

## Crossing the Border?

### Exploring the Cross-State Mobility of the Teacher Workforce

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## **Abstract**

Due to data limitations, very little is known about patterns of cross-state teacher mobility. It is an important issue because barriers to cross-state mobility create labor market frictions that could lead both current and prospective teachers to opt out of the teaching profession. In this paper, we match state-level administrative data sets from Oregon and Washington and present evidence on patterns of in-service teacher mobility between these two states. We find levels of cross-state mobility that are drastically lower than levels of within-state mobility, even when accounting for proximity to the border. These findings are consistent with the hypothesis that there are significant penalties to cross-state mobility that may be attributable to state-specific licensure regulations, seniority rules and pension structures.

## **Citation**

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There is a considerable amount of research on the mobility of teachers within states, but very little is known about the extent to which teachers move from employment in public schools in one state to another. This is not surprising given data limitations that have historically made it difficult to reliably track individuals across state lines. There are, however, reasons to expect cross-state mobility in the teaching profession to be modest.

Several features of the teacher labor market make crossing state borders more costly than moving across districts in the same state. Each state has its own licensure procedures that can be expensive and time-consuming for teachers to navigate. In most states a teacher's level of tenure and seniority are used in important personnel decisions, and a cross-state move generally results in losing whatever seniority a teacher has accumulated. Finally, the majority of teachers are enrolled in traditional defined benefit (DB) pension plans, and teachers who split their careers between two (or more) DB plans tend to earn far less retirement income than if they had stayed in one system.

These labor markets features were not generally designed with the intention of impeding cross-state mobility, but to serve some policy purpose. That said, barriers to the cross-state mobility of the teacher workforce may be undesirable for several reasons. Limits to locational flexibility may decrease the appeal of the teaching profession to prospective entrants. Barriers to mobility may also lead to a loss of teaching talent when in-service teachers opt out of the profession when moving to a new state. Finally, cross-state labor market frictions inhibit labor market adjustments, whereby employees flow from areas of relative surplus to areas of relative shortage. In short, barriers to cross-state mobility impose costs on the labor market without serving a clear or consistent policy purpose.

In this paper, we analyze cross-state teacher mobility using state-level administrative data sets from Oregon and Washington and present evidence on the level of mobility between the states' teacher workforces. Teachers are remarkably unlikely to be observed teaching in Oregon and then later in Washington, and vice versa. The magnitude of difference between the number of teachers making within-state moves (between districts) and the number making cross-state moves is striking: among teachers from school districts located directly on the state border or in the Portland-Vancouver MSA (which straddles the state border), over 8 times as many make within-state moves as make cross-state moves. Moreover, among teachers from these districts, almost three times as many make a within-state move of 75 or more miles than make any cross-state move. These findings are consistent with the hypothesis that there are significant labor market penalties to cross-state mobility that may be attributable to state-specific licensure regulations, seniority rules and pension structures.

## **Background: Teacher mobility and the Oregon and Washington Contexts**

### *Literature on Teacher Mobility*

An extensive academic literature has analyzed patterns of mobility (including movement across schools and districts, and attrition from the profession) to determine why teachers move, and which teachers move (Clotfelter, Ladd, & Vigdor, 2011; Goldhaber, Gross, & Player, 2011; Hanushek, Kain, & Rivkin, 2004; Imazeki, 2005; Jacob, 2007; Ronfeldt, Loeb, & Wyckoff, 2013). But, for all the evidence on patterns of movement within states, very little is available regarding movement across states. What we do know is mostly descriptive; Rollefson (1993) reports that 10.4% of newly hired public school teachers in 1987-1988 were transfers from a different state, suggesting a modest amount of cross-state movement. In North Carolina, a report on teacher turnover by the state's Department of Public Instruction (2014) indicates that 455 teachers (out of approximately 96,000 teachers employed state-wide) listed "resigning in order to teach in another state" as the reason for turnover in 2012-2013 (about 0.5%).

There are reasons to believe that state-specific laws and regulations create significant barriers to cross-state teacher mobility. Coggshall and Sexton (2008), for instance, point out that states' licensure rules create both purposeful and artificial barriers. Purposeful barriers include knowledge testing and degree requirements intended to ensure a minimum level of teacher quality. Artificial barriers include high fees, slow administrative processes, poor communication between agencies in different states, duplicative tests and coursework, and unclear licensure requirements. Regarding teachers' experiences with licensure procedures, Darling-Hammond and Sykes (2003) cite a study by the California Commission on Teacher Credentialing that documents some of the difficulties reported by out-of-state candidates seeking teaching positions in California:

*...costs of courses and exams, confusion about how to complete the many and varied requirements, and redundancy with other requirements teachers had already met elsewhere. In a survey of out-of-state teachers who had received an initial permit to teach in California, credential requirements were the leading factor in decisions to leave the state (p. 40).*

This suggests that a state's licensure procedures can be onerous enough to discourage teachers from seeking a position in a new state. Indeed, ten teachers are suing the state of Minnesota, claiming that barriers imposed by its licensure requirements are preventing well qualified teachers with out-of-state experience from working in the state (Sawchuk, 2015). In spite of this, the issue has received little empirical attention (Goldhaber, 2011).

Seniority policies also may discourage cross-state mobility given that school districts frequently use seniority in making personnel decisions (National Council on Teacher Quality, 2014), and a teacher’s seniority level is not typically transferable across state lines. Yet while there is some empirical evidence on how seniority transfer provisions in collective bargaining agreements may affect within and between district mobility (Anzia & Moe, 2014; Cohen-Vogel, Feng, & Osborne-Lampkin, 2013; Goldhaber, Lavery, & Theobald, 2015; Koski & Horng, 2007), to our knowledge there is no evidence on whether they influence cross-state teacher mobility.<sup>1</sup>

An inhibitor of cross-state mobility in the teacher labor market that *has* received some empirical attention in the literature is the structure of teacher pensions. In most states, a large proportion of teacher compensation is paid as future retirement benefits, typically in the form of defined benefit (DB) pensions that pay a retirement annuity determined by an employee’s final average salary (FAS) and years of service (YOS) (National Education Association, 2010). As shown by Koedel et al. (2011) and Costrell and Podgursky (2010), teachers who split their careers between separate pension systems will often earn less than half the total retirement benefits that would have been earned had they stayed in one system. Koedel et al. (2011) study the influence of an in-state pension border in Missouri and find that it greatly reduces the mobility of school leaders (such as principals). One justification for these types of pension structures is that they incentivize retention by rewarding long tenures, with the potential downsides of dissuading some individuals from pursuing a teaching career and failing to significantly contribute to the retirement security of teachers with shorter teaching careers.

#### *Features of the Oregon and Washington Teacher Labor Markets*

This section describes features of the Oregon and Washington teacher labor markets that may influence cross-state mobility, specifically licensure processes, seniority rules, and pension system characteristics. Key features of these labor market factors are presented in **Table 1**. The relationship between these features and cross-state mobility is discussed below.<sup>2</sup>

[TABLE 1 ABOUT HERE]

Oregon and Washington, like all states, each have unique teacher licensure requirements, and transferring between these states requires teachers to go through the process of re-establishing licensure in a new state. While initial licenses are not directly transferable, states generally recognize qualifications earned out-of-state (i.e., teacher-training programs and some licensure exams). For teachers holding certain continuing licenses, Oregon and Washington do offer a degree of reciprocity. Specifically, Oregon recognizes Washington’s

Professional Certificate as being equivalent to its Continuing Teaching License (CTL), and Washington recognizes the CTL as being equivalent to its Professional Certificate. While this reciprocity may appear to make transitions between Oregon and Washington easy, it is important to keep in mind that many teachers in these states do not currently hold either license. The CTL was only established in 1999 and was made optional in 2005, and the Professional Certificate was established in 2000. Furthermore, the CTL requires at least five years of professional experience, and Washington's initial license is valid during a teacher's first four and a half years of experience.<sup>3</sup>

An additional impediment to reciprocity facilitating cross-state mobility is that information about the reciprocity agreements between Oregon and Washington are not readily accessible. For instance, on Washington's teacher certification website, clicking the "reciprocity" link opens a webpage with the following statement: "Certificates or licenses from another state or jurisdiction do not cover employment in Washington."<sup>4</sup> It is only by reviewing the requirements for professional certification and finding the proper link that one learns the CTL is accepted in lieu of the Professional Certificate. The information provided by Oregon is similarly opaque.<sup>5</sup>

Seniority rules may also discourage teacher mobility. In Washington seniority is determined by in-state experience and teachers can switch districts without losing seniority, but crossing the state border is likely to be significantly less appealing than crossing a district border because seniority status (and the benefits and job protections that come with it, e.g. from layoffs) is lost. In Oregon, seniority is determined by in-district experience and a cross-state move is no more costly in terms of loss-of-seniority than a within-state move across districts.

Teacher pension systems also impose a significant penalty for teachers who split careers between Oregon and Washington. In short, switching from one pension system to another tends to lower the total value of an employee's DB annuity due to pension vesting rules, the fact that a pension's value is determined by a final average salary that is fixed at a lower rate in the state that you leave (due to both inflation and salary growth), and early retirement rules that reward long tenures. The largest cost associated with splitting a career between the two states is imposed by the plans' rules that allow early retirement with the accumulation of 30 YOS. To accumulate 30 YOS in at least one state, a teacher must switch states either very early or very late in her career. As demonstrated in a supplemental appendix available on the journal's website, the difference in the present value of pension wealth for a teacher who spends a full career in one system versus splitting time between two systems can be more than \$100,000.

## **Data**

This section describes the Oregon and Washington data sets and the process of merging the two data sets to identify teachers who crossed the state border.

### *Data Sources*

Job assignments held by Oregon teachers are available from a publicly available administrative data set obtained from the Oregon Department of Education. The data span the school years ending between 2001 and 2014 and provide teacher name, ethnicity, highest degree earned, school district, base salary level, and years of in-state and out-of-state experience. The data spanning 2007 to 2014 also include birth dates. Teachers employed in at least one year during the 2007 to 2014 time span have a unique identification number. For teachers last observed prior to 2007, identification numbers are generated based on unique combinations of teachers' names and characteristics. Overall, the data provide 419,213 teacher-year observations, and 72,035 unique teacher observations.

Job assignments held by Washington teachers are derived from publicly available administrative data obtained from the state's Office of Superintendent of Public Instruction (OSPI) S-275 personnel reporting system. The data provide identification numbers and information on teacher characteristics, assignment type, location of position, salary, highest degree earned, and experience level. For the purposes of this study, we use data from the school years ending between 1997 and 2014 and restrict the sample to individuals identified as holding a classroom teaching position. Overall, the data provide 981,673 teacher-year observations and 113,370 unique teacher observations.

The Washington data is supplemented by other state-level administrative data sets. Teachers who hold a Professional Certification (which is transferable to Oregon) are identified using data from OSPI. Teachers' pension plans are identified using data from the state's Department of Retirement Services (DRS).<sup>6</sup> Lastly, school and district-level characteristics for both Oregon and Washington are obtained from the Common Core of Data (CCD) compiled by the National Center for Education Statistics (NCES). These include information about student demographics, school level, and type of locale (e.g., urban vs. rural).

### *Merging Oregon and Washington Data*

To begin the process of identifying teachers that have moved between Oregon and Washington we isolate the subsample of teachers who exited the teacher workforce of Washington or Oregon during the study period or entered the teacher workforce from outside the states. Specifically, we identify 43,906 individuals who the data show exited the Oregon public teacher workforce prior

to 2014 and 57,461 who exited the Washington teacher workforce prior to 2014. Teachers in the Oregon sample are identified as entering the Oregon teacher workforce based on having out-of-state experience greater than zero (17,161 individuals), and those in the Washington sample are identified as entering the Washington teacher workforce based on having obtained their licensure credentials through OSPI (16,843 individuals).<sup>7</sup> Overall, across all years of our study, we identify 477 teachers as switching from Oregon to Washington and 522 teachers as switching from Washington to Oregon.<sup>8</sup>

To verify whether the level of cross-state movement implied by our data is consistent with other sources of data, we examine cross-state mobility patterns from a national sample of teachers. The Schools and Staffing Survey (SASS) provides a nationally representative snapshot of districts, schools, and teachers. One feature of the SASS is the Teacher Follow-up Survey (TFS), which is administered to a sample of the teachers who were surveyed by the SASS the previous year. We use the 2000-2001 TFS to calculate the proportion of teachers who are employed as public educators in a different state than in the previous year, and find that 0.91% switch states, and 0.43% are employed in an adjacent state. Limiting the TFS sample to the Rocky Mountain and Western states (which like Washington and Oregon are relatively large and sparsely populated), we find that 0.56% of teachers are teaching in a different state the following year, and 0.29% are employed in an adjacent state.<sup>9</sup>

We identify 0.07% of Oregon teachers and 0.03% of Washington teachers as holding a classroom teaching position in the other state in the following year. Considering that Oregon borders four adjacent states, the proportion of teachers moving from Oregon to Washington is fairly consistent with rates implied by the TFS data. The level of movement from Washington to Oregon, however, is considerably lower. One potential reason for observing lower rates of movement from Washington to Oregon is that Washington is considerably larger than Oregon.<sup>10</sup>

### **Patterns of Cross-State Mobility**

In this section we present a descriptive analysis of cross-state mobility and address the following questions:

- What is the overall level of cross-state mobility between Oregon and Washington, and how does it compare to cross-district mobility?
- Where are teachers who cross the state border from, and where do they go?
- What are the characteristics of teachers who cross the state border, and how do they compare to teachers who move within state?



To answer these questions, we look at patterns of cross-state mobility in terms of time-related factors, teacher experience, proximity to the state border, and individual teacher characteristics. In each case, the level of within-state mobility (across districts) provides a baseline for comparison.

### *Cross-State Mobility over Time*

Cross-state mobility is likely to vary over time due to factors that influence the number of teachers being hired (such as population trends and state budget issues), and changes to state policies that affect the cost of cross-state mobility (e.g. pension policies). **Figure 1** presents rates of within-state (Panel A) and cross-state (Panel B) mobility during 2001–2013.

In both Oregon and Washington, there is a good deal of year-to-year variation in the levels of within-state mobility and cross-state mobility.<sup>11</sup> Rates of within-state mobility are highly correlated between the two states ( $\rho = 0.53$  overall and  $\rho = 0.93$  since 2003) and appear to comport with macro-economic trends.<sup>12</sup> Indeed, there is a positive correlation between the annual rate of within-state mobility and the level of in-state hiring as measured by the number of new teachers entering the workforce in the following year ( $\rho = 0.51$  in Oregon and  $\rho = 0.96$  in Washington). The annual rate of cross-state mobility is also positively correlated between the two states ( $\rho = 0.43$ ). But while the rate of movement from Oregon to Washington appears to correspond with hiring levels in Oregon ( $\rho = 0.73$ ), the relationship is less consistent in regard to cross-state moves originating in Oregon ( $\rho = 0.03$  and  $0.24$  since 2003).

[FIGURE 1 ABOUT HERE]

### *Geographic Proximity*

Oregon and Washington are relatively large states and proximity to the border is likely to influence the propensity of teachers to switch states. So, in this subsection, we focus on rates of mobility among teachers employed in districts directly on state border and among teachers within the Portland-Vancouver Metropolitan Statistical Area (MSA), which straddles the state line.<sup>13</sup> **Table 2** presents the levels of within-state and cross-state mobility among all districts, border districts, and districts that overlap with the Portland-Vancouver MSA. Not surprisingly, proximity to the border has a strong influence on cross-state mobility among Washington teachers, but it is a less important predictor of cross-state mobility for Oregon teachers. Specifically, the average proportion (across years of the data in the study) of teachers in Washington that move across the border to teach in Oregon is 0.03% overall, but it is four times higher for teachers who are initially teaching in a Washington district on the border with Oregon and about

five times higher for teachers in Washington who are within the Portland MSA. In Oregon the overall rate of teachers who move to Washington is 0.07% and it is only slightly higher for teachers initially working in Oregon along the Washington border (0.10%), and no different for those in the Portland MSA.

One explanation for the asymmetry in cross-state mobility patterns is that it is related to the states' differing population distributions: there are many more Oregon teachers than Washington teachers in districts near the border.<sup>14, 15</sup> Hence, proximity to the border is closely related to mobility provided that there is a density of employment opportunities on the other side.

[TABLE 2 ABOUT HERE]

By focusing on teachers near the border, we can examine the extent to which there are barriers to cross-state mobility independent of geographical distance. Focusing on Washington teachers in school districts directly on the border or located in the Portland-Vancouver MSA, we find strong evidence of barriers to cross-state mobility. Rates of cross-state mobility in these areas is many times lower than rates of within-state mobility, in spite of the fact that teachers in those districts are proximate to a large proportion of the teaching positions in Oregon. In Washington border districts, the rate of within-state cross-district mobility is 10 times higher than the rate of cross-state mobility, and it is 7 times higher among districts in the Portland-Vancouver MSA. The disparities between within-state and cross-state mobility are even larger in the Oregon to Washington direction, but as noted above, this is not surprising given the states' differing distributions population.

Another way to assess the disparity between within- and cross-state mobility is to look at how many teachers near the border make long-distance within-state moves compared to the number crossing the border. We find that teachers are significantly more likely to move a long distance (measured as the Euclidian distance, or "as the crow flies", between the centroids of the originating district and destination district). More specifically, among teachers from state-border or Portland-Vancouver-MSA school districts, almost three times as many make a within-state move of 75 or more miles than make any cross-state move.

### *Teacher Characteristics*

Here we analyze mobility patterns across teacher characteristics associated with the barriers to cross-state mobility discussed in the Background section. Of particular interest is teacher experience, which is related barriers to cross-state mobility associated with licensure, seniority, and pensions. In interpreting the observed relationship between experience and cross-state mobility, it is also

important to consider its relationship to *within-state* mobility. Others have found that more experienced teachers are less likely to move across schools and districts (e.g., Hanushek et al., 2004; Keigher & Cross, 2010), and it is possible that more experienced teachers are less mobile in general, and not due to experience-related barriers to cross-state mobility in particular.

[FIGURE 2 ABOUT HERE]

**Panel A** of **Figure 2** plots the rates of within-state and cross-state mobility by years of experience for moves originating in Oregon. **Panel B** does the same for moves originating in Washington. Consistent with the prior literature, there is a negative relationship between cross-state mobility and years of accumulated experience. However, it is difficult to say whether the experience-related impediments to cross-state mobility discussed above play an important role in this relationship. The decline in cross-state mobility that occurs between one and five years, for example, is very similar to the decline observed in district mobility: cross-state mobility in Oregon is 55% lower in the fifth year than in the first year, while in-state district mobility is 48% lower; in Washington cross-state mobility is 50% lower and in-state district mobility is 54% lower among teachers with 5 years of experience.

To explore the relation between teacher characteristics and mobility further, we compare the characteristics of cross-state movers to the characteristics of within-state movers. **Table 3** compares the mean characteristics of teachers making within-state moves to those making cross-state moves and tests the differences between these means.<sup>16</sup> The left-hand panel presents teacher moves originating in Oregon, and the right-hand panel teacher moves originating in Washington.

[TABLE 3 ABOUT HERE]

Among Oregon teachers, the mobility patterns associated with experience are fairly consistent with incentives related to licensure, seniority, and pensions. These factors would lead us to expect higher rates of cross-state mobility among less experienced teachers who have, for instance, greater investment in the state's pension system. Indeed, the least experienced teachers in Oregon comprise significantly larger proportions of cross-state movers than within-state movers. For instance, 37% of cross-state movers have less than two years experience compared to 30% of within-state movers. In Washington, however, there is little difference in the experience distributions of within-state and cross-state movers. The Washington findings are surprising given that the state's seniority rules make it relatively more costly for more experienced teachers to leave the state.

One difference between beginning and experienced teachers is that experienced teachers can obtain a continuing license after several years of service. As discussed above, the continuing license in Washington has been the Professional Certificate since 2000. We might expect teachers who hold a continuing license to be reluctant to repeat the process of obtaining one in a new state, and hence less likely to cross the state border. Indeed, we find that Washington teachers who hold a Professional Certificate are significantly under-represented among cross-state movers in spite of the reciprocity between the Professional Certificate and Oregon's CTL. They comprise 18% of teachers switching districts, but only 8% of teachers switching states. It is possible that many teachers are unaware of the licensure reciprocity between Oregon and Washington and that poor communication of these rules is creating a barrier to mobility.

A teacher's pension plan enrollment depends on when he or she was hired (see **Table 1**), and teachers observed in Oregon's Tier 1 and Tier 2 plans or Washington's TRS1 and TRS2 plans are on average, relatively aged and experienced. For teachers in each pension plan (except TRS1), the proportion of within-state movers is significantly different from the proportion of cross-state movers: Teachers in Tier 1 or Tier 2 in Oregon, and TRS2 in Washington, are significantly under-represented among cross-state movers. Unfortunately, in this simple analysis we cannot determine the extent to which this mobility may be driven by the features of the pension plans due to the aforementioned relationship between plan enrollment and age and experience. One pension plan feature that is not related to age and experience is the "PERS pickup", under which many school districts pay teachers' contributions to the pension plan on their behalf (effectively increasing take-home pay by 6%). Teachers in these districts are significantly under-represented among cross-state movers relative to within-state movers, suggesting that this benefit is highly valued.

## **Discussion and Conclusion**

Mobility in the teaching profession is of considerable policy interest, but there is little empirical evidence on the degree to which public school teachers cross state borders. This paper explores patterns of cross-state mobility between Oregon and Washington and the degree to which features typical of the public teacher labor market may influence mobility. To the best of our knowledge, this is the first paper to track the mobility of two adjacent states' teacher workforces across the state border.

We identify a number of potential barriers to cross-state mobility between Oregon and Washington, including licensure requirements, rules related to seniority, and the structure of teacher pension systems. We observe few teachers crossing the

Oregon-Washington border to teach in the other state. In any given year, less than one 10<sup>th</sup> of a percent of Oregon teachers are identified as teaching in Washington the following year, and less than one 20<sup>th</sup> of a percent are identified as moving in the other direction. These rates of cross-state mobility are many times lower than observed rates of *within-state* mobility, indicating significant barriers to cross-state mobility. The evidence is particularly strong when we focus on districts near the state border. Among Washington school districts in the Portland-Vancouver MSA, the rate of within-state mobility is seven times higher than the rate of cross-state mobility in spite of the fact that the majority of the teaching jobs in that regional labor market are on the Oregon side of the border. And in both states, the proportion of teachers making a within-state move of 250 or more miles is over four times higher than the proportion making a cross-state move.

Although we find clear evidence of barriers to cross-state mobility, the evidence on which features of the teacher labor market may be hindering mobility is less conclusive. The costs associated with cross-state mobility suggest that less experienced teachers should be more likely to switch states because they face lower costs associated with cross-state moves. We do indeed observe this pattern, but find that less experienced teachers are also more mobile *within* states. And while more experienced teachers from Oregon are significantly over-represented among cross-state movers, those in Washington are not (see **Table 3**). These results suggest that teachers are not necessarily sensitive to the ways these costs vary with experience and licensure status. More nuanced statistical analyses that control for confounding factors can shed more light on the relationship between features of the states' teacher labor markets and the level of cross-state mobility.

That we find evidence of significant barriers to cross-state mobility should be of interest to policy-makers for a number of reasons. First, prospective teachers may be discouraged from entering the profession if they anticipate that high costs will be associated with future inter-state moves. Second, the high cost of becoming fully licensed in new state is likely to increase attrition from the profession among mobile teachers who otherwise would have stayed in the profession even after leaving the state in which they were originally licensed. Third, barriers to mobility inhibit the ability of the teacher workforce to flow to states where teachers are in high demand.

As pointed out by Coggshall and Sexton (2008), while teacher licensure serves a clear policy purpose, many of the barriers to cross-state mobility associated with licensure rules are artificial and do not serve any policy purpose (e.g., high fees, slow administrative processes, and duplicative testing and coursework). Lowering those artificial barriers could save both states and teachers time and money. For instance, providing better information about licensure reciprocity between Oregon

and Washington could lower a barrier to mobility at virtually no cost. Some features of teacher pension systems may also create “artificial” barriers to mobility. For instance, it is not clear that pension structures that award significantly higher retirement benefits once teachers reach 30 years of service serve a clear policy purpose. Pension systems are intended to provide retirement security to employees, but DB pension structures often fail to benefit the majority of the teacher workforce, over 70% of whom leave within 20 years (Mcgee & Winters, 2015).

One aspect of the interaction between barriers to mobility and the teacher labor market that our data do not address is the extent to which teachers *do* cross the state border, but choose not to re-enter the teacher labor market in their new state (we only observe those who do re-enter the teacher labor market). There is at least anecdotal evidence that this does in fact describe the experience of many teachers (Darling-Hammond & Sykes, 2003; Coggshall & Sexton, 2008). Improving the retention of such teachers may be relatively low hanging fruit for states seeking to address shortages of highly qualified teachers in chronically under-staffed areas such as STEM and special education.

The descriptive evidence presented in this paper points to several areas in the educator labor market literature that would benefit from further exploration. Given that the issues explored in this paper are quite new to the literature, it is important to document: 1) the degree to which our findings appear to generalize to other state boundaries, and 2) to more systematically explore the extent to which the apparent lack of cross-state mobility is driven by the different types of policy barriers we describe (e.g. the degree of licensure reciprocity).

## Notes

<sup>1</sup> While the use of seniority in personnel decisions in the U.S. is well documented (e.g., National Council on Teacher Quality, 2014), to the best of our knowledge there is no documentation of how seniority is calculated. Many states give school districts discretion over how to calculate seniority, and in reviewing the CBAs of a number of large U.S. school districts, we have been unable to find evidence that school districts tend to consider any out-of-district experience when determining seniority. Below, we discuss the seniority policies of Oregon and Washington, but the extent to which they are representative of policies in other states is unclear. The extent to which seniority rules may discourage cross-state mobility more than within-state mobility (i.e., movement across districts) will largely depend on how seniority is calculated. If seniority is determined by in-district experience, the seniority-related costs associated with switching states are essentially the same as the costs associated with switching districts. If seniority is determined by in-state experience, those costs become quite different.

<sup>2</sup> The features of Oregon's and Washington's teacher labor market are discussed in more detail in a supplemental appendix that is available on the journal's website.

<sup>3</sup> A different licensure option that is recognized by both states as equivalent to the CTL and Professional Certificate is certification by the National Board for Professional Teaching Standards (NBPTS). Very few Oregon teachers hold this license, but nearly 10% of Washington teachers are NBPTS certified (Exstrom, 2011). While it would be relatively easy for these Washington teachers to switch states, doing so could be costly. Washington pays a \$5,000 annual bonus to NBPTS certified teachers, and an additional \$5,000 to those who teach in challenging schools. Oregon provides no such financial incentives.

<sup>4</sup> See <https://www.k12.wa.us/certification/Reciprocity.aspx>, accessed April 13, 2015.

<sup>5</sup> For instance, see <http://www.oregon.gov/tspc/Pages/Out-of-State-.aspx>, Accessed April 13, 2015.

<sup>6</sup> The DRS data is restricted to teachers who were employed between the 1996 and 2009 school years.

<sup>7</sup> Teachers originally certified in a different state will generally obtain certification through OSPI rather than from one of the state's approved teacher training program institutions (e.g., University of Washington).

<sup>8</sup> The merging process is described in more depth in a supplemental appendix that is available on the journal's website.

<sup>9</sup> We do not use the Oregon and Washington TFS data alone because the sample sizes in these states are too small to draw meaningful conclusions. The 2000-2001 TFS surveys only 70 Washington teachers (zero of whom switch to Oregon) and 70 Oregon teachers (less than 10 of whom switch to Washington). Note that the aforementioned figures have been rounded to adhere to NCES policies.

<sup>10</sup> For example, given the relative sizes of the teacher workforces in Oregon and Washington, Washington exporting 1% of its teachers to Oregon would correspond with Oregon importing 1.85% of its teachers from Washington. In the other direction Oregon exporting 1% of its teachers to Washington would correspond with Washington importing just 0.54% of its teachers from Oregon.

<sup>11</sup> The average rate of within-state mobility (taken across years) is 1.65% in Oregon and 1.84% in Washington, with standard deviations of 0.46% and 0.57% respectively. The average rate of cross-state mobility (taken across years) is 0.07% in Oregon and 0.03% in Washington, with standard deviations of 0.03% and 0.02% respectively.

<sup>12</sup> The correlation between the annual rate of within-state mobility and GDP growth is 0.38 in Oregon and 0.31 in Washington.

<sup>13</sup> The geographic definition of the regional labor market was obtained from the Bureau of Labor Statistics. For more information, see [http://www.bls.gov/oes/current/msa\\_def.htm#38900](http://www.bls.gov/oes/current/msa_def.htm#38900), accessed April 13, 2015.

<sup>14</sup> In Oregon, 18% of the observations in the study sample are located in border districts (69,830) and 33% are in the Portland Vancouver MSA (129,485). In Washington, only 4% of observations are in located in border districts (34,209) and 5% in the Portland-Vancouver MSA (49,521).

<sup>15</sup> An additional factor to consider is that teacher salaries in many Portland-area school districts are higher than in Washington (which has a single state-wide salary schedule). Teacher compensation structures in Oregon and Washington are discussed in more detail in a supplemental appendix that is available on the journal's website.

<sup>16</sup> We present a similar table in a supplemental appendix that reports the propensities to move within state, to move across state, and to exit the sample (either by exiting the profession or by moving to a teaching position in a state other than Oregon or Washington).



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**Table 1. Key features of the Oregon and Washington teacher labor markets**

OREGON		WASHINGTON				
<b>Panel A - Teacher Licensure</b>						
Initial Licensure	Graduate from recognized teacher preparation program, pass basic skills and subject matter exams.	Graduate from recognized teacher preparation program, pass basic skills and subject matter exams.				
Continuing Licensure	<i>Standard Teaching License</i>	<i>Standard Teaching License</i>				
	Licensed prior to 1999; can be renewed indefinitely given required levels of employment and professional development.	Licensed prior to 1987; valid for life.				
	<i>Initial Teaching License II</i>	<i>Continuing Teaching License</i>				
	Licensed since 1999; requires additional graduate-level coursework; renewable every 3 years.	Licensed during 1987-2000; requires continuing education; renewable every 5 years.				
	<i>Continuing Teaching License</i>	<i>Professional Certificate</i>				
	Required during 1999-2005; optional since 2005; requires 5 years experience, completion of master's degree and assembly of portfolio demonstrating proficiency.	Licensed since 2000; requires completion of certification course (course optional since 2010) and assembly of portfolio demonstrating proficiency.				
<b>Panel B - Teacher Tenure and Seniority</b>						
Time to Tenure	No tenure.	Prior to 2010: two years. Since 2010: 3 years				
Seniority Calculation	In-district experience.	In-state experience.				
Use of seniority in lay-off decisions?	Yes. Districts may also consider competency as a factor.	Yes, at district's discretion (great majority use seniority as a primary criterion)				
<b>Panel C - Teacher Pension Systems</b>						
	Tier One	Tier Two	OPSRP	TRS1	TRS2	TRS3
Membership dates (hired)	pre-1996	1996-2003	2003-pres.	pre-1977	1977-1996; 2007-Pres.	1997 transfer from TR2; 1996-Pres.
Type Vesting	Hybrid 5 years	Hybrid 5 years	Hybrid 5 years	DB 5 years	DB 5 years	Hybrid 10 years
Normal retirement age	58 or 30 YOS	60 or 30 YOS	65 or 58 with 30 YOS	60 or 55 with 25 YOS	65 or 62 with 30 YOS	65 or 62 with 30 YOS
Annual Defined Benefit	0.0167 * FAS * YOS or Account * AEF * 2		0.015 * FAS * YOS	0.02 * FAS * YOS	0.02 * FAS * YOS	0.01 * FAS * YOS
Investment account at retirement?	No	No	Yes	No	No	Yes

**Table 2. Percentages of Teachers Moving near the Oregon-Washington Border**

	Teachers from Oregon			Teachers from Washington		
	All	Border	PDX- VAN	All	Border	PDX- VAN
<b>All Observations</b>						
Switch District	1.65	1.21	1.33	1.92	1.15	1.12
Switch State (in next year.)	0.07	0.10	0.07	0.03	0.12	0.16
Switch State (in any year.)	0.12	0.17	0.13	0.06	0.22	0.28
Observations	391,084	69,830	129,485	925,764	34,209	49,521

**Table 3. Comparing the Composition of “Within-State” and “Cross-State” Movers**

	Oregon Teachers					Washington Teachers				
	Within-State		Cross-State		Diff in Means: P-Value	Within-State		Cross-State		Diff in Means: P-Value
	Mean	Obs.	Mean	Obs.		Mean	Obs.	Mean	Obs.	
<b>Teacher Characteristics</b>										
Experience: < 2	0.30	6,483	0.37	276	0.023	0.18	17,734	0.20	251	0.386
Experience: 2-5	0.24	6,483	0.29	276	0.041	0.29	17,734	0.33	251	0.159
Experience: 5-10	0.22	6,483	0.19	276	0.252	0.25	17,734	0.28	251	0.365
Experience: 10-20	0.17	6,483	0.11	276	0.000	0.17	17,734	0.11	251	0.003
Experience: 20-30	0.07	6,483	0.03	276	0.000	0.01	17,734	0.01	251	0.974
Has Professional Certificate	-	-	-	-		0.18	17,674	0.08	251	0.000
Has Advanced Degree	0.65	6,483	0.59	276	0.065	0.54	17,734	0.65	251	0.000
Salary: Base Compensation	40,699	6,483	39,314	276	0.045	37,664	17,734	39,616	251	0.003
Salary: Next Year – Current Year	2,616	6,483	1,218	276	0.028	2,356	17,734	1,174	251	0.096
Pension: Tier One or Tier 2 (OR)	0.70	6,483	0.62	276	0.008	-	-	-	-	-
Pension: OPSRP (OR)	0.30	6,483	0.38	276	0.008	-	-	-	-	-
Pension: PERS “Pickup” (OR)	0.62	6,483	0.53	276	0.004	-	-	-	-	-
Pension: TRS1 (WA)	-	-	-	-	-	0.06	16,629	0.06	231	0.738
Pension: TRS2 (WA)	-	-	-	-	-	0.12	16,629	0.07	231	0.001
Pension: TRS3 (WA)	-	-	-	-	-	0.81	16,629	0.87	231	0.007
Border District	0.13	6,483	0.25	276	0.000	0.02	17,734	0.17	251	0.000
Portland-Vancouver MSA	0.27	6,483	0.34	276	0.009	0.03	17,734	0.31	251	0.000
Distance Moved (miles)	59	5,572	110	266	0.000	54	17,498	104	242	0.000

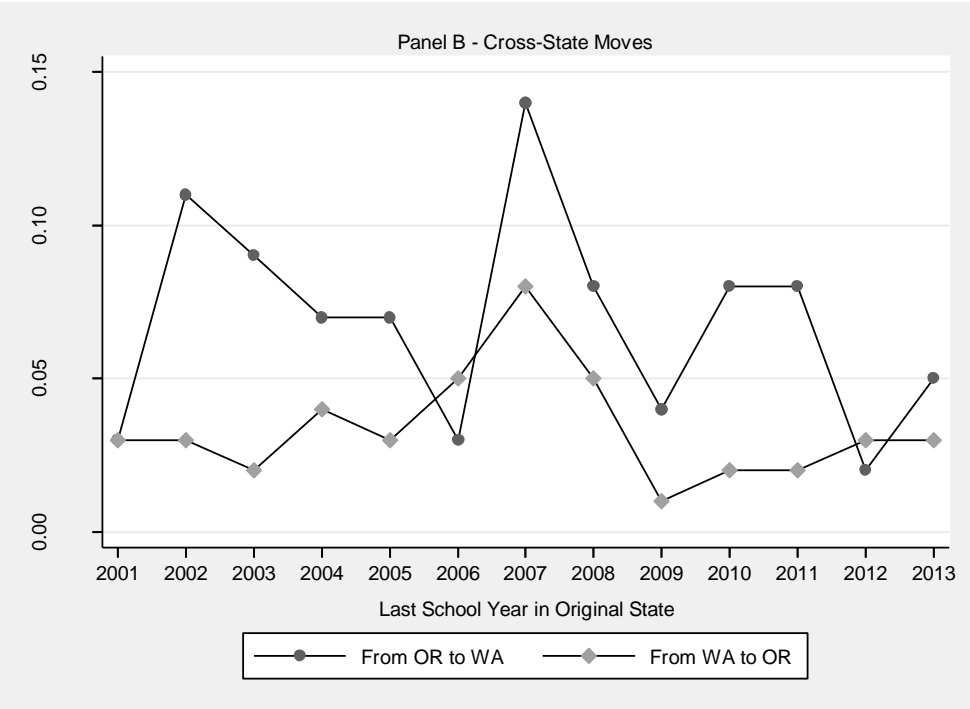
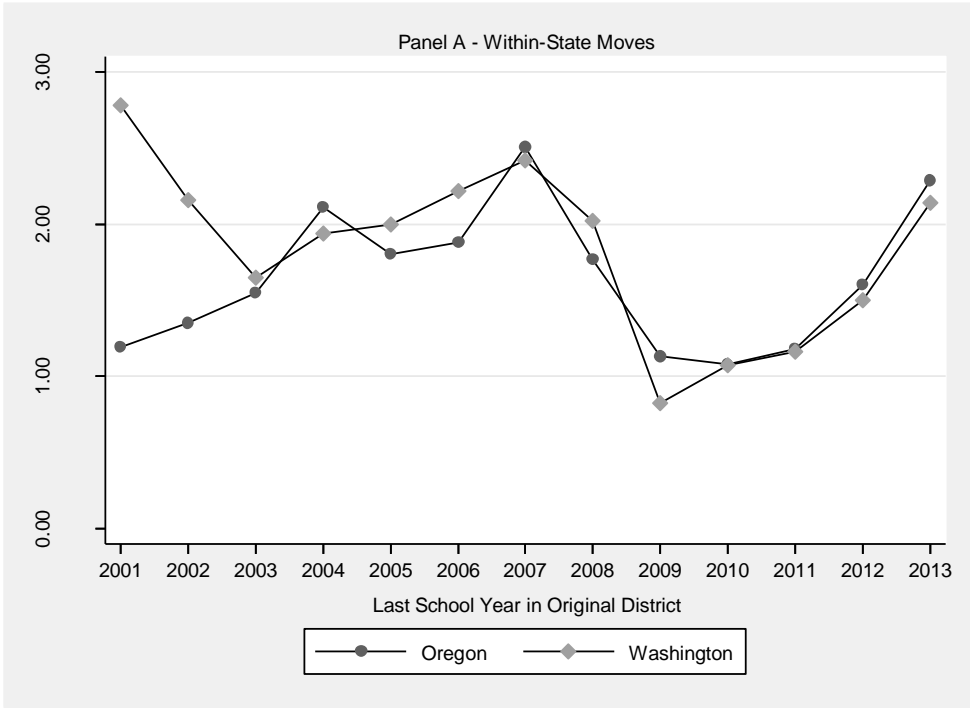
*Note: Teacher characteristics are defined as of the last year a teacher was observed in a particular district or state before moving to a different district or state in the following year. The number of observations are smaller for some characteristics because that data is unavailable for a subset of teachers.*

**Figure 1. With-in State and Cross-state Mobility by School Year**

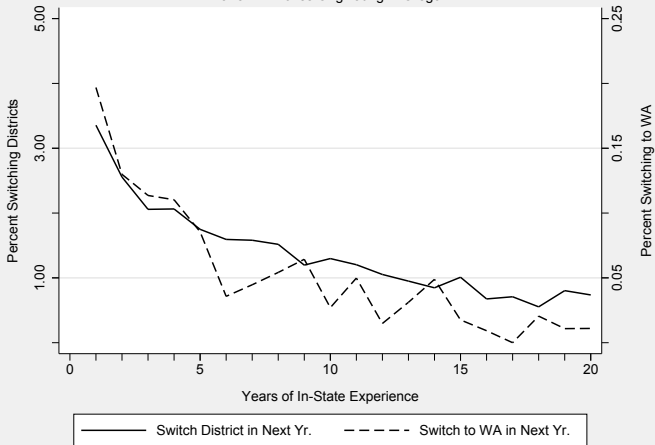
*Note: The vertical axis in Panel A is the percentage of teachers (out of all teachers in the state) who are teaching in a different district in the following year. The vertical axis in Panel B is the percentage of teachers (out of all teachers in the state) who are teaching in the other state (OR or WA) in the following year.*

**Figure 2. Level of Mobility by Experience and State**

*Note: The left-hand axis in each plot is the percentage of teachers (out of all teachers in the state) who are teaching in a different district. The right-hand axis in each plot is the percentage of teachers who are teaching in the other state (Oregon or Washington) in the following year.*

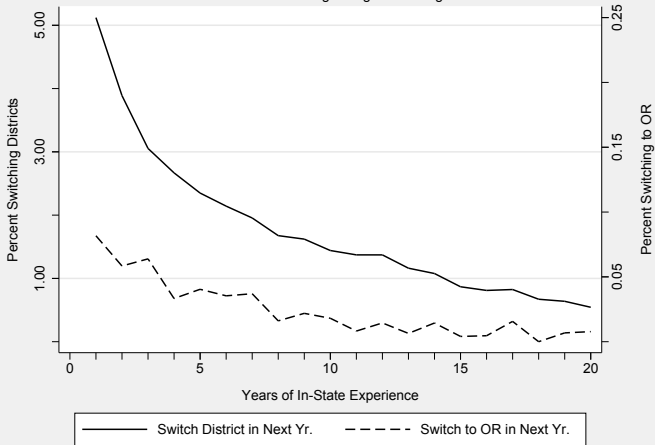


Panel A - Moves Originating in Oregon





Panel B - Moves Originating in Washington



## Supplemental Appendix A

### Features of the Oregon and Washington Teacher Labor Markets

This supplemental appendix describes features of the Oregon and Washington teacher labor markets that may influence cross-state mobility, specifically licensure processes, tenure and seniority rules, compensation levels, and pension system characteristics.

#### *Teacher Licensure Procedures*

Teachers in Oregon and Washington are required to be licensed through state-regulated processes. In both states (as of 2015) there are two tiers of teaching licenses: initial and continuing. Initial licensure requires that a teacher graduate from a recognized teacher preparation program and pass basic skills and subject matter exams. These licenses are valid for a limited period of time, after which a continuing license must be obtained to continue teaching. Depending on the state and hire date, continuing licensure requirements may consist of the accumulation of professional experience, professional development, continuing education, and/or the demonstration of proficiency in areas such as pedagogy and content knowledge.

In Oregon, teachers initially licensed prior to 1999 hold Basic and Standard teaching licenses, which can be renewed indefinitely if teachers had required levels of employment and professional development. Since 1999, newly licensed teachers first obtain the Initial Teaching License I (ITL I),<sup>1</sup> and then the ITL II. Obtaining the ITL II, which can be renewed every three years, requires additional graduate-level coursework germane to public education and the teacher's field of instruction. Between 1999 and 2005, Oregon teachers were required to progress to a Continuing Teaching License (CTL). The CTL requires that a teacher satisfy the requirements for ITL II, hold a master's degree or higher, have at least five years of teaching experience, and complete a CTL program of study at an approved college or university. The CTL program culminates in the assembly of a professional portfolio that demonstrates a teacher's proficiency in a series of teaching standards.<sup>2</sup> Since 2005, the CTL has been optional and a teacher may continually renew the ITL II license.

Washington has also reformed its continuing licensure procedures, though the details and timing are different from Oregon's changes. Teachers licensed prior to 1987 were issued Standard/Continuing licenses that are valid for life. Starting in 1987, new teachers were issued continuing licenses that must be renewed every five years and require a minimum amount of continuing education study.<sup>3</sup> In 2000, the Professional Certificate was established as the state's continuously renewable teaching license. Similar to the CTL in Oregon, it required completion of a program offered by a college or university and the creation of a professional portfolio

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<sup>1</sup> The ITL I is valid for three years and may be renewed twice with the completion of four and a half quarter hours of graduate credit.

<sup>2</sup> In lieu of completing a CTL program a teacher can earn certification from the National Board of Professional Teaching Standards (NBPTS).

<sup>3</sup> Regarding current standards for the renewal of post-1987 certificates, referred to as "Continuing (Clock Hour) Certificates", see <https://www.k12.wa.us/certification/Teacher/ContinuingClockhours.aspx#maintain>.

demonstrating proficiency in teaching. However, the university program component was made optional in January 2010 and dropped in September 2011 (though many teachers still enroll in various support programs) and the state has adopted the ProTeach Portfolio as the assessment to be passed for professional certification.<sup>4</sup> Renewal rules for the Professional Certificate are essentially the same as those for the post-1987 Continuing Certificate.

### *Teacher Tenure and Seniority*

Tenure laws in both Oregon and Washington have changed over the last two decades. Oregon ended tenure as it is traditionally understood when it passed Senate Bill 880 in 1997, which mandated that all current and new teacher contracts be renewable two-year contracts. The law also streamlined the appeals process for dismissals and gave districts the authority to use competency criteria rather than seniority alone in making certain personnel decisions.<sup>5</sup> Tenure still exists in Washington, and is earned after the accumulation of three years of experience. Prior to 2010, tenure was awarded after teaching two years. Teachers moving between districts within the state have a one-year probationary period in the new district, after which tenure is reinstated.

Seniority is also determined by level of experience and is used by both states as an important criterion in personnel decisions. For instance, the teacher layoff procedures dictated by state law specify that districts must first compile a list of available positions and qualified staff and then determine the seniority rank of teachers as a determining factor for which personnel are to be retained.<sup>6</sup> Seniority is calculated as experience accumulated since the first day of service with the school district. The law allows districts to retain a teacher with less seniority if there is evidence that the individual exhibits greater competence or merit.

In contrast to Oregon, Washington calculates teacher seniority based on experience accumulated within the state rather than within a particular school district.<sup>7,8</sup> For example, in Federal Way one year of out-of-state experience counts as 0.75 years of in-state experience. State code allows districts to collectively bargain with their teachers' unions to set regulations on whether and how to use seniority in personnel decisions, but the vast majority of school districts use in-state seniority as the primary factor in determining layoffs and decisions related to within-district transfers (Goldhaber et al., 2015). As of 2015, Washington is in the process of adopting a new performance-based teacher evaluation system and will mandate that seniority not be the sole factor considered in teacher layoffs decisions.

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<sup>4</sup> Like Oregon, Washington accepts certification from the NBPTS in lieu of the professional certification process. See <https://www.k12.wa.us/certification/teacher/procert-program.aspx> for more information on certification under the ProTeach portfolio.

<sup>5</sup> McGuinn (2010) finds that this change and similar reforms in other states did little to alter how teachers are actually dismissed.

<sup>6</sup> See Procedure for Reduction of Teacher Staff Due to Funding or Administrative Reason, Oregon Revised Statute § 324.934.

<sup>7</sup> See Hiring and Discharging of Employees — Written Leave Policies — Seniority and Leave Benefits of Employees Transferring Between School Districts and Other Educational Employers, Revised Code of Washington § 28A.400.300.

<sup>8</sup> However, several districts give at least partial credit for out-of-state experience in determining seniority rankings. For example, in Federal Way one year of out-of-state experience counts toward 0.75 years of in-state experience. The other districts are Centerville, Enumclaw, Pullman, and Woodland. For expanded analysis on reduction in force procedures in Washington see Goldhaber and Theobald (2013).

### *Teacher Pension Systems*

The Oregon Public Employees Retirement System (PERS) currently manages two distinct pension programs that include three specific plans: the Chapter 238 Program (Tier One and Tier Two) and the Oregon Public Service Retirement Plan (OPSRP). Enrollment in these plans is determined by a teacher's date of hire. Within the Chapter 238 Program, teachers hired on or before January 1, 1996 are Tier One members, while Tier Two members were hired between January 1, 1996 and August 28, 2003. Individuals hired after August 28, 2003 are enrolled into the OPSRP program. Each Oregon plan is a hybrid pension plan that includes a defined benefit (DB) that is funded by the employer (i.e., the school district) and a defined contribution (DC) investment account that is funded either by the employee or employer.<sup>9</sup> Each plan has a five-year vesting period, after which a teacher is eligible to receive employer-funded benefits in retirement.

There are several important differences between the Oregon plans. First, employee contributions are placed into separate accounts for each plan. Tier One members can place contributions into a "regular account" that prior to 2000 earned a minimum return of 8 percent (it could earn more under favorable market conditions); since 2000 it has earned the guaranteed return of 8 percent, but not more than that.<sup>10</sup> Tier Two and OPSRP members contribute to accounts that earn market returns on investments, whether positive or negative. Since 2004, all ongoing employee contributions (regardless of pension plan membership) have been placed in the state's Individual Account Program (IAP), which is also subject to market returns. Second, the benefit formulas of the three plans differ. Tier One and Tier Two members earn an annual benefit equal to the maximum of  $0.0167 * YOS * FAS$  and  $Account * AEF * 2$ , where *YOS* is years of service, *FAS* is final average salary,<sup>11</sup> *Account* is the value of the teacher's "regular account", and *AEF* is an actuarial equivalency factor. Tier Two members retain the assets in their IAP account regardless of which two benefit formula is selected but unlike the *account*, IAP assets are not matched by the state. OPSRP members retire with the value of their IAP investment accounts (which can be annuitized based on the AEF) and an annual DB annuity equal to  $0.015 * YOS * FAS$ . Third, retirement eligibility differs for the three plans (see **Table S1**).

Washington State currently operates three retirement systems that cover teachers: TRS1, TRS2, and TRS3.<sup>12</sup> TRS1 and TRS2 are traditional DB systems in which retirees are paid an annuity formulaically determined by *YOS* and *FAS*. The third system, TRS3, is a hybrid system comprised of a DB component funded by employers and a DC component that places employee contributions into a personal investment account. Employees hired prior to 1977 were enrolled in TRS1. Employees hired between 1977 and 1996 were enrolled in TRS2 and active members have had the option to transfer to TRS3 since 1996. Employees hired between 1996 and 2007 were mandated into TRS3, and those hired since 2007 have been able to choose between TRS2 and TRS3, with TRS3 as the default option.

<sup>9</sup> Employees would typically make investment account contributions out of their own salaries, but through collectively bargained agreements, as of 2014, 53 percent of Oregon Employers (covering about 70 percent of employees) cover this cost, which is generally referred to as a PERS "pick up" (Oregon PERS, 2013).

<sup>10</sup> Due to the Oregon pension system's large unfunded liabilities, it is unlikely that "regular account" earnings will ever again exceed the 8 percent minimum. See [http://www.oregon.gov/pers/docs/general\\_information/pers\\_by\\_the\\_numbers.pdf](http://www.oregon.gov/pers/docs/general_information/pers_by_the_numbers.pdf) for funding status and a breakdown of historical earnings on investment account contributions.

<sup>11</sup> Oregon uses the average of a teacher's three highest consecutive years of compensation to determine FAS.

<sup>12</sup> For more details about these plans, see Goldhaber et al. (2012).

There are several important differences between the TRS plans. First, the vesting periods are different: five years for TRS1 and TRS2 and ten years for the DB component of TRS3. Second, the annual benefit formulas for TRS1 and TRS2 are  $0.02 * YOS * FAS$ , and  $0.01 * YOS * FAS$  for TRS3.<sup>13</sup> Like OPSRP members in Oregon, TRS3 members receive the value of their investment accounts, regardless of vesting status. Third, employee contributions under TRS2 are variable and depend on the funding status of the pension fund.<sup>14</sup> TRS1 members contribute 6 percent of salary and TRS3 members can choose from among six contribution options ranging between 5 and 15 percent of salary. Fourth, a provision in TRS3 for employees with at least 20 *YOS* increases the value of the employee's DB annuity by approximately 3 percent for each year between separation and retirement. Finally, TRS1 members are eligible for full retirement at age 60 (or age 55 with 25 *YOS*), much earlier than TRS2 and TRS3 members who are eligible for full retirement at age 65 (or age 62 with 30 *YOS*).

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<sup>13</sup> Under TRS1, FAS is equal to the average of an employee's two highest paid years. Under TRS2 and TRS3, FAS is equal to a teacher's average salary during his or her five consecutive highest paid years.

<sup>14</sup> Historically, TRS2 employee contribution rates have averaged around 4.5 percent.

## Supplemental Appendix B

### Pension Wealth in Oregon and Washington

Each of the pension plans currently operated by Oregon and Washington have a DB component, which provides employees with a retirement annuity defined by *FAS* (final average salary) and *YOS* (years of service),<sup>15</sup> and there are several reasons why splitting a career between two DB systems will tend to generate a significantly lower level of pension wealth than staying in one system. The first reason is related to vesting rules: teachers who separate from a pension system before becoming vested are not entitled to any defined benefit.<sup>16</sup> Teachers who split time between two pension systems are less likely to become fully vested than a teacher who stays in one plan. And teachers with shorter careers (e.g. less than 10 or 15 years) who would have become vested within one pension system may fail to become eligible for retirement benefits in either plan.

A second cost associated with splitting time between two DB plans is that it tends to leave the value of the initial plan vulnerable to inflation. When a teacher leaves a DB plan before retirement, the *nominal value* of her DB annuity stays fixed. Therefore, the *real value* of that annuity will be eroded by inflation until the teacher begins retirement.<sup>17</sup> For example, under 2.5 percent inflation, a \$20,000 annuity as defined by a teacher's *FAS* and *YOS* upon separating in the year 2000 would have a real value of less than \$14,000 if retirement began fifteen years later in 2015.<sup>18</sup> In contrast, the teacher's end-of-career salary (which will have kept pace with inflation) will determine the value of the teacher's second DB plan.

The third reason that switching pension systems tends to be costly is because retirement eligibility rules in many DB plans allow employees to retire at younger ages after crossing some years-of-service threshold (e.g. 30 *YOS*). Crossing that threshold tends to dramatically increase an employee's total pension wealth. Consider a teacher who has earned a \$40,000 retirement annuity and for the sake of simplicity, assume zero inflation. If the normal retirement age is 65 and she lives until age 85, she collects a total of  $\$40,000 * 20 \text{ years} = \$800,000$  in retirement benefits. Now suppose that she has accumulated 30 *YOS* and can retire early at age 60; she will collect her annuity for five additional years, increasing total nominal pension wealth by 25 percent (to \$1 million). Teachers who split time between two DB plans are less likely to be eligible for early retirement in one of those plans. Leaving one plan after 10 years, for example, would require 40 total years of service in public education to reach the 30 *YOS* threshold in the

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<sup>15</sup> While we focus here on DB plans, note that two plans (Oregon's OPSRP and Washington's TRS3) also have defined contribution (DC) components, and Oregon's Tier One and Tier Two plans essentially switch between pure DB and DC plans depending on which provides the largest retirement benefit (see Section 2.2. and Table 1).

<sup>16</sup> Employees who leave a DB plan prior to becoming vested can typically withdraw their own contributions to the plan, plus interest. This is true of Oregon's Tier One and Tier Two plans and Washington's TRS1 and TRS2 plans. Employees do not contribute to the DB components of OPSRP and TRS3, but to the DC components of those plans, which are not subject to vesting rules.

<sup>17</sup> Most plans provide cost of living adjustments (COLAs) once an employee has begun retirement, but not before. An exception to this is TRS3 teachers with 20 or more , for whom the DB component increases by approximately 3 percent each year between separation and retirement, up to age 65.

<sup>18</sup> The real value in 2015 is calculated as follows: .

second plan. At that point, a teacher would likely be of normal retirement age and eligibility for early retirement would be irrelevant.

Here we look at pension wealth accrual under Oregon's and Washington's pension plans. We focus on cross-state movement between the three pension plans that are still enrolling new hires (OPSRP, TRS2, and TRS3) and present the case of a representative teacher who begins her career at age 25 and works for a total of 35 years, until age 60. In particular, we calculate the total pension wealth earned after 35 years when the teacher switches between Oregon and Washington at different points in her career.

**Figure S1** presents the present value of total pension wealth that is accumulated over the 35-year career of the representative teacher if she switches states after accumulating 1-34 years of experience. **Panel A** represents cross-state moves from Oregon (OPSRP) to Washington (TRS2 or TRS3), and **Panel B** represents movement in the other direction. Pension wealth is represented on the vertical axis and, the years of service accumulated in the teacher's initial pension plan before making the cross-state move is represented on the horizontal axis. The points above 20 years of service in **Panel A**, for example, represent total pension wealth given 20 years of service in OPSRP and 15 years of service in TRS2 or TRS3.

Let us first consider switching from Oregon to Washington (Panel A). Because the level of benefits provided by the Oregon plan is greater, pension wealth is highest when the teacher stays in the Oregon plan for 30 or more years. If switching to Washington with less than 30 *YOS*, the teacher is best-off switching with 5 or less *YOS* in Oregon, which allows her to reach the 30-*YOS* threshold in TRS2 or TRS3. Switching to Washington after accumulating between 6 and 29 *YOS* generally results in lower pension wealth. Pension wealth under a switch to TRS3 is less sensitive to the timing of the switch than under a switch to TRS2. This is primarily due to three features of TRS3: 1) The size of the DB component is smaller, 2) With 20 *YOS*, the size of the DB increase by 3 percent each year between separation and retirement (5 years in the case of the representative teacher), and 3) Like OPSRP, TRS3 includes a DC component which is not sensitive to the timing of switching states. In the case of switching from Washington to Oregon (Panel B), the teacher again receives the greatest pension wealth by crossing the 30-*YOS* threshold in OPSRP – this time by switching states early in her career with between 1 and 5 *YOS*. As before, the next best option is to accumulate at least 30 *YOS* in TRS2 or TRS3. Switching plans with between 6 and 29 *YOS* generally produces lower pension wealth, and TRS3 is less sensitive to the timing of the switch for the reasons discussed above.

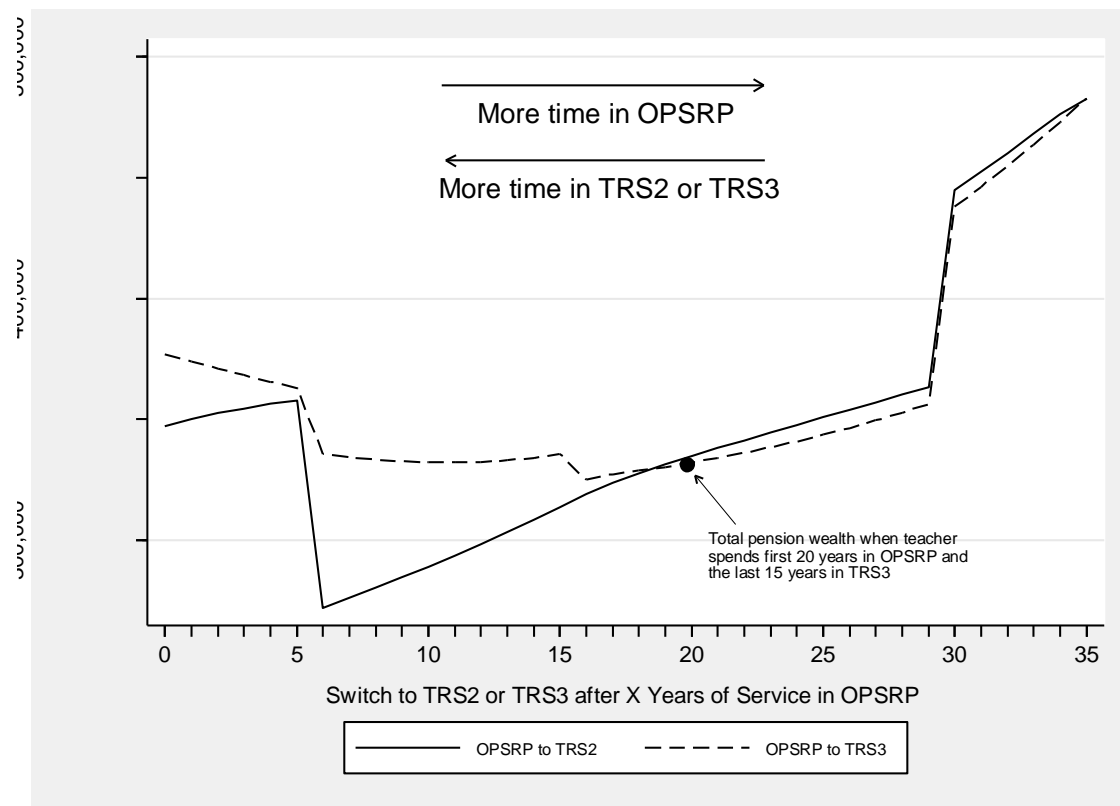
These plots demonstrate the potentially high pension wealth costs associated with splitting one's career between two states. In the case of the representative teacher with a 35-year career, these costs are dominated by the plans' rules that allow early retirement with the accumulation of 30 *YOS*. The costs can be particularly high (depending on the timing of the switch) when switching to or from TRS2, showing how the incorporation of non-traditional plan features (such as those in OPSRP and TRS3) can ameliorate pension-related barriers to cross-state mobility.

While we have not presented the case of Oregon's Tier One and Tier Two plans here, the pension wealth patterns observed in **Panel A** can provide insight into how switching from one of those plans into TRS2 or TRS3 might influence total pension wealth. Like OPSRP, Tier One and Tier Two allow teachers with 30 or more years of experience to retire at younger ages.

Therefore, as in **Panel A**, we would see large discontinuities in pension wealth for teachers who fail to reach the 30-year threshold in either plan. An important difference with OPSRP is that Tier One and Tier Two do not have the same type of DC component. Rather, under the money match provision, they essentially switch between pure DB and pure DC plans depending on how well the PERS investment portfolio performs. This would make early and mid-career exits less costly, particularly under favorable market conditions, because the value of the money match account (unlike the DB annuity) keeps growing until retirement even after a mid-career separation.<sup>19</sup>

**Figure S1. Total Pension Wealth when Splitting a 35-Year Career between Oregon and Washington**

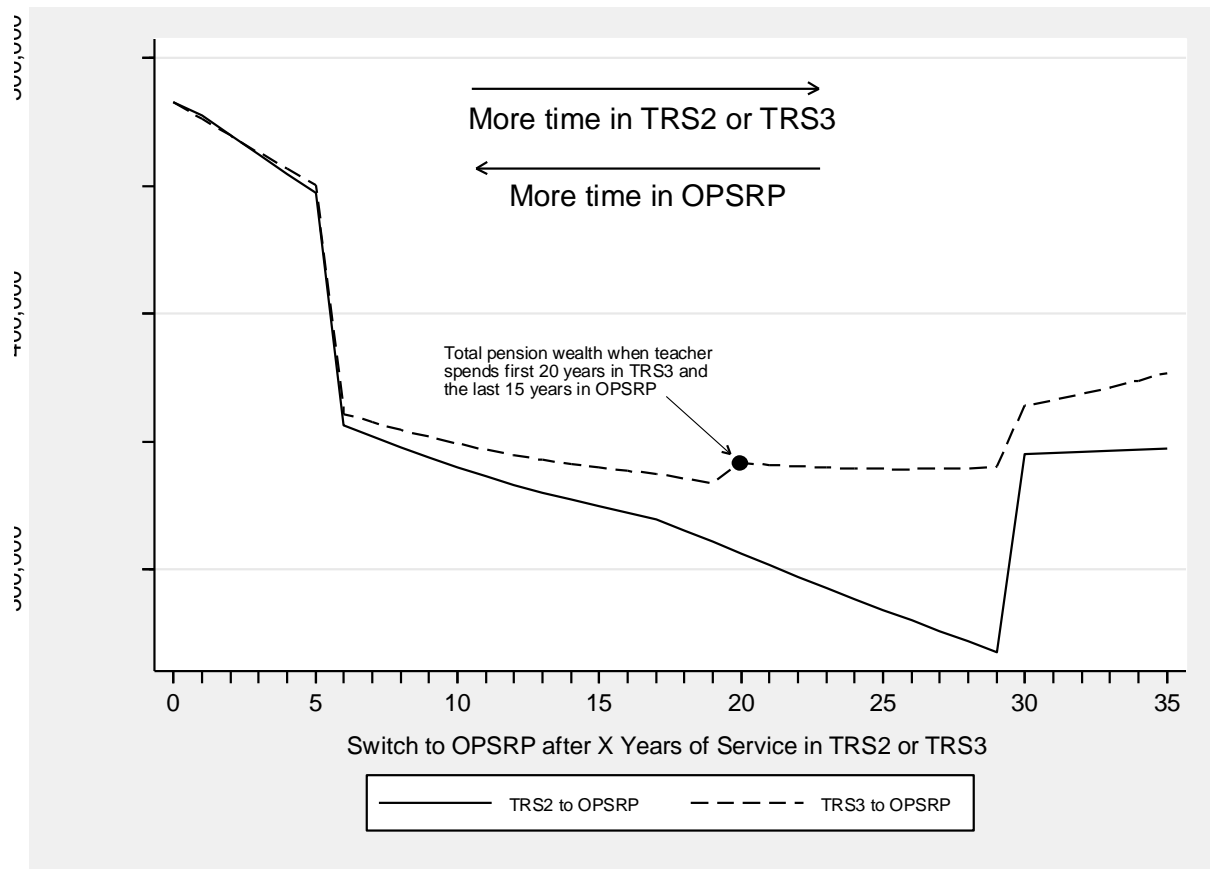
**Panel A. Switching from Oregon to Washington**



<sup>19</sup> Teachers hired since the early 1990's are unlikely to retire under the money match provision because their investment accounts were relatively small when the market was performing well, and since 2000 nominal returns have not exceeded 8 percent (and are unlikely to do so in the future). Furthermore, post-2004 contributions have been placed in the IAP account which is not incorporated into the money match formula.



**Panel B. Switching from Washington to Oregon**



*Note: These plots represent the total career pension wealth accumulated by a female teacher with a master's degree who begins her career at age 25 and works until age 60. In making these calculations we assume a 4 percent discount rate, two percent inflation, and 8 percent nominal returns on investments. The teacher maintains her current levels of salary and salary growth when transferring, and for retirement plans with DC accounts, we assume the teacher contributes 6 percent of her salary. We evaluate the present value of the full balance of the DC account as a lump sum at the commencement of retirement.*

## Supplemental Appendix C

### Merging Oregon and Washington Data

To begin the process of identifying teachers that have moved between Oregon and Washington we isolate the subsample of teachers who exited the teacher workforce of Washington or Oregon during the study period or entered the teacher workforce from outside the states. Specifically, we identify 43,906 individuals who the data show exited the Oregon public teacher workforce prior to 2014 and 57,461 who exited the Washington teacher workforce prior to 2014. Teachers in the Oregon sample are identified as entering the Oregon teacher workforce based on having out-of-state experience greater than zero (17,161 individuals), and those in the Washington sample are identified as entering the Washington teacher workforce based on having obtained their licensure credentials through OSPI (16,843 individuals).<sup>20</sup>

Teachers are matched across states using last name, first initial, date of birth, and the criterion that the last-observed employment date in one state precedes the first-observed employment date in the other.<sup>21,22</sup> In some cases, a teacher's name changes over time. Often, this is due to a teacher being married and adopting a spouse's last name or a hyphenating their name. In other cases, names are simply spelled differently in some years.<sup>23</sup> This is particularly true regarding first names (e.g., "James" in one year and "Jim" in the next), which is the primary reason that we match using first initial rather than first name. To account for various spellings, we keep the first and last-observed first and last names and iteratively match on all possible combinations. Matching on last name, first initial, and date-of-birth yields a small number of duplicate matches, in which case records are inspected to identify the most plausible match. In most cases, the first name clearly indicated the correct match. For teachers without date of birth information, we merge on first and last name (here, using first initial is too imprecise). Each match is inspected to ensure that gender, ethnicity, highest degree, and experience levels and age (as reported in the Washington data) are consistent across the two states. Overall, across all years of our study, we identify 477 teachers as switching from Oregon to Washington and 522 teachers as switching from Washington to Oregon.

The robustness of the primary matching algorithm is assessed by conducting two less restrictive merges. First, we merge on last name and date of birth. Second, we merge on first initial and date of birth. For identifying individuals switching from Oregon to Washington, the last name and

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<sup>20</sup> Teachers originally certified in a different state will generally obtain certification through OSPI rather than from one of the state's approved teacher training program institutions (e.g., University of Washington).

<sup>21</sup> While the Washington data used in the analysis is restricted to individuals in classroom teaching positions, we relax this restriction during the merging process to more accurately identify each person's first and last year of employment in the state by only requiring that the individual be in classroom teaching position during at least one year of employment. The data received from Oregon is already restricted to classroom teachers and does not allow us to perform the same adjustment.

<sup>22</sup> Defining the first and last years of employment in this way is intended to avoid identifying individuals as "exiting" a state's workforce when in fact they left only temporarily. Previous research has found that many teachers who exit teaching do in fact return at a later point in time (Beaudin, 1993; Grissom & Reininger, 2012). This sample restriction does, however, preclude the matching of teachers who cross the border and later return to their original state during the sample period.

<sup>23</sup> Teacher names were standardized by capitalizing all letters, removing spaces, apostrophes, and hyphens, and removing suffixes such as "JR." or "II", since these tend to be inconsistently used across databases.

date of birth merge identified zero additional matches that appeared likely to be legitimate. The first-initial date-of-birth merge identified only three additional matches considered to be legitimate based on reviewing the teacher's full name, gender, ethnicity, and experience levels. For identifying individuals switching from Washington to Oregon, the last name and date of birth merge yielded zero additional matches and the first initial date of birth merge yielded 7 additional legitimate matches.

While the population of matched teachers appears to be fairly robust to the merging algorithm, we do not know how many teachers we *should* be identifying. When merging two data sets, the researcher typically knows that all the observations in one of the data sets should be found in the other. In contrast, we can only identify people who left their current teaching positions and *may have* moved to a different state, or appear to have teaching experience in a different state that *may* include Oregon or Washington. Credential data from OSPI seems to imply a high rate of movement of out-of-state teachers into Washington,<sup>24</sup> but it does not distinguish between individuals who were merely credentialed out-of-state (which would include those who attended an out-of-state teacher-training program) and those who held an out-of-state classroom teaching position. Furthermore, many teachers who obtain a Washington credential never obtain a teaching position in Washington. Using OSPI credential data from the 2005-2006 school year we identify 1,666 individuals who received their initial licensure credentials through OSPI. Only 50 percent of these individuals later appear in Washington's S-275 administrative data as teachers, and only 28 percent later appear with at least one year of experience in their first year of employment. Finally, "experience", as it is reported in the S-275 data, may include experience earned in positions that are not "classroom teaching positions".<sup>25</sup>

To better understand the rate at which teachers cross state boundaries in the U.S., we examine cross-state mobility patterns from a national sample of teachers. The Schools and Staffing Survey (SASS) provides a nationally representative snapshot of districts, schools, and teachers through periodic surveys of these groups. One feature of the SASS is the Teacher Follow-up Survey (TFS), which is administered to a sample of the teachers who were surveyed by the SASS the previous year. The purpose of the TFS is to determine how many teachers remained at the same school, moved to a different school, or left the profession.

We use the 2000-2001 TFS to calculate the proportion of teachers who are employed as public educators in a different state than in the previous year, and find that 0.91 percent switch states, and 0.43 percent are employed in an adjacent state. National levels of cross-state mobility are likely to be higher than mobility between Oregon and Washington due to the fact that Oregon and Washington are geographically large states and a cross-state move is more likely to entail a long-distance move. For example, limiting the TFS sample to the Rocky Mountain and Western states, we find that 0.56 percent of teachers are teaching in a different state the following year, and 0.29 percent are employed in an adjacent state.<sup>26</sup>

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<sup>24</sup> For instance, see the state's 2005-2006 annual report on certificates issued at <http://www.k12.wa.us/certification/pubdocs/annrpt0506.pdf>.

<sup>25</sup> Regarding the calculation of experience in the S-275 administrative data, see Washington Administrative Code WAC 392-121-280, Section (5).

<sup>26</sup> We do not use the Oregon and Washington TFS data alone because the sample sizes in these states are too small to draw meaningful conclusions. The 2000-2001 TFS surveys only 70 Washington teachers (zero of whom switch to

In current the study, we identify 0.07 percent of Oregon teachers and 0.03 percent of Washington teachers as holding a classroom teaching position in the other state in the following year. Considering that Oregon borders four adjacent states, the proportion of teachers moving from Oregon to Washington is fairly consistent with the rates of movement calculated using the TFS data for the Rocky Mountain and Western States. The level of movement from Washington to Oregon, however, is considerably lower than the average levels of cross-state movement implied by the TFS. One potential reason for observing lower rates of movement from Washington to Oregon is that its neighbors are smaller and therefore have less capacity to absorb exports from Washington;<sup>27</sup> in the study sample, the total number of teachers in Washington is over 50 percent greater than in Oregon (113,370 vs. 72,035).

These numbers may seem low compared to other figures on the hiring of “out-of-state” teachers. For instance, Coggshall and Sexton (2008) report that roughly 10 percent of new hires in Georgia are from out-of-state. But, it is worth remembering that figures on out-of-state hiring include teachers who received their training at institutions in a different state, and that many of these individuals may never have been classroom teachers in the state in which they were originally trained. Using OSPI’s certificate and S-275 data from Washington, we identify teachers who are arriving from out-of-state. Among those who later hold a classroom teaching position in Washington, only half have a level of experience in their first year that suggests out-of-state teaching experience.

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Oregon) and 70 Oregon teachers (less than 10 of whom switch to Washington). Note that the aforementioned figures have been rounded to adhere to NCEES policies.

<sup>27</sup> For example, Washington exporting 1 percent of its teachers to Oregon would correspond with Oregon importing 1.85 percent of its teachers from Washington. In the other direction Oregon exporting 1 percent of its teachers to Washington would correspond with Washington importing 0.54 percent of its teachers from Oregon.

## Supplemental Appendix D

## Teacher Characteristics and the Propensity to Move

Table S1. Teacher Characteristics and the Propensity to Stay, Move, or Exit

	Teacher in Oregon					Teachers in Washington				
	Stay	District Move	State Move	Exit Sample	Obs.	Stay	District Move	State Move	Exit Sample	Obs.
<b>Teacher Characteristics</b>										
Overall	0.86	0.016	0.0007	0.128	419,213	0.90	0.018	0.0003	0.078	981,630
Experience: < 2	0.76	0.039	0.0020	0.198	49,657	0.82	0.051	0.0008	0.129	62,592
Experience: 2-5	0.83	0.022	0.0012	0.146	68,521	0.88	0.032	0.0005	0.089	160,733
Experience: 5-10	0.88	0.016	0.0006	0.108	90,671	0.91	0.020	0.0003	0.069	228,135
Experience: 10-20	0.90	0.009	0.0002	0.087	118,914	0.94	0.011	0.0001	0.050	265,969
Experience: 20-30	0.87	0.006	0.0001	0.120	78,390	0.93	0.004	0.0001	0.062	54,807
Has Professional Certificate	-	-	-	-	-	0.94	0.022	0.0001	0.043	143,574
Has Advanced Degree	0.86	0.017	0.0007	0.127	247,273	0.91	0.016	0.0003	0.073	580,409
Pension: Tier One or Tier 2 (OR)	0.87	0.013	0.0005	0.119	353,315	-	-	-	-	-
Pension: OPSRP (OR)	0.80	0.029	0.0016	0.172	65,898	-	-	-	-	-
Pension: PERS "Pickup" (OR)	0.86	0.016	0.0006	0.122	255,427	-	-	-	-	-
Pension: TRS1 (WA)	-	-	-	-	-	0.87	0.012	0.0002	0.121	178,481
Pension: TRS2 (WA)	-	-	-	-	-	0.91	0.018	0.0002	0.074	175,264
Pension: TRS3 (WA)	-	-	-	-	-	0.91	0.021	0.0003	0.067	692,001