Public Plans and Short-Term Employees

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Abstract

Public sector defined benefit pension plans are based on final earnings. As such, these plans are back-loaded; those with long careers receive substantial benefits and those who leave early receive little. The analysis consists of three parts. The first section discusses the design of state and local defined benefit plans, documents the extent to which traditional public sector final earnings plans are back-loaded, and explores the extent to which the incentives may reflect the preferences of employers. The second section shows how participation in final earnings plans affects the lifetime resources of state and local workers of various tenures compared to private sector workers. The third section presents plan-level data on the flows of participants out of the plan by age and tenure and explores the extent to which plan design – specifically, vesting periods, mandatory participation in a defined contribution plan, and Social Security coverage – affects the probability of vesting and the probability of remaining to the earliest full retirement age once vested. The findings suggest that complete reliance on delayed vesting and final earnings plans is detrimental to many public employees. Hence, the recent trend towards hybrid arrangements is a positive development not only for risk sharing between taxpayers and participants but also for a more equitable distribution of benefits between short-term and career employees.

Public sector defined benefit pension plans are based on final earnings. As such, these plans are back-loaded; those with long careers receive substantial benefits and those who leave early receive little. Additionally, employee vesting takes five or ten years. In most cases, participants who leave before vesting receive their own contributions plus some low rate of interest. Even once vested, benefits under the public final earnings plan are trivial for many years. This arrangement raises a basic question of fairness, since it is not possible to identify early leavers and compensate them with higher wages. Fairness is a particularly important issue in states like California, Connecticut, Massachusetts, Illinois, Louisiana, and Ohio, where one or both of the large retirement systems do not participate in Social Security. With no Social Security and long vesting periods, many public sector workers end up with no accrued pension benefits of any kind for their time spent in the public sector.

This pattern of back-loading could reflect an optimal design whereby plan sponsors want to attract and retain workers who will stay with their employer for their entire career. But to the extent that state and local governments benefit from a diverse workforce comprised of both short and long-tenure workers, the current system may be poorly designed. A full career in the public sector may be optimal for both the employer and the employee in some situations, but in other instances shorter periods of employment may be more desirable from the perspective of both parties. For example, social workers, who face burdensome caseloads and constant stress, are often exhausted long before retirement age. These workers need to move to new jobs in either the public or private sector. Therefore, a plan that disproportionately rewards long-service workers probably does not provide the right incentives in all cases.

A major indication that back-loading does not represent an optimal design is the fact that the overall structure of state-local retirement systems varies by whether workers are also covered by Social Security. In those systems that participate, Social Security's more even accrual rate and portability offsets some the back-loading of final earnings public plans. Moreover, plans with Social Security coverage provide significantly larger retirement benefits than those without, because the normal cost of the public plan is roughly equal under both arrangements. It is unlikely that the desired workforce and Social Security coverage are systematically related. It is more likely that the back-loading in pension accrual and lack of portability across pension systems is an artifact of the past that continues to disadvantage young and other short-term employees.

This paper explores how public plans treat short-service employees and attempts to measure how the design of the plan affects outcomes for public sector workers. The analysis consists of three parts. The first section discusses the design of state and local defined benefit plans, documents the extent to which traditional public sector final earnings plans are back-loaded, and explores the extent to which the incentives may reflect the preferences of employers. The second section shows how participation in final earnings plans affects the lifetime resources of state and local participants of various tenures compared to private sector workers. The third section presents plan-level data on the flows of participants out of the plan by age and tenure and explores the extent to which plan design – specifically, vesting periods, mandatory participation in a defined contribution plan, and Social Security coverage – affects the probability of vesting and the probability of remaining to the earliest full retirement age once vested.

The analysis yields several findings. First, both a stylized model and evidence from the HRS suggest that back-loaded final-earnings plans shortchange short-service employees. Second, the variation in structure and level of total benefits between plans with and without Social Security offers a unique opportunity for analyzing the impact of plan design on participant behavior. The results show that both Social Security coverage and participation in a mandatory hybrid reduce the likelihood of participants staying until the earliest full retirement age. In other words, when workers have the option to leave back-loaded plans, through retirement income from Social Security or a defined contribution component in their public plan, they do. Long vesting periods also mean that many workers leave public service with no accrued benefits. The main conclusion from these findings is that complete reliance on delayed vesting and final earnings plans is not good for either public employees or public sector employers. Hence, the recent trend towards hybrid arrangements is a positive development not only for risk sharing between taxpayers and participants but also for a more equitable distribution of benefits between short-term and career employees.

The Design of Public Sector Defined Benefit Plans

State and local defined benefit plans vary enormously across states and between states and localities, because these plans cover three different sets of workers – general government employees, teachers, and public safety personnel – each of which have different career paths (see Table 1). Nevertheless, the defined benefit plans share a basic structure. In almost all cases,

they calculate the initial benefit at the full retirement age as the product of three elements: the plan's benefit factor, the number of years of employee service, and the employee's average earnings.[1] The calculation of average earnings is generally based on the three to five years of highest earnings (see Figure 1).

Benefit factors for state and local plans are clustered between 1.5 percent and 2.4 percent, with a typical rate of about 2 percent (see Figure 2). Those plans where employees are not covered by Social Security tend to be slightly on the higher side, those with coverage slightly on the lower side. While most states use a single benefit factor, some states increase the benefit factor modestly with tenure. Some plans impose a cap on the replacement rate (benefits relative to pre-retirement earnings), but 60 percent do not.

The age at which participants can claim full benefits generally varies with length of service. For example, age 65 with 5 years, age 60 with 10 to 20 years, and any age with 30 years of service. Most plans allow early retirement with a reduced benefit. Plans generally do not provide an enhanced benefit for work beyond the normal retirement age.

After the benefit is in payment status, retirees in nearly all plans receive some type of annual cost-of-living adjustment (COLA). The COLA varies substantially across plans in both the form and generosity (see Figure 3).[2] In the wake of the financial crisis, a number of states have reduced or suspended their COLAs, but this discussion is based on 2009 data.

Updating earlier work with Peter Diamond and Gregory Leiserson (2010), a simple model based on typical public plan characteristics can illustrate the effects of final pay provisions. This exercise uses a plan with a constant 2-percent benefit factor, a three-year averaging period, a full retirement age of 65, actuarially fair adjustments for early retirement, and a COLA that compensates for 1.5 percent inflation after the start of benefits, the average COLA in the *Public Plans Database*. The calculation also assumes 4.5 percent nominal earnings

[1] Nebraska is an exception to this generalization since it has a cash balance plan for general state employees. Nebraska still provides a traditional pension benefit for its public school teachers and state police. The Texas Municipal Retirement System, Texas County and District Retirement System, and California State Teachers' Retirement System (for part time employees of community colleges) also provide a cash balance plan.

[2] The COLA is an annual post-retirement increase in the pension benefit designed to help retain purchasing power over time. There are four main types of COLAs: 1) automatic – the increase is a constant percentage or dollar amount that is not tied to the Consumer Price Index (CPI); 2) CPI-linked – the increase is tied to the CPI; 3) Ad-hoc – the increase is set by the legislature and revised on an ad-hoc basis; and 4) Investment-based – the increase is tied to some financial metric, generally the overall plan funded level or the level of assets in a special COLA fund.

growth (faster at young ages and then slowing) and 3 percent inflation.[3] Employees may claim a pension as early as 55, provided they have accumulated at least 10 years of service. Those who leave prior to age 55 and have accumulated at least 10 years of service are assumed to claim a pension at the full retirement age. No cap is imposed on the replacement rate. Employee pension contributions are 5.5 percent of salary, the most typical rate found among our *Public Plans Database* (PPD) sample of plans (see Figure 4).

One measure of the incentive to keep working an additional year, along with earnings, is the change (relative to the gross salary) in the present value of the promised pension benefit less the pension contribution.[4] As shown in Figure 5, this measure increases markedly throughout a worker's career and particularly at older ages.[5] At age 35, a worker who began working for the government at age 25 for a salary of $30,000 earns a gross salary of $51,784.[6] The value of the employee's future pension benefits increases by $3,136 from working to age 36, but contributions of $2,848 are deducted from his paycheck. Thus, on net, the pension system increases total compensation above quoted salary by $288, or 0.6 percent. In contrast, at age 55 his salary is $124,522, and the value of the pension accrual is $36,232. Contributions are only $6,489, so the pension system increases compensation by $29,383, or 23.6 percent of wages.

Moreover, employees who have equal tenure are affected differently by the pension system based on their age. Workers who have the same experience receive larger compensation additions at older ages. For example, the worker described above who has 10 years of experience at age 35 receives 0.6 percent of gross salary. If the worker has 10 years of experience at age 45, the pension system adds 5.0 percent. At 55, the pension system adds 13.0 percent to the salary.

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[3] Salary increases average 4.5 percent over the course of the worker's career, declining from 6 percent at age 25 to 3 percent at age 65. This pattern is consistent with the graded salary scales provided in most actuarial valuations.

[4] This analysis focuses on the problems of the average earnings formula at the core of the final pay pension. For an analysis that illustrates other erratic patterns of benefit accrual associated with common features of teacher retirement systems, see Costrell and Podgursky (2009). For an analysis that focuses on one state in detail, see the Technical Appendix to the Final Report of the Special Commission to Study the Massachusetts Contributory Retirement Systems (2009). An alternative method for estimating the pension incentive to postpone retirement is to calculate the difference between current pension wealth and pension wealth at the age at which that wealth is maximized (Coile and Gruber, 2000a, 2000b; Friedberg and Webb, 2005).

[5] Present values are computed using a real interest rate of 3 percent, similar to the 2.9 percent rate used in the 2012 Social Security Trustees Report. Mortality rates are formed as a 50-50 gender mix of the RP-2000 combined healthy tables, projected to 2012 using Scale AA. The calculation is pre-tax; it ignores the role of both income and payroll taxes, as well as promised Social Security benefits, in determining the level of compensation.

[6] Calculations use an earnings history with a salary of $30,000 at age 25, 3 percent annual inflation, and 4.5 percent annual earnings growth; however the incentive and distribution measures computed are independent of the absolute salary level.

Figure 6 shows the extent to which the typical final earnings plan is back-loaded. An employee starting at 35 with a 30-year career will earn more than 30 percent of lifetime pension benefits in the last five years of employment; those leaving with 10 years of service receive about 14 percent of the possible lifetime benefits.[7] Thus, participants face a very strong incentive to keep working until full benefits are available.[8]

The question is whether the design of state-local defined benefit plans is consistent with the human resource goals of state and local governments. According to the theory, defined benefit pensions make workers more productive, producing surpluses that can benefit both the employer and the employee (Lazear 1986). Pensions, particularly those based on final earnings, improve productivity by altering the incentives for long-term employment. Employers value long-term employment because it reduces hiring costs and allows them to invest in the human capital of their workers. More human capital investment increases productivity and raises profits. Offering a pension at the end of the career also encourages workers to devote more energy to their job, since shirking could lead to being fired and losing the pension. If the incentive for long-term employment were paid in the form of rising wages, it might encourage workers to stay on the job too long or tempt employers to fire workers as soon as their productivity gains dropped below their wage gains. In contrast, a defined benefit pension encourages the worker to retire when the real value of pension accruals turns negative, even if wages continue to rise, and reduces the incentive to fire older workers, which makes the implicit contract credible.[9]

It is hard to believe that the current design of pensions in the public sector reflects the existing needs of public employers. The most compelling argument that the design cannot be deliberate is that some state-local employees are covered by Social Security and some are not. When Congress enacted the Social Security Act in 1935, it excluded state and local workers from

[7] Back-loading also rewards those with rapidly rising earnings, who tend to be the higher paid, makes the comparison of compensation across workers with different salaries opaque, and makes the cost of employing a worker today depend on past employment. The system also creates a large incentive for employees who left public service at a young age to return to covered public employment for a short period immediately before retirement. See Diamond et al. (2010).

[8] If the plan caps the replacement rate, the strong incentive to continue working stops when the cap is reached.

[9] In the Lazear model, defined benefit plans enhance the productivity of otherwise equal employees. An alternate framework proposed by Ippolito (1997) presents pensions as a mechanism for attracting and retaining high-quality employees. Under this framework, productivity is higher in workers with a low discount rate and a propensity to save because savers are more conscientious of the long-term ramifications of present-day actions. Savers value the delayed gratification of a retirement plan. Interestingly, though, the plan can be either defined benefit or defined contribution. For this reason, the Ippolito framework is less relevant for the current discussion.

mandatory coverage due to constitutional concerns about whether the federal government could impose taxes on state governments. As Congress expanded coverage to include virtually all private sector workers, it also passed legislation in the 1950s that allowed states to elect voluntary coverage for their employees.[10] Nothing in the history suggests that the decision to join or not to join the Social Security program was based on benefit design considerations. Yet, joining Social Security substantially increased total benefits received by the participant and altered the pattern of benefit accrual. As shown in Figure 7, the normal cost of covered plans is only slightly lower than that for non-covered plans in the case of teachers and general employees (albeit a significant difference exists for the small sample of police and fire plans in the *Public Plans Database* (PPD)).[11] Moreover, the pattern of benefit accrual of the combined Social Security/defined benefit structure is significantly less back-loaded than the defined benefit pension alone, because the combination of the two plans changes the ratio of total accruals in later years relative to those earned in earlier years.

The current situation seems perfectly summarized in a footnote to a recent paper (Costrell and Podgursky (2009)) that quotes a 1995 report from the National Education Association on a survey regarding the purpose of the current design of teacher plans. Respondents say that the purpose of the design has "been lost in the mist of time" and "many pension administrators would be hard-pressed to give an account of why their systems are structured as is except to say 'The legislature did it' or 'It is a result of bargaining'." In short, the original purpose of the back-loaded nature of public plans appears to have been lost and what remains is a system that contains haphazard incentives and treats short-service employees unfairly.

Impact on Public Sector Employees

The previous section demonstrates that short-service employees accrue little under state-local defined benefit plans and, in systems without Social Security, can end up with no retirement credits at all after several years of work. It could be, however, that once these short-

[10] Specifically, Amendments to the Social Security Act in 1950, 1954, and 1956 allowed states, with the consent of employees in the pension plan, to elect Social Security coverage through agreements with the Social Security Administration (making their taxation voluntary). The amendments also allowed states to withdraw from the program after meeting certain conditions, although this option was eliminated in 1983.

[11] This pattern is confirmed in a regression reported in Appendix Table A1 with summary statistics in Table A2. Interestingly, the ratio of the plan's average wage to the state's average private sector wage is positively related to both Social Security coverage and the plan's normal cost, as shown in Table A3 with summary statistics in Table A4.

service employees leave public service they more than compensate for failing to accrue retirement protection in their state or local job. To see how public employees with different tenure patterns fare over a lifetime, the following analysis explores whether at the end of the day state-local employees end up with more or less wealth at retirement than their private sector counterparts and the extent to which the outcome depends on tenure in the public sector. That is, the analysis looks at the wealth of couples where the head is age 65 and tests, controlling for many other factors that could affect the outcome, whether state-local employment has a positive or negative effect on wealth and how that effect is related to tenure in the state-local sector.

The analysis uses data from the *Health and Retirement Study* (HRS), a nationally representative panel of older American households.[12] This study began in 1992 by interviewing about 12,650 individuals from about 7,600 households ages 51-61 and their spouses (regardless of age), and the survey has been re-administered every two years since 1992. Over time, other cohorts have been added to the survey, substantially increasing the sample size. The strategy here is to focus on the original 1992 cohort (born between 1931 and 1941) and limit the analysis to retired married couples. Given the age range of the original sample, the first group reaches 65 in 1996 and the last group in 2006. The classification of the couple as retired is based on a RAND labor force classification variable, and the respondent must claim to be completely retired. Spouses must claim to be either partly or fully retired, according to a RAND self-reported retirement variable, and not working full time as reported in the labor force classification variable. The final sample includes 1,476 households, roughly 20 percent of which had spent some time in the state-local sector (see Appendix Figure B1 for the derivation of the sample).

The estimated equation relates total household wealth when the respondent is 65 to the percent of the respondent's and the spouse's career spent as a state-local worker.[13] The calculation of the total wealth variable begins with RAND total household assets, which include financial and business assets, property and transportation assets, and IRA holdings and nets out total debt. RAND does not include 401(k) assets in the wealth measure, since the HRS asks questions about these plans only when respondents change jobs or retire. However, a recent

[12] The HRS is conducted by the Institute for Social Research (ISR) at the University of Michigan and is made possible by funding from the National Institute on Aging. More information is available at the ISR website: http://hrsonline.isr.umich.edu/.

[13] The sample is constructed so that all the respondents are men and all the spouses are women.

study found that 80 percent of 401(k) assets are rolled over into IRA accounts within five years of the employee leaving work, so the assumption is that the IRA variable captures the majority of 401(k) assets.[14]

The next step in the wealth calculation is to add defined benefit pension wealth, Social Security wealth, and retiree health insurance. For pension wealth, as all the members of the sample are retired, it is possible to observe their annual income from defined benefit pensions. Pension amounts are often not reported until a full wave after the respondent claims to have retired, so this value is taken as the base for the wealth calculation. The basic formula for calculating the expected present value of pension wealth is:

$$EPV_{pension} = \sum_{a=a_t}^{a=120} \pi_a * (1+r)^{a_t - a} * P_{a_t} * (1+c)^{a-a_t}$$

Where a_t is the recipient's current age, a represents the pension recipient's age over time, π_a is the probability of living from age a_t to age a, based on Social Security life tables, and r is the discount rate – equal to 3-percent inflation plus a 3-percent real return on assets. P_{at} is the annual pension awarded the recipient at age a_t, augmented by c, the cost-of-living adjustment.[15] The presence of a COLA is determined by the HRS question whether pensions at the current job receive a COLA and, for those with a COLA, the assumed adjustment is 1.5 percent per year.[16] If the variable is missing, the assumption is that state and local workers receive a COLA, and that private sector workers do not.[17]

The calculation of Social Security wealth is similar to that for pensions. For about 75 percent of the sample, Social Security earnings are taken from the restricted data set of the HRS Covered Earnings Records for the years 1951-2007. The earnings history is then used to construct the Average Indexed Monthly Earnings (AIME). The Primary Insurance Amount (PIA) and Social Security benefit – either worker or spousal – are calculated using the Social

[14] Utkus and Young (2010).
[15] The basic equation is complicated by the fact that some pensions are straight life annuity whereas others are joint survivor. In the case of joint survivor, the expected pension benefit in a given year is the average of the benefit received if the worker is alive, and that received if the worker is deceased and the spouse is alive, weighted by the respective survival probabilities. If the joint-survivor pension is reduced upon the worker's death, the surviving spouse's benefit is assumed to be 50 percent of the worker's.
[16] *Public Plans Database* (2009).
[17] The resulting pension wealth values are consistent with those reported in Gustman, Steinmeier, and Tabatabai (2010).

Security benefit formula.[18] For the remaining 25 percent, the RAND variable for Social Security retirement benefits is used as the base of the calculation, and again the amount is taken one wave after the husband has turned 65. RAND imputations are replaced with the first reported value, adjusted for COLAs awarded since age 65. Those who claim to receive Social Security but without any reported values are given the RAND imputations. The COLA is equal to 3 percent, and the discount rate is equal to 6 percent. Survivor benefits were calculated from the Social Security formula, based on the full retirement age, the actual claiming age, a reduction multiplier, and the spouse's benefit.

The final component of wealth is retiree health insurance. The RAND data contain a measure of whether the household head and spouse are covered by retiree health insurance.[19] The individual wave data also indicate whether the employer covers all, part, or none of the premiums. Partial coverage is coded at 50 percent of the total premium. Thus, households where the employer covers the entire premium are awarded the full expected present value of the lifetime stream of premiums, while households where the employer only covers half are awarded half that amount. The premium itself comes from a 2006 Kaiser/Hewitt survey of retiree health benefits.[20] According to the study, the annual average retiree-only premium for new retirees age 65 or older was $3,240 in 2006.[21] The individual premium is doubled for those households where both the husband and wife are covered. Premium wealth equals:

$$EPV_{RHI} = \sum_{a=a_t}^{a=120} \pi_a * (1+r)^{a_t - a} * P_{a_t} * (1+MCI_t)^{a-a_t}$$

Where a_t is the recipient's current age, a represents the pension recipient's age over time, π_a is the probability of living from age a_t to age a, and r is the discount rate – equal to 3-percent inflation plus a 3-percent real return on assets. P_{at} is the retiree health insurance premium

[18] State and local workers with fewer than 30 years of substantial earnings receive reductions due to the Windfall Elimination Provision. Additionally, spousal benefits are reduced by the Government Pension Offset when the beneficiary is also receiving a state-local pension.

[19] Coverage patterns calculated from the RAND data are consistent with those reported in Monk and Munnell (2009).

[20] McArdle et al. (2006).

[21] A survey of limited data in the PPD showed that the average retiree-only individual premium was $300 to $400 per month, $3,600 to $4,800 per year, for three plans that reported between 2006 and 2010. Meanwhile, the private sector premium was $270 per month, $3,240 per year, according to McArdle et al. (2006).

awarded the recipient at age a_t, augmented by *MCI*, historical and projected nominal medical cost inflation at time *t* corresponding to age *a*.[22]

The next step is to define tenure periods for public sector workers. Because of delayed vesting, increasing benefit factors, and benefits based on final earnings, the relationship between state-local tenure and wealth would not be expected to be linear. Thus, tenure is broken into three periods: one percent to 15 percent of career spent as a state-local employee; 15 percent to 50 percent; and over 50 percent. Figure 8 shows that roughly equal numbers of state-local workers fall in each of these categories.[23] Figure 9 compares the wealth of households with a state-local worker to that of households with a history of private sector employment.[24] The relationship clearly varies with how long the individual worked in state and local employment. Couples with a long-tenured state-local worker have 21 percent more wealth, while those with a short-tenured worker have 14 percent less. The question is how much of these differences can be explained by the nature of the individuals and the nature of the jobs.

The Analysis

The empirical model takes the form:

$$\ln W_h = \beta_0 + \beta_1 S_r + \beta_2 M_r + \beta_3 L_r + \beta_4 S_s + \beta_5 M_s + \beta_6 L_s + \boldsymbol{\beta X} + \boldsymbol{\varepsilon}$$

Where the log of household wealth, W_h, is linearly related to the respondent's time spent in the state or local sectors. S_r represents a dummy variable taking the value one if the respondent spent one to 15 percent of his career in the state-local sector, and zero otherwise. M_r is equal to one if tenure equals 15 to 50 percent, and zero otherwise. L_r is equal to one if tenure equals 50 percent or more, and zero otherwise. The corresponding spousal variables are S_s, M_s, and L_s. Additionally, $\boldsymbol{X}$ is a vector of control variables of length 48 that captures demographics, personality factors, other sources of wealth, and job characteristics that could affect wealth

[22] Bureau of Labor Statistics (2012) and U.S. Centers for Medicare and Medicaid Services (2011). Future medical cost inflation estimates do not account for potential cost reductions from the Affordable Care Act.
[23] As one would expect, those with less tenure tend to have left state-local employment early in their careers while those with longer tenure left at older ages. The average age of departure for short-tenured workers was about 36; the average age of departure for long-tenured workers was 54.
[24] Federal workers are included in the private sector group, but account for only 2.5 percent of the total.

accumulation. The focus is on married couples at 65, so no controls are required for marital status or age of the respondent. (The summary statistics are presented in Table 2.)

Demographic variables include:

- *Education.* This variable measures years of education and comes from RAND. More years of schooling for either the husband or wife should be associated with more wealth.
- *Black.* A dummy variable from the 2008 tracker file equal to one if the respondent is black and zero otherwise.
- *Hispanic*. A dummy variable from the 2008 tracker file equal to one if the respondent is Hispanic and zero otherwise.
- *Age of spouse*. Although the respondent is 65, the spouse can be any age.[25] The hypothesis is the older the spouse, the shorter the expected life of the couple and therefore the less need for wealth.
- *Life expectancy*. This variable is the self-reported probability of living to age 75 as reported in the RAND data. Due to the high correlation between the responses for respondents and spouses, the variable equals the maximum reported value for a household. A higher probability of living to age 75 would be expected to result in more household wealth.

The nature of the individuals could also have an impact on wealth accumulation.

- *Stocks %*. The RAND data provide information on both total financial assets and equity holdings. Households with a greater taste for high-risk/high-return investments would be expected to have more wealth.
- *Risk aversion.* The HRS asks participants to choose between pairs of jobs where the pay is more or less risky and, based on the responses, assigns levels of risk aversion ranging from one (lowest) to six (highest). High risk aversion is defined as being in level five or six. Being risk averse and wealth would be expected to be positively related.
- *Long horizon.* A dummy variable from the RAND data is equal to one if the individual's planning horizon is greater than five years and zero otherwise.

[25] The spouse's age when the respondent is 65 is calculated by subtracting the spouse's birth year, observed in the RAND data, from the year the respondent turns 65.

Households with a longer financial planning horizon are more likely to save and end up with more wealth.

Other factors that could affect wealth accumulation include whether the household consists of one or two earners and whether the household has received, or expects to receive, an inheritance.

- *Career spouse.* This variable is equal to one if the spouse worked at least 10 years and retired no earlier than age 50. Two-earner households would be expected to have more wealth than a single earner.
- *Career spouse* ed*. This variable interacts education and career-spouse to reflect the hypothesis that the impact on wealth of a second earner will vary with education.
- *Expect inheritance*: The HRS asks households the probability of either the respondent or spouse receiving an inheritance and the expected amount; the expected amount is multiplied by the probability of receipt. The final variable equals the natural log of the probability-weighted expected inheritance.[26] All else equal, households expecting to receive an inheritance would have less wealth.
- *Received inheritance*: The HRS provides information on up to three past inheritances, including the year in which each inheritance was received. The inheritances are increased by a 6-percent nominal rate from the years they were received until the respondent turns 65. The variable is the natural log of the total amount received. Households having already received an inheritance would have higher wealth.[27]

Job characteristics include occupation, firm size, and region.

- *Occupation.* The ten job categories include: management, professional, service, sales, administrative support, agriculture and forestry, construction and extraction, maintenance and repair, production, and transportation occupations.[28]
- *Firm size.* Firm size consists of five groups: 24 employees or less; 25 to 99; 100 to 499; 500 to 999; and 1000 or greater.[29]

[26] For people not expecting an inheritance, the value is set equal to zero.
[27] Past and future inheritances are consistent with those reported in Coe and Webb (2009).
[28] Members of the armed forces are excluded.
[29] This variable is the number of employees at the respondent's location from the individual wave data. However, a large number of missing values requires an imputation based on occupational averages from the *Current Population Survey* for the public and private sector workers separately.

- *Census region.* The nation is divided into five regions: Northeast, Midwest, South, West, and Other.

Note that the list of control variables does not contain any measure of lifetime earnings. The reason is that we are *not* asking: "For a given level of earnings, what is the impact on wealth of tenure as a state-local worker?" It is generally acknowledged that equivalent individuals have different lifetime earnings depending on whether they worked in the public or private sector.[30] The question of interest here is "Given personal characteristics, occupation, enterprise size, and region of the country, does household wealth at 65 depend on the extent to which each spouse works in the public sector?" This broader question does not require controlling for earnings.[31]

In the regression equation, the coefficients of almost all the control variables come in with the expected signs and most are statistically significant (see Table 3). (The exception is the age of the spouse, which has an unexpected statistically significant positive coefficient.) The impact of state-local employment is presented in Figure 10. The results show that spending more than 50 percent of one's career as a state-local worker is associated with 18 percent (respondent) to 23 percent (spouse) more household wealth at age 65 than one's private-sector counterparts, and the coefficients are statistically significant. As noted earlier, about one-third of those with some state-local employment fall into this category.

The relationships between shorter periods of state-local tenure and wealth are consistent with expectations. Those who spend only a brief time in state-local employment appear to end up with less wealth than those who never work as a public employee. Although the coefficients are not quite statistically significant for this group in the reported specification, they tend to fluctuate between significance and insignificance depending on the definition of the control variables and sample size. As noted earlier, about a third of those with public sector employment fall into this group. This finding is not surprising, given that many leave without vesting in the pension and receive only a refund of their contributions and some small interest payment. And those who work for employers without Social Security leave with much less than they would have accrued in the private sector. Those who spend an intermediate portion of their career (15 percent to 50 percent) in state-local employment look similar to private sector employees in

[30] See Munnell et al. (2011) and citations therein.

[31] Including the earnings variable has no impact on the results. A separate equation was estimated for a subsample of households with Covered Earnings Records; the coefficients of the state-local tenure variables showed the same pattern as that reported below and the control variables had consistent signs, magnitudes, and significance as in the reported equation.

terms of wealth at 65. The coefficients for this group are never statistically significantly different from zero.

A Further Question

The analysis presented above implicitly assumes that state-local and private sector workers retire at the same time. But what if state and local workers had been retired for a significant period of time before they were observed at age 65? To take an extreme example, suppose they had retired from a state-local job and had received a pension and retiree health insurance for 15 years from 50 to 65. Such a pattern requires addressing two issues: 1) the value of pensions and retiree health insurance received during that period; and 2) the value of the leisure enjoyed. The financial aspect of such a situation is captured in the analysis. The pension can be viewed as equivalent to a wage, and to the extent that it is saved or avoids the drawdown of accumulated assets, it will be reflected in the final wealth figure. Similarly, savings from not having to purchase retiree health insurance will show up in wealth at 65. The really troublesome issue would be the fact that someone had 15 years of leisure. Valuing such leisure would be important in any final assessment of well-being at 65.

As it turned out, the leisure issue was not a major problem. Most of the respondents who had spent time in the state-local sector ended up retiring from a private sector job (see Figure 11). In terms of retirement age, those public sector employees who moved to the private sector actually retired later than workers who had spent their entire career in the private sector. Those who retired directly from their state-local job did retire early, but they accounted for only a small fraction of those with state and local employment (see Figure 12). In short, an issue that could have complicated the analysis turned out to not be that important.

A related issue is the treatment of the income received by state-local employees who leave their public sector job and move to the private sector. These individuals would be earning wages from their private employer and (if eligible) could be simultaneously receiving a pension from their former state-local employer. Again, to the extent that any of this income is saved, it will be reflected in the final wealth figure.

The bottom line from the preceding analysis is that households in which one or both of the individuals hold a state-local job for a short period of time end up with less wealth at retirement than private sector workers. Summary statistics not depicted show that these workers

do not differ from their counterparts along any dimension, but rather have just spent a short period in public sector employment.

Impact on the Public Sector Workforce: Insights from the Administrative Data

The first section discussed the delayed vesting and back-loading in public sector plans and its potential for harming short-service workers. The second section suggested, using data from the HRS, that indeed those couples with short-service state and local workers end up with less wealth at age 65. The goal of this section is to provide some insights on how the structure of public sector pensions affects the careers of state-local workers, exploiting the difference in vesting periods, Social Security coverage, and the introduction of hybrid defined benefit/defined contribution plans. The section reports on two exercises. The first uses data from actuarial valuations to confirm that the pattern of tenure reported in the HRS comports with that experienced by the plans themselves. The second explores the extent to which the probability of becoming vested and, once vested, staying until the earliest age for full benefits is related to vesting periods, Social Security coverage, and mandatory participation in a defined contribution plan.

Tenure Patterns from Actuarial Reports

Using each system's actuarial valuation, it is possible to generate the population of those who quit public employment before vesting, quit with deferred benefits, or retire in a given year. Detailed data on participant flows, which come from the plans' most recent (2009-2012) actuarial valuation report, were collected for 113 of the 126 plans in the PPD.[32] These plans provide demographic data on plan membership by age and years of service, accompanied by similar decrement tables stating the rate at which plan members of a given age and tenure are expected to terminate (leave service before retirement) or retire within the next year.[33] Within a given plan, benefit generosity and plan design often vary by occupation and over time, creating "tiers." Whenever possible, demographic tables were collected by plan tier and gender, and the relevant decrement rates applied to each group. When detailed demographic information was not

[32] Three of the 13 plans—Washington LEOFF Plan 1, Washington PERS Plan 1, and Washington Teachers Plan 1—were omitted because they have long been closed to new entrants. The remaining 10 did not provide the required data.

[33] The rates presented in the decrement tables are based on the plan's actual experience over some length of time, and are typically updated by the plan's actuaries every five years, when the plan performs an experience study.

available, the rates of the largest demographic subgroup were applied to the whole population; for example, female rates were often applied to the entire membership of teachers' plans. Appendix Table C1 lists the tiers used and the rates applied to those tiers for the sample plans.

The format of the demographic and decrement tables varies by plan. While the demographic tables are frequently presented by five-year age and tenure brackets (e.g. age 20-25 with 0-4 years of service), many plans provide certain age-by-tenure brackets at one-year intervals (e.g. age 20 with one year of service). In order to take advantage of this detailed information, all of the tables were transformed to one-year intervals. For demographic tables, members within a five-year bracket were divided evenly among the one-year brackets. For decrement tables, the rates within a five-year bracket were assumed to apply to all the members.[34]

The rates were then further transformed to be mutually exclusive according to tier-specific plan design. The retirement and separation rates presented in actuarial valuations do not always reflect plan design. Often, the rates are presented as a vector by either service or age only, not a combination of the two. Taken at face value, rates presented in this manner produce misleading results – for example, that all members with five years of service face a constant probability of retiring, whereas plan design limits retirement eligibility to members over age 65 with five years of service. For this reason, the retirement and separation rates were transformed to be mutually exclusive. All separation rates were set to zero once the members became eligible for retirement; similarly, all retirement rates were set to zero for periods occurring before the members were eligible for retirement. Early retirement rates were applied once members become eligible for reduced benefits, and were replaced by normal retirement rates once members were eligible for unreduced benefits. Retirement eligibility was gathered on a plan and tier-specific basis from the most recent actuarial valuation. Finally, if plans do not have a service requirement for retirement eligibility, the service requirement was set equal to the vesting period.

With these data in hand, the annual flow of separators eligible for deferred vested benefits is equal to,

[34] For example, a 0.2 termination rate for ages 20-24 became 0.2 at age 20, 0.2 at age 21, 0.2 at age 22, etc.

$$D_i = \sum_{a=20}^{100} \left(\sum_{t=0}^{80} \left(M_{i,a,t} * \pi_{i,a,t} * v_{i,a,t} * e_{i,a,t} \right) \right)$$

Where D_i is the total number of members in plan i terminating employment with deferred vested benefits. $M_{i,a,t}$ is the total number of plan members of age a and accrued tenure t. $\pi_{i,a,t}$ is the probability of an individual age a and accrued tenure t terminating before retirement eligibility, and $v_{i,a,t}$ is an indicator function which equals one if t meets the plan's vesting requirements, and zero otherwise. Finally, $e_{i,a,t}$ is an indicator function that takes the value zero if the member is eligible for retirement. The result is summed across tenure, with a minimum of zero years and a maximum of 80 years, and age, with a minimum of 20 and a maximum of 100. Similarly, the flow of separators ineligible for any benefits is equal to,

$$N_i = \sum_{a=20}^{100} \left(\sum_{t=0}^{80} \left(M_{i,a,t} * \pi_{i,a,t} * v_{i,a,t} * e_{i,a,t} \right) \right)$$

Where N_i is the total number of members in plan i terminating employment without deferred vested benefits and $v_{i,a,t}$ is an indicator function which equals one if t does not meet the plan's vesting requirements, and zero otherwise. The other variables are as defined above.

The flow of retirees out of the plan equals,

$$R_i = \sum_{a=20}^{100} \left(\sum_{t=0}^{80} \left(M_{i,a,t} * \pi_{i,a,t} * v_{i,a,t} * e_{i,a,t} \right) \right)$$

Where R_i is the total number of members retiring in plan i. $M_{i,a,t}$ is the total number of plan members of age a and accrued tenure t. $\pi_{i,a,t}$ is the retirement probability of an individual age a and accrued tenure t, and $v_{i,a,t}$ is an indicator function which equals one if t meets the plan's vesting requirements, and zero otherwise. $e_{i,a,t}$ is an indicator function that equals one if the member is eligible for either early or normal retirement according to plan design. The result is summed across tenure, with a minimum of zero years and a maximum of 80 years, and age, with a minimum of 20 and a maximum of 100.

Figure 13 presents the projected distribution by tenure and benefit status of participants in the 113 plans. Of those who leave, only 35 percent claim retirement benefits immediately, 19

percent will receive a deferred benefit based on their earnings at termination, and 47 percent leave without any promise of future benefits (see Figure 14).[35]

Table 4 shows the age and tenure of leavers by benefit status. For the non-vested, the average age is 38 with two years of service; for those with deferred benefits the average age is 44 with nine years of service; for retirees, the average age is 61 with 16 years of service.

The Relationship between Tenure Patterns and Plan Design

The next step is to use the tenure data to determine 1) the probability of a participant in a plan staying until vested and 2) the probability of a vested participant staying until the earliest eligibility for full retirement benefits. The design parameters of interest are the plan's vesting period, whether or not participants are covered by Social Security, and the presence of a mandatory defined contribution plan.[36]

The expected coefficients in the case of the vesting period are fairly straightforward. The longer the vesting period, the less likely the participant is to vest, and the more likely to stay until eligible for full retirement benefits. The positive impact simply represents the fact that with longer vesting the participant is older, and older people are more likely to stay until earliest eligibility.

Social Security coverage represents a much more complicated kettle of fish. On the one hand, coverage means that the combined Social Security/public plan benefit structure is less back-loaded than the public plan alone, because Social Security benefits accrue at a more even pace over the employee's work life. Thus, Social Security coverage would be expected to be associated with less vesting and less staying until earliest eligibility for full benefits. On the other hand, Social Security coverage means that the accruing retirement income is much more substantial than under a public plan alone. More substantial accruals create both an income and

[35] This pattern is similar to that found by the State of Maine Unified Retirement Plan Task Force (2010).

[36] The plans considered to have a defined contribution component were mandatory hybrid plans: Georgia ERS, Hawaii ERS, Indiana PERF, Indiana Teachers, Michigan Public Schools, Ohio Teachers, and Oregon PERS. Washington PERS 2/3, Washington School Employees' Plan 2/3, and Washington Teachers 2/3 each have a hybrid tier and a defined contribution tier. Alaska PERS and Alaska Teachers defined benefit plans were considered hybrids because both these plans have a mandatory supplemental defined contribution component. Florida RS was considered a hybrid because defined benefit members are permitted to switch to the optional defined contribution system at any point in their career. Finally, South Dakota PERS was also categorized as a hybrid because terminating members are returned not only their own contributions, but 85 percent of employer contributions on their behalf. This feature makes South Dakota PERS more portable than traditional defined benefit plans.

substitution effect. The income effect means the participant has more purchasing power and therefore the ability to buy leisure at older ages and to be more mobile at younger ages. That is, the variable would be expected to have a negative coefficient. However, the large accruals also raise the price of leisure and, perhaps, moving jobs, thereby coverage might encourage staying until eligibility and have a positive coefficient.

Several states have introduced mandatory hybrid plans that require participants to participate in both a defined benefit and defined contribution component. Participation in such a plan would be expected to reduce the probability of remaining until vested and of remaining until eligible for full benefits because the defined contribution component reduces the degree of back-loading of benefits.

The two dependent variables – probability of vesting and probability of staying to the earliest age for full benefits – are calculated from the decrement tables in the actuarial valuations. Calculating the cumulative probability of remaining with the plan through the vesting period requires multiplying a diagonal vector of marginal rates:

$$P_i(v|a) = \left(1 - \pi_{i,a,t}\right) * \left(1 - \pi_{i,a+1,t+1}\right) * \ldots * \left(1 - \pi_{i,a+n,t+n}\right)$$

$P_i(v|a)$ is the member's probability of remaining in plan *i* long enough to vest, conditional on the age at hire. $\pi_{i,a,t}$ is the marginal probability of terminating from the plan at hiring age *a* and accrued tenure at hire *t* (by definition, *t* is equal to zero). $P_i(v|a)$ is cumulative from *a* and *t* through *a*+*n* and *t*+*n*, where *n* is the number of years in the plan's vesting period.

Likewise for calculating the probability of remaining in the plan until the earliest age for full benefits once vested, given the hiring age:

$$P_i(r|a_v) = \left(1 - \pi_{i,a_v,t_v}\right) * \left(1 - \pi_{i,a_v+1,t_v+1}\right) * \ldots * \left(1 - \pi_{i,a_v+n,t_v+n}\right)$$

$P_i(r|a_v)$ is the member's probability of remaining in plan *i* long enough to retire, conditional on having already vested. π_{i,a_v,t_v} is the marginal probability of terminating from the plan at vesting age a_v and accrued tenure at vesting t_v. $P_i(r|a_v)$ is cumulative from a_v and t_v through $a_v + n$ and $t_v + n$, where *n* is the number of years remaining from a_v and t_v until the plan's earliest normal retirement eligibility (for those instances where the plan permits normal retirement at different combinations of age and tenure).

The analysis on probability of vesting takes the form:

$$P_i(v|a) = \beta_0 + \beta_1 SS_i + \beta_2 V_i + \beta_3 DC_i + \beta_4 W_i + \beta_5 T_i + \boldsymbol{\beta X} + \boldsymbol{\varepsilon}$$

Where the member's probability of vesting is linearly related to SS_i, the plan's Social Security coverage, the vesting period V_i , and participation in a defined contribution plan, DC_i. Social Security coverage is a dichotomous variable equal to one if a majority of plan members are covered by Social Security, and zero otherwise.[37] Additional variables include the ratio of average annual salaries in the plan divided by the average annual private-sector salary in the state, W_i; and whether the plan only covers teachers and school employees (including universities), T_i..[38] Finally, a vector of eight dichotomous variables, $\boldsymbol{X}$, captures the member's age at hire. The ages are broken into five-year brackets, from 20 to 54.

A similar regression is estimated for the probability, once vested, of remaining until the earliest age for full benefits:

$$P_i(r|a_v) = \beta_0 + \beta_1 SS_i + \beta_2 V_i + \beta_3 DC_i + \beta_4 W_i + \beta_5 T_i + \boldsymbol{\beta X} + \boldsymbol{\varepsilon}$$

The equations are estimated using ordinary least squares, because the dependent variables do not take on a value of zero or one, but rather equal a specific probability associated with each individual achieving each of the two hurdles. Because police and fire personnel have such unique career paths, vesting provisions, and retirement options, the equation is limited to general employees and teachers.

[37] The coverage data come from the *Public Plans Database*, but were initially compiled by the National Association of State Retirement Administrators' *Public Fund Survey*. The coverage classification was subsequently checked against a U.S. Government Accountability Office (2010) report that lists the percent of earnings in each state covered by Social Security. If all the PPD plans within a state were classified as having Social Security, the GAO report was expected to show at least 80 percent of earnings covered by Social Security. Similarly, if all the PPD plans within a state were classified as *not* having Social Security, the GAO report should have shown at least 80 percent of earnings *not* covered. For states where some plans are classified by the PPD as having Social Security and others are not, an average of the Social Security variable, weighted by payroll, should have resulted in a percentage of covered payroll similar to that in the GAO study. In the rare instance of any discrepancies, contact with plan administrators provided helpful guidance. The only remaining question was how to classify plans with significant numbers of both covered and uncovered workers. In these instances, the PFS/PPD classifications were retained.

[38] The average plan wage was obtained by dividing total payroll in the PPD by active members in the PPD. The average private sector wage was produced by the March Supplement of the *Current Population Survey* (2011). The private sample was limited to non-military workers between the ages of 16 and 75, earning more than $9,000 per year.

The results for the vesting equation are shown in Figures 15. (Full regressions and summary statistics are shown in Appendix Tables C2 and C3.) The probability of vesting is related to the public/private wage ratio and the vesting period, both of which have statistically significant coefficients. The higher the average wage in the plan relative to wages in the private sector, the more likely the participant is to stay until vested; the longer the vesting period, the less likely. In addition, generally the later the age at which people are hired, the more likely they are to remain until vesting. Neither Social Security nor participation in a defined contribution plan have a statistically significant effect. Thus, the main message from the vesting equation is that long vesting periods are likely to lead to participants leaving with no accrued benefits.

The results for the probability of remaining in the plan until the earliest age for full benefits are presented in Figure 16. (Full regressions and summary statistics are shown in Appendix Tables C4 and C5.) Again, the ratio of public to private wages is related positively to remaining on the job. And again the vesting period has a statistically significant coefficient, although it is positive as opposed to negative in the vesting equation. As noted, the most straightforward interpretation is that the longer the vesting period, the older the vested participant and the more likely to remain. And again the probability of remaining rises with the age of hire. In the retirement equation, as opposed to the vesting equation, both Social Security coverage and mandatory participation in a defined contribution plan have statistically significant coefficients. In both cases, the coefficients have a negative sign. One way to interpret this result is that these alternative sources of retirement income moderate the back-loading of the plan and reduce the likelihood that people will remain. That is, despite the fact that plans with Social Security are significantly more generous, when participants have the ability to leave they take it.

Conclusion

This paper has used a variety of approaches to explore the impact of final earnings defined benefit plans on the well-being of employees. Both a stylized model and evidence from the HRS show that final earnings plans are back-loaded and short change short-service employees. It is very difficult to argue that this outcome is the result of an optimal design to attract and retain workers who will stay with their employers for their entire careers. The design varies dramatically with the presence or absence of Social Security coverage, and it is unlikely that Social Security coverage is systematically related to the desired workforce profile.

Thus, continued reliance solely on final earnings defined benefit plans raises human resource and equity issues as well as financial concerns. On the financial side, the risk is that benefits are not funded on a timely basis, shifting costs to future taxpayers. The financial crisis has also demonstrated that fluctuations in financial markets put benefits at risk for not only current workers but also retirees. On the human resource side, final earnings plans produce strongly back-loaded benefits. These incentives may be desirable for some types of employees, but it is unlikely that they are appropriate for all. More importantly, for the topic of this paper, they deprive short-term employees of retirement protection, especially for those systems that do not participate in Social Security. Thus, human resource considerations, like the financial issues, argue for less reliance on final pay defined benefit plans.

References

Allen, Steven, Robert Clark, and Ann McDermed. 1993. "Pensions, Bonding, and Lifetime Jobs." *Journal of Human Resources* 28(3): 463-81.

Coe, Norma B., and Anthony Webb. 2009. "Actual and Anticipated Inheritance Receipts." CRR WP 2009-32. Chestnut Hill, MA: Center for Retirement Research at Boston College.

Coile, Courtney, and Jonathan Gruber. 2000a. "Social Security Incentives for Retirement." In *Themes in the Economics of Aging*, edited by David Wise. Chicago: University of Chicago Press.

_____. 2000b. "Social Security and Retirement." Working Paper 7830. Cambridge, MA: National Bureau of Economic Research.

Costrell, Robert M. and Michael Podgursky. 2009. "Peaks, Cliffs, and Valleys: The Peculiar Incentives in Teacher Retirement Systems and their Consequences for School Staffing." *Education Finance and Policy* 4(2): 175-211.

Diamond, Peter A., Alicia H. Munnell, Gregory Leiserson, and Jean-Pierre Aubry. 2010. "The Problem with State-Local Final Pay Plans and Options for Reform." *State and Local Issue in Brief* 12. Chestnut Hill, MA: Center for Retirement Research at Boston College.

Friedberg, Leora, and Anthony Webb. 2005. "Retirement and the Evolution of Pension Structure." *The Journal of Human Resources* 40(2): 281-308.

Gustman, Alan L., Thomas L. Steinmeier, and Nahid Tabatabai. 2010. *Pensions in the Health and Retirement Study.* Cambridge, MA: Harvard University Press.

Hirsch, Barry T. and David A. Macpherson. 2010. *Union Membership and Coverage Database*. Available at: http://www.unionstats.com.

Ippolito, Richard A. 1997. *Pension Plans and Employee Performance.* University of Chicago Press.

Lazear, Edward P. 1986. "Retirement from the Labor Force." In *Handbook of Labor Economics*, Volume 1, edited by Orley Ashenfelter and Richard Layard. New York: Elsevier Science Publishers.

McArdle, Frank, Amy Atchison, Dale Yamamoto, Michelle Kitchman Strollo, and Tricia Neuman. 2006. "Retiree Health Benefits Examined: Findings from the Kaiser/Hewitt 2006 Survey on Retiree Health Benefits." The Henry J. Kaiser Family Foundation.

Monk, Courtney, and Alicia H. Munnell. 2009. "The Implications of Declining Retiree Health Insurance." CRR WP 2009-15. Chestnut Hill, MA: Center for Retirement Research at Boston College.

Munnell, Alicia H., Jean-Pierre Aubry, Joshua Hurwitz, and Laura Quinby. 2011. "Are State-local Workers Overpaid?" *State and Local Issue in Brief* 20. Chestnut Hill, MA: Center for Retirement Research at Boston College.

National Association of State Retirement Administrators. 2010. *Public Fund Survey, FY2010* (PFS). Washington, DC.

Public Plans Database (PPD), 2009-2012. Center for Retirement Research at Boston College and Center for State and Local Government Excellence.

Salop, Joanne, and Steven Salop. 1976. "Self-Selection and Turnover in the Labor Market." *Quarterly Journal of Economics* 90(4): 620-27.

Special Commission to Study the Massachusetts Contributory Retirement System. 2009. "Final Report of the Special Commission to Study the Massachusetts Contributory Retirement System." Boston, Mass.

State of Maine Unified Retirement Plan Task Force. 2010. *Task Force Study and Report: Maine State Employee and Teacher Unified Retirement Plan*. Augusta, ME.

University of Michigan. *Health and Retirement Study* (HRS), 1992-2008. Ann Arbor, MI.

U.S. Bureau of Labor Statistics. *Consumer Price Index* (CPI), 2012. Washington, DC.

U.S. Census Bureau. 2010. *Annual Public Employment Survey*. Washington, DC.

U.S. Department of Labor. *Current Population Survey* (CPS), 1990-2011. Washington, DC.

U.S. Government Accountability Office. 2010. *Social Security Administration: Management Oversight Needed to Ensure Accurate Treatment of State and Local Government Employees.* GAO-10-938. Washington: U.S. Government Printing Office.

U.S. Social Security Administration. 2012. *The Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds.* Washington, DC: U.S. Government Printing Office.

U.S. Centers for Medicare and Medicaid Services. 2011. *The Annual Report of the Boards of Trustees of the Federal Hospital Insurance and Federal Supplementary Medical Insurance Trust Funds.* Washington, DC: U.S. Government Printing Office.

Utkus, Stephen P., and Jean A. Young. 2010. "Distribution decisions among retirement-age defined contribution plan participants." Vanguard Research. Valley Forge, PA: The Vanguard Group, Inc.

Table 1. *State and Local Full-time Equivalent Employees by Function, 2010, in Millions*

Activity	State	Local	Total
Education	1.8	7.1	8.9
Elementary and Secondary	0.1	6.8	6.9
Higher Education	1.7	0.3	2.0
Protective Services	0.8	1.7	2.4
Health	0.6	0.8	1.4
Community Development*	0.6	0.8	1.4
Transportation	0.3	0.5	0.8
Financial and Other Administration	0.2	0.5	0.7
Public Welfare	0.2	0.3	0.5
Public Utilities and Waste Management	0.0	0.5	0.5
Total	4.4	12.2	16.6

*Includes Libraries, Housing, Community Development, Environment, Recreation, and All Other.
Source: U.S. Census Bureau, *Annual Public Employment Survey* (2011).

Table 2. *Summary Statistics for Regression on Total Household Wealth, 1996-2006*

Variable	Mean	Standard Deviation	Minimum	Maximum
Total wealth	977329	1470860	535	3.76E+07
S/L 1 to 15 [R]	0.073	0.260	0	1
S/L 15 to 50 [R]	0.062	0.241	0	1
S/L over 50 [R]	0.089	0.285	0	1
S/L 1 to 15 [S]	0.068	0.252	0	1
S/L 15 to 50 [S]	0.089	0.285	0	1
S/L over 50 [S]	0.072	0.259	0	1
Education [R]	12.52	3.057	0	17
Education [S]	12.40	2.566	0	17
Black [R]	0.069	0.254	0	1
Hispanic [R]	0.061	0.240	0	1
Age [S]	61.50	5.324	35	85
Probability of Living to 75 [H]	78.68	18.08	10	100
Stocks % [H]	22.27	32.75	0	100
Risk aversion [R]	0.214	0.410	0	1
Risk aversion [S]	0.355	0.479	0	1
Long horizon [R]	0.498	0.500	0	1
Long horizon [S]	0.461	0.499	0	1
Career spouse [S]	0.696	0.460	0	1
Expect inheritance [H]	63266	233964	0	5929255
Received inheritance [H]	52607	201789	0	4733007

Source: Authors' calculations from *Health and Retirement Study* (1992-2006).

Table 3. *Regression Results on the Log of Total Household Wealth, 1996-2006*

Variable	Coefficient
S/L 1 to 15 [R]	-0.1052
	0.0768
S/L 15 to 50 [R]	-0.1153
	0.0912
S/L over 50 [R]	0.1632 **
	0.0772
S/L 1 to 15 [S]	-0.1203
	0.0785
S/L 15 to 50 [S]	-0.0077
	0.0863
S/L over 50 [S]	0.2043 **
	0.0869
Education [R]	0.0476 ***
	0.0103
Education [S]	0.0425 **
	0.0177
Black [R]	-0.4101 ***
	0.0808
Hispanic [R]	-0.3224 ***
	0.1210
Age [S]	0.0219 ***
	0.0041
Probability of living to 75 [H]	0.0037 ***
	0.0013
Stocks %	0.0045 ***
	0.0008
Risk aversion [R]	-0.0236
	0.0488
Risk aversion [S]	0.3182 ***
	0.0469
Long horizon [R]	0.1839 ***
	0.0475
Long horizon [S]	0.1176 ***
	0.0457
Career spouse	0.3104
	0.2254
Career * ed [S]	-0.0200
	0.0189

Received inheritance [H]	0.0278 ***
	0.0043
Expect inheritance [H]	-0.0197 ***
	0.0051
Constant	9.4740 ***
	0.3707
R-squared	0.3773
Number of Observations	1476

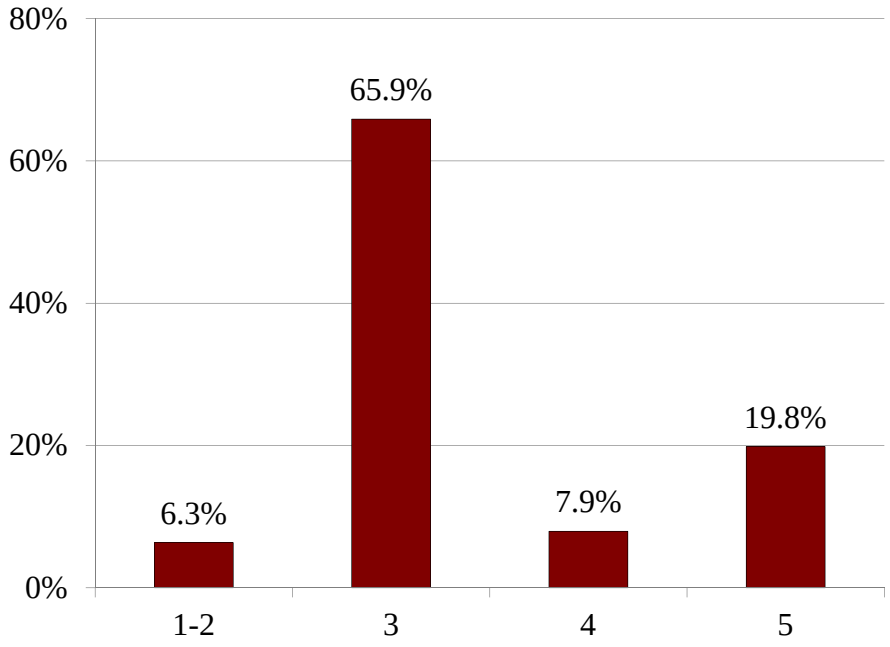
Note: Robust standard errors are in parentheses. Additional controls not depicted include vectors of occupation, firm size, and regional dummy variables. [R] denotes the respondent, [S] denotes the spouse, and [H] denotes the household. Coefficients are significant at the 10-percent level (*), the 5-percent level (**), or the 1-percent level (***).
Source: Authors' calculations from *Health and Retirement Study* (1992-2006).

Table 4. *Age and Tenure of Leavers by Benefits Status, 2011*

Characteristics	Non-Vested	Deferred Benefit	Retired
Average age	37.9	41.8	60.6
Average tenure	1.5	9.1	16.1

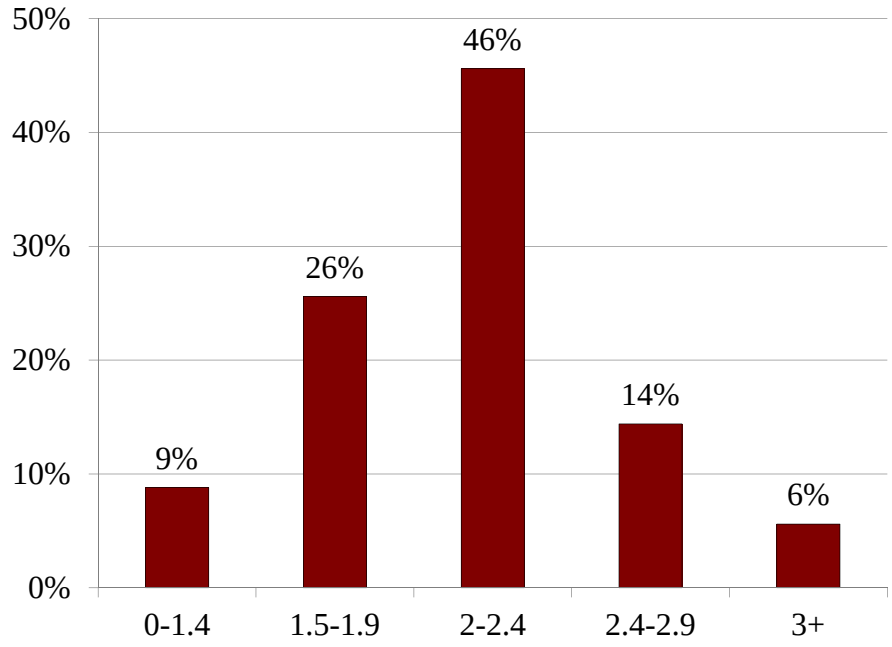
Source: Authors' estimates from various actuarial reports.

Figure 1. *Distribution of State and Local Plans, by Years in Averaging Period, 2009*



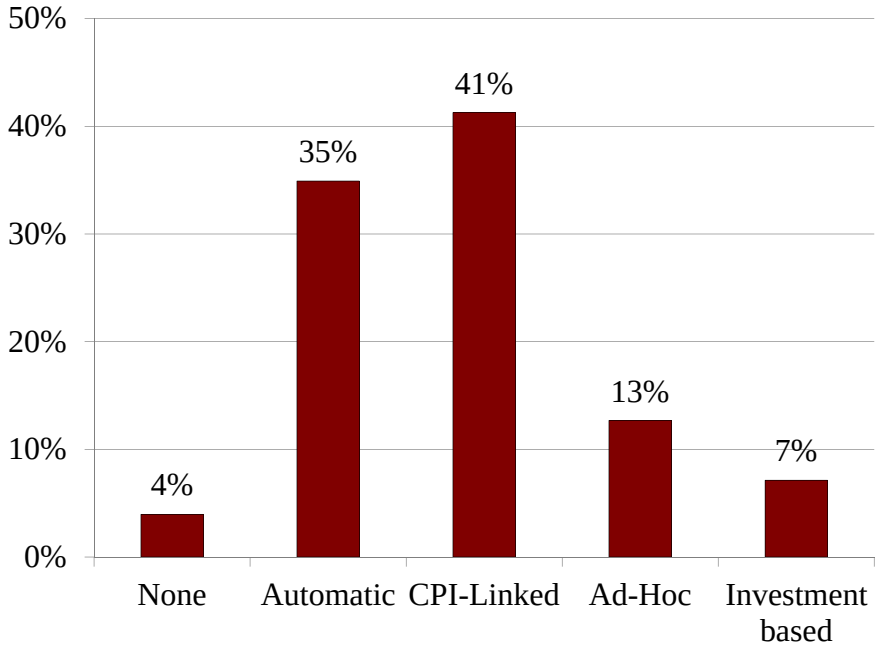
Source: *Public Plans Database* (2009).

Figure 2. *Distribution of State and Local Plans, by Benefit Factor, 2009*



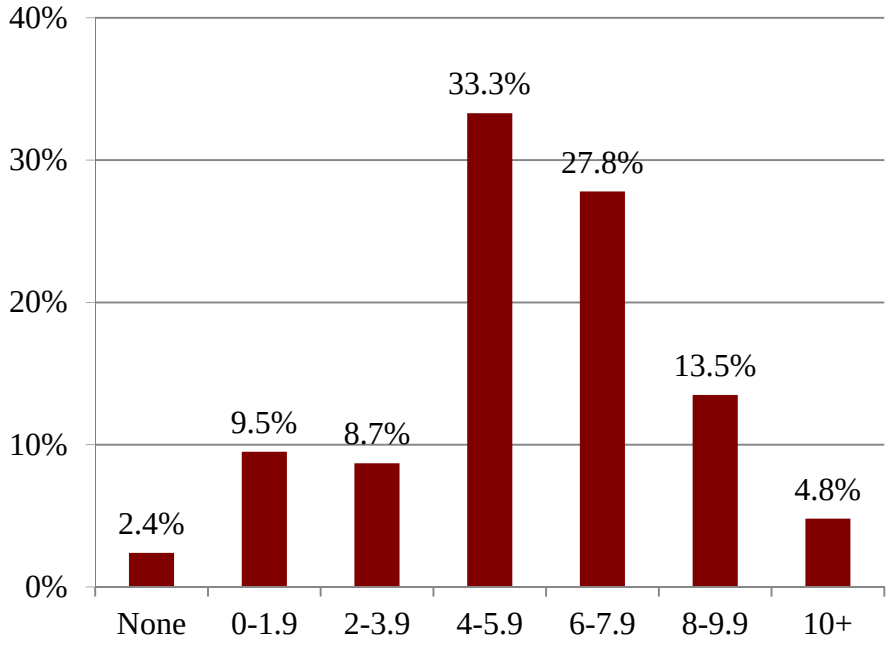
Source: *Public Plans Database* (2009).

Figure 3. *Distribution of State and Local Plans, by COLA Type, 2009*



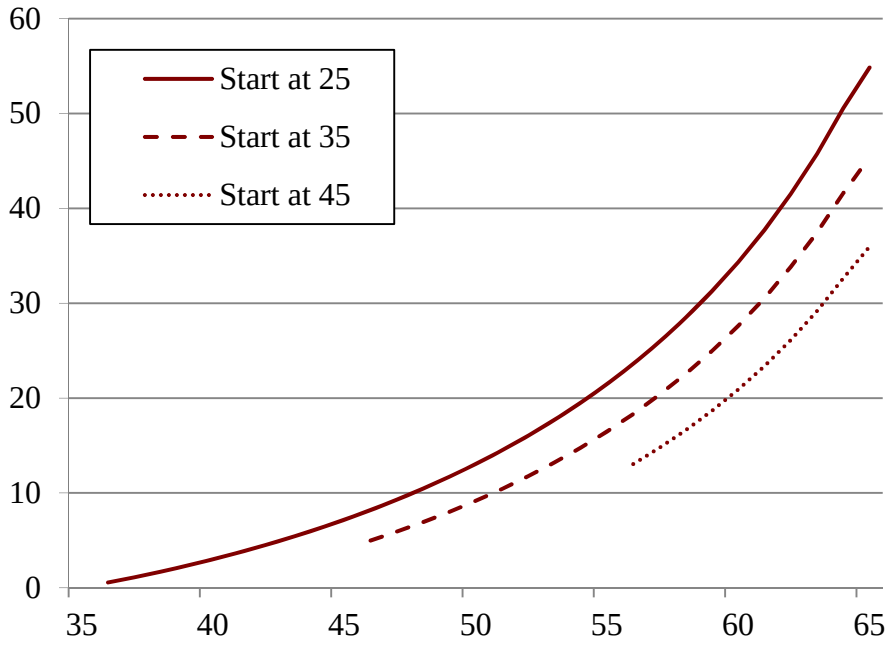
Source: *Public Plans Database* (2009).

Figure 4. Distribution of State and Local Plans by Employee Contribution Rate, 2010



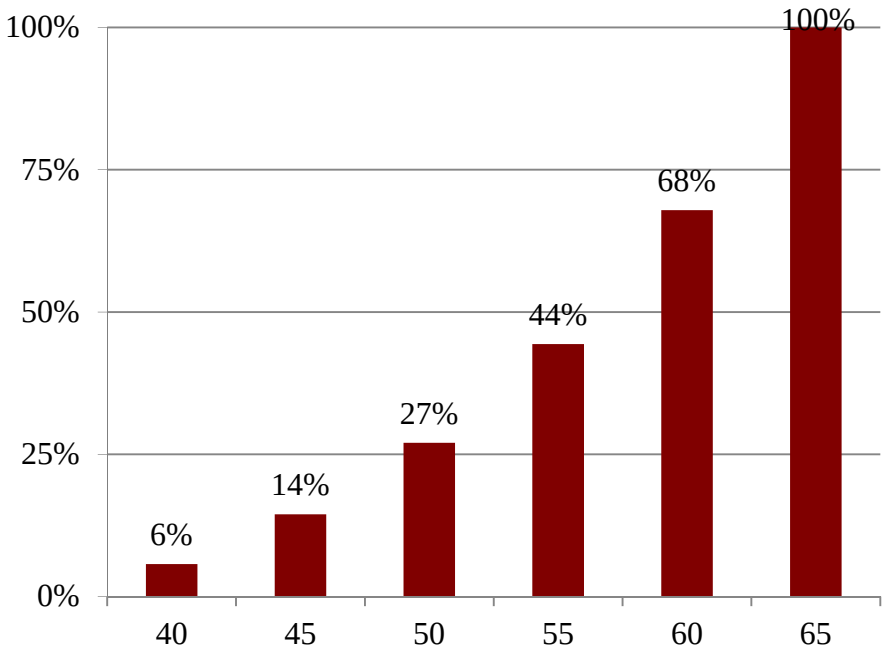
Source: *Public Plans Database* (2010).

Figure 5. *Increase in Lifetime Pension Benefit as a Percentage of Annual Earnings*



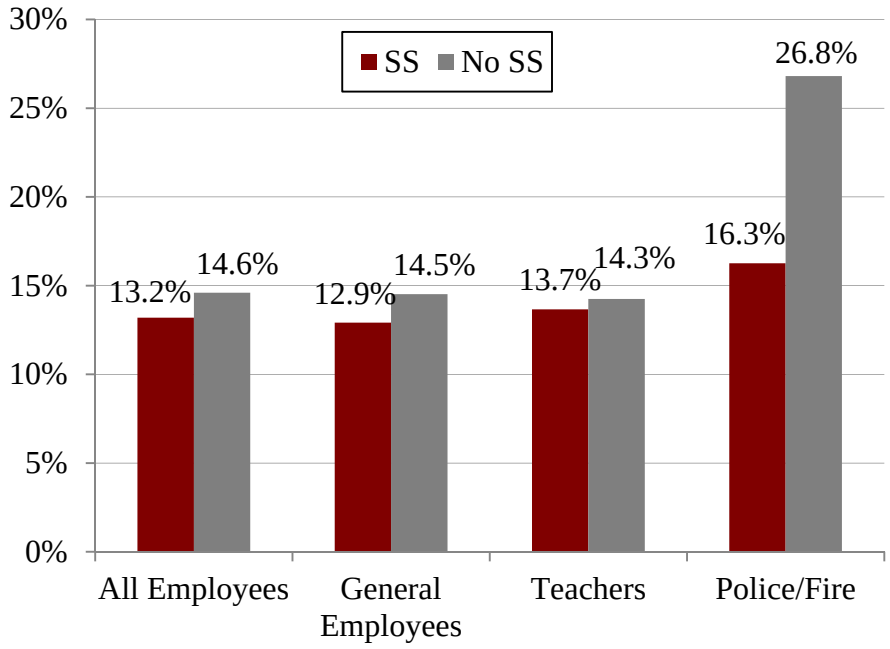
Source: Authors' calculations.

Figure 6. *Percent of Lifetime Pension Benefits Earned over an Employee's 30-year Career, Starting at Age 35*



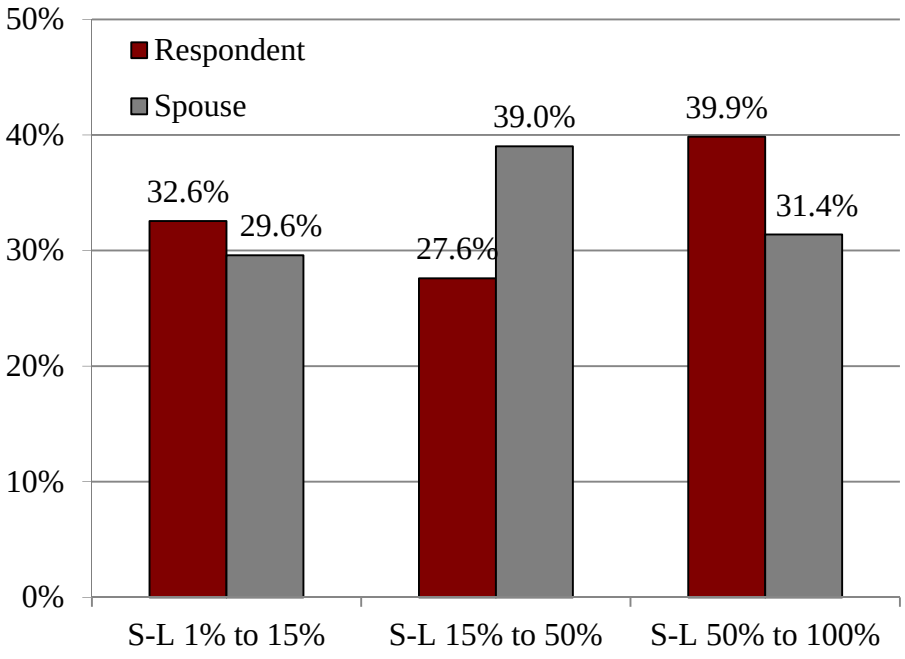
Source: Authors' calculations from the *Public Plans Database* (2010).

Figure 7. *Total Normal Cost as a Percentage of Payroll, by Plan Type and Social Security Coverage, 2010*



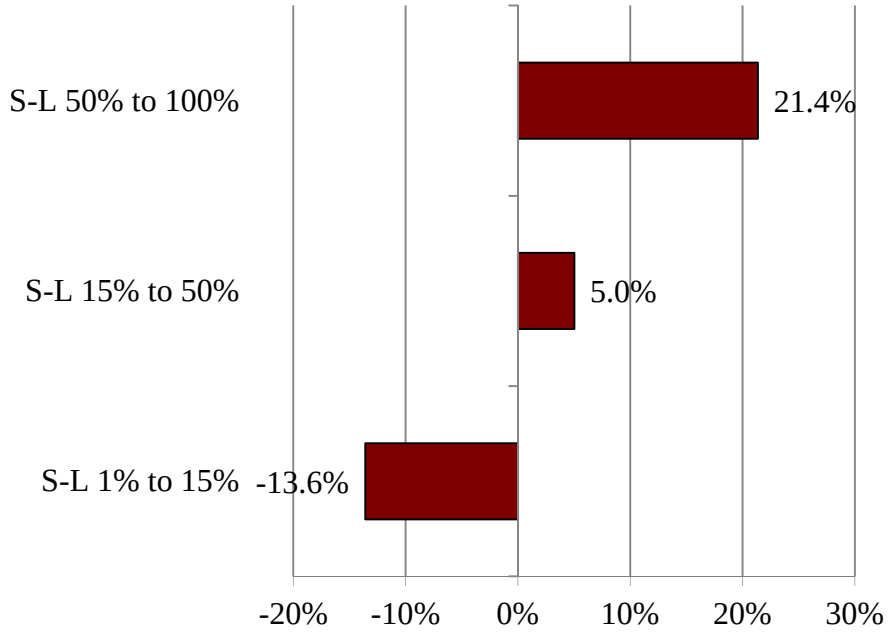
Sources: *Public Plans Database* (2010) and Government Accountability Office (2010).

Figure 8. *Distribution of HRS State/Local Workers by Percent of Career Spent in the State/Local Sector, 1996-2006*



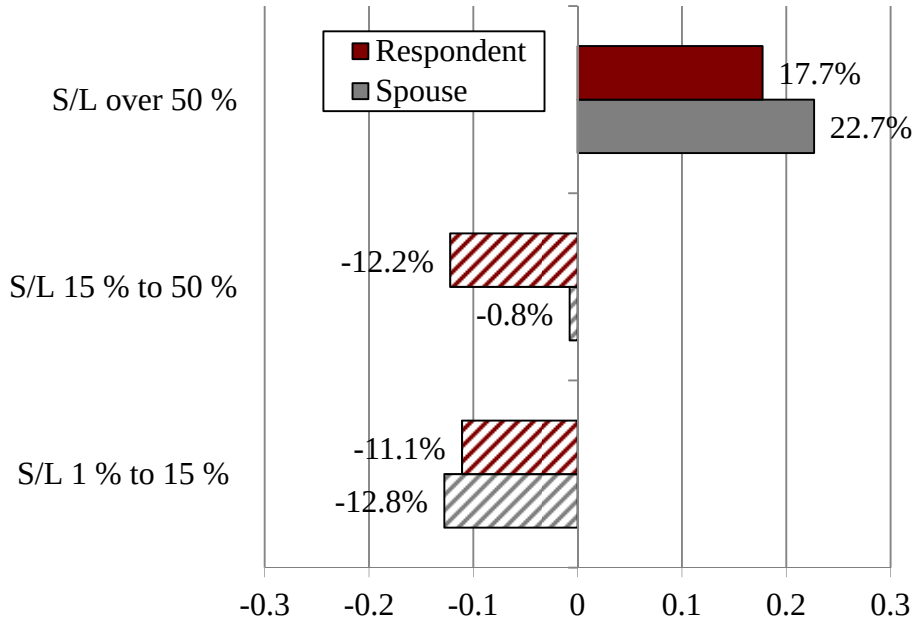
Source: Authors' calculations from *Health and Retirement Study* (1992-2006).

Figure 9. *Ratio of Age-65 Wealth for HRS Households with State/Local Employment versus HRS Households with Private Sector Employment, by State/Local Tenure 1996-2006*



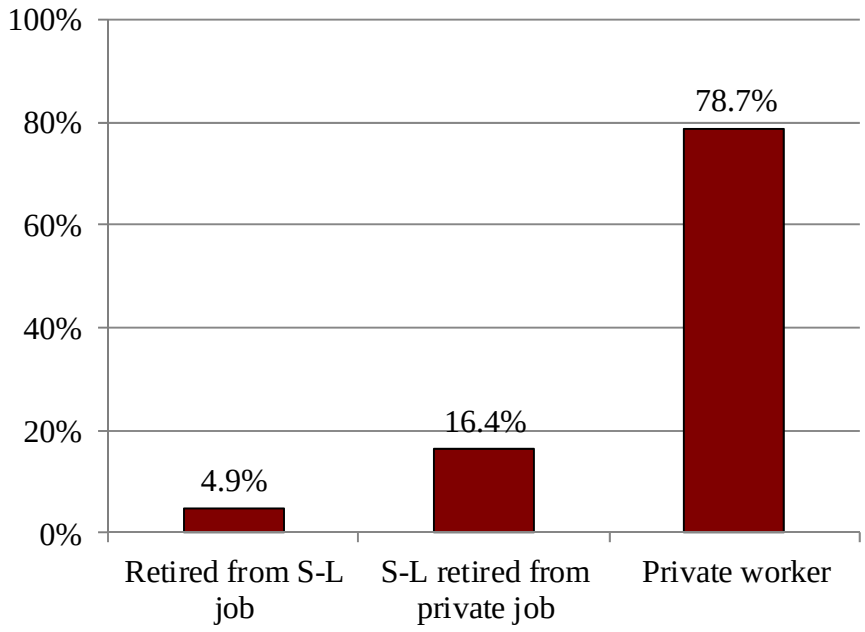
Source: Authors' calculations from *Health and Retirement Study* (1992-2006).

Figure 10. *Impact of Percent of Career as a State/Local Worker on Relative Wealth of Public Sector versus Private Sector Households at Age 65, 1996 -2006*



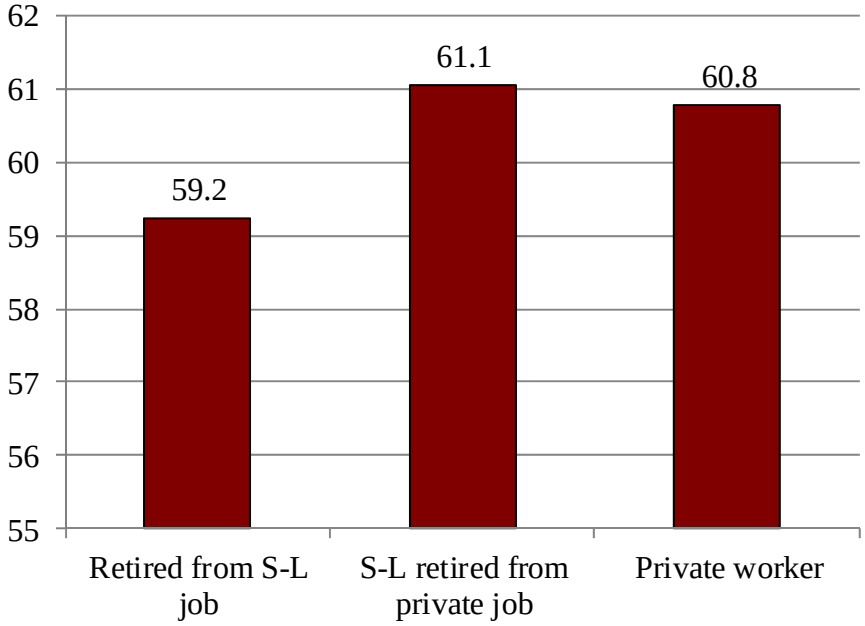
Note: Solid bars indicate the coefficient is statistically significant at least at the 5-percent level. The bars represent the relationship (percent) between the characteristic and total wealth.
Source: Authors' calculations from *Health and Retirement Study* (1992-2006).

Figure 11. *Distribution of HRS Workers by Job at Retirement, 1996-2006*



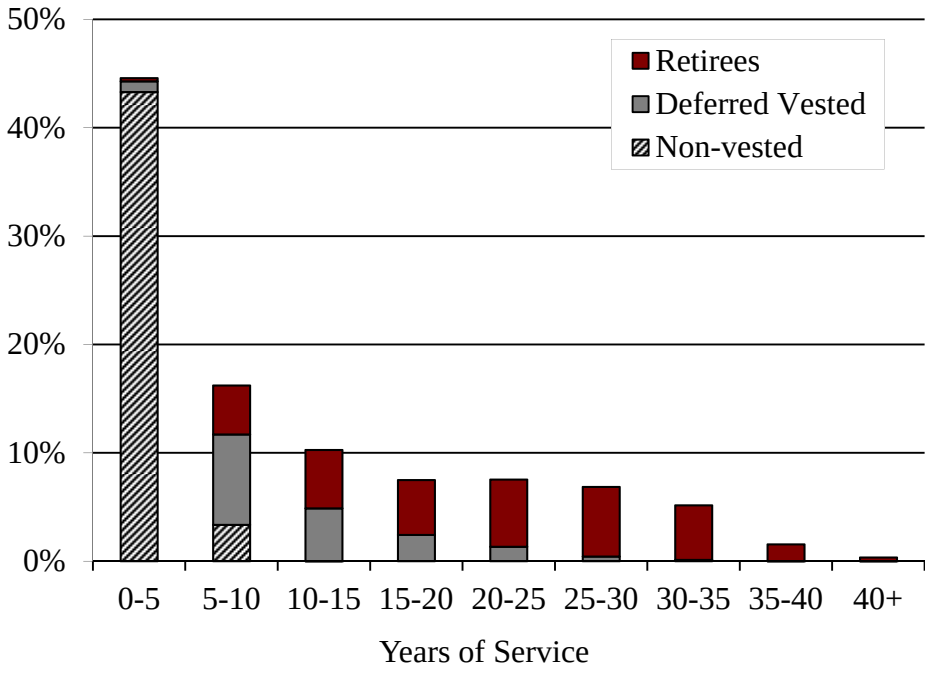
Source: Authors' calculations from *Health and Retirement Study* (1992-2006).

Figure 12. *Average Retirement Age of HRS Men Who Have Retired by Age 65, by Sector*



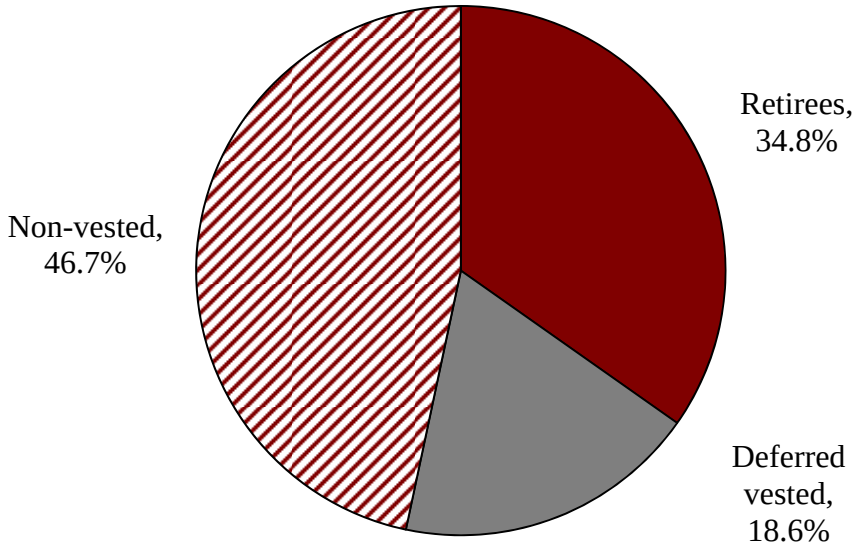
Source: Authors' calculations from *Health and Retirement Study* (1992-2006).

Figure 13. *Distribution of Leavers in Public Plans Database by Tenure and Benefit Status, 2011*



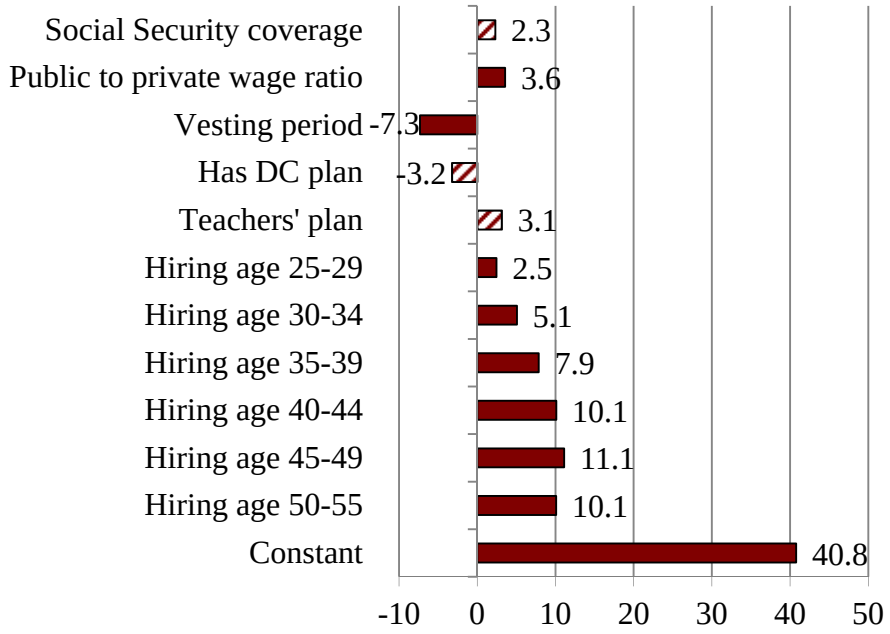
Source: Authors' estimates from various actuarial reports.

Figure 14. *Percent of Leavers by Benefit Status in Public Plans Database*



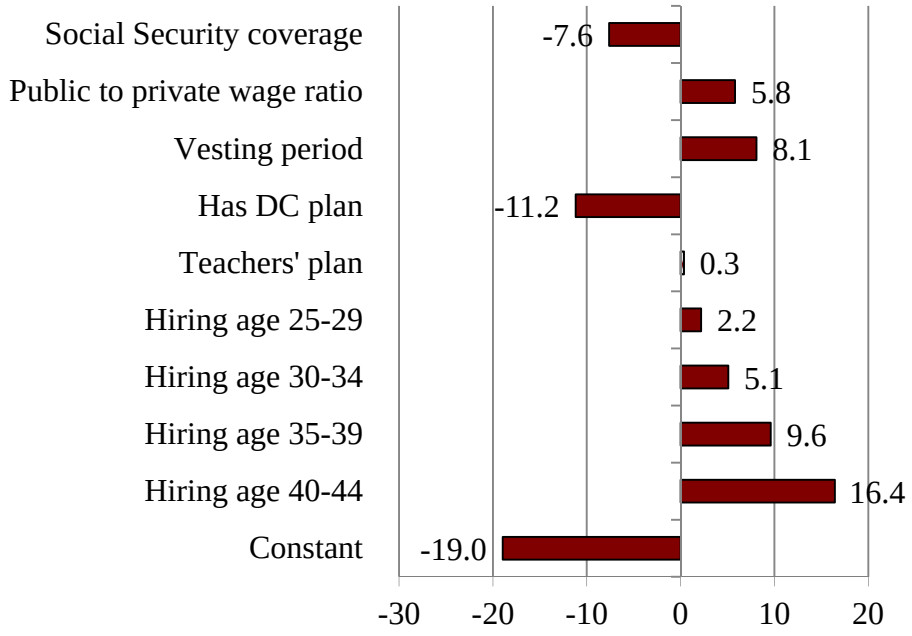
Source: Authors' calculations from various actuarial reports.

Figure 15. *Coefficients for Regression on Probability of Vesting, Excluding Police and Fire Plans, 2010*



Notes: Solid bars indicate significance at the 10 percent level or better. The association is for a change from zero to one for dichotomous variables, and a one-standard deviation change for continuous variables.
Sources: Authors' estimates from the *Current Population Survey* (2011) and the *Public Plans Database* (2010).

Figure 16. *Coefficients for Regression on Probability of Remaining in Plan until Earliest Normal Retirement Eligibility Once Vested, Excluding Police and Fire Plans, 2010*



Notes: Solid bars indicate significance at the 10 percent level or better. The association is for a change from zero to one for dichotomous variables, and a one-standard deviation change for continuous variables.
Sources: Authors' estimates from the *Current Population Survey* (2011) and the *Public Plans Database* (2010).

Appendices

Table A1. *Regression Results on Ratio of Average Plan Wage to Average State Private Sector Wage, Excluding Police and Fire Plans, 2010*

Variable	Coefficient	
Social Security coverage	0.0988	**
	(0.045)	
Total normal cost	0.0174	***
	(0.004)	
Closed plan	0.2927	***
	(0.090)	
Teachers' plan	0.0825	**
	(0.038)	
Union membership	0.0027	***
	(0.001)	
Constant	0.5776	***
	(0.075)	
R-Squared	0.3265	
Number of observations	113	

Notes: Robust standard errors are in parentheses. Coefficients are significant at the 10-percent (*), 5-percent (**), or 1-percent (***) levels.
Sources: Authors' estimates from the *Current Population Survey* (2011), Hirsch and Macpherson (2010), and the *Public Plans Database* (2010).

Table A2. *Summary Statistics for the Regression on Ratio of Average Plan Wage to Average State Private Sector Wage, Excluding Police and Fire Plans, 2010*

Variable	Mean	Standard deviation	Minimum	Maximum
Public to private wage ratio	1.015	0.221	0.508	1.706
Social Security coverage	0.761	0.428	0	1
Total normal cost	12.44	4.404	5.850	32.84
Closed plan	0.053	0.225	0	1
Teachers' plan	0.345	0.478	0	1
Union membership	36.89	19.44	6.2	72.4

Sources: Authors' calculations from the *Current Population Survey* (2011), Hirsch and Macpherson (2010), and the *Public Plans Database* (2010).

Table A3. *Regression Results on Total Normal Cost as a Percent of Payroll, Excluding Police and Fire Plans, 2010*

Variable	Coefficient	
Social Security coverage	-2.9566	***
	(0.835)	
Public to private wage ratio	7.5315	***
	(2.172)	
Closed plan	-5.8957	***
	(1.665)	
Teachers' plan	-0.9086	
	(0.856)	
Union membership	0.0317	
	(0.023)	
Constant	6.5105	***
	(2.335)	
R-Squared	0.2654	
Number of observations	113	

Notes: Robust standard errors are in parentheses. Coefficients are significant at the 10-percent (*), 5-percent (**), or 1-percent (***) levels.
Sources: Authors' estimates from the *Current Population Survey* (2011), Hirsch and Macpherson (2010), and the *Public Plans Database* (2010).

Table A4. *Summary Statistics for Regression on Total Normal Cost as a Percent of Payroll, Excluding Police and Fire Plans, 2010*

Variable	Mean	Standard deviation	Minimum	Maximum
Total normal cost	12.44	4.404	5.850	32.84
Social Security coverage	0.761	0.428	0	1
Public to private wage ratio	1.015	0.221	0.508	1.706
Closed plan	0.053	0.225	0	1
Teachers' plan	0.345	0.478	0	1
Union membership	36.89	19.44	6.2	72.4

Sources: Authors' calculations from the *Current Population Survey* (2011), Hirsch and Macpherson (2010), and the *Public Plans Database* (2010).

Figure B1. *Derivation of HRS Sample*

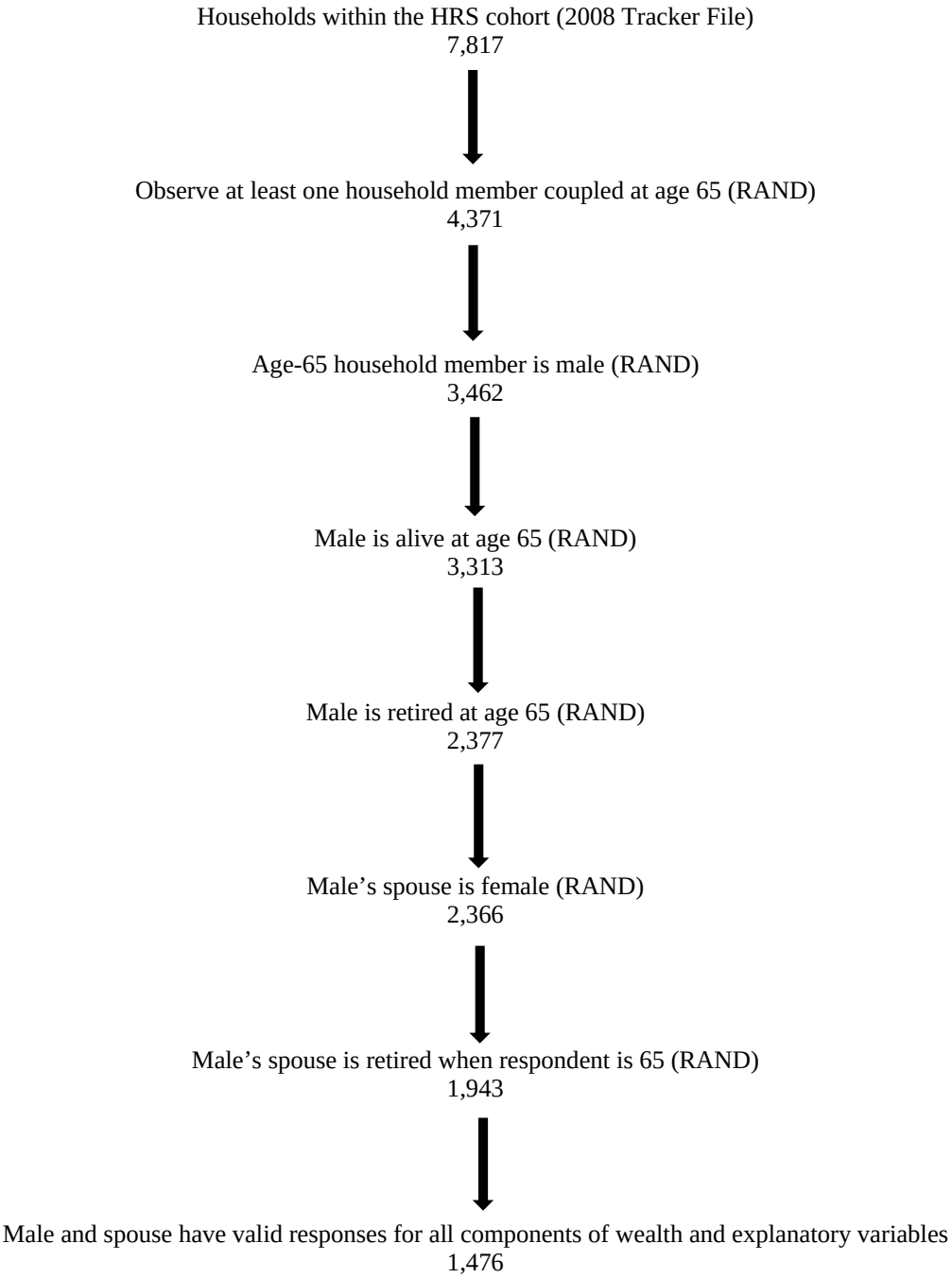


Table C1. *Information Used for Construction of Plan Administrative Data*

Plan Name	Valuation Year	Tiers Used	Percent of Plan Members Male	Male or Female Rates Used
Alabama ERS	2011	State, Local		Male
Alabama Teachers	2010	All members	26.5%	Female
Alaska PERS	2010	Others		Male
Alaska Teachers	2010	All members		Female
Arizona Public Safety Personnel	2011	All members	82.7%	Male
Arizona SRS	2011	State, County, Other Education	32.6%	Female
Phoenix ERS	2011	All members		Female
Arkansas PERS	2011	State and Local (Excluding General Assembly)		Female
Arkansas Teachers	2011	All members (Education rates used)	21.7%	Female
California PERF	2010	State Misc. Tier 1, Schools, State Police Officer		Both
California Teachers	2010	Male, Female		Both
Contra Costa County	2010	General Tier 3 Enhanced, Safety Tier A Enhanced		Male
LA County ERS	2011	General	37.2%	Female
San Diego County	2011	General Tier A, Safety Tier A		Female
San Francisco City & County	2011	All members (Miscellaneous rates used)		Female
University of California	2011	All members		Female
Colorado Municipal	2010	Local		Female
Colorado School	2010	School		Female
Colorado State	2010	State		Female
Denver Employees	2011	All members		Female
Denver Schools	2009	Male, Female		Both
Connecticut SERS	2010	Tier II- Others, Tier IIA - Others		Female
Connecticut Teachers	2010	All members		Female
DC Police & Fire	2011	Police, Fire		Male
DC Teachers	2011	Teachers		Female
Delaware State Employees	2011	All members		Female
Florida RS	2011	Regular (Male, Female)		Both
Georgia ERS	2010	All members		Female
Georgia Teachers	2010	All members		Female

Hawaii ERS	2011	Hybrid plan (General Employees, Teachers)	37.9%	Female
Chicago Teachers	2010	All members		Female
Illinois Municipal	2010	Regular	37.1%	Female
Illinois SERS	2011	Pre-2011 (Regular SS covered, Regular Non-SS covered, Alternative SS-covered, Alternative non-SS covered)		Both
Illinois Teachers	2011	Pre-2005 (Full-time teachers)		Both
Illinois Universities	2011	Pre-2011 (General)		Both
Indiana PERF	2011	All members		Female
Indiana Teachers	2011	Pre-1996 Account, Post-1996 Account		Female
Iowa PERS	2011	Regular membership		Female
Kansas PERS	2010	State (Tier 1), School (Tier 1), Local (Tier 1)		Female
Kentucky ERS	2011	Non-hazardous		Female
Kentucky Teachers	2011	All members		Female
Louisiana SERS	2011	Regular before 7/06, Regular after 7/06		Unisex
Louisiana Teachers	2011	All members	17.4%	Female
Maine Local	2011	Regular, Special		Unisex
Maine State and Teacher	2011	State, Teachers		Female
Maryland PERS	2011	Employees		Female
Maryland Teachers	2011	Teachers		Female
Massachusetts SERS	2011	Group 1		Female
Massachusetts Teachers	2011	All members		Female
Michigan Municipal	2010	All members		Unisex
Michigan Public Schools	2010	Teachers		Female
Michigan SERS	2010	All members		Female
Duluth Teachers	2011	All members		Unisex
Minnesota PERF	2011	All members		Female
Minnesota State Employees	2011	All members		Female
Minnesota Teachers	2011	All members		Female
St. Paul Teachers	2011	All members		Female
Mississippi PERS	2011	All members		Female
Missouri DOT and Highway Patrol	2011	MoDot Closed, MoDot 2000, MoDot 2011		Male
Missouri Local	2010	General Members (Male, Female)	54.7%	Male
Missouri PEERS	2011	All members	25.6%	Female
Missouri State Employees	2011	All members	39.5%	Female

Missouri Teachers	2011	All members	22.6%	Female
St. Louis School Employees	2011	All members		Female
Montana PERS	2011	All members		Female
Montana Teachers	2011	All members		Female
Nebraska Schools	2011	All members		Female
Nevada Police Officer and Firefighter	2011	All members		Male
Nevada Regular Employees	2011	All members		Female
New Hampshire Retirement System	2011	Employees, Teachers	31.7%	Female
New Jersey PERS	2011	State, Local		Unisex
New Jersey Police & Fire	2011	All members		Unisex
New Jersey Teachers	2011	All members		Both
New Mexico PERF	2011	State General, Municipal General		Female
New Mexico Teachers	2011	All members		Female
New York City ERS	2011	Tier 4 Basic 62/5 plan (Male, Female; General employee rates)		Unisex
New York State Teachers	2011	Tier IV (Male, Female)		Both
NY State & Local ERS	2011	NY ERS Tier 3,4 Coordinated Plan (Male, Female)		Unisex
NY State & Local Police & Fire	2011	NY PFRS Tier 2 Special 20yr (add'l 60ths) (Male, Female)		Unisex
North Carolina Local Government	2010	General Employees	54.6%	Male
North Carolina Teachers and State Employees	2010	All members	31.1%	Female
Ohio PERS	2010	State, Local (Male, Female)	47.0%	Female
Ohio Police & Fire	2011	Police, Fire	98.1%	Male
Ohio School Employees	2011	All members	25.9%	Female
Ohio Teachers	2011	All members	28.2%	Female
North Dakota PERS	2011	All members	39.4%	Female
North Dakota Teachers	2011	All members	25.9%	Female
Oklahoma PERS	2011	Regular membership	42.2%	Female
Oklahoma Teachers	2011	All members		Female
Oregon PERS	2010	Tier 1, Tier 2, (General Service)		Female
Pennsylvania School Employees	2011	All members	27.3%	Female
Pennsylvania State ERS	2010	All members (Male, female)		Both
Rhode Island ERS	2010	State, Teachers		Female
Rhode Island Municipal	2010	General, Police and Fire		Female
South Carolina Police	2010	All members		Male

South Carolina RS	2010	Employees, Teachers (Employee rates used)		Female
South Dakota PERS	2011	All members		Unisex
City of Austin ERS	2010	All members		Female
Houston Firefighters	2011	All members		Male
Texas ERS	2011	All members		Female
Texas LECOS	2011	All members		Male
Texas Teachers	2011	All members		Female
Vermont State Employees	2011	All members		Unisex
Vermont Teachers	2011	All members		Female
Fairfax County Schools	2010	All members (Male, Female)		Both
Virginia Retirement System	2011	State, Teachers		Female
Washington LEOFF Plan 2	2010	All members	92.0%	Male
Washington PERS 2/3	2010	Plan 2, Plan 3	47.7%	Female
Washington School Employees Plan 2/3	2010	Plan 2, Plan 3	21.9%	Female
Washington Teachers Plan 2/3	2010	Plan 2, Plan 3	28.4%	Female
West Virginia PERS	2011	State, Non-State		Female
West Virginia Teachers	2011	Teachers, Non-teachers		Female
Wisconsin Retirement System	2010	General	37.7%	Female
Wyoming Public Employees	2012	All members	35.9%	Female

Source: Various actuarial reports.

Table C2. *Regression Results on Probability of Vesting, Excluding Police and Fire Plans, 2010*

Variable	Coefficient	
Social Security coverage	2.2971	
	(3.417)	
Public to private wage ratio	16.5380	**
	(6.676)	
Vesting period	-3.2045	***
	(0.633)	
Has DC plan	-3.2339	
	(3.238)	
Teachers' plan	3.1349	
	(3.225)	
Hiring age 25-29	2.4542	***
	(0.438)	
Hiring age 30-34	5.0787	***
	(0.693)	
Hiring age 35-39	7.8640	***
	(0.966)	
Hiring age 40-44	10.1072	***
	(1.213)	
Hiring age 45-49	11.1162	***
	(1.374)	
Hiring age 50-55	10.0817	***
	(1.444)	
Constant	40.7831	***
	(8.633)	
R-Squared	0.2813	
Number of observations	3570	

Notes: Robust standard errors are in parentheses. Coefficients are significant at the 10-percent (*), 5-percent (**), or 1-percent (***) levels.
Sources: Authors' estimates from the *Current Population Survey* (2011) and the *Public Plans Database* (2010).

Table C3. *Summary Statistics for Regression on Probability of Vesting, Excluding Police and Fire Plans, 2010*

Variable	Mean	Standard deviation	Minimum	Maximum
Probability of vesting	47.19	17.94	3.629	96.04
Social Security coverage	0.725	0.446	0	1
Public to private wage ratio	1.012	0.216	0.508	1.706
Vesting period	6.054	2.283	0	10
Has DC plan	0.137	0.344	0	1
Teachers' plan	0.373	0.484	0	1
Hiring age 25-29	0.143	0.350	0	1
Hiring age 30-34	0.143	0.350	0	1
Hiring age 35-39	0.143	0.350	0	1
Hiring age 40-44	0.143	0.350	0	1
Hiring age 45-49	0.143	0.350	0	1
Hiring age 50-55	0.143	0.350	0	1

Sources: Authors' calculations from the *Current Population Survey* (2011) and the *Public Plans Database* (2010).

Table C4. *Regression Results on Probability of Remaining in Plan until Earliest Normal Retirement Eligibility Once Vested, Excluding Police and Fire Plans, 2010*

Variable	Coefficient	
Social Security coverage	-7.6109	*
	(4.224)	
Public to private wage ratio	26.8500	***
	(9.440)	
Vesting period	3.5407	***
	(0.714)	
Has DC plan	-11.1892	**
	(4.437)	
Teachers' plan	0.3446	
	(3.764)	
Hiring age 25-29	2.1849	***
	(0.705)	
Hiring age 30-34	5.0819	***
	(1.374)	
Hiring age 35-39	9.6116	***
	(1.698)	
Hiring age 40-44	16.4492	***
	(1.983)	
Constant	-18.9512	**
	(8.846)	
R-Squared	0.2926	
Number of observations	2550	

Notes: Robust standard errors are in parentheses. Coefficients are significant at the 10-percent (*), 5-percent (**), or 1-percent (***) levels.
Sources: Authors' estimates from the *Current Population Survey* (2011) and the *Public Plans Database* (2010).

Table C5. *Summary Statistics for the Regression on Probability of Remaining in Plan until Earliest Normal Retirement Eligibility Once Vested, Excluding Police and Fire Plans, 2010*

Variable	Mean	Standard deviation	Minimum	Maximum
Probability of retire, if vested	29.40	21.82	0	95.30
Social Security coverage	0.725	0.446	0	1
Public to private wage ratio	1.012	0.216	0.508	1.706
Vesting period	6.054	2.283	0	10
Has DC plan	0.137	0.344	0	1
Teachers' plan	0.373	0.484	0	1
Hiring age 25-29	0.200	0.400	0	1
Hiring age 30-34	0.200	0.400	0	1
Hiring age 35-39	0.200	0.400	0	1
Hiring age 40-44	0.200	0.400	0	1

Sources: Authors' calculations from the *Current Population Survey* (2011) and the *Public Plans Database* (2010).