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Pension Generosity in Oregon and its Impact on the K12 Workforce

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Oregon's Tier One Public Employees Retirement System (PERS), which covered members prior to January 1, 1996, was one of the most generous pension plans ever devised. In this paper we document the generosity of Oregon's Tier One plan and examine the extent to which Oregon's pension system impacted its K12 workforce, as greater pension generosity could incentivize longer tenures. In the case of Oregon, however, the true magnitude of its pension generosity was largely unknown to teachers until just prior to retirement. As such, any economic incentives to promote longer tenure among mid-career teachers were muted, while the plan's generosity, once revealed just prior to retirement, created strong wealth effects that enabled earlier K12 exits. Based on an analysis of more than 57,000 Oregon teachers active from 2000 to 2013 we find that mid-career quit rates among teachers covered under Tier One did not differ systematically from those covered under Oregon's more recent pension plan provisions. Quit rates among Oregon's Tier One teachers were even somewhat higher than those among teachers in Washington who were covered by plans that were substantially less generous. Further, using work histories on 8,621 teachers in Oregon who were aged 50 and older in 2000 we find that the generosity of Oregon's Tier One pension encouraged earlier departures from the K12 workforce, with teachers leaving, on average, one year earlier than what would have been expected under Oregon's full formula, defined-benefit plan. We conclude that pension generosity alone does not incentivize longer tenure—even in the extreme case of Oregon—as the true generosity of a plan must be known to employees in advance.

I. Introduction

Oregon's Tier One Public Employees Retirement System (PERS) was perhaps "one of the most generous" state pension plans ever devised.¹ The plan's generosity was the product of a series of policy decisions by Oregon's state government made in the 1970s and 1980s that, most notably, guaranteed rates of return of eight percent and provided "excess crediting" when market rates exceeded this minimum threshold. Oregon's benefit calculation rules generated amounts that far exceeded the Oregon PERS Board's target of 50 percent replacement after 30 years of service. In fact, even before including worker Social Security retirement benefits, replacement rates for a large segment of the Tier One population exceeded 100 percent (Brewer, 2004; Oregon Public Employees Retirement System, 2015; Tapogna & Batten, 2007).

In this paper we explore the relationship between Oregon's pension generosity and its K12 workforce. Oregon provides a compelling case for analysis because it not only provided one of the most generous teacher pension plans in the nation, but also because the state adopted reforms in the 1990s and 2000s that substantially reduced the level of generosity, thereby allowing comparisons across teachers in the state (Brewer, 2004; Oregon Public Employees Retirement System, 2015; Tapogna & Batten, 2007). Further, the true generosity of Oregon's pension plan was not relayed to teachers on an individual basis until just prior to retirement. Therefore, while standard economic theory suggests that greater pension generosity could incentivize longer tenures, in the case of Oregon a priori one might expect that its pension generosity likely had minimal impact on mid-career attrition and then a sizable impact on earlier departures from the K12 workforce.

¹ Brewer (2004), p. 33.

We find evidence for both of these outcomes. An analysis of attrition based on Oregon teachers active from 2000 to 2013 revealed that quit rates among those covered under Tier One did not differ systematically from those covered under Oregon's more recent plans. Quit rates among Oregon's Tier One teachers were even somewhat higher than those among teachers in Washington who were covered by plans that were substantially less generous than Oregon's. These findings suggest that the generosity of Oregon's Tier One plan did not induce mid-career teachers to remain in Oregon's K12 workforce longer. Further, using work histories on 8,621 teachers in Oregon who were aged 50 and older in 2000, we find that the generosity of Oregon's Tier One money match provision encouraged earlier departures from the K12 workforce, with teachers leaving, on average, one year earlier than what would have been expected under Oregon's defined-benefit plan formula. These findings suggest that pension generosity alone does not incentivize longer tenure as the true generosity of a plan must be known to employees in advance to impact mid-career work decisions.

II. The evolution of Oregon's public pension system

Oregon's Tier One PERS pension began in 1945 and covers individuals who were hired prior to January 1, 1996. The original program was a "money match" retirement plan in which employees contributed to a personal account throughout their careers and were credited with earnings on those contributions at a rate established by PERS. At the end of the employee's career, the employer would match this amount dollar for dollar. Based on the matched amount, the employer would then calculate an annuity using an assumed rate of return and discount rate (Brewer, 2004).

The money match plan initially fell short of policymakers' anticipated income replacement due primarily to low investment returns during the 1950s and 1960s. The PERS Board made a

series of changes with a goal of increasing the income replacement ratio obtained by the retiree. The new goal was a 75 to 85 percent replacement rate based on a combination of a public employees' PERS pension and Social Security retirement benefits, with Social Security providing 20 to 40 percentage points.

Under the revised plan, an employee's benefit was computed using three separate formulas with the employee receiving the highest of the three. Benefits under the first method, known as the "full formula," were determined using a traditional defined-benefit formula with an annual annuity based on final average salary, years of service, and benefit factor (1.67 percent in this case). The formula was designed to obtain the income replacement goal whereby after 30 years of service the PERS defined-benefit pension alone would provide 50-percent replacement ($50\% = 30 \times 1.67\%$), with Social Security providing the rest (Board of Trustees of OASDI, 2015; Brewer, 2004; Tapogna and Batten, 2007).

Under the second method, referred to as the "money match" formula, the pension board acted as if six percent of the employee's salary was contributed to an account and the account received a guaranteed minimum annual rate of return (ranging from 5.5 to 8.0 percent over time), in addition to excess crediting when the market rate of return exceeded this amount.² The contribution was originally paid for by the employee (i.e., subtracted from salary), but over time was increasingly paid for by the employer (i.e., not subtracted from salary). At the time of retirement, the employee's account balance was used to calculate an annual annuity which was then doubled (or matched).

The third method, called the "formula plus annuity," was available to those employees who began contributing to their account before 1981. The value of the individual's benefit under the

² The assumed nominal earnings rate was increased from 5.5% to 7.0% in 1975; from 7.0% to 7.5% in 1979, and from 7.5% to 8.0% in 1989. See Oregon Public Employees Retirement System (2015), pp. 9-10, for details.

formula plus annuity method was equal to the employee's account balance (annuitized) plus the product of 1 percent of final average salary and years of employment.³ For each of the three methods, a cost of living adjustment was made to payments over time that was equal to the lesser of 2 percent or the rate of inflation (Brewer, 2004; Oregon Public Employees Retirement System, 2015).

The money match formula yielded substantially higher benefit amounts than those under the full formula or the formula plus annuity method. As shown in Figure 1, between 1998 and 2004 nearly 9 out of 10 Oregon employees retired with benefits calculated using the money match formula. Further, the average amount by which the money match method exceeded the full formula amount was large, ranging from 11 percentage points (61% compared with the 50% target) to 50 percentage points (100% compared with the 50% target) among employees with 30 years of service (Figure 2).

The generosity of the money match formula is even more pronounced relative to the defined-benefit-style full formula when all eligible PERS members are included, not just those with 30 years of service. Using publicly-available, individual-level records for all Tier One beneficiaries in Oregon in the year 2000 we plot actual replacement ratios, not including Social Security retirement benefits, by months of service and overlay the formulaic amount under the defined-benefit plan (Figure 3). For the large majority of Tier One beneficiaries in the year 2000, replacement rates based on the money match formula far exceeded the full formula amount, and for a substantial minority of employees the amount under the money match method was as much as four to ten times higher than the amount under the full formula approach.

³ Since 1998, the formula plus annuity benefit was used for less than 10 percent of retirees, with the exception of 2010, when approximately 17 percent of retirees had benefits calculated this way. See Figure 1 and Oregon Public Employees Retirement System (2015) for details.

The reason the money match provision overshot the target was due in large part to the *combination* of guaranteed eight percent returns, even during market downturns, and excess crediting when market returns exceeded the threshold. Figure 4 plots investment returns and Tier One earnings from 1970 through 2014. As shown in the chart, when investment returns exceeded the guaranteed minimum rate, PERS members were awarded the market rate of return, net of a minor adjustment. When the market performed below the guaranteed rate of return, members were shielded from low stock market returns and awarded a guaranteed minimum. PERS members, therefore, received the rewards of investing in the market (high rates of return in strong years) but were immune to the risks of doing so (low or negative returns in weak years). The system was primed to fail because the state took the other side of this deal—to pass through market returns during strong years and make up for the shortfalls in weak ones. In short, the state insured against market risk and received no compensation for doing so.

The PERS Board recognized that the money match provision was unsustainable and beginning with employees hired after January 1, 1996, Oregon's PERS Board replaced the Tier One system with a Tier Two system. The Tier Two plan still contained a money match component, but without the guaranteed eight percent rate of return that existed under the Tier One plan. The full formula benefit calculation method of the Tier Two system resembled that of the Tier One system albeit with an increase in the normal retirement age from age 58 to age 60 (Brewer, 2004; Oregon Public Employees Retirement System, 2015).

Still, the PERS Board determined that even the Tier Two system was too costly and additional reforms were taken such that employees hired after August 28, 2003 were enrolled in the Oregon Public Service Retirement Plan (OPSRP). Under the OPSRP plan the normal retirement age under the full formula was increased from 60 to 65. Further, the credit per year of

service was reduced from 1.67% to 1.5%, yielding 45 percent replacement after 30 years of service ($45\% = 1.50\%/year * 30 \text{ years}$) instead of 50 percent ($50\% = 1.67\%/year * 30 \text{ years}$). Most importantly, the money match provision was no longer offered under OPSRP. The outcome of these policy changes is that Oregon currently operates three plans (Tier One, Tier Two, OPSRP) with participation depending on when individuals were hired (Brewer, 2004; Oregon Public Employees Retirement System, 2015; Tapogna & Batten, 2007).

The impact of Oregon's pension system reforms was visible within a decade. Average replacement ratios for individuals with 30 years of service, not including Social Security retirement benefits, declined substantially from 100 percent in 2000 to 66 percent in 2014 (Figure 2). Further, a scatter plot of replacement rates by years of service for all Oregon PERS beneficiaries in 2012, again based on publicly-available, individual-level records, reveals a general drift downward towards the 50-percent target replacement rate under the full formula plan (Figure 5). Several actions taken by the PERS Board, including moving new hires from the Tier One plan to the Tier Two plan (for those hired between January 1, 1996 and August 28, 2003) or the OPSRP plan (for those hired on or after August 29, 2003), led to substantial improvements with respect to how actual replacement rates aligned with the target.

III. The generosity of Oregon's Tier One plan in perspective

According to a replacement rate analysis conducted by Oregon PERS using a study population of 82,298 retirements, the mean final average salary among retirees from 1990 to 2014 was \$49,441, and the average replacement ratio from the PERS pension was 54 percent (Oregon Public Employees Retirement System, 2015). These values imply an average annual benefit of roughly \$26,700 ($\$26,700 = \$49,441 * 54\%$) though, notably, the actual amount might differ from this simplified calculation if final average salary and replacement rates are correlated.

These values, while meaningful in many contexts, are not particularly insightful when assessing the generosity of the Tier One plan because these values mix benefits under both the Tier One and Tier 2 plans and also mix teachers with varying years of service.

A more meaningful way to assess the generosity of Oregon's Tier One plan is to compare the present discounted value of pension wealth across plans, holding a teacher's profile constant and using average life expectancy, an assumed rate of return on assets, and the same discount rate across plans. The Center for Public Service (CPS) at Portland State University conducted this type of analysis and the results illustrate just how large the gap is between the full formula and the money match benefit calculation method for teachers retiring in 2013 (Keisling, Winthrop, Crawford, 2013). According to the CPS study, the present discounted value of the full formula defined-benefit retirement benefits for a representative teacher in Portland retiring in 2013, including the value of Social Security benefits, is roughly \$1.1 million. Under the Tier One money match method the benefit is roughly \$1.7 million—more than 50 percent higher (Figure 6). The present discounted value under the money match formula is also more than 50 percent higher than the benefits for teachers in nearby Seattle, Washington, who were covered under a defined-benefit plan if they were hired prior to 1996, and a defined-benefit or hybrid plan if hired thereafter.

We take the CPS study one step further by examining the present discounted value of pension benefits across the three Oregon Plans (Tier One, Tier Two, OPSRP) and the three Washington plans (TRS1, TRS2, TRS3) that have been in place at various points in time over the past several decades.⁴ For our analysis we use as an example a hypothetical teacher who retired at age 62 in 2014 with 30 years of credited service and a final average salary of \$65,000 per year.

⁴ See Goldhaber, Grout, and Holden (2015) for details on each plan.

The present discounted value of Tier One money match benefits for this teacher is \$1,476,822, notably similar to the values calculated by Keisling, Winthrop, Crawford (2013), once Social Security benefits are removed from their estimate.

The present discounted value of benefits under the next highest plan for this teacher is \$817,811 under Oregon's OPSRP plan—only slightly more than half (55%) that of the Tier One money match amount (Figure 7). Notably, the OPSRP plan is a hybrid that includes a defined-contribution component, and for the defined-contribution part of the plan we assume an annual employee contribution of five percent and an annual market rate of return of eight percent. Similarly, the present discounted value of pension benefits under Washington's TRS1 and TRS2 plans is roughly half (51%) that of Oregon's Tier One money match plan. The present discounted value of pension benefits under Washington's TRS3 plan, a hybrid, falls below Washington's TRS2 and TRS3 plans, and is just 43 percent of the Tier One money match amount.

The generosity of Oregon's Tier One money match is also substantially higher than that of a representative public-sector defined-benefit plan with benefits of two percent of final average salary multiplied by years of service (\$1,476,822 compared with \$710,818) or with benefits defined as 1.5 percent of final average salary multiplied by years of service (\$1,476,822 compared with \$533,114). Finally, Oregon's Tier One money match formula yields a present discounted value benefit that is more than *seven times* larger than a representative defined-contribution plan based on a five percent contribution and an eight percent return. This large discrepancy is notably a product of applying the eight percent rate of return in all future years when calculating the annuity amount associated with the money match account balance. Simply put Oregon's Tier One money match method produced benefits that were substantially larger than other public sector pension plans.

What aspects of Oregon's Tier One plan explain such large benefit amounts? To answer this question we first calculate the present discounted value of Tier One pension benefits for all active teachers in Oregon aged 50 and older in the year 2000, using administrative records from the Oregon Department of Education (ODE). Based on age, years of service, and current salary for 8,621 teachers in Oregon in 2000, we calculate the mean present discounted value of pension benefits under the full formula to be approximately \$522,000, not counting the value of Social Security benefits. Under a simplistic assumption that retirement lasts 20 years, and another simplistic assumption of a zero net discount rate, this amount yields an annual pension of approximately \$26,100, which is more or less in line with the calculations provided by the PERS Board.

In contrast the mean present discounted value of Tier One pension assets under the money match formula for this sample of Oregon teachers is approximately \$1.43 million—nearly three times as large as the \$522,000 estimate for the full formula estimate (Figure 8). Each component of the money match provision has a substantial impact on pension wealth. If the Tier One formula options are adjusted slightly we estimate the effect of each component of the present discounted value of pension wealth for participants. The present discounted value of pension assets is approximately \$816,000 using the money match provision and the guaranteed rate of return of 8 percent but without the excess crediting provision. The present discounted value becomes \$1.15 million under the money match method with excess crediting but not the 8 percent guaranteed rate of return. In short, both the minimum rate of return and excess crediting had a sizable impact on the pension wealth of Oregon's teachers.

IV. What did Oregon receive in return for its pension generosity?

Oregon arguably received something in return for the expenditures associated with its Tier One pension system, and it is important to understand the magnitude of this benefit when considering the full impact of the money match pension promises. One way to assess the economic impacts of Oregon's PERS system is to quantify the economic impacts of Oregon's pension payments. Oregon's PERS administrators have done so and estimate that these payments generate \$3.9 billion in total economic value to the state annually (Oregon Public Employees Retirement System, 2015). While such estimates might be useful for some purposes, these types of calculations are limited for at least two reasons. First, these economic impacts do not represent the *net* impact of these retirement benefits because the calculations do not take into account the next best alternative use of such funds. Had these funds not been used for pension benefits, they would have been used some other way and the PERS administrators' calculations should be compared against the economic impacts of this alternative use. Second, the PERS administrators' calculations are highly dependent on an assumed economic multiplier, which could overstate the magnitude of certain economic impacts, including the estimated 35,999 jobs resulting from these pension payments.

A more direct impact of the Tier One pension system is its impact on teachers' work decisions, including whether to remain in the K12 workforce throughout their career and when to leave the K12 workforce. One justification for the provision of generous retirement benefits is that it will help attract and retain a high quality workforce. Defined-benefit pension plans with well-defined formulas based on an employee's final average salary and years of service provide economic incentives for workers to remain with their employers. The longer the employee remains with their employer, the larger their retirement benefit becomes because salaries by and large increase over time and because additional years of service increase the percentage of final

average salary upon which retirement benefits are based. Defined-contribution plans may also contain incentives for an employee to remain with their employer if the employer makes a contribution on behalf of the employee or matches a portion of the employee's contribution (Cahill, Giandrea, & Quinn, 2015a,b). In both cases, the benefit structure needs to be known to the employee in order to incentivize the employee to remain with their employer.

Importantly in the case of Oregon, the magnitude of its pension benefits under the money match provision was largely not known to teachers for much of their tenure. Annual statements prior to 1994 and after 2001 provided just the teacher's contributions and credited earnings, and from 1994 to 1996 annual statements included the defined-benefit formula amounts. Only from 1997 to 2001 did annual statements include projected monthly benefit amounts under the money match provision (Brewer, 2004).

Other features of the money match benefit calculation also imply that teachers were likely not aware of the provision's scale. First, the full thrust of the Tier One money match formula includes not just the guaranteed eight percent return over the teachers' work history, but also the guaranteed eight percent return throughout retirement. So, even for teachers monitoring their account value, the impact of guaranteed returns of eight percent (later reduced to 7.75%) into the future, used to calculate the annuitized amount, were likely not fully appreciated until these amounts were actually tallied for teachers. Second, for the cohort of teachers covered under Tier One, market returns more or less were largely positive for the 25-year period between the mid-1970s and 2000, with some notable exceptions in the early 1990s. The largest differences between market returns and the guaranteed eight percent minimum did not occur until the market downturns in the early 2000s and in 2008. While other investors were experiencing substantial reductions in principal during these periods, those covered under Tier One received a full eight-

percent return. As noted in Brewer (2004), “More than other benefit forms, Money Match allowances cannot reasonably be determined or valued in advance of a member’s retirement. That is largely so because the employer matching benefit is calculated at retirement. The value of the benefit is the joint product of market performance, which defies accurate prediction, PERS’ administrative practices and, ultimately, the terms of the PERS contract.”⁵

V. The impact of Oregon’s Tier One plan on mid-career teacher attrition

Given that the true generosity of the money match provision was likely not fully appreciated until much later in teachers’ careers, a priori we would anticipate little impact on mid-career teacher attrition. We find that average tenure among teachers in Oregon declined precipitously during the time that the vast majority of teachers were retiring under the Tier One pension plan (Figure 9). Further, relative to teachers in nearby Washington, who were covered under a standard defined-benefit formula or hybrid plan, Oregon’s teachers had lower levels of tenure on average for much of the 2000 to 2010 time period. Perhaps more importantly, the trend in tenure for Oregon teachers over this decade resembled that of teachers in both Washington and the United States generally. The similarity of these trends is perhaps “the dog that didn’t bark”—Oregon’s Tier One pension generosity certainly did not appear to disrupt the broader trend. However, a more detailed analysis is required in order to say anything definitive.

We use administrative records from the Oregon Department of Education (ODE) and the National Center for Education Statistics’ (NCES) Common Core of Data (CCD) to examine how attrition among mid-career teachers in Oregon differs by pension plan status. The ODE data contain 57,763 unique teacher observations from the 2000-1 academic year through the 2013-4 academic year, for a total of 388,154 teacher-year observations. For each teacher we know his or

⁵ Brewer (2004), p. 35.

her work status and full-time equivalent (FTE) status in each academic year, as well as the teacher's age, gender, ethnicity, and years of service both within Oregon and outside of Oregon. School-level identifiers allow us to match the teacher-level data with the CCD dataset. The CCD dataset provides information on school size, school ethnic composition, and school level (elementary, middle, high school), potentially important factors when evaluating teacher attrition.

We first evaluate the impact of Oregon's Tier One plan on teacher attrition descriptively by plotting the quit rates among Oregon's teachers by years of service. Our dataset limits the extent we can examine new teacher attrition because it begins with the academic year 2000-1 and Tier One eligibility ended for new teachers starting on January 1, 1996. Similarly, our dataset extends to the 2013-4 academic year which by and large limits an analysis of teacher attrition beyond 15 years of service for those covered under the Tier Two and OPSRP plans. Therefore, we focus on quit rates among teachers with between 6 to 15 years of service. Further, one goal of our analysis is to compare quit rates in Oregon with those in nearby Washington, whose teachers were covered under plans that were substantially less generous than Oregon's Tier One plan, as noted earlier (see Figure 7). The quit-rate comparisons between Oregon and Washington shed light on whether teachers covered under Oregon's more-generous Tier One plan had lower quit rates relative to their counterparts in Washington.

We find that quit rates among Oregon's teachers are generally higher than those among Washington's teachers (Figure 10). Further, within the Oregon sample, teacher quit rates for those covered under Tier One are not consistently lower than those covered under Tier 2 or OPSRP. Quit rates are somewhat lower between 6 to 10 years of service and then somewhat higher for 10 to 12 years of service, and nearly identical thereafter. So, descriptively, the

evidence suggests that Oregon’s Tier One plan did not lower turnover among its teachers. Of course, descriptive analyses do not control for a multitude of factors that might explain (or mask) differences between teachers covered under the Tier One plan or the Tier 2 and OPSRP plans. To do so, we examine quit rates in a multivariate context.

We hypothesize that after controlling for other observable factors participation in the Tier One pension plan does not reduce the likelihood of leaving teaching relative to those in the Tier Two and the OPSRP pension plans. We estimate a series of discrete choice hazard models that follow a structure proposed by Goldhaber, Grout, and Holden (2015). The model estimates a teacher’s propensity to quit in a given school year as a function of teacher and school characteristics as well as years of service and pension plan type. The model is as follows:

$$p_{it} = \frac{e^{\sum_{t=2000}^{2013}(\sigma_t \mathbf{1}(YOS=t)) + \sum_{t=2000}^{2013}(\gamma_t \mathbf{1}(YOS=t) * \text{Tier } 1_i) + \beta'_1 \mathbf{T}_i + \beta'_2 \mathbf{S}_i}}{1 + e^{\sum_{t=2000}^{2013}(\sigma_t \mathbf{1}(YOS=t)) + \sum_{t=2000}^{2013}(\gamma_t \mathbf{1}(YOS=t) * \text{Tier } 1_i) + \beta'_1 \mathbf{T}_i + \beta'_2 \mathbf{S}_i}} \quad (1)$$

where:

- p_{it} = propensity that teacher i does not return between year t and $t+1$
- $\sum_{t=1}^T(\mathbf{1}(YOS = t))$ = series of dichotomous indicators denoting years of service
- Tier One = dichotomous indicator denoting if teacher i is covered under the Tier One plan
- \mathbf{T}_i = a set of teacher characteristics
- \mathbf{S}_i = a set of school characteristics

The set of teacher characteristics includes age at first year of service, ethnicity, and educational attainment. School characteristics include school level, percent minority, and school size measured in terms of hundreds of students. We estimated this model using a variety of specifications and show the results in Table 1. For example, in several specifications we restrict the sample of teachers to those hired between 1994 and 1997, that is, two years prior to the end of Tier One eligibility and two years afterwards. This restriction helps control for differences in labor market conditions by focusing on teachers hired within a relatively short timeframe. As

with the descriptive analysis, data for teachers covered under Tier One are available for those with at least six years of service.

The results of the multivariate analysis validate the descriptive findings. In some model specifications teachers covered under Tier One have lower quit rates prior to obtaining 10 years of service and higher quit rates between 10 and 12 years of service. A specification that includes a single dichotomous indicator for Tier One status reveals that quit rates for teachers covered under Tier One are not systematically higher or lower than those covered under Tier Two or OPSRP, other things equal. The results of both the descriptive and multivariate analysis indicate that Tier One's generosity did not systematically lower Oregon teachers' mid-career rates of attrition.

VI. The impact of Oregon's Tier One plan on older teachers' K12 workforce exit decisions

As noted earlier, the benefits of the money match provision only became apparent to teachers at the end of their careers. Therefore, we hypothesize that, once revealed, the generosity of Oregon's pension plan lowered teachers' retirement ages. To test this hypothesis we use the ODE administrative records matched to the NCES CCD data to evaluate the timing of teacher exits from the K12 workforce among 8,621 Oregon teachers aged 50 or older in 2000. For each teacher we know the year in which they exited, as well as their age at that time, their base salary, and years of experience. Using this information we examine how older teacher exits in Oregon vary by their estimated pension wealth.⁶ We isolate this pension wealth affect by controlling for

⁶ We estimate the present discounted value of pension wealth as of the year 2000 for each teacher under both the full formula and the money match provision using data on the teacher's base salary in 2000 (extrapolated backwards through time), years of experience teaching in Oregon, and annual contributions and interest payments.

other factors that could impact the decision to retire, following a model by Munnell, Cahill, and Jivan (2003). The equation is as follows:

$$ExitAge_i = \alpha + \beta_1 penwealth_i + \beta_2 age2000_i + \beta_3 gender_i + \beta_4 education_i + \beta_5 yrsteaching_i + \beta_6 ethnicity_i + \beta_7 salary_i + \beta_8 contractlength_i + \beta_9 schlevel_i + \beta_{10} numstudents_i + \varepsilon_i \quad (2)$$

The coefficients from the equation explaining older teachers' exit ages are shown in Table 2.⁷ We find support for the hypothesis that, all else equal, the retirement ages of Oregon's teachers are inversely related to pension generosity. An additional \$100,000 in pension wealth reduces the retirement age by about 0.012 of one year, or one month and a half. Using the coefficients from Specification 1 we calculate that the base exit age for a teacher 54 years old in 2000 with 30 years of experience is 59.9 years for men⁸ and 60.2 years for women (Table 3).⁹ Both results are intuitive and resemble the average retirement age of teachers in Oregon (Oregon Public Employees Retirement System, 2012). The size of the coefficient of the pension wealth variable, in conjunction with re-estimated pension wealth under the 8-percent guaranteed returns and excess crediting, enable us to estimate the impact of different pension calculation scenarios on the average exit age. We find that the impact of the 8-percent guarantee reduces the average exit age by roughly four months (0.3 years) and the excess crediting further reduces the average exit age by roughly eight months (0.7 years). Therefore, the overall impact of the 8-percent guarantee and excess crediting led teachers in Oregon to exit the K12 workforce on average

⁷ We estimate the coefficients in equation (2) using ordinary least squares. Alternative specifications could make use of teacher-year observations from 2000 to 2014 to explore the discrete choice in each year of whether to continue teaching or to exit the K12 workforce. Within such a framework the model could be refined to control for individual heterogeneity and to allow for an evaluation of incremental year-to-year changes in pension generosity on the decision to exit. While these more sophisticated approaches might enhance the model, we believe the issue of pension generosity is not a subtle one. Several sensitivity analyses we have conducted revealed that the impact of pension wealth on exit ages was remarkably robust across various model specifications.

⁸ $59.9 = \text{constant} + b_{age} * 54 + b_{exp} * 20 = 33.4 + .524 * 54 + -.091 * 20$.

⁹ $60.2 = \text{constant} + b_{age} * 54 + b_{exp} * 20 + b_{female} * 1 = 33.4 + .524 * 54 + -.091 * 20 + .347$.

about one year earlier than would have otherwise been the case under the defined-benefit pension formula.¹⁰ Using the average tenure of 24.4 years among teachers aged 50 or older in 2000, this one year reduction represents a four percent decline in the career length of Oregon's K12 teachers. Importantly, these analyses are conditional on a teacher reaching age 50 and remaining in the K12 workforce until that time.

VIII. Conclusion

The money match provision of Oregon's Tier One pension system credited members with a minimum guaranteed rate of return of eight percent, and higher rates when the market rate of return exceeded eight percent. This formula generated replacement rates that far exceeded the replacement rates of Oregon's subsequent plans, potentially creating strong incentives for Tier 1 workers to remain in the workforce. In the case of Oregon, however, the magnitude of its Tier One benefits was largely unknown to teachers until just prior to retirement, which muted any economic incentives that might have encouraged mid-career teachers to remain in Oregon's K12 workforce. The economic incentives, rather, applied to teachers on the cusp of retirement, when the PERS program tallied their benefits based on an eight-percent guaranteed rate of return in all future years to calculate the lump-sum and annuitized value of their pension benefits. The revelation of this pension wealth was likely viewed as a windfall gain for teachers that incentivized earlier departures from the K12 workforce.

Consistent with these incentives we find that the pension generosity of Oregon's money match provision under the Tier One plan appears not to have induced Oregon's teachers to remain in the workforce substantially longer than what would have otherwise been the case

¹⁰ This finding is consistent with another study by Chalmers, Johnson, and Reuter (2013) who also find that Oregon's Tier One money match provision induced earlier exits from the K12 workforce.

under the Tier One defined-benefit full formula alone. We also find that Oregon's older teachers, on average, exited the K12 workforce approximately one year earlier as a result of their pension wealth under the Tier One money match provision. Oregon's Tier One pension was not only costly but the plan appears to have negatively impacted Oregon's K12 workforce by enabling earlier retirements.

One key policy implication from the case of Oregon is that the generosity of a pension plan in and of itself does not create incentives for longer tenures. In order for the economic incentives to matter, the true generosity of the plan must be known to employees in advance, so that employees are aware of how their work decisions impact their retirement benefits. The work histories of Oregon's teachers are a testament to the need for clear communication about the value of pension benefits. Oregon's policymakers and citizens allocated substantial resources to its retirement system and, in return, received little economic benefit in the form of promoting longer teacher tenures. Parties can learn from Oregon by communicating more information regarding the value of pension benefits to teachers early in the hiring process and throughout teachers' careers.

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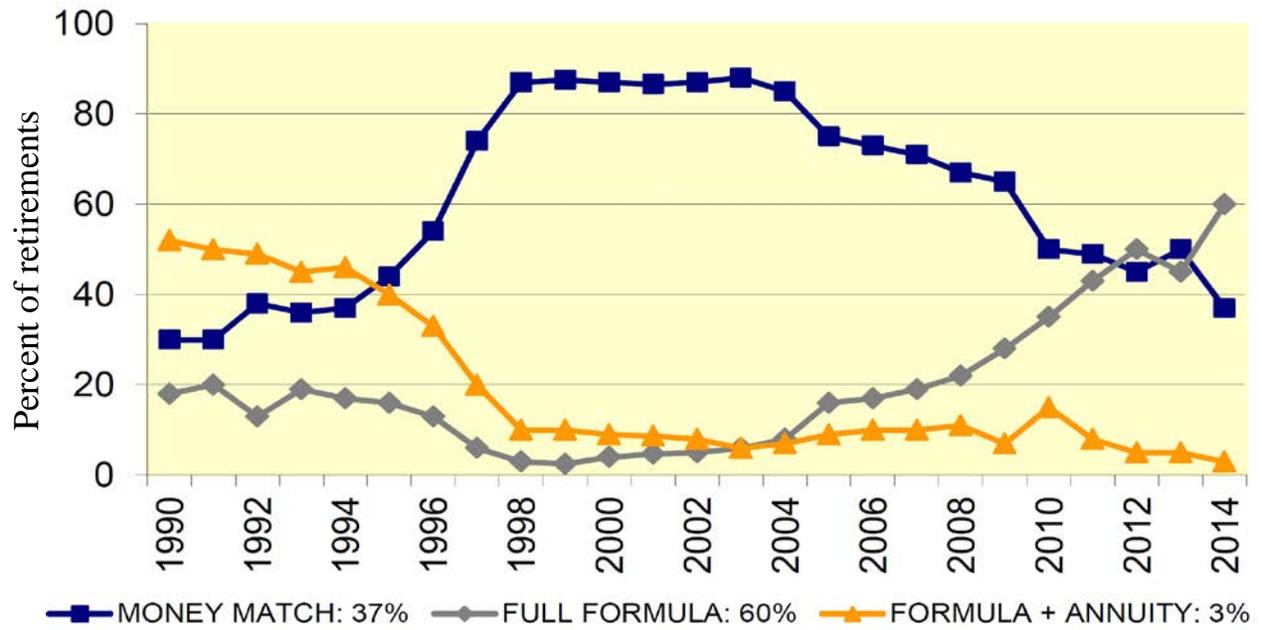
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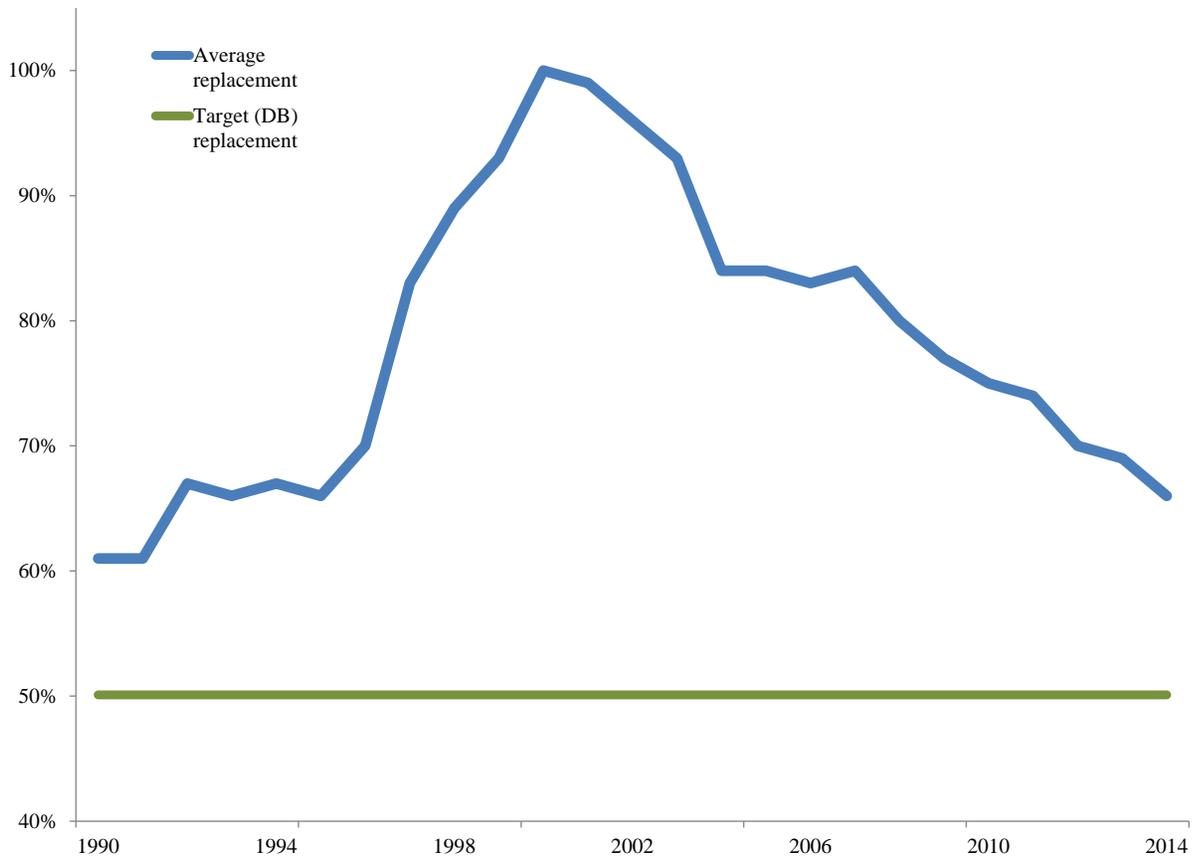
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Figure 1: Oregon PERS retirement calculation method trends



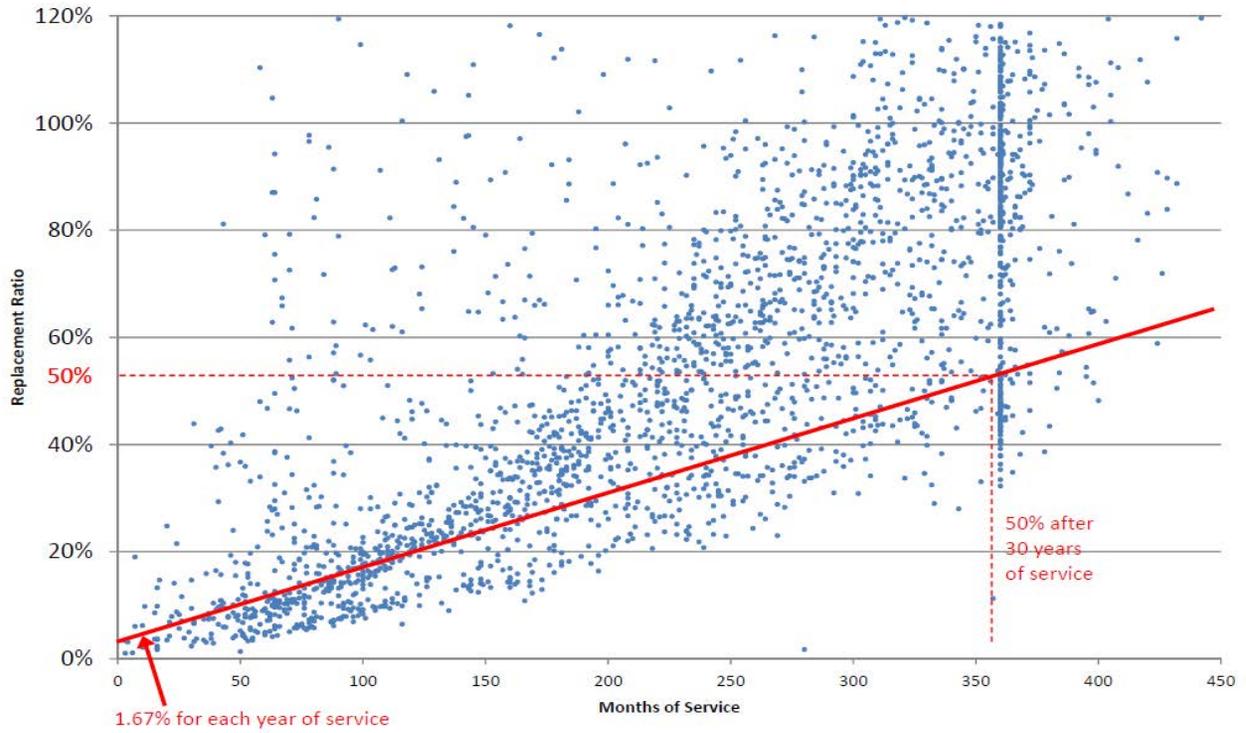
Source: Oregon Public Employees Retirement System. (2015). *PERS: By the numbers*. Tigard, OR: Oregon Public Employees Retirement System (p. 7).

Figure 2: Average replacement ratio based on PERS benefit and final salary among retirees with 30 years of service



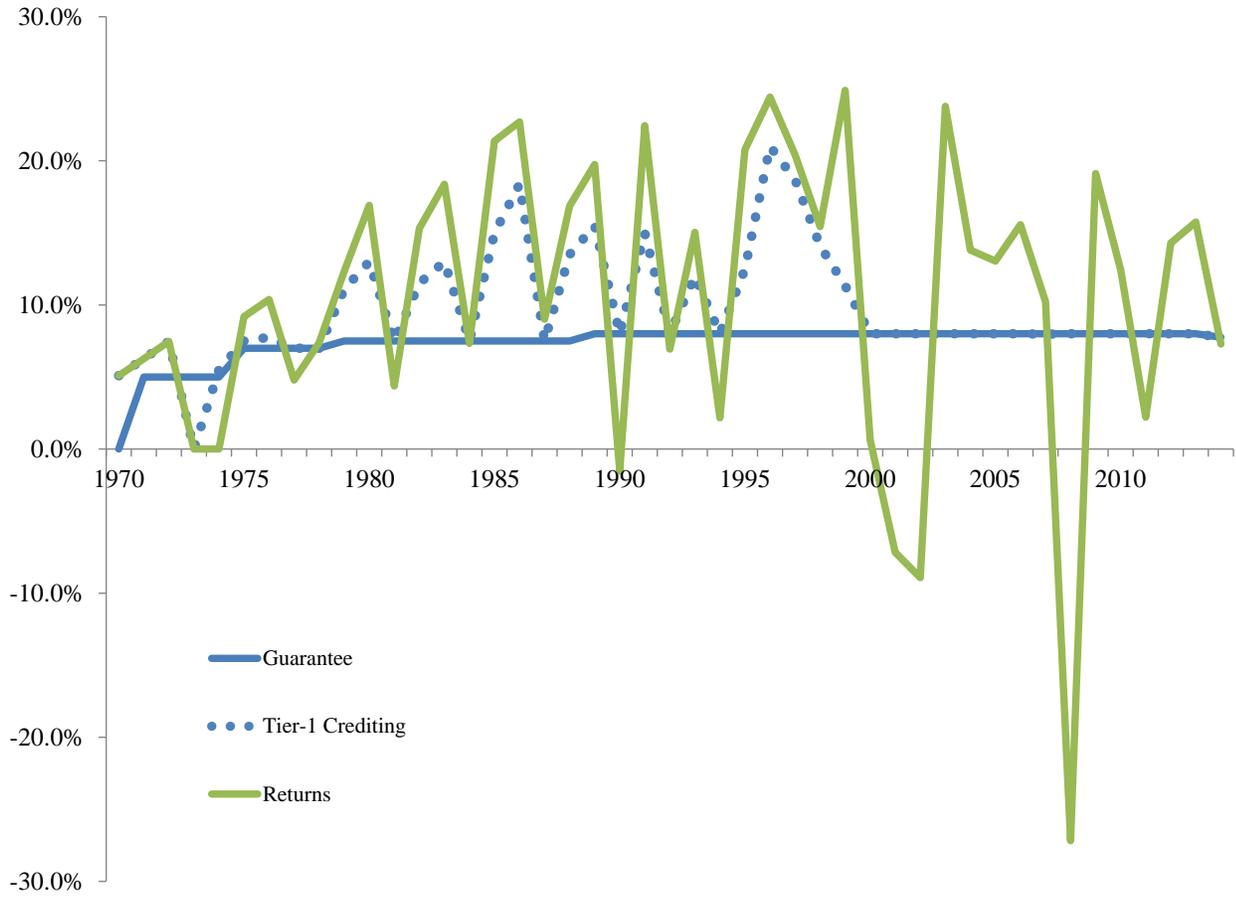
Source: Oregon Public Employees Retirement System. (2015). *PERS: By the numbers*. Tigard, OR: Oregon Public Employees Retirement System (p. 5).

Figure 3: Replacement ratios for Tier One beneficiaries who retired in 2000



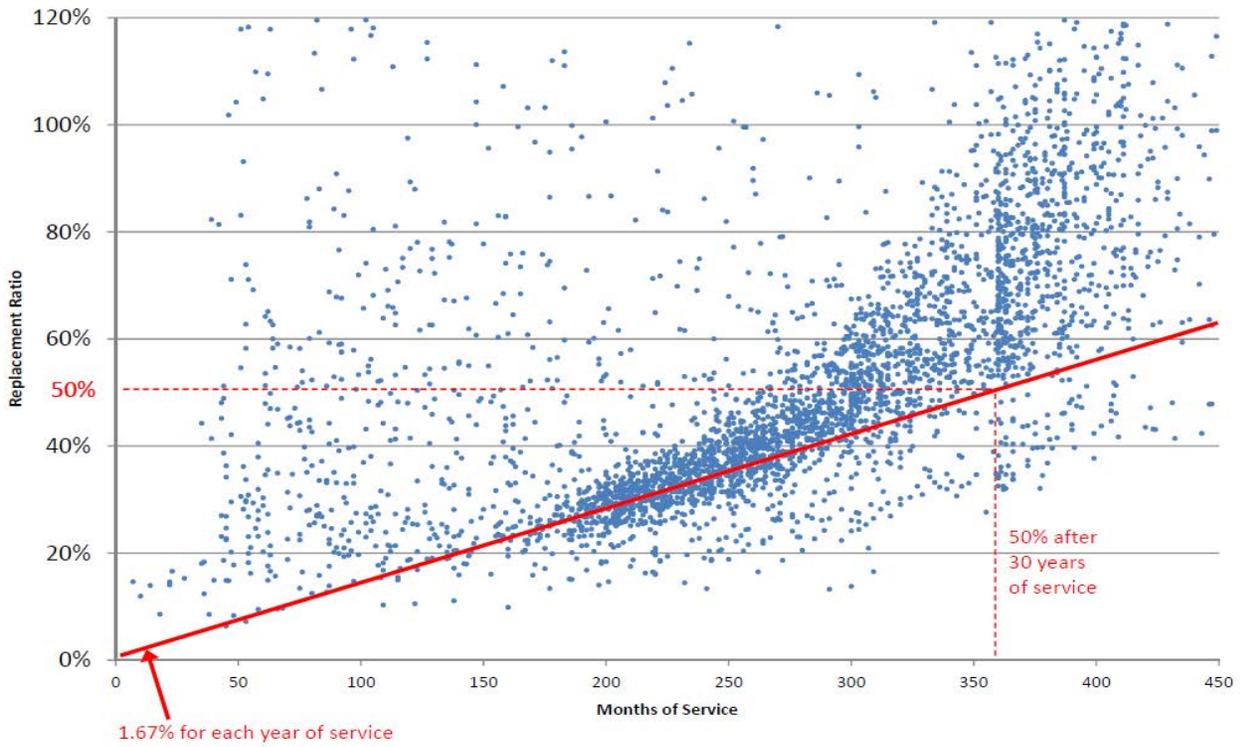
Source: ECONorthwest analysis of data available through PERS and the Oregonian.

Figure 4: Guaranteed rates of return and excess crediting, Tier One, 1970 to 2014



Source: Oregon Public Employees Retirement System. (2015). *PERS: By the numbers*. Tigard, OR: Oregon Public Employees Retirement System (p. 15).

Figure 5: Replacement ratios for Tier One beneficiaries who retired in 2012



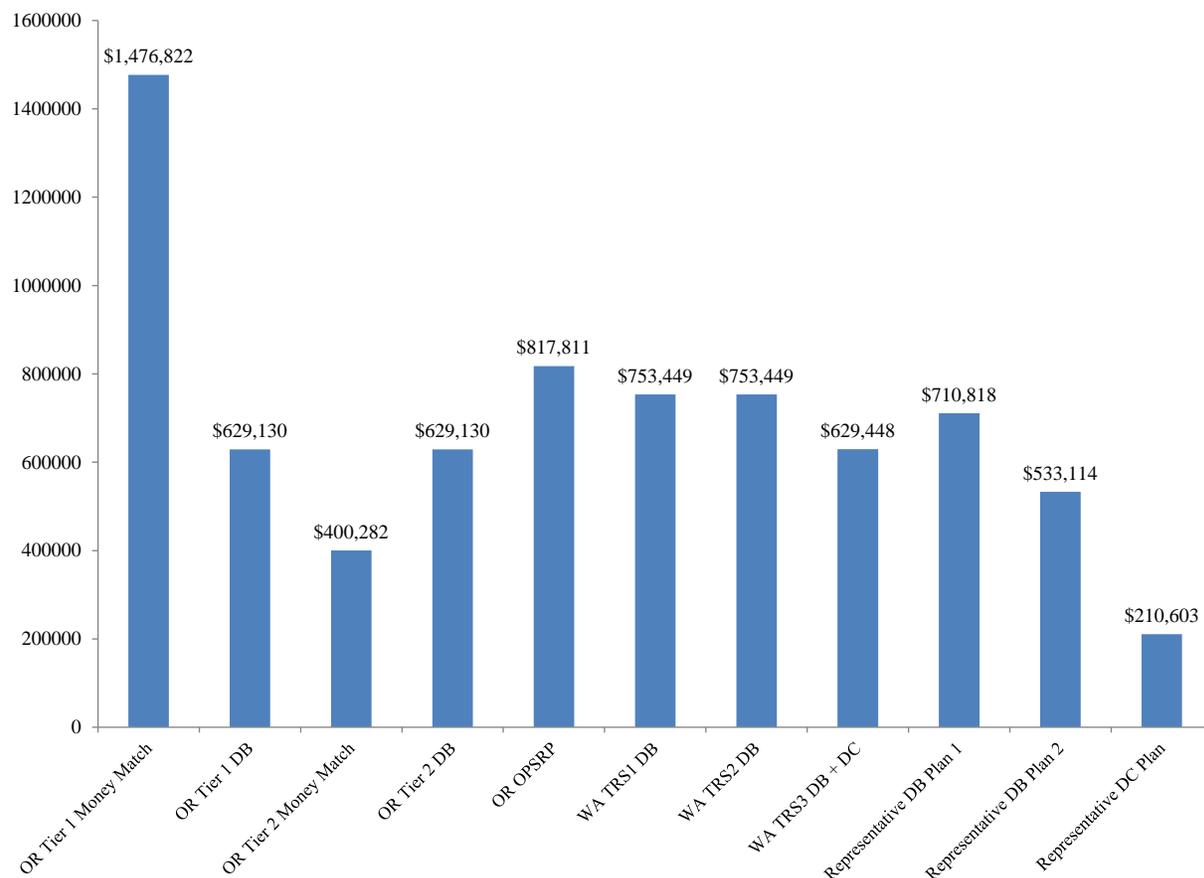
Source: ECONorthwest analysis of data available through PERS and the Oregonian.

Figure 6: Present discounted value of pension wealth for a K12 teacher retiring in 2013, Portland and Seattle



Source: Keisling, P., Winthrop, B., & Crawford, B. (2013). *Economic value of retirement benefits for atypical public sector retirees in Oregon, Washington, and Idaho*. Portland, OR: Portland State University Center for Public Service (p. 16).

Figure 7: Present discounted value of pension wealth under various plans for a representative K12 teacher retiring in 2014 at age 62 with 30 years of service

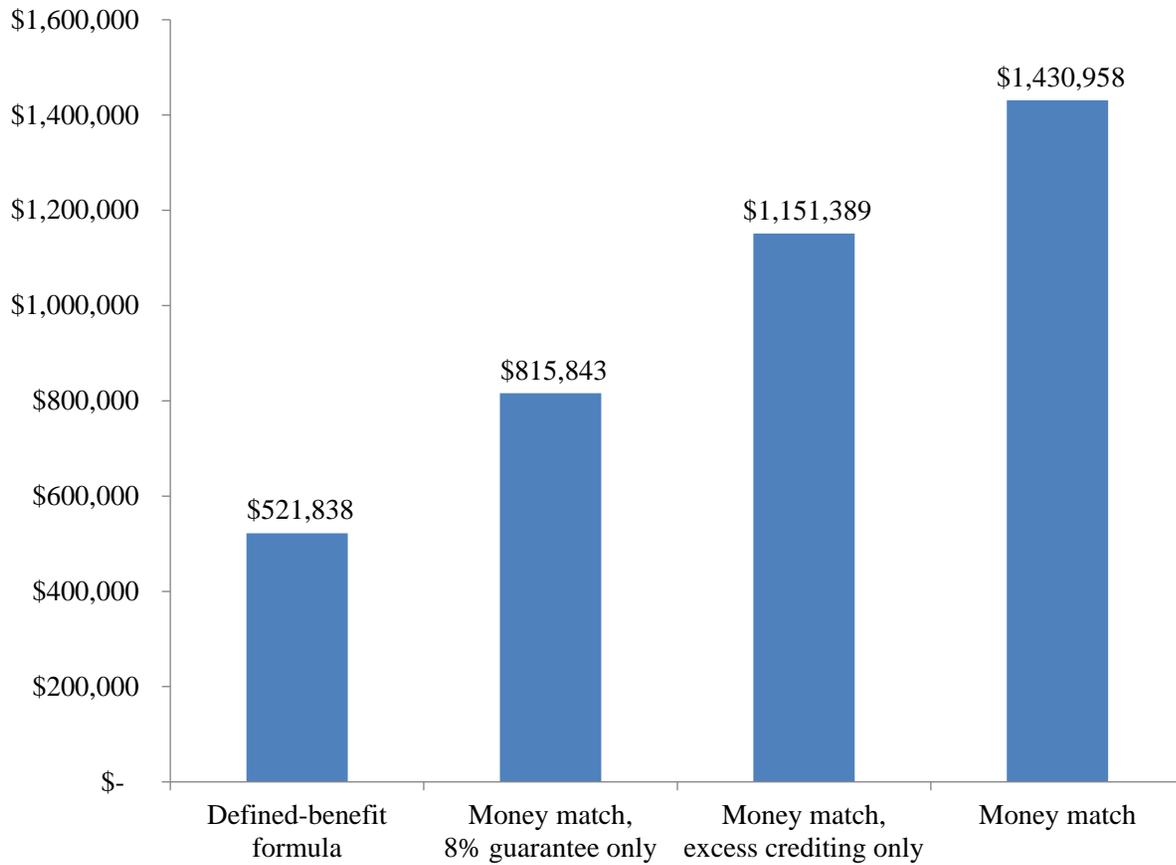


Notes:

Calculations are based on a representative teacher who retires at age 62 in 2014 with 30 years of credited service and an annual salary of \$65,000. Annual retirement benefits under representative DB plan 1 are based on the following formula: $2\% * FAS * YOS$, where FAS = Final Average Salary and YOS = Years of Service. Annual retirement benefits under representative DB plan 2 are based on the following formula: $1\% * FAS * YOS$. The representative DC plan consists of a 5% annual contribution plus an assumed rate of return of 8%. The Tier 1 Money Match amount is converted to present discounted value using investment returns of 7.75% and a discount rate of 4.0%, similar to the approach taken by Keisling, Winthrop, and Crawford (2013). The present discounted value of future annual retirement benefits under DB plans are calculated using a cost-of-living increase of 3.0% and a discount rate of 4.0%. The present discounted value for Oregon's OPSRP plan and for Washington's TRS3 plan includes the value of a DC account based on a 5% contribution and an assumed 8% rate of return, in addition to the present discounted value of DB benefits under these plans. Amounts shown for defined-contribution plans without guaranteed future rates of return are based on the account value at retirement.

Source: Authors' calculations.

Figure 8: Present discounted value of pension wealth for Oregon teachers under different benefit calculation scenarios, 2000

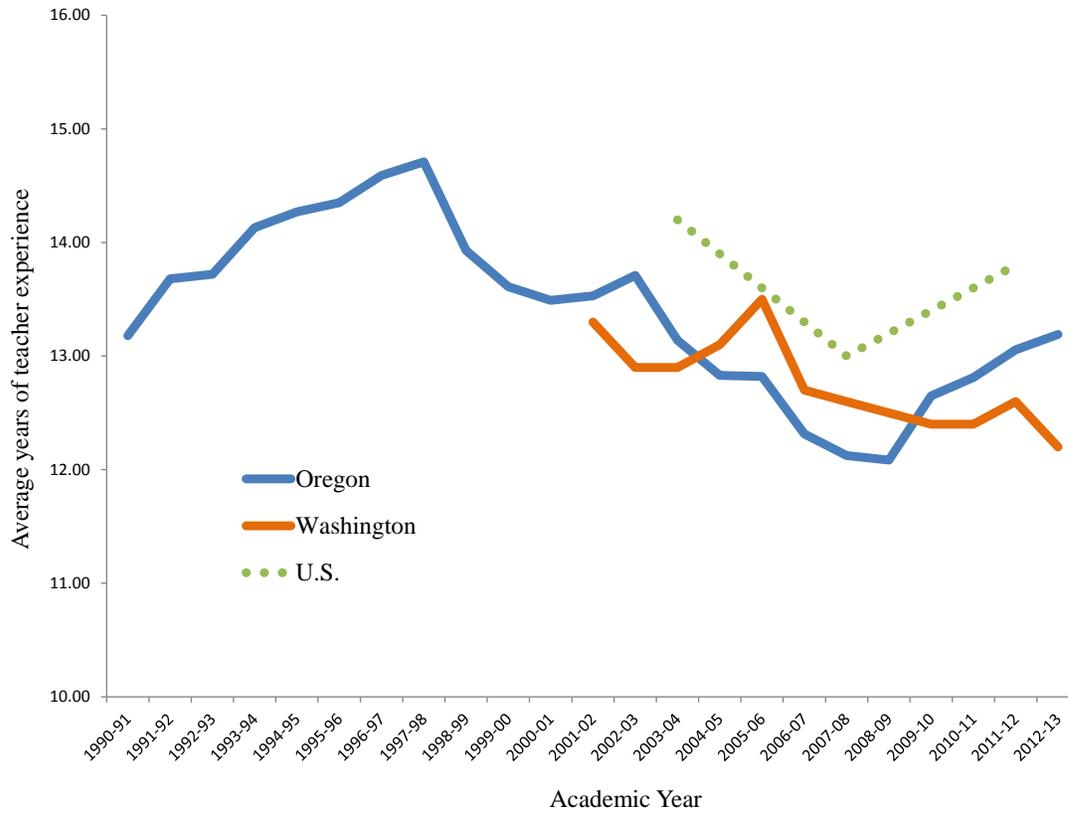


Note:

[1] Pension wealth is estimated using a contribution rate of six percent, an assumed rate of return of eight percent, a cost of living adjustment of three percent, a wage growth rate of three percent, and a discount rate of four percent.

Source: ECONorthwest analysis of ODE data.

Figure 9: Average years of teacher experience in Oregon, Washington, and the United States, 1990 to 2014

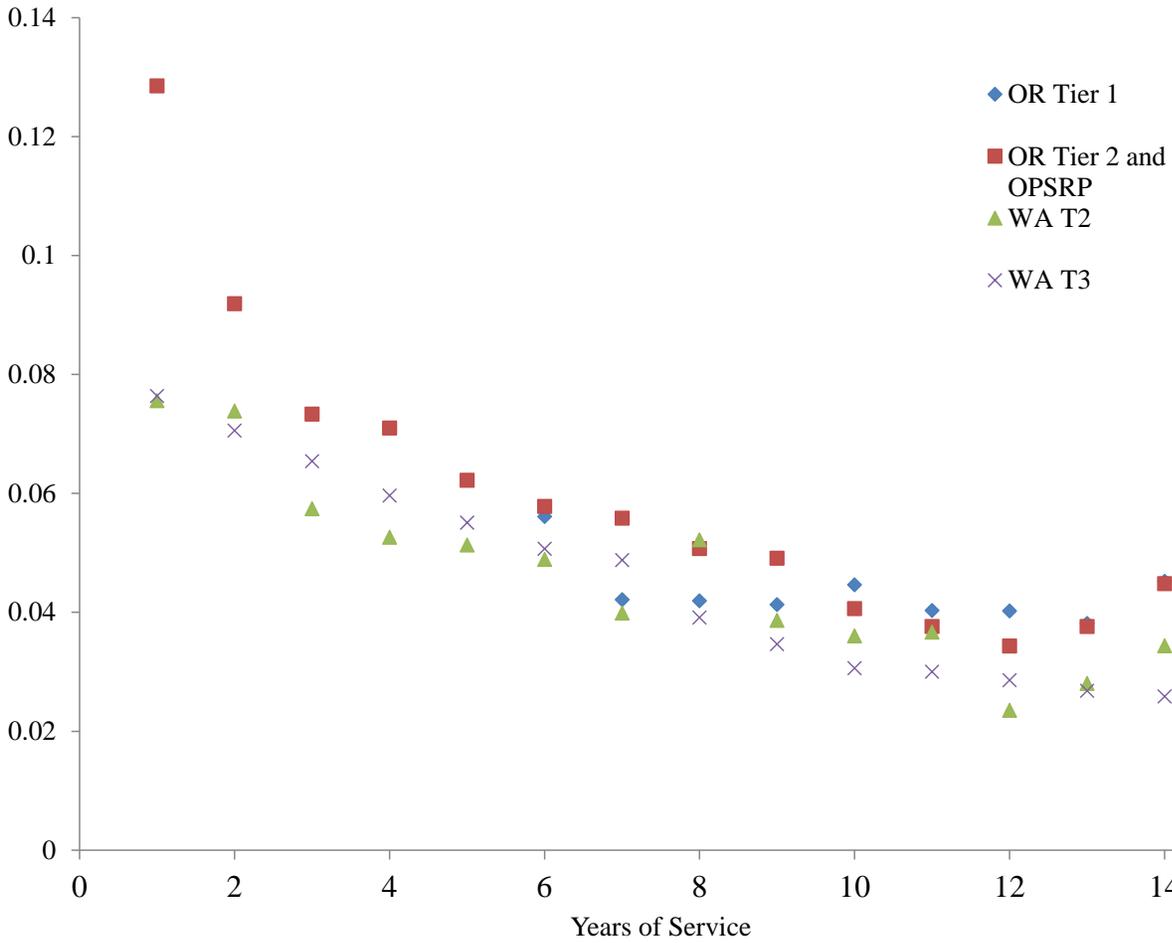


Note:

[1] Data for the United States available for 2003, 2007, and 2011 only; data for Washington State available for 2001 - 2013 only.

Sources: Oregon Department of Education. (2015b). *Average Years of Experience of Oregon Public K-12 Teachers, 1990 - 2014*. Salem, OR: Oregon Department of Education, Office of Research and Data Analysis; State of Washington Office of Superintendent of Public Instruction. (2015). *Washington State Report Card, Average Years of Teacher Experience*. Olympia, WA: State of Washington Office of Superintendent of Public Instruction; National Center for Education Statistics. (2011). *Schools and staffing survey*. Washington, DC: National Center for Education Statistics Institute of Education Sciences.

Figure 10: Proportion exiting employment by pension plan and year of service



Notes:

Oregon teachers starting prior to January 1, 1996 were eligible to participate in the Tier 1 plan. The sample for this analysis includes teachers in Oregon who were observed to be teaching between 2000 and 2014 and who had teaching experience in Oregon ranging from 1 to 15 years. Tier 1 employees were required to have at least six years of teaching experience in Oregon. Tier 1 eligibility is defined using an estimate of start year based on the number of years of experience in Oregon. Teachers who returned within two years of an initial exit were not considered to have exited.

Source: Authors' calculations based on Oregon Department of Education data.

Table 1: Quit patterns among teachers hired before and after the end of Oregon's Tier 1 pension plan

	Specification #1		Specification #2		Specification #3		Specification #4	
	ln(odds ratio)	p-value						
Years of service								
1	-----	-----						
2	-0.279	0.000 ***						
3	-0.535	0.000 ***						
4	-0.577	0.000 ***						
5	-0.693	0.000 ***						
6	-0.783	0.000 ***						
7	-0.820	0.000 ***	-----	-----	-----	-----	-----	-----
8	-0.923	0.000 ***	-0.087	0.483	-0.115	0.376	-0.117	0.378
9	-0.956	0.000 ***	0.193	0.105	0.078	0.539	0.075	0.563
10	-1.155	0.000 ***	-0.047	0.716	-0.100	0.467	-0.095	0.491
11	-1.235	0.000 ***	-0.472	0.002 ***	-0.432	0.005 ***	-0.417	0.007 ***
12	-1.330	0.000 ***	-1.235	0.000 ***	-0.566	0.000 ***	-0.545	0.001 ***
13	-1.234	0.000 ***	-0.766	0.000 ***	-0.712	0.000 ***	-0.678	0.000 ***
14	-1.052	0.000 ***	-0.819	0.000 ***	-0.772	0.000 ***	-0.730	0.000 ***
15	-1.007	0.000 ***	-0.313	0.041 **	-0.236	0.134	-0.179	0.259
16	-0.689	0.000 ***	-0.210	0.098 *	-0.161	0.224	-0.101	0.452
17	-0.859	0.000 ***						
Tier 1 cohort								
(Tier 1 cohort)*(YOS=6)	-0.033	0.723	0.011	0.928	0.004	0.974	-0.006	0.963
(Tier 1 cohort)*(YOS=7)	-0.297	0.002 ***	-0.312	0.030 **	-0.316	0.039 **	-0.335	0.030 **
(Tier 1 cohort)*(YOS=8)	-0.198	0.026 **	-0.528	0.000 ***	-0.452	0.002 ***	-0.469	0.002 ***
(Tier 1 cohort)*(YOS=9)	-0.180	0.039 **	-0.496	0.002 ***	-0.465	0.006 ***	-0.495	0.003 ***
(Tier 1 cohort)*(YOS=10)	0.098	0.267	0.507	0.001 ***	0.361	0.027 **	0.316	0.054 *
(Tier 1 cohort)*(YOS=11)	0.072	0.445	0.478	0.005 ***	0.468	0.008 ***	0.447	0.012 **
(Tier 1 cohort)*(YOS=12)	0.166	0.106	0.354	0.075 *	0.342	0.090 *	0.322	0.110
(Tier 1 cohort)*(YOS=13)	0.014	0.897	0.117	0.595	0.126	0.572	0.097	0.664
(Tier 1 cohort)*(YOS=14)	0.010	0.932	0.036	0.844	0.002	0.993	-0.029	0.875
(Tier 1 cohort)*(YOS=15)	0.078	0.596						
(Tier 1 cohort)*(YOS=16)	-0.220	0.265						
Age in first year (YOS=1)							0.045	0.000 ***
Female							0.211	0.001 ***
Ethnicity								
White							-----	-----
Asian							0.258	0.298
Black							-0.611	0.257
Hispanic							-0.188	0.300
Native American							-0.544	0.264
Other							0.199	0.365
Advanced degree holder							0.041	0.452
School level								
Elementary					-----	-----	-----	-----
Middle					0.129	0.065 *	0.158	0.025 **
High					0.327	0.000 ***	0.362	0.000 ***
Other					0.472	0.013 **	0.550	0.004 ***
Percent under-represented minority					-0.002	0.150	-0.002	0.156
School size (100s students)					-0.039	0.000 ***	-0.033	0.000 ***
Constant	-2.008	0.000 ***	-2.748	0.000 ***	-2.602	0.000 ***	-4.409	0.000 ***
Observations	245,883		34,915		33,649		33,628	
Pseudo-R ²	0.0247		0.0089		0.0110		0.0314	
Log-Likelihood	-59065		-6644		-6131		-6003	

Notes:
 ***: Statistically significant at the 1-percent level; **: Statistically significant at the 5-percent level; *: Statistically significant at the 10-percent level.
 Coefficients are reported as log-odds ratios. Standard errors are clustered at the individual level. Specification 1 is based on a sample of teachers who began working between 1956 and 2012, with teacher-year observations included for the first 17 years of service for Tier 2 and OPSRP teachers and between 6 and 17 years of service for Tier 1 teachers. Specifications 2, 3, 4, and 5 are based on a sample of teachers who began working between 1994 and 1997 (2 years before or 2 years after Tier 1 ended). Specification 6 is based on a sample of teachers who began working between 1992 and 1999 (4 years before and 4 years after Tier 1 ended).

Source: Authors' calculations based on data from the Oregon Department of Education (ODE).

Table 1 (continued): Quit patterns among teachers hired before and after the end of Oregon's Tier 1 pension plan

	Specification #5		Specification #6	
	ln(odds ratio)	p-value	ln(odds ratio)	p-value
Years of service				
1				
2				
3				
4				
5				
6				
7	-0.260	0.009 ***	-0.030	0.703
8	-0.122	0.215	-0.141	0.089 *
9	-0.309	0.003 ***	-0.325	0.000 ***
10	-0.242	0.020 **	-0.578	0.000 ***
11	-0.298	0.006 ***	-0.630	0.000 ***
12	-0.510	0.000 ***	-0.748	0.000 ***
13	-0.679	0.000 ***	-0.580	0.000 ***
14	-0.191	0.100	-0.398	0.001 ***
15	-0.096	0.421	-0.330	0.000 ***
16				
17				
Tier 1 cohort	-0.051	0.344		
(Tier 1 cohort)*(YOS=6)			-0.126	0.223
(Tier 1 cohort)*(YOS=7)			-0.408	0.000 ***
(Tier 1 cohort)*(YOS=8)			-0.257	0.010 **
(Tier 1 cohort)*(YOS=9)			-0.150	0.169
(Tier 1 cohort)*(YOS=10)			0.320	0.004 ***
(Tier 1 cohort)*(YOS=11)			0.329	0.005 ***
(Tier 1 cohort)*(YOS=12)			0.469	0.000 ***
(Tier 1 cohort)*(YOS=13)			0.177	0.170
(Tier 1 cohort)*(YOS=14)			0.025	0.861
(Tier 1 cohort)*(YOS=15)				
(Tier 1 cohort)*(YOS=16)				
Age in first year (YOS=1)	0.045	0.000 ***		
Female	0.211	0.001 ***		
Ethnicity				
White				
Asian	0.246	0.323		
Black	-0.607	0.261		
Hispanic	-0.186	0.304		
Native American	-0.528	0.276		
Other	0.211	0.333		
Advanced degree holder	0.042	0.445		
School level				
Elementary				
Middle	0.155	0.027 **		
High	0.361	0.000 ***		
Other	0.563	0.003 ***		
Percent under-represented minority	-0.002	0.181		
School size (100s students)	-0.033	0.000 ***		
Constant	-4.394	0.000 ***	-2.662	0.000 ***
Observations	33,628		68,702	
Pseudo-R ²	0.0285		0.0050	
Log-Likelihood	-6021		-13186	

Notes:

***: Statistically significant at the 1-percent level; **: Statistically significant at the 5-percent level; *: Statistically significant at the 10-percent level. Coefficients are reported as log-odds ratios. Standard errors are clustered at the individual level. Specification 1 is based on a sample of teachers who began working between 1956 and 2012, with teacher-year observations included for the first 17 years of service for Tier 2 and OPSRP teachers and between 6 and 17 years of service for Tier 1 teachers. Specifications 2, 3, 4, and 5 are based on a sample of teachers who began working between 1994 and 1997 (2 years before or 2 years after Tier 1 ended). Specification 6 is based on a sample of teachers who began working between 1992 and 1999 (4 years before and 4 years after Tier 1 ended).

Source: Authors' calculations based on data from the Oregon Department of Education (ODE).

Table 2: Coefficients from equation explaining teacher exit age

Variable	Specification #1		Specification #2	
	Coefficient	t-statistic	Coefficient	t-statistic
Age in 2000	0.524	0.000 ***	0.512	0.000 ***
Gender				
Male	-----	-----	-----	-----
Female	0.347	0.000 ***	0.368	0.000 ***
Educational attainment				
BA only	-----	-----	-----	-----
BA plus some graduate work	-0.210	0.084 *	0.114	0.430
Masters	0.155	0.200	0.358	0.009 ***
Doctorate	0.407	0.369	0.454	0.317
Years teaching	-0.091	0.000 ***	-0.082	0.000 ***
Pension wealth (\$10,000) ¹	-0.011	0.000 ***	-0.012	0.000 ***
Ethnicity				
White			0.055	0.824
Black			0.276	0.556
Hispanic			-0.184	0.664
Other			-----	-----
Base salary				
First quantile			-----	-----
Second quantile			0.817	0.000 ***
Third quantile			0.937	0.000 ***
Fourth quantile			1.160	0.000 ***
Fifth quantile			0.925	0.026 **
Contract length				
< 170 days			-----	-----
170 to 189 days			1.140	0.002 ***
190 days			0.661	0.052 *
191 to 200 days			0.703	0.039 **
> 200 days			0.767	0.233
School level				
Elementary			-----	-----
Middle			0.008	0.934
High			0.059	0.677
Number of students				
First quantile			-----	-----
Second quantile			-0.400	0.001 ***
Third quantile			-0.144	0.226
Fourth quantile			-0.147	0.269
Fifth quantile			-0.261	0.137
Constant	33.383	0.000 ***	32.078	0.000 ***
R-squared	0.340		0.350	
Sample size	8,621		8,621	

Notes:

[1] Pension wealth is estimated using a contribution rate of six percent, an assumed rate of return of eight percent, a cost of living adjustment of three percent, a wage growth rate of three percent, and a discount rate of four percent.

Source: Authors' calculations based on data from the Oregon Department of Education (ODE) and the National Center for Education Statistics' (NCES) Common Core of Data (CCD).

Table 3: Average exit age, by Tier One pension characteristic and gender

	Men	Women
Base retirement age	59.9	60.2
Defined-benefit pension	-0.6	-0.6
Tier One money match provision		
8-percent guarantee	-0.3	-0.3
Excess crediting	-0.7	-0.7
Average Retirement Age	58.3	58.7

Source: Authors' calculations based on data from the Oregon Department of Education (ODE) and the National Center for Education Statistics' (NCES) Common Core of Data (CCD); see Figure 7 and Table 1 for details.