose it instead of the payment of $10,000 in ten years?
Q40	Given your answer to the previous question, please specify the minimum amount that the immediate cash payment would have to be for you to choose it instead of the payment of $10,000 in ten years.
Q41	What is your sex?
Q42	Are you of Hispanic, Latino, or Spanish origin?
Q43	What is your race?
Q44	What is the highest degree or level of school you have completed?
Q45	What is your marital status?
Q46	We thank you for your time spent taking this survey. Is there anything else you'd like to tell us?

Table A.2: Pension Survey Questions (cont'd)

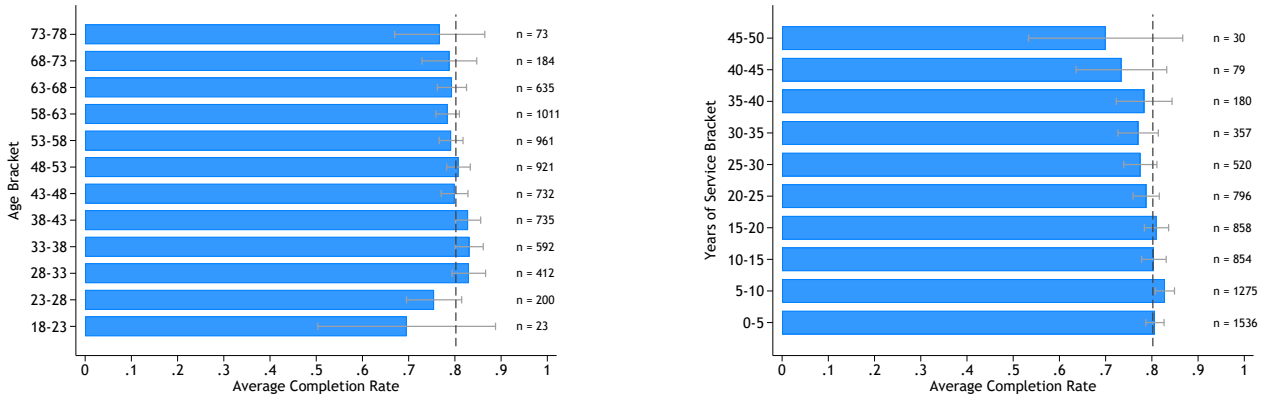
A.2 Plan Type Distribution

State	DB Plan	DC Plan	Hybrid Plan	Other Plan
AR	101	22	14	4
CA	273	14	78	7
CO	47	4	5	1
CT	150	30	64	4
DE	57	7	16	2
IA	299	35	69	12
ID	199	39	46	2
KS	222	44	55	11
MD	95	72	33	8
MN	227	16	87	1
MT	270	71	21	4
NC	670	100	122	14
NE	116	259	54	91
PA	1,000	58	226	23
VA	524	403	404	32
VT	126	15	33	4

Table A.3: Summary Statistics Plan Type

Notes: This tables tabulates the number of respondents by state and plan type. We classify the respondents' retirement plan by its economic relevance if multiple answers are provided. In particular, if a respondent has a DB and a DC plan, we classify it as a DB plan if the expected DB benefit payment exceeds 85% of the total expected payment, as a DC plan if the annuity from the DC balance exceeds 85% of the total expected payment and as a hybrid plan otherwise. The "other plan" category encompasses guaranteed return plans and responses that do not fall in other of the previously mentioned categories.

A.3 Average Completion Rates



(a) Age Bracket

(b) Years of Service Bracket

Figure A.1: Average Completion Rate

Notes: The left panel shows the average completion rate by age brackets and the right panel shows the average completion rate by years of service brackets. The bars represent the mean completion rate and the whisker plots represent the 95% confidence interval of the mean estimates.

A.4 Public Pension Liability and Fiduciary Assets

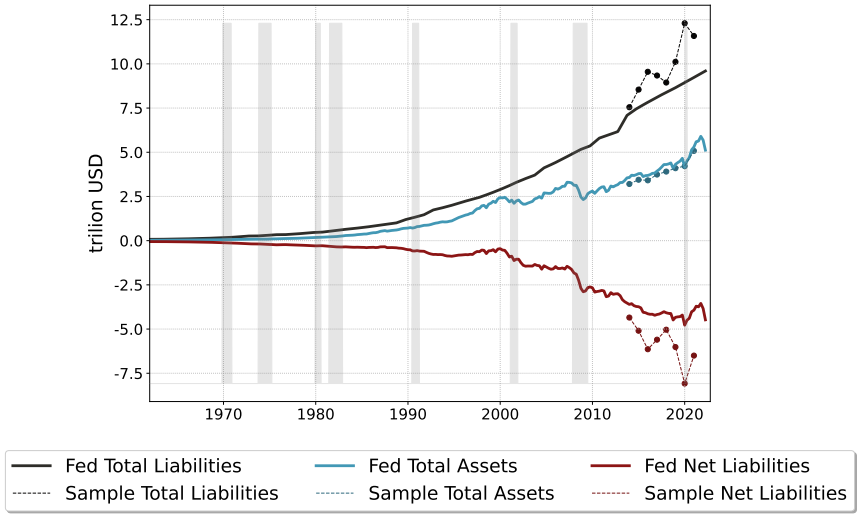
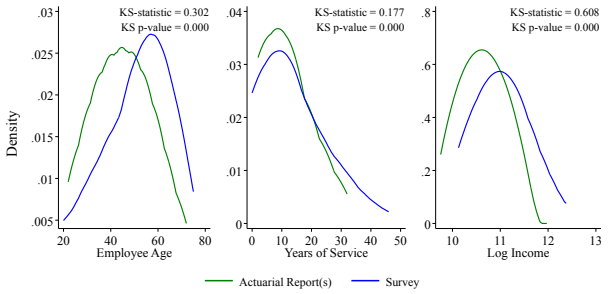


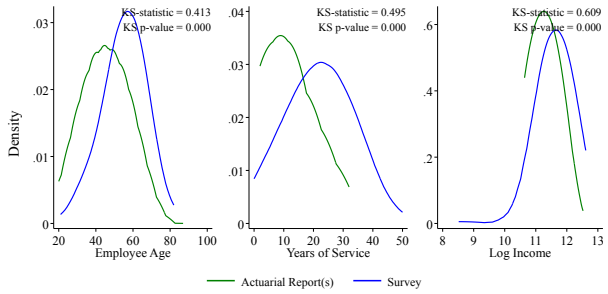
Figure A.2: Pension Asset and Liabilities

Notes: The pension entitlements of state and local government employees defined benefit retirement funds (Fed Total Liabilities), the total assets (Fed Total Assets) and the unfunded liabilities (Fed Net Liabilities) are estimates of the Board of Governors of the Federal Reserve and retrieved from FRED, Federal Reserve Bank St. Louis, with the series code BOGZ1FL224190043Q, BOGZ1FL222000075Q, BOGZ1FL223073045Q, respectively. The Sample Total Liabilities, the Sample Total Assets, and the Sample Net Liabilities are the calculations of the authors which is based on the collected data of 647 city, county and state pension funds from Giesecke and Rauh (2022). The total liabilities, and net liabilities are re-stated to reflect the market valuation. The list of included pension funds is available in the Appendix.

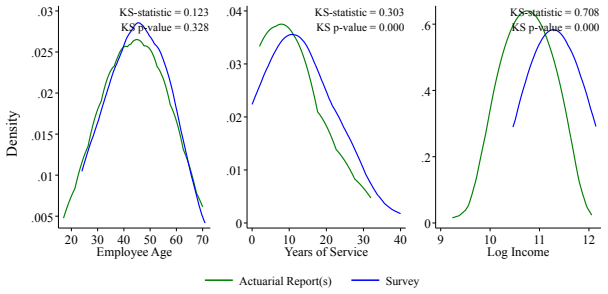
A.5 Covariates by State



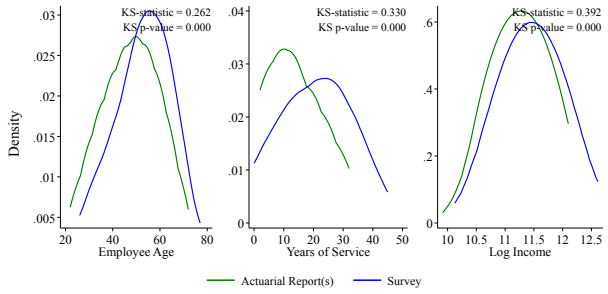
(a) Arkansas



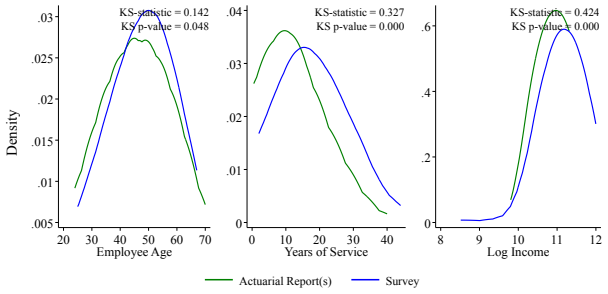
(b) California



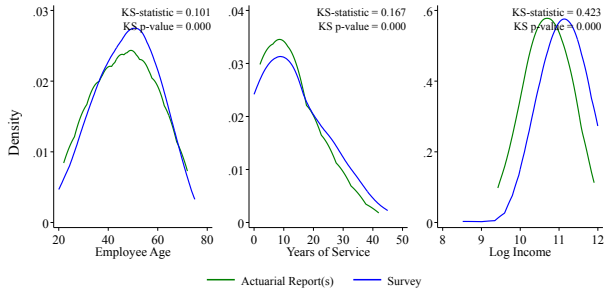
(c) Colorado



(d) Connecticut



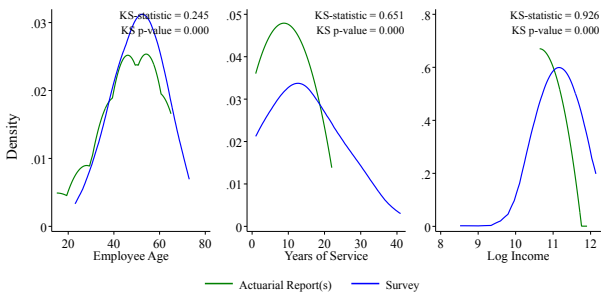
(e) Delaware



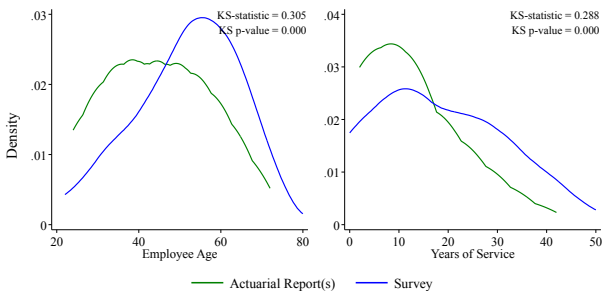
(f) Iowa

Figure A.3: Covariate Comparison

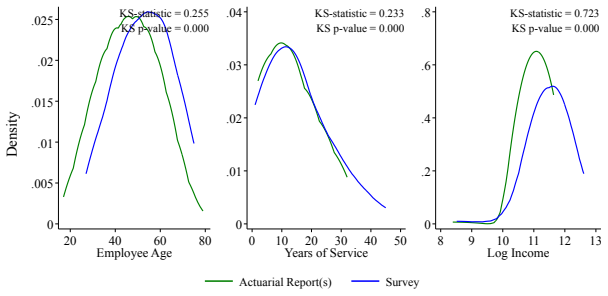
Notes: The density plots compare the age, years of service, and if available income distribution of the survey with the corresponding distribution in the actuarial valuation reports of pension plans for each state.



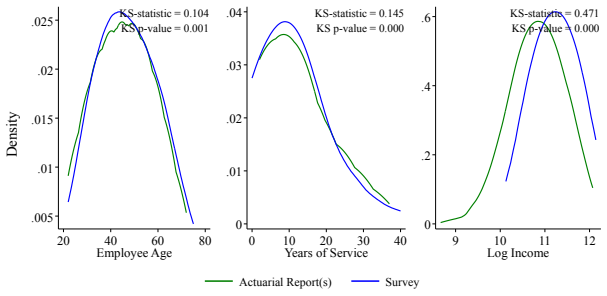
(a) Idaho



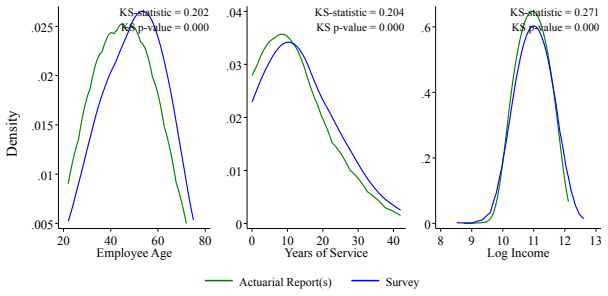
(b) Kansas



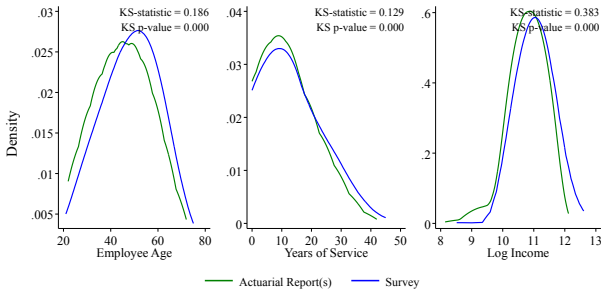
(c) Maryland



(d) Minnesota



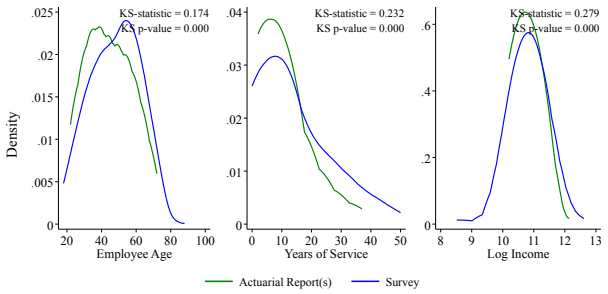
(e) Montana



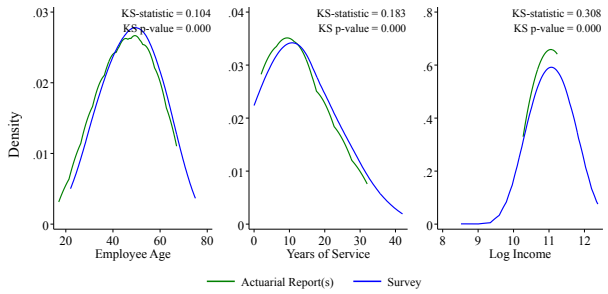
(f) North Carolina

Figure A.4: Covariate Comparison (cont'd)

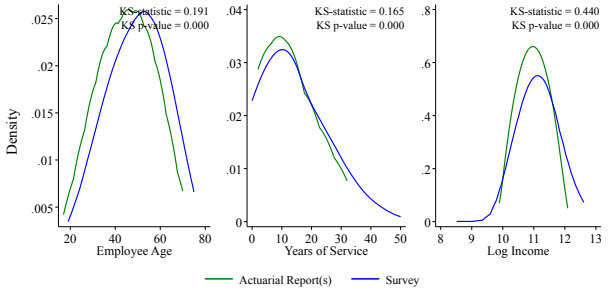
Notes: The density plots compare the age, years of service, and if available income distribution of the survey with the corresponding distribution in the actuarial valuation reports of pension plans for each state.



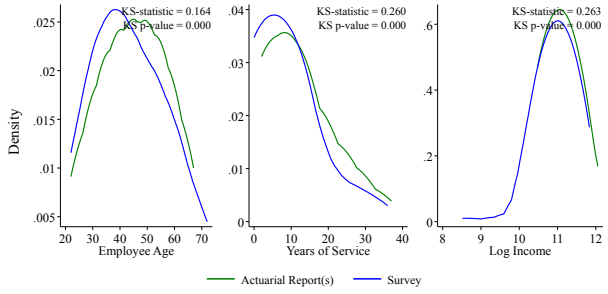
(a) Nebraska



(b) Pennsylvania



(c) Virginia



(d) Vermont

Figure A.5: Covariate Comparison (cont'd)

Notes: The density plots compare the age, years of service, and if available income distribution of the survey with the corresponding distribution in the actuarial valuation reports of pension plans for each state.

A.6 Actuarial Valuation Reports

State	Plan Name	Tier	Active Members
AR	Arkansas Public Employees Retirement System (APERS)	District Judges	12
AR	Arkansas Public Employees Retirement System (APERS)	State and Local Public Employees	42,667
AR	Arkansas Teachers Retirement System (ATRS)	Teachers	66,900
CA	California Public Employee Retirement System (CalPERS) - Judges I	Judges I	110
CA	California Public Employee Retirement System (CalPERS) - Judges II	Judges II	1,625
CA	California Public Employee Retirement System (CalPERS) - State Miscellaneous	State Miscellaneous	178,628
CA	California Public Employee Retirement System (CalPERS) - State Peace Officers and Firefighters	State Peace Officers and Firefighters	41,787
CO	Public Employees' Retirement Association of Colorado (PERA) - Judicial Division	Judicial Division	344
CO	Public Employees' Retirement Association of Colorado (PERA) - School Division	School Division	119,421
CO	Public Employees' Retirement Association of Colorado (PERA) - State Division	State Division	53,643
CT	Connecticut Judicial Retirement System (JRS)	Judges	184
CT	Connecticut State Employee Retirement System (SERS)	Tier I Plan B	258
CT	Connecticut State Employee Retirement System (SERS)	Tier I Plan C	9
CT	Connecticut State Employee Retirement System (SERS)	Tier II All Others	7,492
CT	Connecticut State Employee Retirement System (SERS)	Tier II Hazardous Duty	336
CT	Connecticut State Employee Retirement System (SERS)	Tier II Hybrid Plan	380
CT	Connecticut State Employee Retirement System (SERS)	Tier IIA All Others	13,531
CT	Connecticut State Employee Retirement System (SERS)	Tier IIA Hazardous Duty	4,222
CT	Connecticut State Employee Retirement System (SERS)	Tier IIA Hybrid Plan	871
CT	Connecticut State Employee Retirement System (SERS)	Tier III All Others	7,244
CT	Connecticut State Employee Retirement System (SERS)	Tier III Hazardous Duty	2,297
CT	Connecticut State Employee Retirement System (SERS)	Tier III Hybrid Plan	626
CT	Connecticut State Employee Retirement System (SERS)	Tier IV All Others	7,810
CT	Connecticut State Employee Retirement System (SERS)	Tier IV Hazardous Duty	1,932
CT	Connecticut State Employee Retirement System (SERS)	Tier IV Hybrid Plan	1,007
DE	Delaware Public Employee Retirement System (DPERS) - State Employees	State Employees	36,406

Table A.4: Plans and Tiers

Notes: The table lists the plan / tiers of pension plans that we use to evaluate the sample representativeness of our survey. As the survey asks only for the plan, not the tier, in which the respondent is enrolled in, we aggregate all tiers at the plan level. In some cases there is only one tier by plan.

State	Plan Name	Tier	Active Members
IA	Iowa Judicial Retirement System (JRS)	Judges	198
IA	Iowa Public Employees' Retirement System (IPERS) - Regular Membership	Public Employees Protection Occupations	7,519
IA	Iowa Public Employees' Retirement System (IPERS) - Regular Membership	Public Employees Regular Memberships	169,514
IA	Municipal Fire & Police Retirement System of Iowa (MFPRSI)	Municipal Fire and Police	4,084
IA	Peace Officers' Retirement, Accident and Disability System (PORS)	Peace Officers	547
ID	Idaho Judges' Retirement System (JRS)	Judges	55
ID	Public Employee Retirement System of Idaho (PERSI)	General Employees	46,147
KS	Kansas Public Employees Retirement System (KPERS)	Judges	244
KS	Kansas Public Employees Retirement System (KPERS)	Police and Fire	7,835
KS	Kansas Public Employees Retirement System (KPERS)	State KPERS 1	8,423
KS	Kansas Public Employees Retirement System (KPERS)	State KPERS 2	4,409
KS	Kansas Public Employees Retirement System (KPERS)	State KPERS 3	7,964
MD	Maryland Employees' Retirement and Pension Systems (ECS)	Employees	79,854
MD	Maryland State Police Retirement System (SPRS)	State Police	1,353
MD	Maryland State Retirement and Pension System - Law Enforcement Officers	LEOPS	2,697
MD	Maryland Teachers' Retirement and Pension Systems (TCS)	Teachers	109,958
MN	Minnesota Teachers Retirement Association (TRA)	Teachers	81,821
MN	Public Employees Retirement Association (PERA) - General Employees Fund	State Employees PERA	149,272
MN	State Retirement System (SRS) - Correctional Employees Retirement Fund	Correctional	4,504
MN	State Retirement System (SRS) - General Employees Retirement Fund	State Employees SRS	50,223
MN	State Retirement System (SRS) - Judges Retirement Fund	Judges Tier 1	156
MN	State Retirement System (SRS) - Judges Retirement Fund	Judges Tier 2	164
MN	State Retirement System (SRS) - Legislators Retirement Fund	Legislators	12
MN	State Retirement System (SRS) - State Patrol Retirement Fund	State Patrol	912

Table A.5: Plans and Tiers (cont'd)

Notes: The table lists the plan / tiers of pension plans that we use to evaluate the sample representativeness of our survey. As the survey asks only for the plan, not the tier, in which the respondent is enrolled in, we aggregate all tiers at the plan level. In some cases there is only one tier by plan.

State	Plan Name	Tier	Active Members
MT	Public Employees' Retirement System (PERA) - Firefighters' Unified Retirement System	Firefighters	708
MT	Public Employees' Retirement System (PERA) - Game Wardens' and Peace Officers' Retirement System	Game Wardens	881
MT	Public Employees' Retirement System (PERA) - Highway Patrol Officers' Retirement System	Highway Patrol	222
MT	Public Employees' Retirement System (PERA) - Judges' Retirement System	Judges	56
MT	Public Employees' Retirement System (PERA) - Public Employees Retirement System	State Employees	21,372
MT	Public Employees' Retirement System (PERA) - Sheriffs' Retirement System	Sheriffs	1,341
MT	Teachers' Retirement System (TRS)	Teachers	13,803
NC	North Carolina Consolidated Judicial Retirement System (CJRS)	Judges	569
NC	North Carolina Legislative Retirement System (LRS)	Legislators	170
NC	North Carolina Local Governmental Employees' Retirement System (LGERS)	Local Government	132,235
NC	North Carolina Teachers and State Employees' Retirement System (TSERS)	Teachers and State Employees	300,310
NE	Nebraska Public Employees Retirement System (NPERS) - Judges	Judges	145
NE	Nebraska Public Employees Retirement System (NPERS) - State Employees	Employees	13,917
NE	Nebraska Public Employees Retirement System (NPERS) - State Patrol	State Patrol	403
PA	Pennsylvania State Employees Retirement System (SERS)	Active Member Valuation Female	43,893
PA	Pennsylvania State Employees Retirement System (SERS)	Active Member Valuation Male	57,069
VA	Judicial Retirement System (JRS)	Judges	453
VA	State Police Officers' Retirement System (SPORS)	State Police	1,947
VA	Virginia Law Officers' Retirement System (VaLORS)	Law Officers	7,823
VA	Virginia Retirement System (VRS) - State Employees	State Employees	73,686
VA	Virginia Retirement System (VRS) - Teachers	Teachers	149,793
VT	Vermont State Employee Retirement System (VSERS)	General Employees Group A	1
VT	Vermont State Employee Retirement System (VSERS)	General Employees Group F	8,028
VT	Vermont State Employee Retirement System (VSERS)	Judges	52
VT	Vermont State Employee Retirement System (VSERS)	Law Enforcement	458

Table A.6: Plans and Tiers (cont'd)

Notes: The table lists the plan / tiers of pension plans that we use to evaluate the sample representativeness of our survey. As the survey asks only for the plan, not the tier, in which the respondent is enrolled in, we aggregate all tiers at the plan level. In some cases there is only one tier by plan.

A.7 Survey Invitation and Follow-up

Hello,

You are invited to participate in a survey that explores public sector employee retirement options and alternatives.

The survey is conducted by researchers at the **Stanford University** Graduate School of Business. Your participation may help ensure the long term stability and sustainability of public sector retirement benefits.

If you want to learn more about the pension survey please visit: https://pensionsurvey.stanford.edu.

Your participation is **voluntary** and **anonymous**. If you choose to participate, please accept your invitation by clicking the link below and completing our brief survey.

Go To Survey

Thank you for your consideration and have a wonderful day.

Stanford Pension Study
Stanford Graduate School of Business

Stanford University

DESCRIPTION: You are invited to participate in a **research study** exploring public sector employee knowledge and preference regarding defined benefit and defined contribution retirement plans. This study will be used to develop solutions for maintaining the long-term stability of public sector retirement plans. You will be asked to complete a brief online survey.

TIME INVOLVEMENT: Your participation will take approximately 10 minutes.

RISKS AND BENEFITS: There are no risks associated with the study. The benefits which may reasonably be expected to result from this study are improvement of the long-term stability of public sector retirement plans. **We cannot and do not guarantee or promise that you will receive any benefits from this study.** Your decision whether or not to participate in this study will not affect your employment or retirement.

PAYMENTS: You will receive no payment for your participation.

PARTICIPANT'S RIGHTS: If you have read this form and have decided to participate in this project, please understand your **participation is voluntary** and you have the **right to withdraw your consent or discontinue participation at any time without penalty or loss of benefits to which you are otherwise entitled. The alternative is not to participate.** You have the right to refuse to answer particular questions. The results of this research study may be presented at scientific or professional meetings or published in scientific journals. Your individual privacy will be maintained in all published and written data resulting from the study.

CONTACT INFORMATION:
Questions: If you have any questions, concerns or complaints about this research, its procedures, risks and benefits, email the survey team at **pensionfeedback@stanford.edu** or contact the the Protocol Director, **Tim Rosenberger at**

Independent Contact: If you are not satisfied with how this study is being conducted, or if you have any concerns, complaints, or general questions about the research or your rights as a participant, please contact the Stanford Institutional Review Board (IRB) to speak to someone independent of the research team at 650-723-2480 or email at irbnonmed@stanford.edu or toll free at 1-866-680-2906. You can also write to the Stanford IRB, Stanford University, 1705 El Camino Real, Palo Alto, CA 94306.

Please print a copy of this page for your records

If you agree to participate in this research, please complete the attached survey.

Figure A.6: Initial Survey Invitation

Hello,

This is a follow-up to our previous invitation to participate in the pension survey conducted by researchers at the **Stanford University** Graduate School of Business. We would appreciate your input and time as this survey may help ensure the long term stability and sustainability of public sector retirement benefits.

Please ignore this invitation if you have already participated. This is the last invitation to participate and there will be no additional follow-up.

If you want to learn more about the pension survey please visit: https://pensionsurvey.stanford.edu.

Your participation is **voluntary** and **anonymous**. If you choose to participate, please accept your invitation by clicking the link below and completing our brief survey.

Go To Survey

Thank you for your consideration and have a wonderful day.

Stanford Pension Study
Stanford Graduate School of Business

DESCRIPTION: You are invited to participate in a **research study** exploring public sector employee knowledge and preference regarding defined benefit and defined contribution retirement plans. This study will be used to develop solutions for maintaining the long-term stability of public sector retirement plans. You will be asked to complete a brief online survey.

TIME INVOLVEMENT: Your participation will take approximately 10 minutes.

RISKS AND BENEFITS: There are no risks associated with the study. The benefits which may reasonably be expected to result from this study are improvement of the long-term stability of public sector retirement plans. **We cannot and do not guarantee or promise that you will receive any benefits from this study.** Your decision whether or not to participate in this study will not affect your employment or retirement.

PAYMENTS: You will receive no payment for your participation.

PARTICIPANT'S RIGHTS: If you have read this form and have decided to participate in this project, please understand your **participation is voluntary** and you have the **right to withdraw your consent or discontinue participation at any time without penalty or loss of benefits to which you are otherwise entitled. The alternative is not to participate.** You have the right to refuse to answer particular questions. The results of this research study may be presented at scientific or professional meetings or published in scientific journals. Your individual privacy will be maintained in all published and written data resulting from the study.

CONTACT INFORMATION:
Questions: If you have any questions, concerns or complaints about this research, its procedures, risks and benefits, email the survey team at pensionfeedback@stanford.edu or contact the the Protocol Director, **Tim Rosenberger at**

Independent Contact: If you are not satisfied with how this study is being conducted, or if you have any concerns, complaints, or general questions about the research or your rights as a participant, please contact the Stanford Institutional Review Board (IRB) to speak to someone independent of the research team at 650-723-2480 or email at irbnonmed@stanford.edu or toll free at 1-866-680-2906. You can also write to the Stanford IRB, Stanford University, 1705 El Camino Real, Palo Alto, CA 94306.

Please print a copy of this page for your records

If you agree to participate in this research, please complete the attached survey.

Figure A.7: Follow-up Survey Invitation

A.8 Service Cost Modeling

Pension plans disclose the reported service cost of their members typically at the plan level. As such, the service cost represents an average among all plan members and conceals potential heterogeneity across plan members. There are at least two factors that contribute to the heterogeneity in service cost. First, pension plans have introduced new tiers that tend to have less generous benefit parameters. Second, individuals differ in their years of service and their retirement age. In order to recover the heterogeneity among plan members, we calculate the service cost building on an established methodology as outlined by e.g. Winklevoss (1993) and Forman and Sabin (2018). Subsequently, we verify that the weighted individual service cost is consistent with the overall service cost at the plan level. We find reasonable alignment between the reported and the individually calculated service cost at the plan level; thus, providing an important internal consistency check.

Data Requirements We use detailed information on years of service, remaining years, public sector income, and plan membership that we collected as part of the survey. In addition, we use data on pension benefit terms by tier and pension plan from the Urban Institute (2014) dataset. The calculation of the service cost requires further assumptions about the wage growth and the assumed inflation rate. We collect these data points from individual plan and tier disclosures. All values for wage growth and the assumed inflation rate are tabulated in Appendix Tables A.7 and A.8.

Tier Match Respondents were matched to plan tiers based on their occupation (public safety, teacher, etc.), level of government (state/local), and their year of entry into the pension system.[21] If these matching criteria were insufficient to match a respondent to a tier, we select the best match based on the closest match between the participant's reported accrued benefits and the calculated accrued benefits if the member were part of a specific tier.

Individual Service Cost Methodology We follow Winklevoss (1993) and Forman and Sabin (2018) in the calculation of the entry age normal (EAN), level-percent of payroll service cost and make adjustments where appropriate. Concretely, we calculate the projected

[21] The participation in a specific tier is, for a large share of plans, determined by the year of entry into public service.

annual benefits at retirement age, r, as:

$$Benefits_{i,l,r} = ServiceMultiplier_{l,k,r} * income_{i,t} * (1+w)^{(r-t)}, \tag{1}$$

where i indexes the individual, l the plan/tier of the individual and t the employee's current age.[22] We then convert the *annual benefits* into an *annuity of benefits*. First we, calculate the annuity factor, $\ddot{a}_r$, (Winklevoss, 1993) via:

$$\ddot{a}_r = \Sigma_{i=r+1}^{\infty} p_{r,i}^{(m)} * \left(\frac{1+e}{1+d}\right)^{i-r}, \tag{2}$$

where $p_{r,i}^{(m)}$ is the survival probability, d is the assumed discount rate, and e is the cost-of-living adjustment (COLA) assumption derived from the plan's actuarial valuation report (AVR). We derive the survival probability, using the mortality rates, $q_{r+j}^{(m)}$ from the modified RP-2014 mortality table in Forman and Sabin (2018) as:

$$p_{r,i}^{(m)} = \prod_{j=r}^{i-1} 1 - q_{r+j}^{(m)} \tag{3}$$

Using Equations (1) and (2), we obtain the entry age normal (EAN), level-percent service cost (Forman and Sabin, 2018) as:

$$SVC_{i,l,t} = Benefits_{i,l,r} * \ddot{a}_r * \frac{\frac{(1+d)}{(1+w)} - 1}{\frac{(1+d)}{(1+w)}^{r-k+1} - 1} * \frac{1}{(1+w)^{r-t}} \tag{4}$$

Implicit in this calculation is the assumption that the employee does not retire prematurely, nor would they be fired, quit, die, or become disabled prior to their projected retirement date.[23]

Consistency Checks There are several consistency checks to verify our approach. First we compare the computed annuity values with the answers of the respondents' accrued and expected benefits in Figure A.8.

Second, we compare weighted individual calculated service cost as of payroll with the

[22] The service multiplier can be tenure specific for some plan and $ServiceMultiplier_{l,k,r} = \sum_{j=k}^{r} mult_{l,j}$, where k is the age of entry. Equation (1) calculates the projected benefits. Alternative we can calculate accrued benefits as follows: $Benefits_{i,l,t} = ServiceMultiplier_{l,k,t} * income_{i,t}$, where $ServiceMultiplier_{l,k,t} = \sum_{j=k}^{t} mult_{l,j}$.

[23] Another implicit assumption to equations (4) is that the last employer contributions occur in year *r* and the first annuity payments occur in year *r+1*.

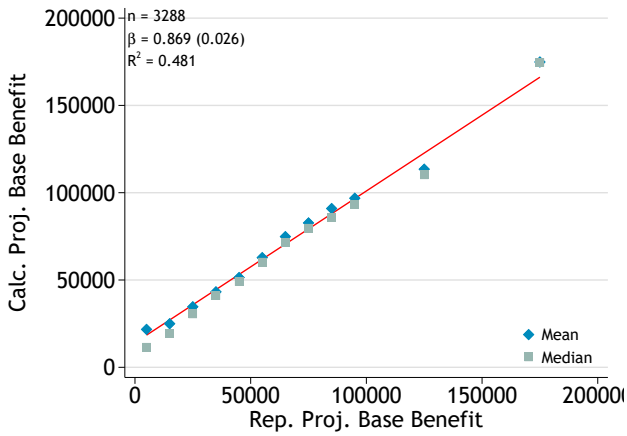


Figure A.8: Calculated vs. Reported Annuity

Notes: The figure displays the regression analysis between the calculated and reported annuities, along with the means and medians of calculated annuities by level of reported annuities

reported service cost as of payroll, as reported in the plan's AVR. For this comparison we only include plans with $n \geq 30$ to exclude plans with the potential for a lot of idiosyncratic variation. The results are displayed in Figure A.9.

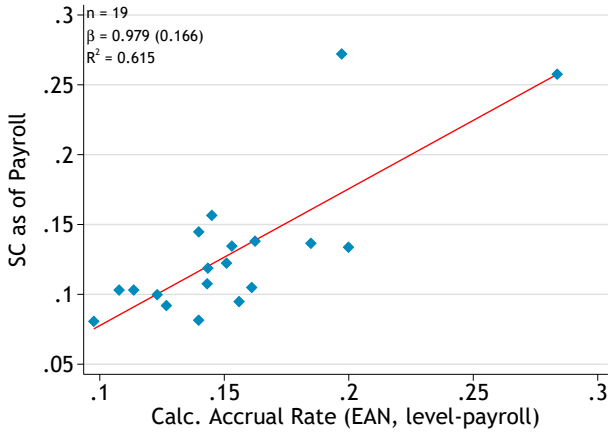


Figure A.9: Reported vs. Calculated Service Cost

Notes: The figure displays the relationship between reported service cost as of payroll and calculated service cost, which we obtain by aggregating the individual calculated service cost via $SVC_{l,t} = \frac{\Sigma_{i \in l} SVC_{i,l,t}}{\Sigma_{i \in l} income_{i,t}}$. All instances where the number of survey participants in a given plan was fewer than 30 are omitted.

Market Value of Individual Service Cost Methodology The individual service cost calculation in the previous paragraph is meant to replicate the service cost calculation by the actuary as close as possible. Giesecke and Rauh (2022) show that there is substantial discrepancy between the actuarially calculated service cost and the actual economic cost for the pension sponsor. Thus, we adjust the individual service cost to reflect the true actual economic cost. We calculate an individual service cost adjustment factor using the individual's characteristics to account for the discrepancy between the assumed discount rate and the economically relevant discount rate.

We first compute the duration and the convexity of the pension claim for each individual and subsequently derive the individual adjustment factor. For the duration, we first define:

$$\bar{a}_r = \Sigma_{i=r+1}^{\infty} p_{r,i}^{(m)} * \left(\frac{1+e}{1+d}\right)^{i-r} (i-r) \tag{5}$$

and use the annuity factor from Equation (8) to obtain the duration of the pension benefit at retirement age r:

$$Dur_r = \frac{\bar{a}_r}{\ddot{a}_r} \tag{6}$$

Then, the duration for the individual of age t and retirement age r can be calculated as:

$$Dur_{t,r} = (r-t) + Dur_r \tag{7}$$

Equation (7) implies that the duration increases with the years until retirement, as expressed by $r-t$. The further the retirement is in the future the longer is the duration of the retirement obligation as benefit payments are only paid upon retirement. Second, we calculate the convexity of the retirement claims as:

$$Conv_{t,r} = \frac{\sum_{i=r+1}^{\infty} p_{r,i}^{(m)} * \left(\frac{1+e}{1+d}\right)^{i-r} ((i-t)^2 + (i-t))}{\ddot{a}_r * (1+y)^2} \tag{8}$$

Thus, we obtain the individual service cost adjustment factor as:

$$\text{Adj. Factor Ind. Service Cost}_{t,r} = 1 + Dur_{t,r} * (d-y) + \frac{Conv_{t,r}}{2} * (d-y)^2, \tag{9}$$

Adj. Factor Ind. Service Cost$_{t,r}$ is the adjustment factor of the service cost for an employee of age, t, and retirement age, r, where d is the reported discount rate of the plan in which

the individual is enrolled in and y is the duration matched Treasury yield. For the majority of plans, if not all plans, the discrepancy between discount rate and treasury yield, $(d - y)$, is positive. Thus, the first order adjustment, reflected by $Dur_{t,r} * (d - y)$, is increasing in the number of years until retirement as a result of the longer duration as discussed above. Thus, the adjustment factor for the service cost is increasing with the number of years until retirement. In other words, the adjustment factor is larger for young relative to older employees. Economically speaking, the discrepancy between the assumed discount rate and the economically relevant discount rate has a larger impact on the service cost for younger employees as their benefit payments are further in the future relative to older employees.

Retirement Plan	Tier Members	Membership Requirments	# of Respondents in Plan	# of Respondents in Tier	Wage Growth Assumption (in %)	Inflation Assumption (in %)
Iowa Judicial Retirement System (JRS)	Judges		30	30	4.25	2.60
California Public Employee Retirement System (C...	Firefighters	Hired before January 15, 2011	35	34	3.20	2.00
Public Employees' Retirement Association of Col...	General state government employees	Hired after December 31, 2006 and before Januar...	44	8	3.00	2.00
Public Employees' Retirement Association of Col...	General state government employees	Hired before July 1, 2005; vested on January 1,...	44	14	3.00	2.00
Public Employees' Retirement Association of Col...	General state government employees	Hired after December 31, 2010	44	20	3.00	2.00
North Carolina Local Governmental Employees' Re...	Police and Fire	LGERS Police and Fire	57	7	3.25	0.00
Delaware Public Employee Retirement System (DPE...	Teachers	Hired on or after Jan. 1, 2012	57	15	2.50	0.00
Delaware Public Employee Retirement System (DPE...	Teachers	Hired on or after Jan. 1, 1997 and before Jan. ...	57	40	2.50	0.00
North Carolina Local Governmental Employees' Re...	General local government employees	LGERS General local government employees	57	50	3.25	0.00
Virginia Law Officers' Retirement System (VaLORS)	Police and Fire	Hired before July 1, 2001 and vested on January...	64	15	3.00	2.50
Virginia Law Officers' Retirement System (VaLORS)	Police and Fire	Hired after June 30, 2001 and before July 1, 20...	64	23	3.00	2.50
Virginia Law Officers' Retirement System (VaLORS)	Police and Fire	Hired after June 30, 2010 (VaLORS)	64	26	3.00	2.25
Maryland Employees' Retirement and Pension Syst...	General state government employees	Hired on or after July 1, 2011	82	34	2.75	1.00
Maryland Employees' Retirement and Pension Syst...	General state government employees	Hired between Jan. 1, 1980 and July 30, 2011	82	48	2.75	1.96
Arkansas Public Employees Retirement System (AP...	Certain state and local public safety workers	Hired after Jan. 1, 1978 and before July 1, 2005	96	33	3.25	3.00
Arkansas Public Employees Retirement System (AP...	General state government employees	Hired on or after July 1, 2005	96	63	3.25	3.00
Vermont State Employee Retirement System (VSERS)	State police and firefighters		153	13	3.40	2.40
Vermont State Employee Retirement System (VSERS)	General state government employees	Hired on or after January 1, 1991 and before Ju...	153	22	3.40	2.40
Vermont State Employee Retirement System (VSERS)	General state government employees	Hired on or after July 1, 2008 (Group F)	153	115	3.40	2.40
Connecticut State Employee Retirement System (S...	State Police	Hired on or after July 1, 1997 and before July ...	197	6	3.00	1.95
Connecticut State Employee Retirement System (S...	General state government employees	Hired on or after July 1, 2011	197	42	3.00	1.95
Connecticut State Employee Retirement System (S...	General state government employees	Hired on or after July 1, 1997 and before July ...	197	69	3.00	1.95
Connecticut State Employee Retirement System (S...	General state government employees	Hired after July 1, 1984 and before July 1, 1997	197	76	3.00	1.95
Kansas Public Employees Retirement System (KPERS)	State and local police officers and firefighters	Hired on or after July 1, 1989	203	18	3.00	0.00
Kansas Public Employees Retirement System (KPERS)	General state government employees	Hired on or after July 1, 2009 and before Jan. ...	203	22	3.00	0.00
Kansas Public Employees Retirement System (KPERS)	General state government employees	Hired before July 1, 2009	203	157	3.00	0.00
California Public Employee Retirement System (C...	General state government employees	Hired on or after January 1, 2013 (CalPERS, Tie...	207	16	2.80	3.00
California Public Employee Retirement System (C...	General state government employees	Hired on or after January 1, 2013 (CalPERS, Tie...	207	19	2.80	2.00
California Public Employee Retirement System (C...	General state government employees	Hired before January 15, 2011 (CalPERS, Tier 2)	207	50	2.80	3.00

Table A.7: Wage Growth and Inflation Rates by Tier

Notes: The table lists the tiers where $n \geq 5$ and the parent plan has $n \geq 30$. The table lists the wage growth and inflation assumptions obtained for that tier from the tier's AVR.

Retirement Plan	Tier Members	Membership Requirments	# of Respondents in Plan	# of Respondents in Tier	Wage Growth Assumption (in %)	Inflation Assumption (in %)
California Public Employee Retirement System (C...	General state government employees	Hired before January 15, 2011 (CalPERS, Tier 1)	207	117	2.80	2.00
State Retirement System (SRS) - General Employe...	General state government employees	Hired before July 1, 1989	213	7	3.00	1.50
State Retirement System (SRS) - General Employe...	General state government employees	Hired on or after July 1, 1989 and before July ...	213	66	3.00	1.50
State Retirement System (SRS) - General Employe...	General state government employees	Hired on or after July 1, 2010	213	140	3.00	1.50
Public Employee Retirement System of Idaho (PERSI)	Teachers		214	11	3.05	1.00
Public Employee Retirement System of Idaho (PERSI)	General local government employees		214	13	3.05	1.00
Public Employee Retirement System of Idaho (PERSI)	State and local police and firefighters		214	13	3.05	1.00
Public Employee Retirement System of Idaho (PERSI)	General state government employees		214	177	3.05	1.00
Public Employees' Retirement System (PERA) - Pu...	General local government employees	Hired on or after July 1, 2011	254	9	3.50	1.50
Public Employees' Retirement System (PERA) - Pu...	General state government employees	Hired on or after July 1, 2011	254	110	3.50	1.50
Public Employees' Retirement System (PERA) - Pu...	General state government employees	Hired before July 1, 2011	254	134	3.50	3.00
Iowa Public Employees' Retirement System (IPERS...	General state government employees	Hired after June 30, 2012	301	136	3.25	0.00
Iowa Public Employees' Retirement System (IPERS...	Protection occupations not covered by other plans		301	161	3.25	0.00
North Carolina Teachers and State Employees' Re...	Teachers	Hired before August 1, 2011	566	7	3.25	0.00
North Carolina Teachers and State Employees' Re...	Teachers	Hired after July 31, 2011	566	7	3.25	0.00
North Carolina Teachers and State Employees' Re...	Police and Fire	Hired after July 31, 2011	566	23	3.25	0.00
North Carolina Teachers and State Employees' Re...	Police and Fire	Hired before August 1, 2011	566	28	3.25	0.00
North Carolina Teachers and State Employees' Re...	General state government employees	Hired before August 1, 2011	566	250	3.25	0.00
North Carolina Teachers and State Employees' Re...	General state government employees	Hired after July 31, 2011	566	251	3.25	0.00
Virginia Retirement System (VRS) - State Employees	General state government employees	Hired on or after July 1, 2010 and before Janua...	602	105	3.00	2.25
Virginia Retirement System (VRS) - State Employees	General state government employees	Hired on or after January 1, 2014	602	196	3.00	2.25
Virginia Retirement System (VRS) - State Employees	General state government employees	Hired before July 1, 2010 and vested on January...	602	301	3.00	2.50
Pennsylvania State Employees Retirement System ...	General state government employees	Hired on or after January 1, 2019 (Class A-5)	909	51	2.80	0.00
Pennsylvania State Employees Retirement System ...	State police	Hired before July 1, 2012	909	62	2.80	0.00
Pennsylvania State Employees Retirement System ...	State police	Hired on or after July 1, 2012 (Class A-3)	909	63	2.80	0.00
Pennsylvania State Employees Retirement System ...	General state government employees	Hired on or after January 1, 2011, and before J...	909	104	2.80	0.00
Pennsylvania State Employees Retirement System ...	General state government employees	Hired on or after January 1, 2011, and before J...	909	107	2.80	0.00
Pennsylvania State Employees Retirement System ...	General state government employees	Hired before July 1, 2001	909	209	2.80	0.00
Pennsylvania State Employees Retirement System ...	General state government employees	Hired on or after July 1, 2001 and before Janua...	909	311	2.80	0.00

Table A.8: Wage Growth and Inflation Rates by Tier (cont'd)

Notes: The table lists the tiers where $n \geq 5$ and the parent plan has $n \geq 30$. The table lists the wage growth and inflation assumptions obtained for that tier from the tier's AVR.