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Working Paper 491
August 2016

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August 8, 2016

Acknowledgment/Disclaimer: The Laura and John Arnold Foundation supported this research through a grant to the 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 the U.S. Bureau of Labor Statistics, ECONorthwest, AIR, or the Laura and John Arnold Foundation.

The Impact of Oregon's Pension Legacy Costs on New Teacher Turnover and Quality

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Pension legacy costs can restrict the amount of resources available for current public education and make it more difficult to attract and retain high quality teachers. Oregon provides a useful case study in pension legacy costs because many school districts in the state are now reallocating General Fund expenditures to cover sizeable past pension promises. We first describe how Oregon's past pension promises, as compared with nearby Washington's, affect the level of resources available to compensate new teachers. We then assess potential impacts by examining how new teacher turnover differs in districts along the Oregon-Washington border and within Oregon across school districts. We find early-career quit rates in school districts on the Oregon side of the Oregon-Washington border have exceeded those on the Washington side in recent years, and overall teacher experience on the Oregon side has fallen below that on the Washington side. Further, using district-level variation within Oregon, we find early-career quit propensities are positively associated with the percentage of General Fund revenues allocated to PERS expenditures. These findings are consistent with the hypothesis that Oregon's pension legacy costs negatively affect current teacher quality and retention.

I. Introduction

Throughout the second half of the 20th century public-sector teacher salaries in the United States were by and large supplemented with defined-benefit public-sector pension coverage. This deferred compensation enabled districts to offer additional financial incentives to attract and retain a quality workforce (Rajnes, 2001; Gustman, Mitchell & Steinmeier, 1994; Zeehandelaar & Winkler, 2013). While school districts presumably benefited by offering teachers higher levels of overall compensation, states accrued substantial pension liabilities over time (Munnell, Aubry & Carafelli, 2015; Novy-Marx & Rauh, 2011; The Pew Center on the States, 2010). A recent study by The Pew Charitable Trusts reported that, nationwide, state public retirement pensions were just 72 percent funded (The Pew Charitable Trusts, 2015). These unfunded pension liabilities now present a challenge for K12 education as pension legacy costs—school district payments required to cover the pension benefits of teachers who have retired—can restrict the amount of resources available for public education and make it more difficult to attract and retain high quality teachers. In particular, current teacher salaries might be reduced to cover higher pension contributions rates.

We explore the effect of pension legacy costs on the level of turnover among newly hired teachers in the state of Oregon. Oregon provides a useful case study in pension legacy costs because its pension legacy costs are large and because the burden varies across districts within the state (Brewer, 2004; Tapogna & Batten, 2007). In many Oregon school districts, the proportion of General Fund resources dedicated to paying for past pension promises has been increasing during the past decade. We hypothesize that this reallocation of resources away from teacher salaries, supplies, and other current education expenditures has made it more difficult for Oregon districts to attract and retain high quality teachers.

To test this hypothesis, we first examine early-career quit rates among teachers in school districts along the Oregon-Washington border, where teacher populations face similar economic circumstances and different unfunded actuarial liabilities (UAL) associated with each state's pension system (the legacy costs in Washington are relatively small).¹ If pension legacy costs do impact teacher attrition, we would expect to see differences in teacher attrition between border districts. Variation within the state of Oregon also provides an opportunity for analysis. Oregon school districts differ with respect to their pension legacy costs due in part to their issuance of pension obligation bonds. As a result, the percentage of the General Fund allocated to Oregon's Public Employees Retirement System (PERS) varies substantially across school districts. If pension legacy costs impact teacher attrition we would expect the amount of resources allocated to PERS to be positively related to teacher attrition, all else equal.

Using teacher-level data from the Oregon Department of Education and data from the National Center for Education Statistics we find that early-career quit rates in school districts on the Oregon side of the Oregon-Washington border have exceeded those on the Washington side in recent years, corresponding to increases in Oregon's UAL relative to Washington's UAL. Average teacher experience on the Oregon side has also fallen below that on the Washington side. Further, using district-level variation within Oregon, we find that early-career quit propensities are positively associated with the percentage of General Fund revenues allocated to PERS. We conclude that Oregon's pension legacy costs do appear to be negatively affecting current teacher retention.

This paper is structured as follows. The next section describes Oregon's and Washington's pension systems and compares teacher attrition and experience within districts along the Oregon-

¹ See Goldhaber, Grout, Holden, and Brown (2015) for a detailed description of the Oregon and Washington teacher labor markets, including licensure procedures, tenure and seniority, and salaries.

Washington border. Section III describes district-level variation in Oregon with respect to PERS expenditures and explains the process through which districts issued pension obligation bonds to cover their PERS costs. Section IV examines the extent to which this district-level variation in PERS expenditures affects K12 early-career quit rates. Section V translates the teacher turnover impacts into overall teacher quality impacts using information about gains in effectiveness during teachers' early years.

II. Public pension legacy costs and teacher attrition and quality in Oregon and Washington

Oregon's Tier One pension system, closed to new enrollment in January 1996, has been described as "one of the most generous in the nation among both private and public sector retirement plans" (Brewer, 2004). The plan's generosity stemmed largely from its "money match" provision that guaranteed a minimum annual rate of return of eight percent and paid higher returns if the market exceeded this rate. Upon retirement, the employee's account was doubled and an annuity was calculated based on the doubled amount.² This annuitized value was then compared to that calculated under the traditional defined-benefit formula, and the employee received the higher of the two amounts. Not surprisingly, the vast majority of Oregon PERS beneficiaries retiring between 1998 and 2004 had benefits calculated using the money match formula, and in 2000 the average replacement rate for retirees with 30 years of service was 100 percent, far exceeding the PERS Board's 50 percent target (excluding Social Security benefits) (Oregon Public Employees Retirement System, 2015).³

² Contributions to the employee's account, equal to six percent of an employee's salary, were originally paid for by the employee (i.e., subtracted from salary), but over time the contribution was paid for by some employers (i.e., not subtracted from salary). Currently 72 percent of PERS employees have their member contribution paid for by their employer (Oregon Public Employees Retirement System, 2016).

³ The unsustainability of the money match provision became apparent in the 1990s and new employees starting in 1996 and later were not eligible for the guaranteed returns. Teachers hired between January 1, 1996 and August 28, 2003 were enrolled in Oregon's Tier Two pension plan and teachers hired thereafter have been enrolled in the Oregon Public Service Retirement Plan (OPSRP). Tier Two and OPSRP have a defined-benefit component, though

In contrast to Oregon’s Tier One plan, Washington’s public plans did not include a money match provision. Teachers hired prior to 1977 were enrolled in Washington’s TRS1 plan which consisted of a traditional defined-benefit plan. Employees hired between 1977 and 1996 were enrolled in TRS2, also a defined-benefit plan but notably with higher normal retirement ages than the TRS1 plan. Teachers hired between 1996 and 2007 were enrolled in TRS3, a hybrid plan with both a defined-benefit component funded by the employer (albeit with a less generous formula than that of the TRS1 and TRS2 plans) and a defined-contribution component based on employee’s contributions in an investment account. Teachers hired since 2007 have the option to join TRS2 or TRS3. Teachers hired under the TRS2 plan and who are active have had the option of joining TRS3 since 1996.⁴ A recent descriptive analysis of Oregon’s Tier 1 pension plan and the Washington plans shows that Oregon’s Tier 1 plan was nearly twice as generous as Washington’s TRS1, TRS2, and TRS3 plans for a representative K12 teacher retiring in 2014 at age 62 with 30 years of service (Cahill, Giandrea, Dyke, and Tapogna, 2016).⁵ Among the two ways for a state to experience large unfunded liabilities—one being to devise a plan with generous benefits and the other to underfund promised benefits—Oregon aligns with both.

Oregon’s pension system, according to some measures, remains relatively well funded compared with other states.⁶ However, the actual burden of Oregon’s pension legacy costs is

the credit per year of service differs between the two (1.67% for Tier Two and 1.5% for OPSRP) as well as with respect to a final actuarial adjustment that is applied to determine actual benefits. Tier Two plan and OPSRP participants can also participate in Oregon’s Individual Account Program (IAP), with account balances subject to market returns.

⁴ See Goldhaber, Grout, Holden, & Brown (2015) for a detailed comparison of the Oregon and Washington pension plans.

⁵ See also Keisling, Winthrop & Crawford (2015).

⁶ As of 2013, Oregon’s public pension liabilities were 96 percent funded, belonging to a group of just four states with pension liabilities funded above 90 percent (The Pew Charitable Trusts, 2015). Washington’s pension system—with 88 percent of pension liabilities funded in 2013—is also relatively well funded. While pension liabilities in Oregon appear to be well funded on a percentage basis, the magnitude of Oregon’s pension liability is particularly noteworthy relative to the size of its economy. For example, Oregon and Washington have similar liabilities associated with their public pension benefits (\$63 billion and \$74 billion, respectively), but Washington’s total personal income is nearly twice that of Oregon’s (\$425 billion and \$229 billion, respectively, in 2015) (The Pew

larger than some published estimates would indicate. First, Oregon's UALs are at times reported with employer side accounts included as assets.⁷ As of 2014, side accounts were valued at \$5.9 billion, with outstanding pension obligation bonds representing more than 90 percent of these assets (93.9% or \$5.5 billion).⁸ To the extent that bond payments remain, the employer side accounts do not denote a net asset to the school district and, therefore, should not be included when determining Oregon's UALs.

Second, Oregon's legislature passed pension reforms that were later overturned by Oregon's Supreme Court, which declared it to be unconstitutional to retroactively reduce cost-of-living adjustments to PERS beneficiaries (Balmer, 2015).⁹ As a result the actuarial valuation of Oregon's pension legacy costs increased substantially between 2013 and 2014. Oregon's UAL is currently \$18 billion when side accounts are not included, of which \$7.8 billion is estimated to be associated with school districts, compared with Washington's UAL of \$6.8 billion for its TRS1 and TRS2/3 plans (\$2.8 billion for TRS1 and \$3.9 billion for TRS2/3 (Figure 1).

With the exception of Oregon's UAL estimates in 2012 and 2013 (which are now known to be artificially low because of the Supreme Court ruling) Oregon's pension legacy costs have been markedly higher than those in Washington since the start of the Great Recession. Further, the relative burden of Oregon's UAL is substantially larger than that of Washington's, as Washington's total personal income is nearly twice that of Oregon's (U.S. Bureau of Economic Analysis, 2015).

Charitable Trusts, 2015; U.S. Bureau of Economic Analysis, 2015). The relative burden of Oregon's pension obligation is substantially larger than that of Washington's.

⁷ Oregon PERS reports unfunded liabilities both with and without employer side accounts.

⁸ School districts accounted for 96 of the 144 Oregon PERS employers with side accounts (Oregon Public Employees Retirement System, 2016).

⁹ Oregon Senate Bills 822 and 861 were signed into law in 2013. See Balmer (2015) for details.

One way to assess the burden of Oregon’s pension obligations is to examine the pension contribution rates associated with Oregon’s Tier 1 and Tier 2 UAL and those associated with Washington’s TRS1 and TRS2/3 UAL. Teachers and employers contribute a percentage of salary to funding their retirement benefits (the Tier 1/Tier 2 pension contribution rate for school districts in Oregon is currently 21.2 percent, plus a 6.0 percent contribution by employees to the Individual Account Program (IAP);¹⁰ the TRS rate for employers and employees in Washington is currently 14.8 percent and 6.9 percent, respectively).¹¹ A portion of these contributions are made towards paying down the accrued UALs. For Oregon, the Tier 1/Tier 2 UAL rate for school districts from an actuarial valuation as of December 31, 2014 was 9.3 percent, representing 43.7 percent of the total pension rate (Larrabee & Preppernau, 2015).¹² In Washington, the TRS UAL rate based on an actuarial valuation as of June 30, 2014 was 7.9 percent, representing approximately 36.2 percent of the total pension rate (Smith, 2015). These UAL contributions squeeze the level of funding available for current education spending, including spending on teacher salaries.

Indeed, these Oregon and Washington UAL rates are consistent with state-level school district spending on a per-student basis. In the academic year 2012-13 Oregon and Washington were more or less similar with respect to overall spending, with Oregon spending \$9,183 per student and Washington spending \$9,714 per student (Table 1). While each state spends a similar

¹⁰ The 21.2 percent rate for Oregon Tier 1/Tier 2 school districts excludes the 6 percent member contribution (which goes to the Individual Account Program) and pension obligation bond debt service payments. The employer rate is 10.6 percent when side account offsets are included; notably, however, without pension obligation bond debt service payments (Larrabee & Preppernau, 2015; Oregon Public Employees Retirement System, 2015).

¹¹ The Washington TRS1 member rate is 6.0 percent (Smith, 2015).

¹² Larrabee & Preppernau (2015) comment on increases in Oregon’s UAL contribution rates: “Normal cost and UAL rates calculated in this valuation both increased compared to the contribution rates calculated in the December 31, 2013 valuation, which produced rates effective July 1, 2015. This is primarily due to changes in projected plan benefits as an outcome of the *Moro* decision, along with the effect of a lower investment return assumption and increased assumption for the life expectancies of members” (p. 3).

fraction of these funds on purchased services (11%) and supplies (6%), a substantial discrepancy exists with respect to the portion of per-student spending allocated to salaries and the portion allocated to benefits. In Oregon, 52 percent of per-student spending is allocated to salaries and 29 percent is allocated to benefits. In Washington, 61 percent of per-student spending is allocated to salaries and 21 percent is allocated to benefits. Therefore, while both states spend about the same per student, Oregon allocates fewer resources than Washington to salaries as a result of its pension legacy costs.¹³

As noted above, we hypothesize that Oregon will experience higher turnover than Washington as a result of this difference because lower salaries and classroom resources have been linked to higher turnover (Loeb & Myung, 2010). We find that Oregon and Washington border districts do not differ systematically with respect to two-year quit rates between academic years 2000-1 and 2006-7 (Figure 2a). In contrast, two year quit rates are higher among teachers in Oregon border districts relative to those in Washington from academic years 2007-8 through 2011-12, with the percentage in Oregon nearly double that of Washington for all but one year (2009-10). We find a similar result for five-year quit rates as well (Figure 2b). So, while quit rates between Oregon and Washington are mixed earlier in the observation period, as pension legacy costs have grown so has the discrepancy in quit rates along the Oregon-Washington border. A comparison of average teacher experience among all teachers in districts along the Oregon-Washington border reveals a similar result. Notably, average teacher experience in

¹³ We note that differences between Oregon and Washington would be expected even in the absence of pension legacy costs because Oregon currently provides a more generous pension than Washington and because, on average, districts in Oregon pay lower salaries than those in Washington. Oregon also has a higher number of students enrolled per teacher than Washington (21.8 and 19.7, respectively) (National Education Association, 2014). That said, a disproportionately large fraction of Oregon's UAL contributions are used to pay for past teachers' benefits due to the generosity of Oregon's Tier One pension plan (see Cahill, Giandrea, Dyke, and Tapogna, 2016).

academic year 2013-14 is a full one year lower in Oregon districts relative to Washington districts (12.7 years in Oregon compared with 13.7 years in Washington) (Figure 3).

III. District-level variation in pension expenditures within Oregon

The pension costs associated with Oregon's Tier One plan (e.g., payments to retirees) are covered by each district's General Fund. General Fund revenues come from state and local property taxes and are used to fund seven expenditure categories: salaries, associated payroll costs, purchased services, supplies and materials, capital outlays, transfers, and other costs (Oregon Department of Education, 2015). Associated payroll costs include PERS costs,¹⁴ Social Security, contractual employee benefits, and other payroll costs.¹⁵ For the purposes of our analysis, we measure pension legacy costs as the financial burden of the PERS program as a fraction of General Fund expenditures.

Between 2002 and 2008, several school districts in Oregon facing the financial strains of their pension obligations covered their current and anticipated future shortfalls by issuing pension obligation bonds (Larrabee & Preppernau, 2015; Sickinger, 2012; Tapogna & Batten, 2007). Districts that issued the bonds used the proceeds to pay off their pension obligations in advance. So long as the rate of return on their pre-paid pension assets exceeded the interest rate at which the bonds were issued, the district gained an advantage by issuing these bonds. Indeed, districts such as Portland Public Schools that issued bonds in the mid-2000s benefited

¹⁴ Line item 210 of the Oregon Department of Education's Actual Expenditures by Fund and Object is allocated specifically to PERS expenditures.

¹⁵ Salaries include licensed salaries and classified salaries for teachers, as well as salaries for administrators, managerial positions, substitutes, temporary workers, and others. The third category of the General Fund is purchased services. Purchased services include property services, instructional, professional, and technical services, student transportation services, travel, communication and other services. The fourth category is supplies and materials: consumable and non-consumable supplies and materials, textbooks, library books, periodicals, and computer software and hardware. The last three categories of the General Fund are capital outlays, other objects, and transfers (Oregon Department of Education, 2015).

substantially. Those districts that issued bonds in 2008 just prior to the market downturn, such as David Douglas, in contrast, did not fare well, as they faced a negative rate of return on their pension assets against positive interest payments on the issued bonds.¹⁶ The takeaway from Oregon school districts' experience with pension obligation bonds is that some districts gained a short-term advantage by leveraging the market, while others lost.

The percentage of General Fund revenues allocated to the PERS program takes into account any costs associated with the issuance of pension obligation bonds and varies by school district and over time. In the 2000-01 academic year, for example, the 25th percentile for the portion of districts' General Fund expenditures allocated to PERS was approximately seven percent and the 75th percentile was just under 10.0 percent; the median was just above 8 percent (Figure 4). In the 2013-14 academic year, the 25th and 75th percentiles were approximately 9 percent and 13 percent, respectively, with a median value of nearly 11 percent. While district PERS expenditures vary somewhat year to year, a general trend upward exists over the 2000-1 to 2013-4 time period.

IV. The impact of Oregon's pension legacy costs on K12 early-career quit rates

We use district-level variation in PERS expenditures as a percentage of General Fund revenues to examine the impact of Oregon's pension legacy costs on early-career quit rates. Nearly two thirds (63%) of Oregon's current PERS liabilities are for members who are retired and another 17 percent are for active Tier One members (Oregon Public Employees Retirement System, 2015). Changes in General Fund expenditures on PERS from 2000-1 to 2013-4 by and large represent pension costs associated with Oregon's Tier One plan and, therefore, we assume

¹⁶ Other factors besides the timing of issuance could have contributed to a school districts' ability to leverage pension obligation bonds as well, and these features might also influence new teacher turnover. Districts' ability to limit legacy costs in this way could also play a role in teacher turnover decisions.

that observed changes in PERS expenditures can reasonably be attributed to pension legacy costs. First, we observe that early-career quit rates among all Oregon teachers between 2000-1 and 2013-4 resemble those for Oregon teachers in districts along the Oregon-Washington border (Figure 5 and Figures 2a and 2b). In particular, the general decline in quit rates in recent years is consistent with the early-career-quit patterns among teachers on the Washington side of the Oregon-Washington border, suggesting the decline is part of a broader trend.

If legacy costs are causing higher levels of turnover, we may expect to see districts with higher fractions of PERS expenditures to have higher turnover. At first glance, a systematic relationship does not appear to exist between early-career quit rates and the percentage of district General Fund expenditures allocated to PERS (Figures 6a and 6b).¹⁷ Two-year quit rates for new teachers who started working in districts with more than 10 percent of General Fund revenues allocated to PERS were higher in some years relative to their counterparts in other districts, but lower in other years. The same is true when examining five-year quit rates. One plausible conclusion based on these results is that a district's PERS expenditures do not impact early-career quit rates. Another explanation is that a relationship does exist, but that it is clouded by confounding factors. We explore the second explanation using a multivariate approach.

We use teacher-level data from the Oregon Department of Education (ODE), the National Center for Education Statistics' (NCES) Common Core of Data (CCD), and the NCES National Public Education Financial Survey Data obtained from the ODE School Finance Department (SFD). The ODE data contain information on 57,763 unique teachers from the 2000-1 academic year through the 2013-4 academic year. For each teacher we know their work status and full-time equivalent (FTE) status in each academic year, as well as their age, gender, ethnicity, base salary,

¹⁷ The correlation coefficient between district-level two-year (five-year) quit rates and the percentage of district General Fund expenditures allocated to PERS varies year to year, ranging between -.11 and .10 (-.24 and .00).

and years of service both within Oregon and outside of Oregon. The CCD and SFD datasets essentially provide controls for our analysis, including school size, school level, and school ethnic composition as well as district size, district ethnic composition, and whether a district covers an employee’s pension contribution.

The framework of our empirical model is based on Goldhaber, Grout, and Holden (2015), as follows:

$$q_{ijd} = \beta'_1 \text{benefitshare}_d + \beta'_2 T_i + \beta'_3 S_j + \beta'_4 D_j + \sum_{t=2000-1}^{2013-4} (\sigma_t 1(\text{FY} = t)) + \varepsilon_{ijd}$$

where:

q_{ijd} = propensity that new teacher i in school j and district d quits within x years of starting
 benefit share = share of district d ’s General Fund revenues allocated to the PERS system at
 time the time teacher i is hired

T_i = characteristics of teacher i measured at the time teacher i is hired

S_j = school-level characteristics measured at the time teacher i is hired

D_j = district-level characteristics measured at the time teacher i is hired

$\sum_{t=1}^T (1(\text{FY} = t))$ = series of dummy variables denoting the teacher’s hire year

We estimate separate models to examine early-career quit rates over different time periods, ranging from one to five years. Each new teacher in Oregon who started between academic years 2000-1 and 2013-4 contributes one observation, although the number of years used in each model depends on the time period over which quits are observed. For example, the analysis of quits within two years includes new teachers who started between 2000-1 and 2011-2 only in order to allow two years of follow-up data for the most recent cohort. Each model is estimated using logistic regression with standard errors clustered at the school district level.

The key explanatory variable is the new teacher’s district’s share of general revenues allocated to the PERS system, based on line item 210 (“Public Employees Retirement System”) from the ODE’s financing/funding reports as a share of the General Fund. This variable is

entered directly into the model as a continuous variable (“Specification 1”) and, to allow for potential nonlinearities, is entered as a categorical variable using dichotomous indicators (<7.5%, 7.5% to 10.0%, and >10.0%) (“Specification 2”).

We find that the PERS share of the General Fund is positively associated with two-year quit rates when entered as a continuous variable ($p=0.033$) and marginally significant when entered as a categorical variable ($p=0.099$ for a district’s percentage being < 7.5% and $p=0.222$ for a district’s percentage being > 10.0%) (Table 2).¹⁸ The coefficient of the PERS share of the General Fund has the expected sign and magnitude when examining five-year quit rates, but is not statistically significant. This latter result is not too surprising, as the PERS share of the General Fund is measured as of the time of hire and the time period over which this model is estimated extends through 2008-9 only in order to allow five years of follow-up. The PERS share of the General Fund is a statistically-significant predictor of one-year quit rates and marginally significant for three-year quit rates (see Appendix Tables A.1 and A.2).

This multivariate analysis of early-career quit rates suggests that, once confounding factors are taken into account, the share of PERS expenditures does appear to impact one- and two-year quit rates. The relationship between early quit rates and the PERS percentage becomes less clear with a broader time horizon, such as four and five years. One potentially fruitful area for future research is to explore these longer time horizons using alternative models and alternative measures of pension legacy costs that might quantify UALs at the district level.

V. Translating teacher turnover impacts into overall teacher quality effects

The derived odds ratios from the multivariate analysis suggest that the odds of quitting within one year are 4.3 percent higher for a district that has an extra percentage point of General

¹⁸ The level of statistical significance is more pronounced in the one-year quit rate model. See Appendix Table A.1.

Fund revenues applied to PERS, all else equal, and that the odds of quitting within two years is 2.7 percent higher. As noted above, the median district PERS expenditures as a share of the General Fund increased from approximately 8 percent in 2000-1 to 11 percent in 2013-4 (see Figure 4). Given that the one-year quit rate in Oregon was 16.9 percent in the 2012-3 academic year (see Figure 5), the increase in PERS expenditures from 8 to 11 percent corresponds to a 1.8 percentage point increase in the probability of quitting within one year. The two-year quit rate in the 2011-2 academic year was 27.8 percent (again, see Figure 5), so the increase in the PERS percentage corresponds to a 1.6 percentage point increase in the probability of quitting within two years. In terms of the number of teachers for each new cohort, the increase in the share of district PERS expenditures as a share of the General Funds is projected to result in approximately 25 additional teachers quitting within two years.

The loss of teachers within the first two years can potentially have a substantial impact on Oregon's students. Teacher effectiveness has been shown to increase substantially in the first two years and then increase gradually or plateau thereafter. For example, student math scores are on average approximately five percent of a standard deviation higher with a teacher who has two years of experience compared with a new teacher, and reading and English/Language Arts (ELA) scores are approximately ten percent of a standard deviation higher (Boyd, Grossman, Lankford, et al., 2006; Center for Education Policy Research, 2011). Thus, students who are taught by new teachers instead of those with two or more years of experience can be expected to have lower math and reading scores. With a median class size in Oregon of 25 (Oregon Department of Education, 2016), and assuming districts replace the 25 teachers who separate, one could expect that the predicted increase in early-career quit rates would lower math and reading scores for approximately 625 students each year. The increases in early-career quit rates alone could

substantially impact Oregon's students, not to mention any other impacts to Oregon's school districts that might be attributed to higher teacher turnover. Moreover, Oregon's PERS costs are expected to increase substantially within the next few years, implying the magnitude of these impacts could be much larger in the years ahead (Sickinger, 2015).

V. Conclusion

Pension reforms in Oregon over the past two decades have limited the extent to which the state's unfunded pension liabilities continue to grow. However, the pension legacy costs from benefit promises made in past decades remain, and Oregon is faced with the challenge of paying for these past benefit promises while funding current K12 education. In this paper we examine the impact of pension legacy costs on teacher turnover, and find that teachers in districts along the Oregon-Washington border differ in ways that are consistent with cross-state differences in pension legacy costs. Further, using district-level variation within Oregon, we find that a higher share of General Fund revenues allocated to PERS (and lower share of General Fund revenues allocated to other expenditures including teacher salaries) is associated with higher early-career quit rates. These results suggest that the pension legacy costs associated with pension promises made decades ago may have a negative impact on today's teachers and students in Oregon.

A key attribute of Oregon's pension challenge is that the source of financial strain is not the result of an ongoing chronic underfunding of its pension liabilities but rather the creation of a generous plan with benefits that substantially increased in the midst of the market volatility of the past two decades. Oregon's pension shortfalls, therefore, will likely eventually decrease over time as the share of retirees who began working under PERS prior to January 1, 1996 declines. Any interim solution to solving the pension shortfall involves tradeoffs among reducing the

promised Tier One pension benefits, other reductions in pension benefits, or finding alternative sources of funding.

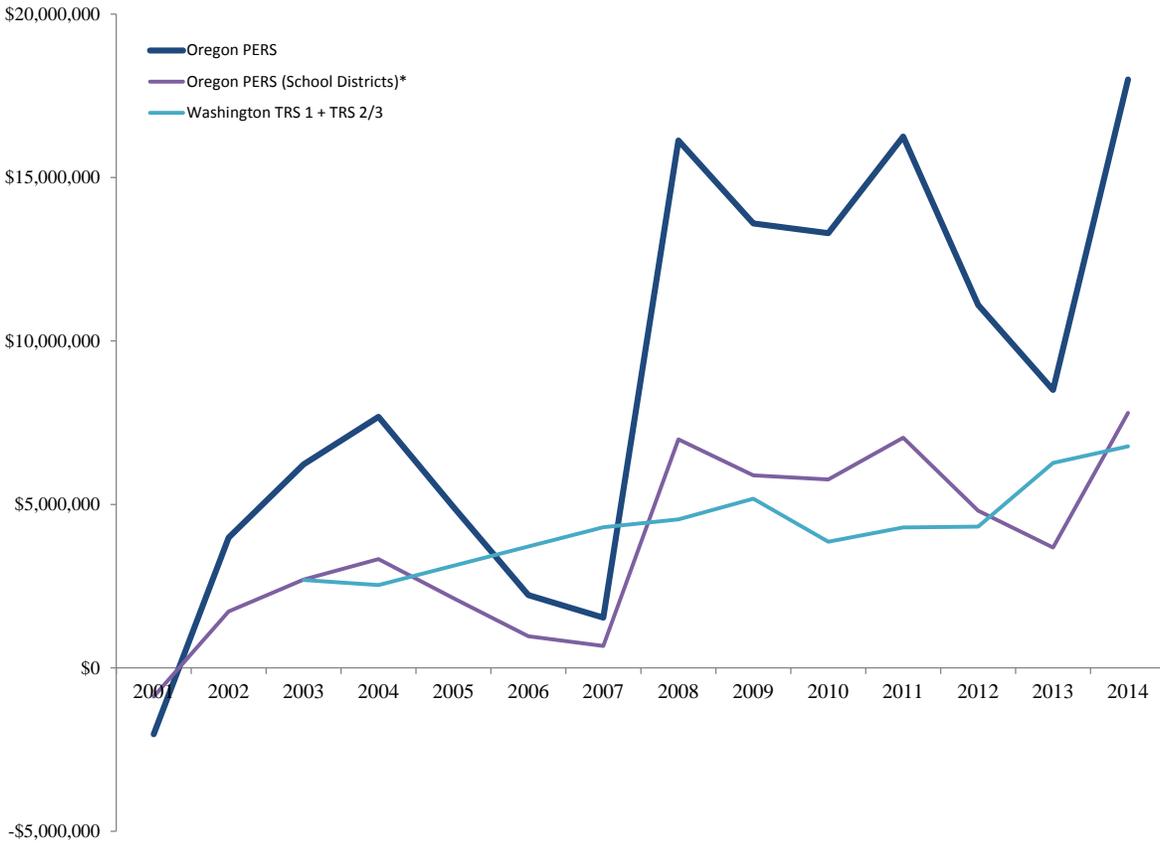
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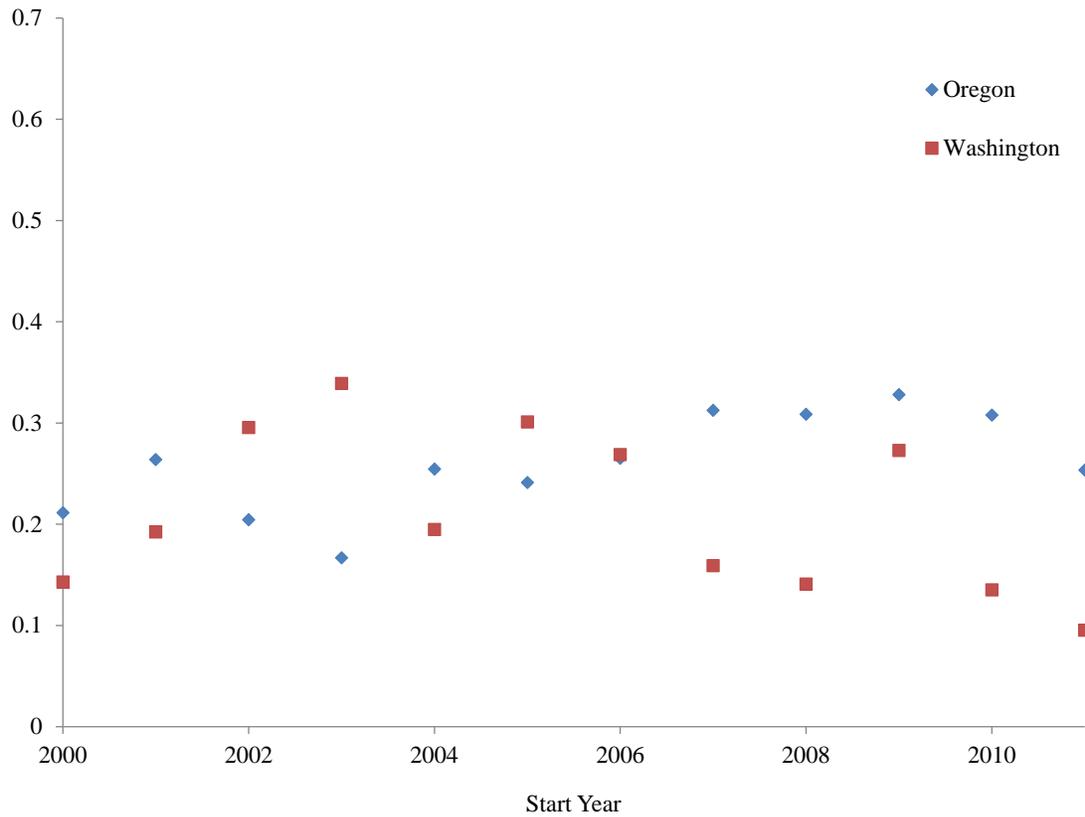
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Figure 1: Unfunded actuarial liability (UAL), Oregon PERS and Washington TRS plans, 2001 to 2014



Notes:
Negative UAL amounts indicate a surplus. Side accounts, which include assets from pension obligation bonds and other lump-sum payments, and not included. Oregon PERS Tier One values for 2012 and 2013 include liability reductions due to legislative changes; values for 2014 incorporate a ruling by Oregon's Supreme Court (Moro, et al. vs. State of Oregon, et al.) that declared it to be unconstitutional to retroactively reduce cost-of-living adjustments to PERS beneficiaries. Values for Washington TRS plan in 2005 and 2006 are imputed based on values in 2004 and 2007.
*: Estimated based on the School District Pool (Tier 1/Tier 2) percentage of UAL (excluding side accounts) as of December 31, 2013.
Sources: Oregon Public Employees Retirement System (2015); Washington State Actuarial Valuation Reports, various years.

Figure 2a: Early-career quit rates (within 2 years) among Oregon and Washington teachers in border districts, academic years 2000-1 to 2011-12

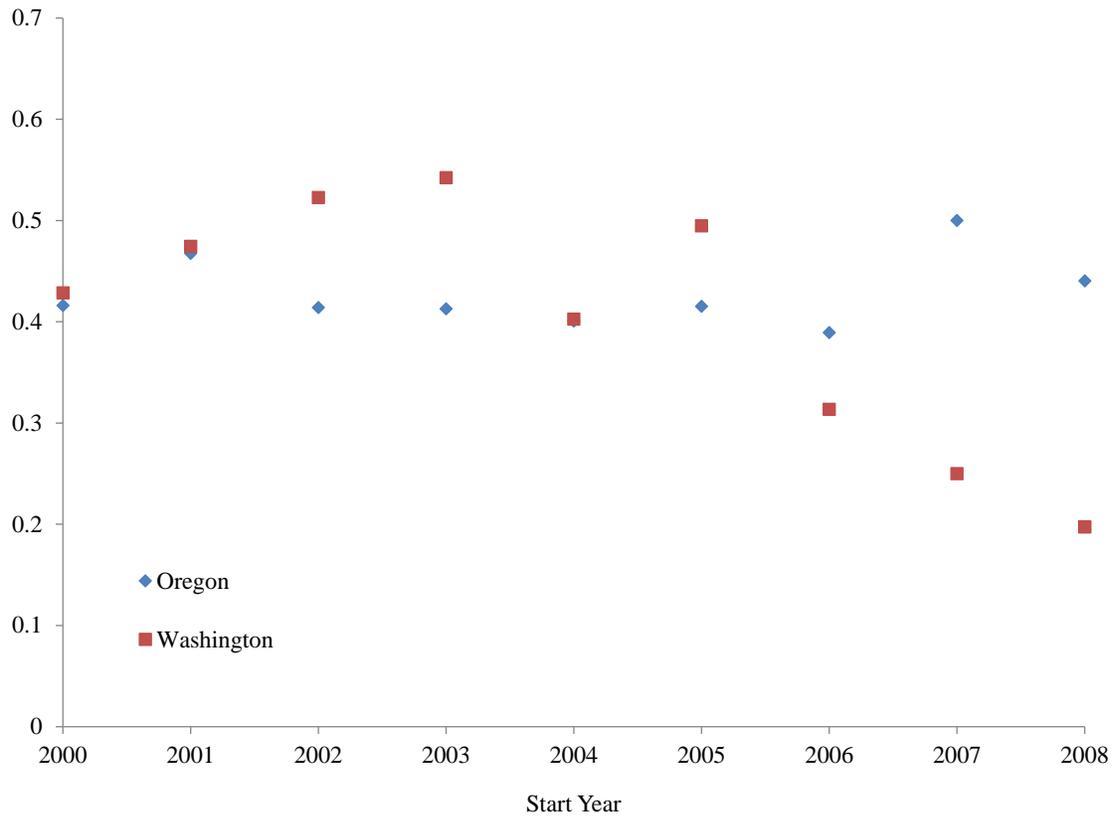


Notes:

The early-career quit rates shown are for teachers who worked in districts along the Oregon-Washington border, who began working between academic years 2000-1 and 2011-2, and who were working in an instructional position for at least 0.5 FTE. Data are available through academic year 2011-2 only because two years of follow-up data are necessary to assess whether a quit took place in the 2-year period from 2012-3 through 2013-4.

Source: Authors' calculations based on Oregon Department of Education data. Data for Washington provided by the National Center for Analysis of Longitudinal Data in Education Research (CALDER).

Figure 2b: Early-career quit rates (within 5 years) among Oregon and Washington teachers in border districts, academic years 2000-1 to 2008-9

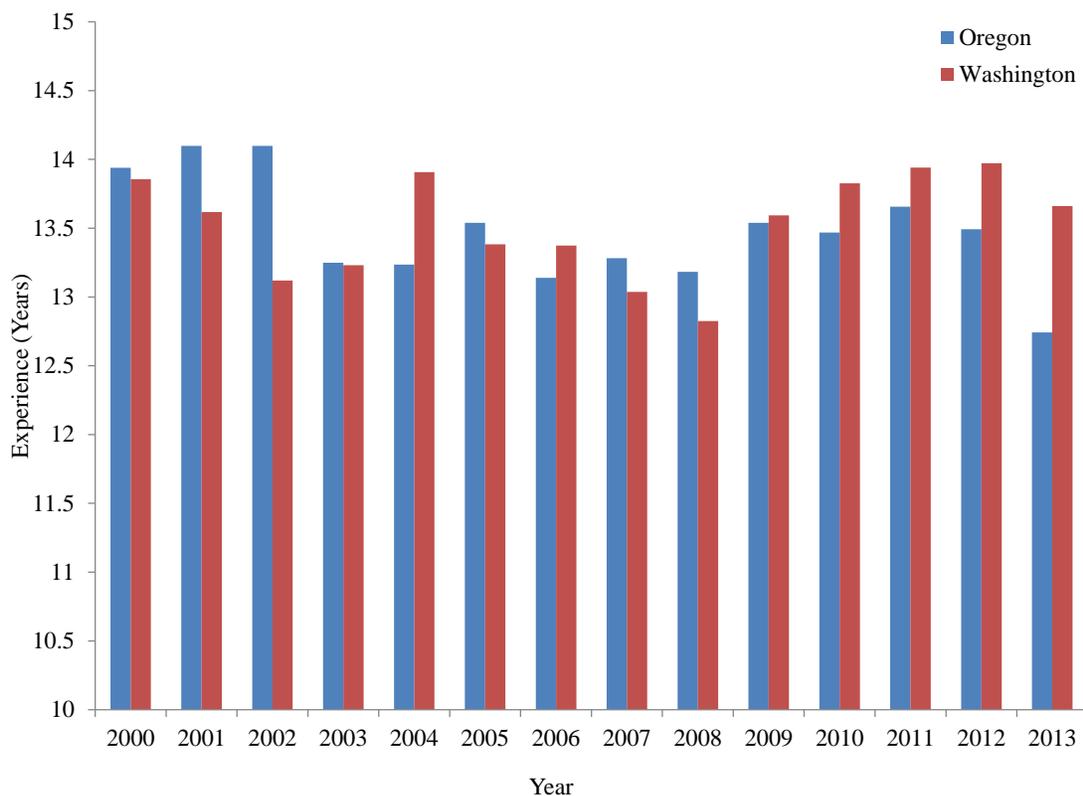


Notes:

The early-career quit rates shown are for teachers who worked in districts along the Oregon-Washington border, who began working between academic years 2000-1 and 2009-10, and who were working in an instructional position for at least 0.5 FTE. Data are available through academic year 2008-9 only because five years of follow-up data are necessary to assess whether a quit took place in the 5-year period from 2009-10 through 2013-4.

Source: Authors' calculations based on Oregon Department of Education data. Data for Washington provided by the National Center for Analysis of Longitudinal Data in Education Research (CALDER).

Figure 3: Average experience among Oregon and Washington teachers in border districts, academic years 2000-1 to 2013-4

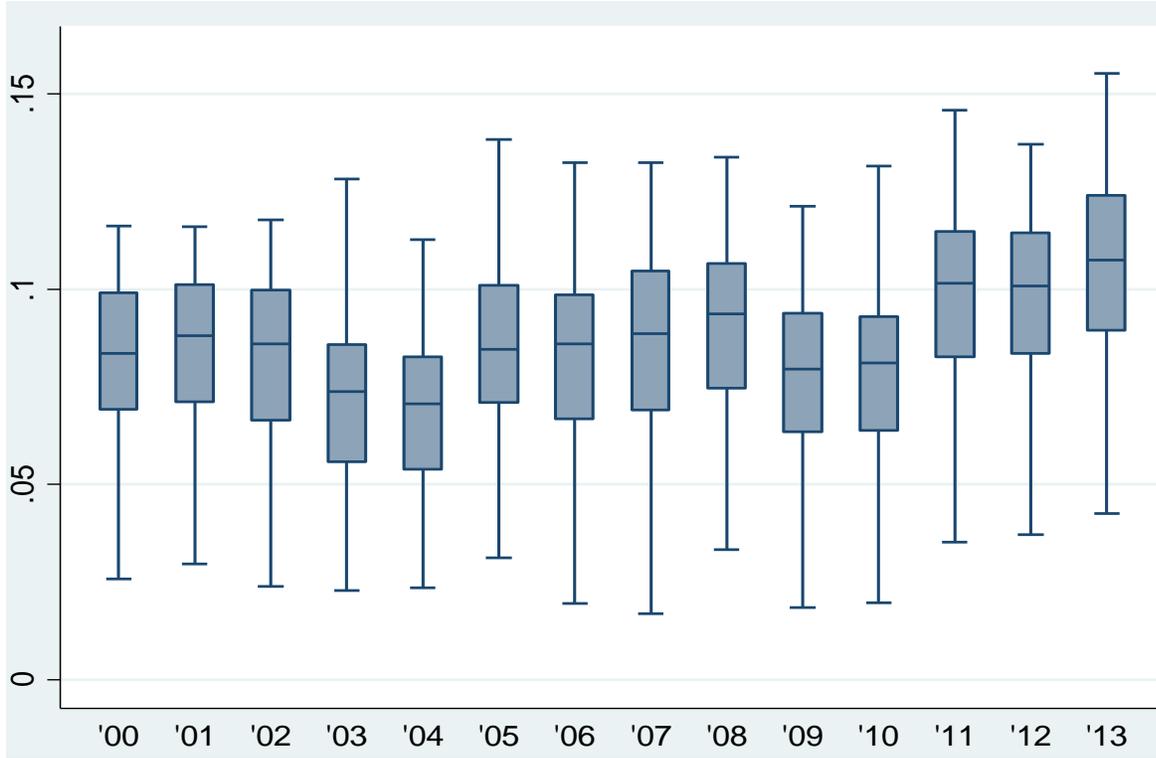


Notes:

Average teacher experience is based on teachers who worked in districts along the Oregon-Washington border and who were working in an instructional position for at least 0.5 FTE.

Source: Authors' calculations based on Oregon Department of Education data. Data for Washington provided by the National Center for Analysis of Longitudinal Data in Education Research (CALDER).

Figure 4: Annual distribution of district PERS expenditures as a share of General Fund revenues, academic years 2000-1 to 2013-14

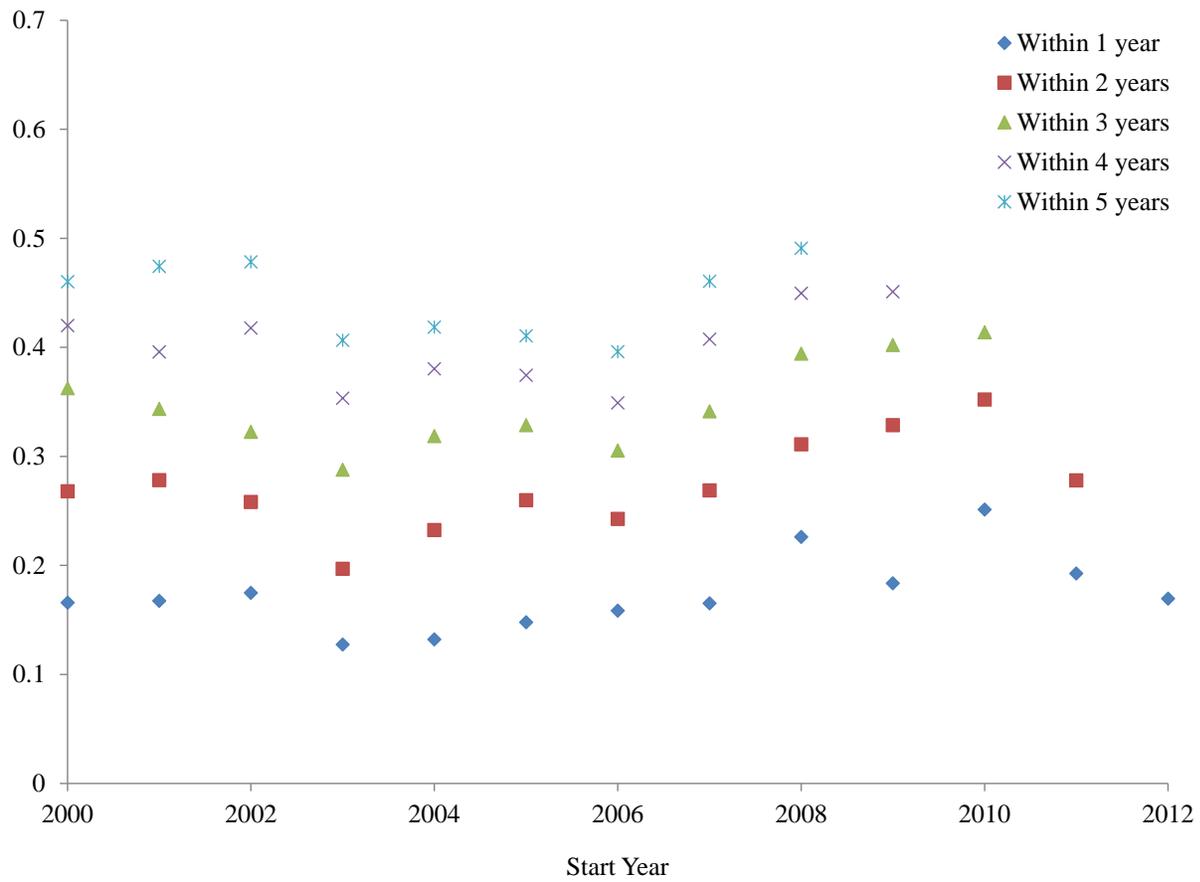


Notes:

Observations are at the school district level and are not weighted for district size. Four district-year observations were set equal to the prior year's value because values were deemed to be erroneous. The four district-years were as follows: District 2051-Ashwood, 2002-3; District 2086-Creswell, 2007-8; District 2104-Santiam Canyon, 2003-4; and District 2142-Salem-Keizer, 2007-8.

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

Figure 5: Early-career quit rates among Oregon teachers, academic years 2000-1 to 2012-13

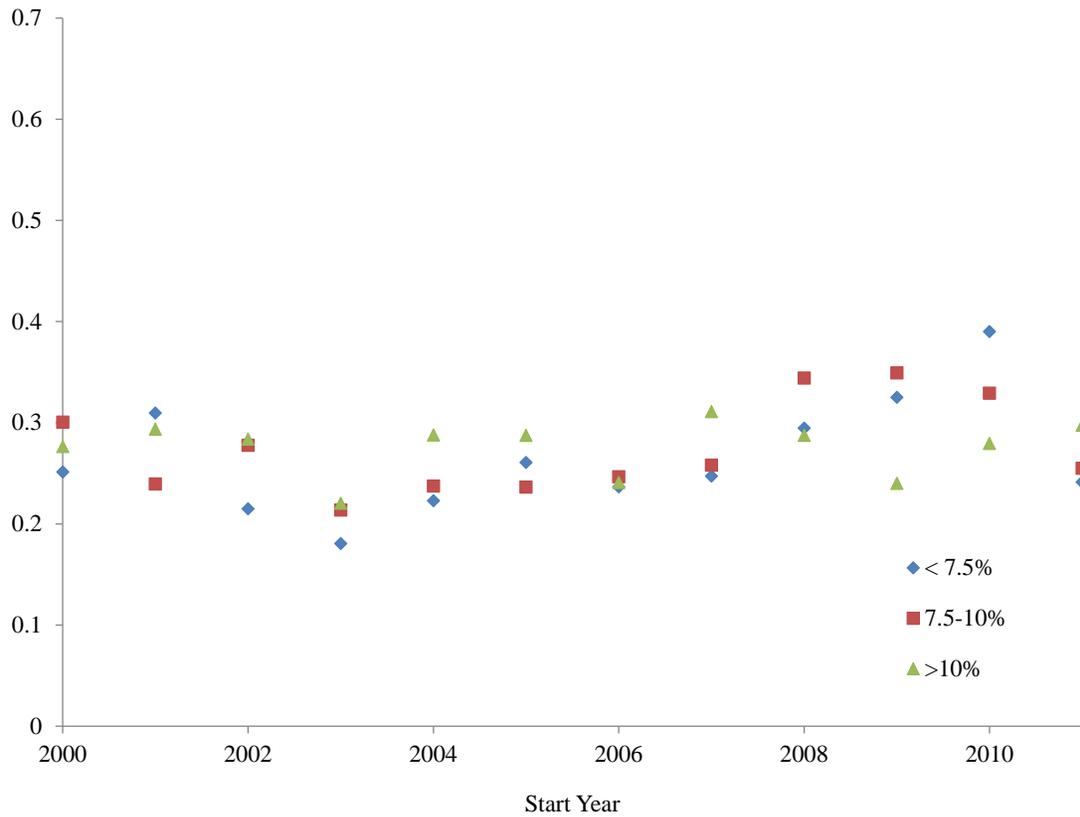


Notes:

The early-career quit rates shown are for Oregon teachers who began working between academic years 2000-1 and 2012-3, and who were working in an instructional position for at least 0.5 FTE. The number of academic years available for analysis depends on the length of time over which quits are observed. For example, data are available through academic year 2010-1 for 3-year quit rates because three years of follow-up data are necessary to assess whether a quit took place in the 3-year period from 2011-2 to 2013-4.

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

Figure 6a: Early-career quit rates (within 2 years) by district PERS expenditures category, academic years 2000-1 to 2011-2

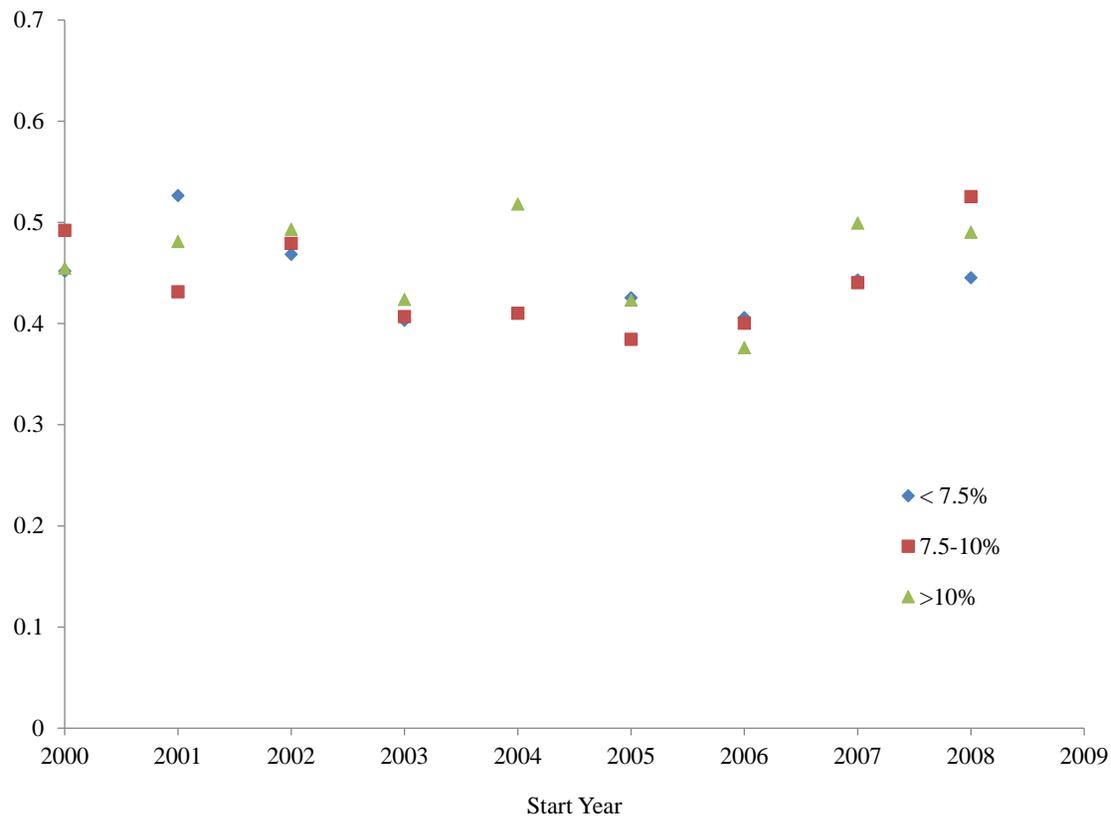


Notes:

The early-career quit rates shown are for Oregon teachers who began working between academic years 2000-1 and 2011-2, and who were working in an instructional position for at least 0.5 FTE. Data are available through academic year 2011-2 only because two years of follow-up data are necessary to assess whether a quit took place in the 2-year period from 2012-3 through 2013-4. District-level PERS expenditures are measured as of the year the teacher was hired.

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

Figure 6b: Early-career quit rates (within 5 years) by district PERS expenditures category, academic years 2000-1 to 2008-09



Notes:

The early-career quit rates shown are for Oregon teachers who began working between academic years 2000-1 and 2008-9, and who were working in an instructional position for at least 0.5 FTE. Data are available through academic year 2008-9 only because five years of follow-up data are necessary to assess whether a quit took place in the 5-year period from 2009-10 through 2013-4. District-level PERS expenditures are measured as of the year the teacher was hired.

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

Table 1: Per-student spending, Oregon and Washington, academic year 2012-13¹

Oregon (Enrollment: 587,564)

Expenditure type	Expenditure category		
	Instruction	Other spending categories ²	Total
Salaries	3,119	1,671	4,791
Benefits	1,704	978	2,682
Purchased services, tuition, supplies, and other	498	1,213	1,711
Total	5,321	3,862	9,183

Washington (Enrollment: 1,051,694)

Expenditure type	Expenditure category		
	Instruction	Other spending categories ²	Total
Salaries	3,828	2,094	5,922
Benefits	1,273	749	2,022
Purchased services, tuition, supplies, and other	528	1,242	1,770
Total	5,630	4,085	9,714

Oregon-Washington Difference

Expenditure type	Expenditure category		
	Instruction	Other spending categories ²	Total
Salaries	-709	-423	-1,132
Benefits	430	229	659
Purchased services, tuition, supplies, and other			
Total	-308	-223	-531

Notes:

[1] Per fall enrollee. Values shown are in US dollars.

[2] Other spending categories includes: student support services, instructional staff support, general administrative support, school administration, operations and maintenance, student transportation, other support services, food services, and enterprise operations.

Source: ECONorthwest calculations based on NCES data.

Table 2: Early-career quit propensities for Oregon teachers, academic years 2000-1 to 2013-4

	Exit within 2 years				Exit within 5 years			
	Specification 1		Specification 2		Specification 1		Specification 2	
	ln(odds ratio)	p-value	ln(odds ratio)	p-value	ln(odds ratio)	p-value	ln(odds ratio)	p-value
Year hired								
2000	-----	-----	-----	-----	-----	-----	-----	-----
2001	-0.002	0.983	-0.026	0.810	0.015	0.862	-0.001	0.995
2002	-0.042	0.621	-0.068	0.411	-0.006	0.940	-0.018	0.816
2003	-0.349	0.000 ***	-0.363	0.000 ***	-0.207	0.006 ***	-0.208	0.006 ***
2004	-0.163	0.112	-0.178	0.077 *	-0.158	0.040 **	-0.160	0.036 **
2005	0.014	0.877	0.004	0.967	-0.164	0.041 **	-0.169	0.035 **
2006	-0.060	0.533	-0.075	0.426	-0.207	0.004 ***	-0.217	0.003 ***
2007	0.136	0.167	0.114	0.252	0.088	0.274	0.084	0.310
2008	0.376	0.000 ***	0.367	0.000 ***	0.235	0.004 ***	0.225	0.006 ***
2009	0.412	0.001 ***	0.401	0.001 ***				
2010	0.565	0.000 ***	0.562	0.000 ***				
2011	0.171	0.215	0.166	0.224				
Age at hire	0.019	0.000 ***	0.019	0.000 ***	0.004	0.072 *	0.004	0.083 *
Female	0.048	0.375	0.050	0.349	0.166	0.001 ***	0.166	0.001 ***
Ethnicity								
Asian	0.178	0.226	0.181	0.220	0.210	0.057 *	0.210	0.056 *
Black	0.093	0.628	0.090	0.638	0.234	0.135	0.251	0.114
Hispanic	-0.222	0.122	-0.228	0.118	-0.025	0.859	-0.028	0.842
Native American	0.164	0.461	0.168	0.452	-0.091	0.722	-0.094	0.715
White	-----	-----	-----	-----	-----	-----	-----	-----
Other	0.233	0.009 ***	0.232	0.008 ***	0.209	0.003 ***	0.207	0.004 ***
Advanced degree holder	-0.134	0.000 ***	-0.134	0.000 ***	-0.103	0.001 ***	-0.103	0.001 ***
Salary (\$10,000s)	-0.195	0.000 ***	-0.194	0.000 ***	-0.098	0.004 ***	-0.091	0.007 ***
School level								
Elementary	-----	-----	-----	-----	-----	-----	-----	-----
Middle	0.147	0.002 ***	0.148	0.002 ***	0.161	0.000 ***	0.161	0.000 ***
High	0.314	0.000 ***	0.318	0.000 ***	0.411	0.000 ***	0.415	0.000 ***
Other	0.339	0.009 ***	0.357	0.006 ***	0.239	0.028 **	0.245	0.026 **
Percent under-rep minority	0.000	0.939	0.000	0.906	-0.001	0.131	-0.001	0.165
Students (100s)	-0.022	0.000 ***	-0.023	0.000 ***	-0.026	0.000 ***	-0.027	0.000 ***
PERS contribution covered	-0.095	0.035 **	-0.109	0.014 **	-0.051	0.159	-0.063	0.078 *
PERS pct of General Fund								
Continuous	0.027	0.033 **			0.012	0.245		
< 7.5%			-0.094	0.099 *			-0.050	0.246
7.5% to 10.0%			-----	-----			-----	-----
> 10.0%			0.081	0.222			0.056	0.316
Constant	-1.168	0.000 ***	-0.916	0.000 ***	-0.117	0.443	-0.018	0.879
Observations	16,499		16,549		14,355		14,392	
Pseudo-R ²	0.0199		0.0202		0.0110		0.011	
Log-pseudolikelihood	-9321		-9346		-9723		9749	

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 district level. Sample consists of Oregon teachers who began working between academic years 2000-1 and 2013-4 and who were working in an instructional position for at least 0.5 FTE. Time-varying independent variables are measured as of the year the teacher was hired.

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

Table A.1: Early-career quit propensities for Oregon teachers, academic years 2000-1 to 2013-4

	Exit within 1 year				Exit within 3 years			
	Specification 1		Specification 2		Specification 1		Specification 2	
	ln(odds ratio)	p-value	ln(odds ratio)	p-value	ln(odds ratio)	p-value	ln(odds ratio)	p-value
Year hired								
2000								
2001	-0.021	0.853	-0.049	0.670	-0.130	0.149	-0.152	0.098 *
2002	0.120	0.220	0.085	0.382	-0.193	0.022 **	-0.215	0.009 ***
2003	-0.227	0.036 **	-0.250	0.018 **	-0.318	0.000 ***	-0.326	0.000 ***
2004	-0.149	0.197	-0.177	0.114	-0.170	0.040 **	-0.178	0.024 **
2005	-0.059	0.589	-0.072	0.500	-0.096	0.255	-0.102	0.219
2006	0.050	0.683	0.033	0.789	-0.191	0.022 **	-0.204	0.012 **
2007	0.155	0.128	0.134	0.202	0.021	0.794	0.008	0.927
2008	0.606	0.000 ***	0.589	0.000 ***	0.283	0.003 ***	0.275	0.004 ***
2009	0.291	0.028 **	0.267	0.047 **	0.277	0.017 **	0.268	0.017 **
2010	0.764	0.000 ***	0.758	0.000 ***	0.377	0.001 ***	0.376	0.001 ***
2011	0.358	0.050 *	0.338	0.059 *				
2012	0.093	0.446	0.098	0.421				
Age at hire	0.025	0.000 ***	0.025	0.000 ***	0.014	0.000 ***	0.014	0.000 ***
Female	0.015	0.714	0.015	0.706	0.082	0.089 *	0.083	0.083 *
Ethnicity								
Asian	0.434	0.006 ***	0.449	0.005 ***	0.086	0.529	0.088	0.520
Black	0.342	0.128	0.367	0.112	0.248	0.144	0.243	0.146
Hispanic	-0.274	0.008 ***	-0.263	0.015 **	-0.127	0.339	-0.128	0.331
Native American	0.287	0.156	0.291	0.150	0.263	0.320	0.266	0.318
White								
Other	0.178	0.047 **	0.181	0.036 **	0.256	0.000 ***	0.258	0.000 ***
Advanced degree holder	-0.144	0.000 ***	-0.142	0.000 ***	-0.149	0.000 ***	-0.149	0.000 ***
Salary (\$10,000s)	-0.251	0.000 ***	-0.251	0.000 ***	-0.146	0.000 ***	-0.146	0.000 ***
School level								
Elementary								
Middle	0.107	0.047 **	0.113	0.035 **	0.104	0.019 **	0.105	0.017 **
High	0.202	0.005 ***	0.208	0.004 ***	0.303	0.000 ***	0.307	0.000 ***
Other	0.406	0.007 ***	0.419	0.005 ***	0.254	0.043 **	0.267	0.031 **
Percent under-rep minority	0.000	0.786	0.000	0.805	-0.002	0.063 *	-0.002	0.063 *
Students (100s)	-0.018	0.000 ***	-0.018	0.000 ***	-0.025	0.000 ***	-0.025	0.000 ***
PERS contribution covered	-0.157	0.000 ***	-0.162	0.000 ***	-0.086	0.026 **	-0.102	0.006 ***
PERS pct of General Fund								
Continous	0.043	0.001 ***			0.021	0.065 *		
< 7.5%			-0.111	0.086 *			-0.081	0.102
7.5% to 10.0%								
> 10.0%			0.140	0.02 **			0.072	0.229
Constant	-1.926	0.000 ***	-1.542	0.000 ***	-0.645	0.000 ***	-0.443	0.001 ***
Observations	17,259		17,313		15,828		15,871	
Pseudo-R ²	0.027		0.0273		0.0160		0.0163	
Log-pseudolikelihood	-7596		-7621		-9954		-9979	

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 district level. Sample consists of Oregon teachers who began working between academic years 2000-1 and 2013-4 and who were working in an instructional position for at least 0.5 FTE. Time-varying independent variables are measured as of the year the teacher was hired.

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

Table A.2: Early-career quit propensities for Oregon teachers, academic years 2000-1 to 2013-4

	Exit within 4 years Specification 1		Exit within 4 years Specification 2	
	ln(odds ratio)	p-value	ln(odds ratio)	p-value
Year hired				
2000	-----	-----	-----	-----
2001	-0.133	0.117	-0.146	0.091 *
2002	-0.094	0.229	-0.104	0.186
2003	-0.265	0.000 ***	-0.266	0.000 ***
2004	-0.147	0.045 **	-0.150	0.039 **
2005	-0.146	0.064 *	-0.147	0.061 *
2006	-0.239	0.001 ***	-0.243	0.001 ***
2007	0.058	0.487	0.048	0.569
2008	0.252	0.002 ***	0.250	0.002 ***
2009	0.219	0.039 **	0.216	0.040 **
Age at hire	0.009	0.000 ***	0.009	0.000 ***
Female	0.138	0.009 ***	0.138	0.009 ***
Ethnicity				
Asian	0.197	0.075 *	0.198	0.073 *
Black	0.256	0.064 *	0.246	0.075 *
Hispanic	-0.025	0.869	-0.028	0.848
Native American	0.097	0.656	0.097	0.660
White	-----	-----	-----	-----
Other	0.252	0.000 ***	0.254	0.000 ***
Advanced degree holder	-0.147	0.000 ***	-0.146	0.000 ***
Salary (\$10,000s)	-0.124	0.001 ***	-0.124	0.001 ***
School level				
Elementary	-----	-----	-----	-----
Middle	0.143	0.001 ***	0.144	0.000 ***
High	0.387	0.000 ***	0.391	0.000 ***
Other	0.257	0.026 **	0.269	0.020 **
Percent under-rep minority	-0.002	0.070 *	-0.002	0.068 *
Students (100s)	-0.026	0.000 ***	-0.027	0.000 ***
PERS contribution covered	-0.059	0.109	-0.072	0.042 **
PERS pct of General Fund				
Continous	0.015	0.161		
< 7.5%			-0.045	0.333
7.5% to 10.0%			-----	-----
> 10.0%			0.072	0.21
Constant	-0.312	0.050 *	-0.177	0.141
Observations	14,906		14,947	
Pseudo-R ²	0.0134		0.0135	
Log-pseudolikelihood	-9837		-9862	

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 district level. Sample consists of Oregon teachers who began working between academic years 2000-1 and 2013-4 and who were working in an instructional position for at least 0.5 FTE. Time-varying independent variables are measured as of the year the teacher was hired.

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