CEDR Working Paper | WP #2016-5

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Pension Generosity in Oregon and Its Impact on Midcareer Teacher Attrition and Older Teachers' K12 Workforce Exit Decisions

Kevin E. Cahill, ECONorthwest, Center for Aging & Work
Andrew Dyke, ECONorthwest
John Tapogna, ECONorthwest

The Center for Education Data & Research
University of Washington Bothell
3876 Bridge Way N. Ste. 201 Seattle, WA 98103
(206) 547-5585 cedr@u.washington.edu
www.cedr.us

Summary

Oregon's Tier One Public Employees Retirement System (PERS) covered members prior to January 1, 1996. This *Issue Brief* documents the generosity of the money match provision under Oregon's Tier One plan relative to the Tier One defined-benefit formula, and relative to other plans in Oregon and Washington and to representative plans nationally. We then 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's money match provision, however, the true magnitude of its generosity was largely unknown to teachers until just prior to retirement. As such, any economic incentives to promote longer tenure among midcareer teachers may have been muted, while the plan's generosity, once apparent just prior to retirement, created strong wealth effects that may have enabled earlier K12 exits. We find evidence for both of these outcomes. Midcareer quit rates in Oregon were unremarkable based on an analysis of teacher work histories in Oregon from 2000 to 2013. Further, based on an analysis of 8,621 teachers in Oregon who were aged 50 and older in 2000, our findings suggest that the generosity of Oregon's Tier One money match 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—even in the extreme case of Oregon—as the true generosity of a plan must be known to employees throughout their careers to impact midcareer work decisions.

Acknowledgment/Disclaimer: The Laura and John Arnold Foundation supported this research through a grant to American Institutes for Research (AIR) and ECONorthwest. All views expressed in this paper are those of the authors and do not necessarily reflect the views or policies of ECONorthwest, AIR, or the Laura and John Arnold Foundation.

Suggested citation:
Cahill, K., Dyke, A., and Tapogna, J. (2016). Pension Generosity in Oregon and Its Impact on Midcareer Teacher Attrition and Older Teachers' K12 Workforce Exit Decisions. CEDR Policy Brief 2016-6. University of Washington, Seattle, WA.

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I. Introduction

Public pension reform has emerged as an important policy issue in the United States. In many states, the generosity of public pension benefits outstripped the level of funding required to support them, resulting in a nationwide shortfall in the range of several trillion dollars (Novy-Marx & Rauh, 2011; Pew Center on the States, 2010). These unfunded pension obligations are straining the finances of state and local governments (Zeehandelaar & Winkler, 2013), who have a keen interest in adopting reforms that will help avoid being in similar circumstances in the future.

One way to limit future exposure to pension obligations is to reduce the generosity of pension plans. Indeed, many states now operate multiple tiers of plans with newer employees generally being enrolled in less generous plans. A concern about such reforms is that they will have the undesirable effect of increasing levels of turnover in the public-sector workforce. After all, one motivation for the use of employer-sponsored pension plans is to regulate employee turnover and the timing of retirement (Gustman, Mitchell, & Steinmeier, 1994).

In this *Issue Brief*, we explore the relationship between pension generosity and employee turnover in the context of Oregon's Public Employee Retirement System (PERS) and its public teacher workforce. Oregon provides a compelling case for analysis because it provided one of the more generous teacher pension plans in nation, but it also adopted reforms in the late 1990s and early 2000s that substantially reduced the level of generosity (Brewer, 2004; Oregon Public Employees Retirement System, 2015; Tapogna & Batten, 2007). Importantly in the case of Oregon, however, the true generosity of its pension plan—which entailed a guaranteed 8% return and excess crediting when market returns exceeded this amount, as well as other features that enhanced benefit amounts—was not relayed to teachers on an individual basis until just prior to

retirement. Therefore, although 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 had a minimal impact on midcareer attrition and then a sizable impact on earlier departures from the K12 workforce.

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 Tier Two or Oregon Public Service Retirement Plan (OPSRP) 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 Tier One plan. These findings suggest that the generosity of Oregon's Tier One plan did not induce midcareer 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 may have actually 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 midcareer work decisions.

II. The evolution and generosity of Oregon's public pension system

Oregon's Tier One PERS program began in 1945 and covers individuals who were hired before January 1, 1996. The original program consisted of a money match component in which employees would contribute to a personal account throughout their careers and be credited with earnings on those contributions at a rate established by PERS. At the end of their careers, the

employer would match this amount dollar for dollar. Based on the matched amount, the employer would then calculate an annuity based on an assumed rate of return and discount rate (Brewer, 2004).

The money match plan fell short of policymakers' anticipated replacement due primarily to low investment returns during the 1950s and 1960s. In an effort to boost replacement rates, the PERS Board made a series of changes and in 1979 set a 75-85 income replacement goal, with the replacement rate based on a combination of public employees' PERS pensions and Social Security benefits. Oregon's Tier One defined-benefit formula was designed to obtain this income replacement goal by providing an annuity equal to 1.67% × FAS × YOS, where FAS is final average salary and YOS is years of service. After 30 years of service, the PERS defined-benefit pension alone would provide 50% replacement (50% = 30 × 1.67%), with Social Security making up the rest (Board of Trustees of OASDI, 2015; Brewer, 2004; Tapogna & Batten, 2007).

The key driver of Oregon's Tier One pension generosity was a series of changes to the money match provision that increased the guaranteed rate of return from 5.5% before 1975 to 8% in 1989. The returns earned on personal account assets are represented in Figure 1. The money match provision resulted in substantially higher benefit amounts than those under the traditional defined-benefit formula. Between 1998 and 2004 nearly 9 out of 10 Oregon employees retired with benefits calculated using the money match formula (Oregon Public Employees Retirement System, 2015). Further, the average amount by which the money match annuity exceeded the defined-benefit annuity was large, ranging from 22% in 1990 (a 61% replacement rate compared with the 50% target) to 100% in 2000 (a 100% replacement rate compared with the 50% target) among employees with 30 years of service (Oregon Public Employees Retirement System, 2015).

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 8% rate of return that existed under the Tier One plan. The defined-benefit portion 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 OPSRP. Under the OPSRP plan the normal retirement age under the full formula was increased from 60 to 65 and an actuarial adjustment was made to the full formula benefit factor used to calculate monthly benefits. Further, the credit per year of service was reduced from 1.67% to 1.5%, yielding 45% replacement after 30 years of service (45% = 1.50% * 30 years) instead of 50% (50% = 1.67% * 30 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).

To put the generosity of Oregon's Tier One plan in perspective, we compare 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. (See Goldhaber, Grout, & Holden, 2015, for details on each Washington plan.) 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 salary of $65,000 per year. We calculate present discounted value of Tier One benefits for this teacher to be $1,476,822.[1]

The present discounted value of benefits under the next highest plan for the hypothetical teacher is $817,811 under Oregon's OPSRP plan—only slightly more than half (55%) that of the Tier One money match amount (Figure 2).[2] 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 TRS1 and TRS2 plans, and is just 43% of the Tier One money match amount.

III. The impact of Oregon's Tier One plan on midcareer teacher attrition

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, 2015b). In both cases, the benefit structure needs to be known to the employee in order to incentivize the employee to remain with their employer.

[1] This amount is similar to the values calculated by Keisling, Winthrop, and Crawford (2013), once Social Security benefits are removed from their estimate.
[2] The OPSRP plan is a hybrid that includes a defined-contribution component. For the defined-contribution part of the plan, we assume an annual employee contribution of 5% and an annual market rate of return of 8%.

Importantly in the case of Oregon, the magnitude of its pension benefits under the money match provision was largely unknown to teachers for much of their tenure. Annual statements before 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 only the guaranteed 8% return over the teachers' work history but also the guaranteed 8% return throughout retirement. So, even for teachers monitoring their account value, the impact of guaranteed returns of 8% (later reduced to 7.75%) into the future, used to calculate the annuitized amount, were likely not salient 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 8% minimum did not occur until the market downturns in the early 2000s and in 2008. While other investors were experiencing substantial reductions in principle during these periods, those covered under Tier One received a full 8% return. As noted in Brewer (2004, p. 35), "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."

Given that the true generosity of the money match provision was likely not fully apparent until much later in teachers' careers, a priori we would anticipate little impact on midcareer teacher attrition. To test this hypothesis, 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 midcareer teachers in Oregon differs by pension plan status. The ODE data contains 57,763 unique teacher observations from the 2000–01 academic year through the 2013–14 academic year, for a total of 388,154 teacher-year observations. For each teacher we know their work status and full-time equivalent status in each academic year, as well as their 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 data set. The CCD data set provides information on school size, school ethnic composition, and school level (elementary, middle, and high school), potentially important factors when modeling teacher attrition.

First, we 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 attrition among less experienced teachers because the dataset begins with the academic year 2000-1 and Tier One eligibility ended for teachers starting on January 1, 1996. Similarly, our dataset extends to the 2013–04 academic year, which limits the 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 and 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. The quit-rate comparisons between Oregon and Washington shed

light on the extent to which 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 3). Further, within the Oregon sample, teacher quit rates for those covered under Tier One are not consistently lower than those covered under Tier Two or OPSRP. Quit rates are somewhat lower between 6 and 10 years of service and then somewhat higher for teachers with 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, this descriptive analysis does not control for a multitude of factors that might explain (or mask) differences between teachers covered under the Tier One plan or the Tier Two and OPSRP plans. To account for these factors, we examine quit rates in a multivariate context.

We estimate a series of discrete choice hazard models that follow a structure proposed by Goldhaber et al. (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:

$$p_{it} = \frac{e^{\sum_{t=2000}^{2013}(\sigma_t 1(\mathrm{YOS}=t))+\sum_{t=2000}^{2013}(\gamma_t 1(\mathrm{YOS}=t)*\mathrm{Tier\ 1_i})+\beta_1' \mathrm{T_i}+\beta_2' \mathrm{S_i}}}{1+e^{\sum_{t=2000}^{2013}(\sigma_t 1(\mathrm{YOS}=t))+\sum_{t=2000}^{2013}(\gamma_t 1(\mathrm{YOS}=t)*\mathrm{Tier\ 1_i})+\beta_1' \mathrm{T_i}+\beta_2' \mathrm{S_i}}} \qquad (1)$$

where

p_{it} = propensity that teacher i does not return between year t and $t + 1$
$\sum_{t=1}^{T}(\mathbf{1}(\mathbf{YOS} = \mathbf{t}))$ = 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 (elementary, middle, high, and other), percentage underrepresented 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. In one specification, for example, 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 afterward. 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 are consistent with the descriptive findings. We find that 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. Notably, 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. The results of both the descriptive and multivariate analysis indicate that attrition for the Tier One cohort was lower in some years and higher in others, yielding little evidence that the money match provision reduced attrition overall, again, as expected.

IV. Impact of Oregon's Tier One plan on older teachers' K12 workforce exit decisions

As noted earlier, the benefits provided the money match provision only became fully apparent to teachers at the end of their careers. We therefore test whether the larger-than-expected levels of pension wealth under the money match provision impacted the timing at which they exited the K12 workforce. Using the ODE administrative records matched to the NCES CCD data, we 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. Using this information, we examine how older teacher exits in Oregon vary by their estimated level of wealth under the Tier One pension system.

Pension wealth is estimated as of the year 2000 using each teacher's base salary in that year (extrapolated backward through time), years of experience teaching in Oregon, and annual contributions and interest payments under the Tier One plan from 1960 to 2000. We isolate this pension wealth affect by controlling for other factors that could impact the decision to retire. The equation is as follows:

$$\text{ExitAge}_i = \propto + \beta_1 \text{penwealth}_i + \beta_2 \text{age2000}_i + \beta_3 \text{gender}_i + \beta_4 \text{education}_i + \beta_5 \text{yrsteaching}_i + \beta_6 \text{ethnicity}_i + \beta_7 \text{salary}_i + \beta_8 \text{contractlength}_i + \beta_9 \text{schllevel}_i + \beta_{10} \text{numstudents}_i + \varepsilon_i \quad (2)$$

Following Munnell, Cahill, and Jivan (2003), we estimate the coefficients in Equation 2 using OLS to assess how the generosity of the Tier One pension system impacted the exit ages of older teachers in Oregon.

The coefficients from Equation 2 are shown in Table 2. Using these coefficients, the base exit age for a teacher aged 54 years old in 2000 with 30 years of experience is 59.9 years for men[3] and 60.2 years for women (Table 3).[4] Both results are intuitive and resemble that of 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% 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% guarantee reduces the average exit age by approximately four months (0.3 years) and the excess crediting further reduces the average exit age by approximately eight months (0.7 years). Therefore, the overall impact of the 8% guarantee and excess crediting suggests that teachers in Oregon exit the K12 workforce on average about one year earlier than

[3] 59.9 = constant + b_{age} * 54 + b_{exp} * 20 = 33.4 + .524 * 54 + -.091 * 20.
[4] 60.2 = constant + b_{age} * 54 + b_{exp} * 20 + b_{female} * 1 = 33.4 + .524 * 54 + -.091 * 20 + .347.

would have otherwise been the case under the defined-benefit pension formula.[5] Using the average tenure of 24.4 years among teachers aged 50 or older in 2000, this one-year reduction represents a 4% 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.

V. Conclusion

The money match provision of Oregon's Tier One pension system credited members with a minimum guaranteed rate of return of 8%, and higher rates when the market rate of return exceeded 8%. This formula generated replacement rates that far exceeded the replacement rates of Oregon's subsequent plans, potentially creating strong incentives for Tier One 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 midcareer 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 8% 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.

In this *Issue Brief,* we explore the impact of these incentives. We find little evidence of any impact on midcareer teacher tenure, as expected. Further, we find evidence 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. In short, the pension generosity of

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

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 under the Tier One defined-benefit formula.

The key policy implication from the case of Oregon is that the generosity of a pension plan in and of itself does not incentive longer tenures. 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. Policymakers can learn from Oregon by emphasizing the value of their pension benefits to teachers early in the hiring process and throughout teachers' careers.

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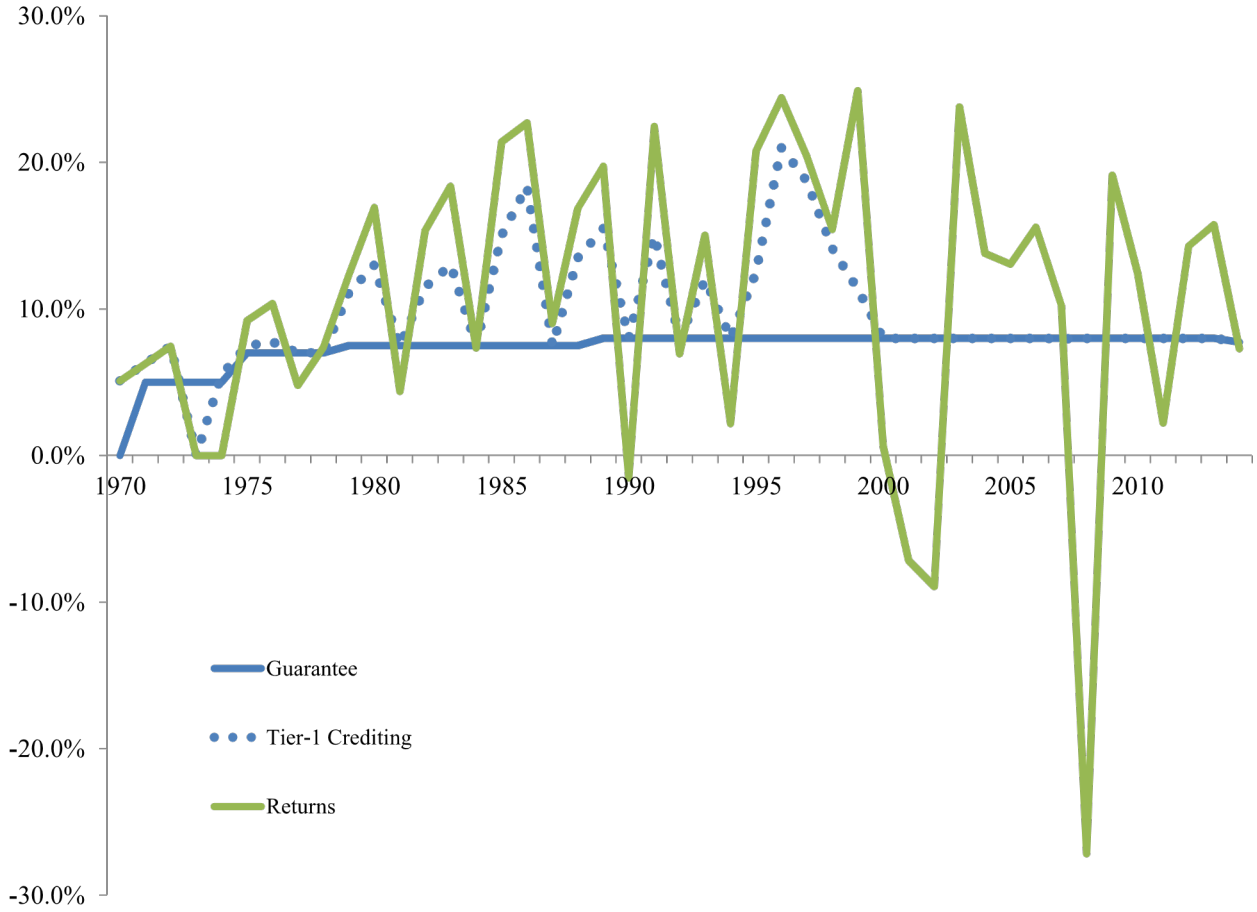
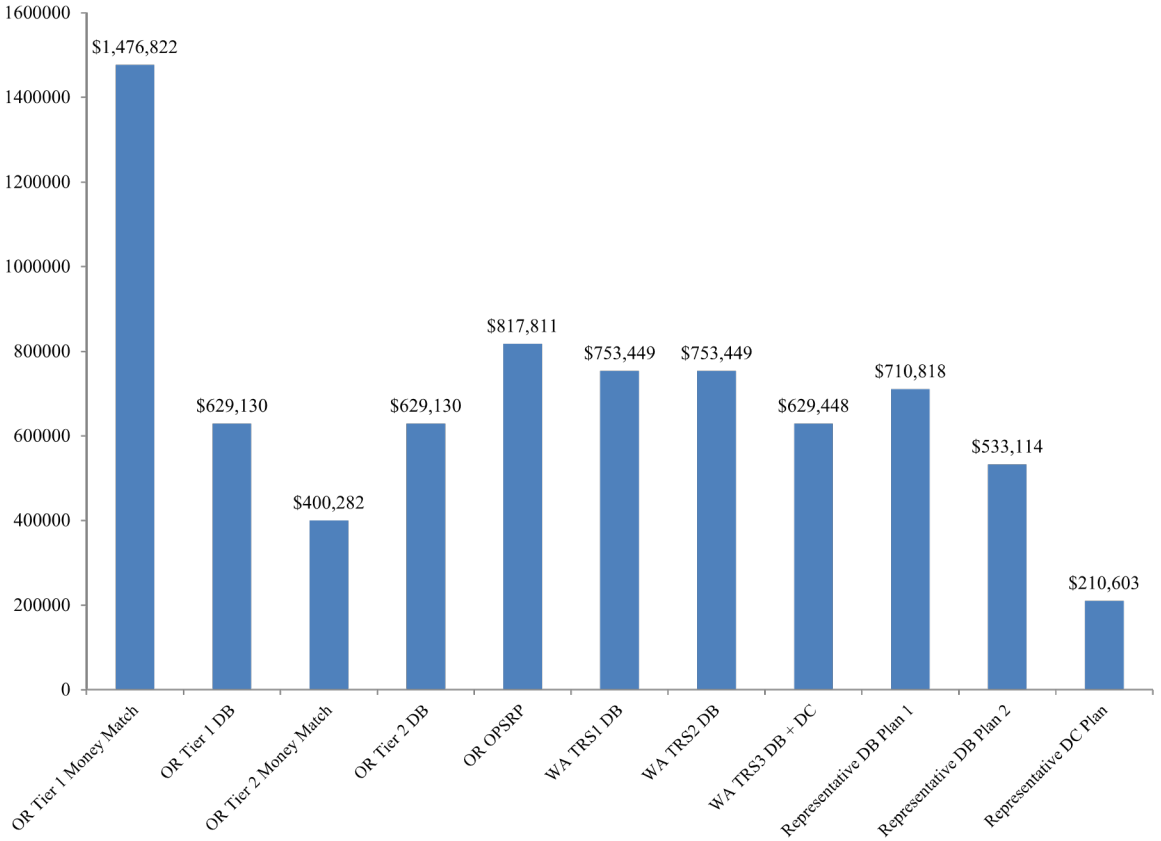
Figure 1: Guaranteed rates of return and excess crediting, Tier One, 1970 to 2014



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

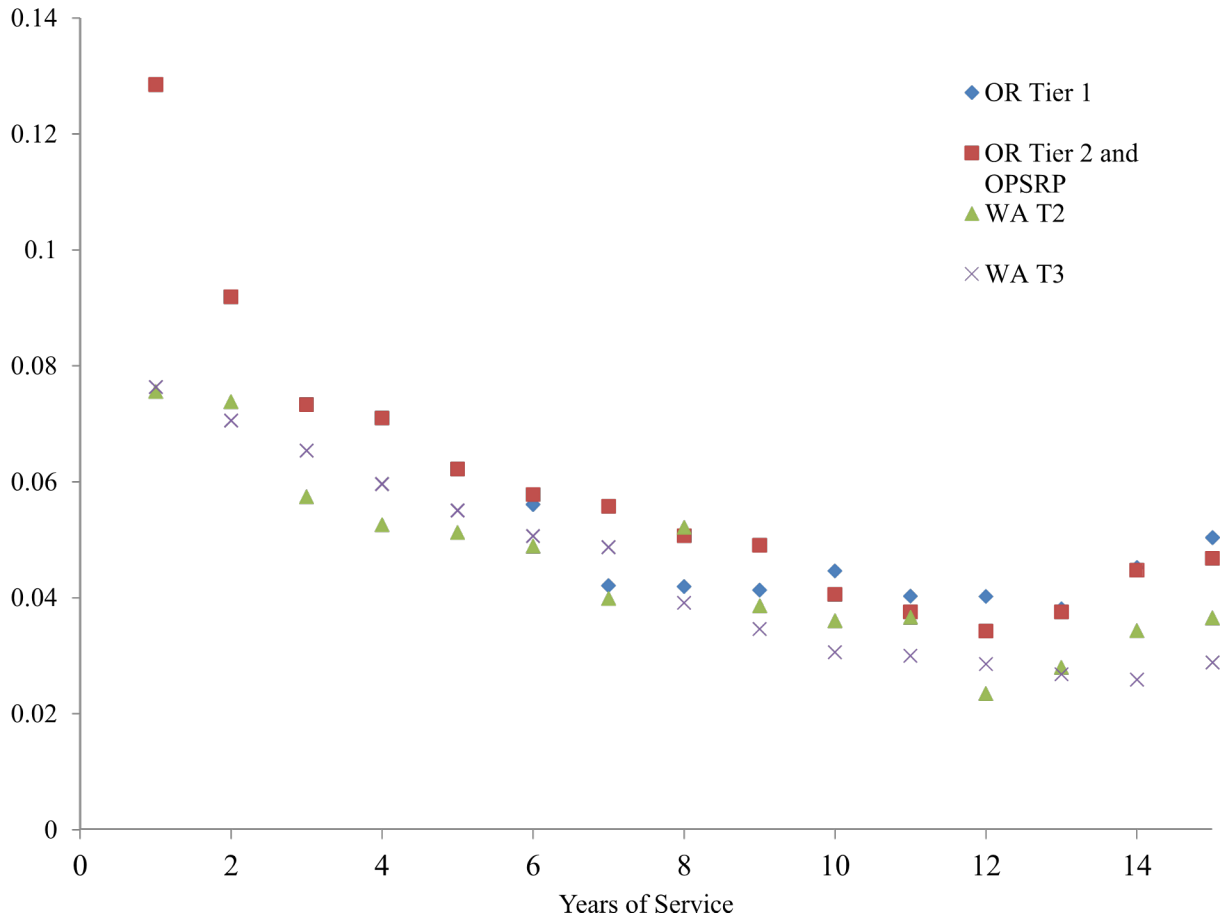
Figure 2: Present discounted value of pension wealth under various plans for a representative K12 teacher retiring in 2014 at age 62 with 30 years of service



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. Amounts shown for defined-benefit plans do not take into account variations in generosity that may arise due to differences in plan rules regarding when benefits can first be claimed.

Source: Authors' calculations.

Figure 3: 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		Specifcation #4	
	ln(odds ratio)	p-value	ln(odds ratio)	p-value	ln(odds ratio)	p-value	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 ***	-0.087	0.483	-0.115	0.376	-0.117	0.378
8	-0.923	0.000 ***	0.193	0.105	0.078	0.539	0.075	0.563
9	-0.956	0.000 ***	-0.047	0.716	-0.100	0.467	-0.095	0.491
10	-1.155	0.000 ***	-0.472	0.002 ***	-0.432	0.005 ***	-0.417	0.007 ***
11	-1.235	0.000 ***	-0.593	0.000 ***	-0.566	0.000 ***	-0.545	0.001 ***
12	-1.330	0.000 ***	-0.766	0.000 ***	-0.712	0.000 ***	-0.678	0.000 ***
13	-1.234	0.000 ***	-0.819	0.000 ***	-0.772	0.000 ***	-0.730	0.000 ***
14	-1.052	0.000 ***	-0.313	0.041 **	-0.236	0.134	-0.179	0.259
15	-1.007	0.000 ***	-0.210	0.098 *	-0.161	0.224	-0.101	0.452
16	-0.689	0.000 ***						
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	
Psuedo-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

	Specifcation #5		Specifcation #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	
Psuedo-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 Coefficient	Specification #1 t-statistic	Specification #2 Coefficient	Specification #2 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 Table 2 for details.