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Lost to the System? A Descriptive Exploration of Where Teacher Candidates Find Employment and How Much They Earn

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Abstract

We use data on over 14,000 teacher candidates in Washington state, merged with employment data from the state's public schools and Unemployment Insurance system, to investigate the career paths and earnings of teacher candidates in the state. Around 75% of candidates are employed in some education position in each of the 5 years after student teaching, but we find considerable movement from education positions outside of public schools into public school teaching positions in the first few years after candidates complete student teaching. Candidates with STEM endorsements and candidates who graduated after the Great Recession are disproportionately likely to be employed in public K–12 teaching positions compared with other education positions. Finally, candidates employed in K–12 public schools earn considerably more on average than candidates employed outside of public schools, but due to the considerable compression of teacher salaries, many candidates who do not enter teaching—particularly candidates with STEM endorsements—earn more than they would have in K–12 public schools.

1. Introduction

There are a number of compelling reasons to better understand the early teacher pipeline—the point at which decisions about which teacher candidates end up teaching in public schools are made by candidates themselves, their teacher education programs (TEPs), and K–12 schools and districts. The first is that the importance of teacher quality is now supported by an abundance of empirical evidence showing that teachers affect both short-run test and non-test student outcomes as well as long-run outcomes such as postsecondary enrollment and labor market earnings.[1]

Who becomes a teacher matters, given the considerable variation in teacher effectiveness in the workforce (Rivkin et al., 2005), and evidence that changing the effectiveness of new teachers is challenging (Atteberry et al., 2015). Who enters and stays in the teacher workforce also provides insights into how desirable teaching is as a profession to individuals with differing backgrounds, and provides the capacity to address policy objectives such as the diversifying the teacher workforce (National Academies of Sciences, Engineering, and Medicine, 2020; Sleeter et al., 2014) and increasing the supply of teachers in science, technology, engineering, and mathematics (STEM; American Association for Employment in Education, 2008).

Although information about the specific attributes of the teacher candidates who transition (or do not) into the teacher workforce is somewhat sparse, there is evidence that many teacher candidates do not enter the teacher workforce in the near term, i.e., in the years immediately after receiving a teaching credential (Cowan et al., 2016; Goldhaber, Krieg, & Theobald, 2014; Goldhaber, Krieg, Theobald, & Goggins, 2020). Where these candidates go and

[1] See Jacob et al. (2010), Kane et al. (2013), McCaffrey et al. (2009), and Rivkin et al. (2005) for teacher effects on test outcomes; Gershenson (2016), Jackson (2018), and Kraft (2019) for teachers' effects on non-test outcomes; and Chamberlain (2013), Chetty et al. (2014), and Lee (2018) for teachers' effects on later life outcomes such as employment probabilities and labor market earnings.

whether they eventually return to teaching provides insights into the supply of new teachers. For instance, it may be that a significant number of individuals who do not immediately (in the fall after being credentialed) show up in the teacher workforce eventually enter the workforce in later years. Alternatively, the propensity to enter the teaching workforce for those who don't immediately enter a teaching position may be low, perhaps because they find employment in other industries.

Whether we expect individuals trained as teachers to eventually be employed in schools has enormous implications for how we think about the current capacity of teacher preparation to address current and future staffing needs. For example, assumptions about rates of delayed workforce entry have important implications for projections of teacher shortages (e.g., Sutcher et al., 2016). Relatedly, a significant portion of the investment in teachers happens before they step into a classroom with teacher-of-record responsibilities (Goldhaber et al., 2017). Understanding the extent to which those trained to teach eventually make use of this training is therefore essential in estimating the return on this investment—as is understanding the potential delays in applying this training in a classroom.[2] Finally, while prior research has investigated wage differentials for teachers who enter (Han, 2020) and leave (Chingos & West, 2012; Han, 2020), we are not aware of any prior evidence about the relative wages of teacher candidates who never enter the workforce in the first place, which clearly has important implications for compensation and hiring policies in K–12 public schools.

Using a unique panel dataset on 11 cohorts of over 14,000 teacher *candidates* from Washington state, we provide descriptive evidence about the propensity of teacher candidates to enter the teacher workforce in the years after they graduate from TEPs and receive a teaching

[2] For more on subsidies to the providers of teacher education, see Winston (1999) and Zumeta (2001).

credential. In addition, we investigate where teacher candidates who are not employed as public school teachers find employment and how much they earn in these positions. Specifically, we draw on unique data on teacher candidates supplied by 15 TEPs in Washington state, linked to state administrative data on inservice teachers and Unemployment Insurance (UI) data maintained by the state, to answer three specific questions:

1) What are the characteristics of teacher candidates employed in different employment categories the year following student teaching?
2) How do these candidates transition between these different employment categories over the first several years after student teaching, and do these patterns vary for different types of teacher candidates?
3) How much do different types of candidates earn in different employment categories in their first several years after student teaching?

We document substantial variation in initial employment outcomes for different candidates depending on their endorsement area and when they did their student teaching. Specifically, candidates with STEM endorsements are considerably more likely to be hired into public K–12 teaching positions the year after student teaching than candidates without STEM endorsements. There is also evidence of the significant consequences of the Great Recession on the likelihood of observing teacher candidates in public school teaching roles. For instance, we observe only about 30% of candidates who student taught during the Great Recession (i.e., 2007–08 through 2009–10) in public school teaching roles in the year after student teaching, but this figure bounces up to nearly 65% after state and school system budgets recovered (for teacher candidates doing their student teaching in the 2013–14 and 2014–15 school years). While we cannot say whether this is related to the demand or supply of teacher labor, these periods do track closely with the impacts of the Great Recession on state and school district budgets and staffing (Chakrabarti & Livingston, 2013; Evans et al., 2019).[3]

Interestingly, we find little variation over time in the proportion of teacher candidates who find employment in *any* education position sector over time. In other words, many teacher candidates who do not end up employed as public school teachers find employment in non-certificated education positions like substitute teaching, private school teaching, and early childhood education, particularly in years when rates of hiring into public K–12 teaching were low. Candidates in these positions are a potentially important source of teacher supply, as individuals in this sector are likely still closely connected to teaching. The large number of candidates in this group, about 35% of all candidates the first year after student teaching, also suggests that we need to consider this reserve pool—the potential teacher bench—when considering the degree to which the early teacher pipeline might satisfy school staffing needs.

Indeed, when we investigate transitions between employment sectors over time, we document considerable movement from education positions outside of public schools into public school teaching positions in the first few years after candidates complete student teaching. In fact, about 60% of candidates who initially find employment in education positions outside of public schools eventually transition into public K–12 teaching positions in their next 4 years after student teaching. But we document very little movement from non-education fields into K–12 public teaching positions—less than 30% of candidates who are *not* initially employed in an education position (because they are employed outside of education or are not in the UI data) transition to K–12 public teaching positions in the next 4 years—which is important because it

[3] Note, in particular, that even while the Great Recession officially ended in 2009, it had a long-tail impact on school finances. Leachman and Mai (2014), for instance, find that, as late as the 2013–14 school year, 34 states provide less funding per pupil than they did before the Great Recession.

suggests that the “bench” of potential K–12 teachers consists largely of individuals employed in education positions outside of K–12 public schools. Importantly, however, the potential teacher bench is not equally robust across teacher candidate endorsement areas. In particular, because of the dramatically higher rates of entry into the public teaching workforce by candidates with STEM endorsements discussed above, there are consequently fewer potential teachers with STEM credentials who are in this “reserve pool” of potential K–12 teachers.

Finally, we find that the average earnings of candidates employed in K–12 public schools are substantially higher than the average earnings of candidates employed outside of K–12 public schools. This contrasts with findings based on movement into and out of the teaching workforce (e.g., Chingos & West, 2012; Han, 2020), and may reflect selection effects in terms of which candidates who are eligible to teach in public schools are actually hired into available positions. That said, these mean differences mask some heterogeneity across different employment categories and candidate characteristics. Specifically, due to the compression of teacher salaries relative to salaries we observe outside of education, many candidates who do not enter teaching—particularly candidates with STEM endorsements—earn more than they would have in K–12 public schools.

The remainder of the paper proceeds as follows. In Section 2, we provide background on the literature on teacher career paths that informs this study. We discuss the data sources in Section 3, present results in Section 4, and discuss these results in Section 5.

2. Background on Who Chooses to Pursue a Public School Teaching Career

Much of what is known about the early teacher pipeline and decisions to pursue a teaching career is derived from national surveys of college students (e.g., Corcoran et al., 2004;

Goldhaber & Liu, 2003; Goldhaber & Walch, 2013; Hanushek & Pace, 1995; Henke et al., 1996; Hoxby & Leigh, 2004; Ingersoll & Perda, 2010; Podgursky, Monroe, & Watson, 2004). On the whole, this body of work finds that the decisions that students make at various junctures influencing their career paths—for example, when deciding on a college major, or when choosing an occupation—that females and White college students are more likely to pursue teaching, and college graduates who are more academically capable are less likely to pursue teaching.[4]

A number of studies explore potential explanations for these findings. There is speculation that compensation opportunities outside of education, combined with compression of salaries in teaching due to the widespread use of single salary schedules, drives more academically capable students out of teaching.[5] But it is challenging to draw conclusions about the extent to which compensation outside of teaching influences the decisions of potential teachers about workforce entry decisions, because researchers typically do not observe job searches or employment offers, but only the match between an employee and a job (Boyd et al., 2013). There is evidence from information on earnings of teachers who leave the labor market that those teachers who are more effective or have a math and science background earn more outside of public school teaching jobs (Chingos & West, 2012; Goldhaber & Player, 2005; Han, 2020).[6]

[4] Note, however, that more recent evidence finds that the academic caliber of the teacher workforce improved from the mid-1990s such that the teachers from the graduating class of 2008–09 had college entrance exam scores that were comparable to college graduates who entered non-teaching occupations (Lankford et al., 2014; Goldhaber & Walch, 2014).
[5] For more on changes over time in teacher academic proficiency, the financial rewards in and outside of teaching, and connections between these two, see Bacolod (2007), Corcoran et al. (2004) and Hoxby and Leigh (2004).
[6] There have been increasing returns over time in the private sector to academic skills and math and science majors (Grogger & Eide, 1995), so it is likely that teacher candidates with those credentials will face higher opportunity costs to enter and remain in teaching.

There is also some research on whether teacher licensure requirements are positively (Larsen et al., 2020) or negatively (Angrist & Guryan, 2008; Hanushek & Pace, 1995) related to the academic caliber of those who opt into teaching. Here too it is challenging to credibly assess the implications of licensure on who is hired given that we only observe job matches and do not have much information about either how the teacher pipeline might change over time with changes in licensure requirements or how local hiring officials would react to licensure changes (Goldhaber, 2011).

Finally, there is some research on the preferences of hiring officials for specific teacher attributes. Some of this suggests that school systems do not generally favor hiring more academically capable teachers; Ballou (1996) and Hinrichs (2014), for instance, find little evidence of returns to academic proficiency in public school teaching positions (relative to other occupations, in the case of Ballou). But these findings contrast with other studies that do find that school systems favor job applicants with stronger academic credentials, such as having higher licensure test scores and having graduated from more selective colleges (Boyd et al. 2011, 2013).

One of the striking characteristics of the teacher workforce is how predominantly White and female it is—according to the National Center for Education Statistics (NCES, 2020), about 75% of teachers are female and nearly 80% are White. The fact that teachers are not representative of the diversity of the student population is a matter of considerable policy discussion (Cowan et al., 2020; Gershenson et al., 2021; Goldhaber et al., 2019). There is evidence that it is related to licensure test requirements (e.g., Goldhaber et al., 2017; Rucinski & Goodman, 2019), but research using state administrative data (Goldhaber et al., 2014) also finds that teacher candidates of color who are fully credentialed are about 5 percentage points less likely to end up in the public school teacher workforce, all else equal.

The study we describe in this paper is most closely related to a small body of work that examines transitions from teacher education programs (TEPs) into the teacher workforce, and whether aspects of teacher education, and student teaching experiences in particular, are related to the likelihood of observing teacher candidates in state teacher workforces. There are several studies that show that teacher labor markets are quite localized in the sense that teacher candidates tend to find employment in districts that are close to both where they received their teaching credentials and their hometown (Boyd et al., 2005, Goldhaber et al., 2014; Reininger, 2012), and that where student teaching occurs (Krieg et al., 2016) is also highly predictive of the location of a first teaching job.

Research on the attributes of individual teacher candidates, and their student teaching experiences, finds relatively few predictors of whether they teach.[7] One notable exception is that holding STEM or special education endorsements significantly increases the likelihood of observing individuals in the teacher workforce relative to holding an elementary education endorsement (Goldhaber et al., 2014; Goldhaber, Krieg, Theobald, & Goggins, 2020), likely reflecting the challenge that school systems face in staffing these classrooms (Dee & Goldhaber, 2017).[8] Recent evidence has also found that more qualified teacher candidates, as measured by licensure test scores (e.g., Cowan et al., 2020) and clinical teaching observation scores (Bartanen & Kwok, 2021; Vagi et al., 2019), are more likely to enter the teaching workforce.

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[7] There is mounting evidence about the importance of cooperating teachers for future candidate *effectiveness* (e.g., Bastian et al., 2020; Goldhaber, Krieg, & Theobald, 2020; Ronfeldt et al., 2018) and other aspects of student teaching experiences, such as the cooperative environment of the host school (Ronfeldt et al., 2012, 2015) or the alignment of the demographics of the student teaching classroom and a teacher's first job classroom (Krieg et al., 2020). Yet there is little evidence that any of these attributes of student teaching predict workforce entry decisions.
[8] That said, among candidates with a special education endorsement, candidates with a dual endorsement in special education and a subject area endorsement are significantly less likely to be observed in special education teaching positions (Theobald et al., 2020).

Goldhaber, Krieg, Theobald, and Goggins (2020) find, related to the slackness of the labor market generally, that there are dramatic differences in the hiring rates of teacher candidates over time. But we are unaware of any research that uses longitudinal information from teacher education programs to assess the employment outcomes of the relatively large share of teacher candidates who do not end up in the teacher workforce immediately, and to assess the extent to which candidates later return to the teacher labor market.[9] This represents a significant gap in the literature, given the aforementioned challenges school systems face in recruiting and retaining teachers in particular areas and the ensuing policy debates about whether the supply of teachers is adequate to meet the demand (e.g., Sutcher et al., 2016).

3. Data and Analytic Approach

We use three sources of data to investigate entry into either the public school teaching workforce or other sectors of the workforce in Washington state in which employees pay unemployment insurance (UI). The first is information on teacher candidates provided by 15 Washington teacher education programs (TEPs) participating in the Teacher Education Learning Collaborative (TELC). The TELC data include information about when and where each teacher candidate's student teaching occurred. For the purposes of this analysis, we focus on teacher candidates who did their student teaching between 2004–05 and 2014–15. Importantly, we limit the sample to candidates who completed their student teaching and are licensed to teach in Washington; thus, we focus on the employment outcomes of teacher candidates who appear to

[9] Estimates from national data suggest that only 30% to 40% of candidates will end up finding a job in the next year (Cowan et al., 2016), which is consistent with rates of one-year hiring from state data (e.g., Goldhaber et al., 2014), though these rates have increased substantially in recent years (Goldhaber, Krieg, Theobald, & Goggins, 2020).

have a strong desire to teach, given that they obtained the legal credentials necessary to become public school teachers in the state.[10]

One limitation of the TELC data is that we only have information on student teaching placements for teachers who graduate from the 15 TEPs participating in TELC. This excludes in-state teachers from the six other TEPs that were certified to train new teachers during the years of data we consider. Recent papers using the same dataset (e.g., Goldhaber, Krieg, & Theobald, 2020) have shown that new teachers in the TELC data are not representative of all new teachers in the state; for example, TELC programs prepare over 90% of all new in-state teachers west of the Cascade Mountains but only about 60% of new in-state teachers in the eastern half of the state, and institutions not participating in TELC tend to graduate more candidates of color than institutions participating in TELC. Thus, the results of this analysis should only be generalized to graduates of the 15 TEPs that participated in this study.

We merge the TELC data to public school employment records maintained by the Washington Office of the Superintendent of Public Instruction (OSPI).[11] Specifically, the OSPI employment data include annual records of classroom assignments for all certificated public school employees in the state. The OSPI data include information on public school employee positions that allow us to create indicators for whether each candidate was employed in a teaching position, an administrative position (e.g., principal or assistant principal), or other certificated position (e.g., aide or office staff) in each school year after they completed student

[10] One data limitation is that some TEPs only provided information on candidates who received initial certification in Washington. Data from one large program that provided data on all candidates who completed student teaching suggests that 98% of these candidates received initial teaching certification in Washington. We cannot know whether the other 2% did not graduate, did not pursue a license, or pursued one in a different state. We also cannot observe candidates who dropped out of the their TEP prior to completing student teaching.

[11] TELC data are first merged to comprehensive teacher credential data maintained by the state, which in turn are merged to state employment data using teachers' certificate numbers. Ninety-seven percent of candidates merge into the credential data, while the remaining 3% are dropped from the analysis because we focus only on candidates who receive an in-state teaching credential.

teaching. Unfortunately, the OSPI data do *not* systematically track substitute teachers, so we cannot observe whether they are teaching in that capacity in public schools.[12]

Finally, the OSPI teacher credential records include demographics and credentialing information for each candidate in the dataset. For the purposes of this analysis—and motivated by prior work discussed in the previous section about employment outcomes for female candidates, candidates of color, STEM candidates, and candidates with better qualifications—we create indicators for female candidates, non-White candidates, and candidates who are endorsed in a STEM subject.[13]

This dataset was then merged with data maintained by Washington state's Education Data and Research Center (ERDC), which is the state agency tasked with maintaining the state's P–20 data warehouse.[14] Key for the work described here, the ERDC data have information on employment outcomes, including quarterly earnings, hours, and North American Industry Classification System (NAICS) employment sectors for all individuals employed in occupations that pay Unemployment Insurance. These data generally exclude individuals who are self-employed or in the military, but otherwise provide comprehensive coverage of employment outcomes in Washington state between 2006 and 2018. To facilitate comparisons over time, we convert all earnings to 2020 dollars using indices from the Consumer Price Index.[15]

[12] We also do not know precisely if they are teaching in private schools, though, as we describe below, they should show up in the unemployment insurance system, so may be in our sample.
[13] There are good reasons to also potentially consider special education teachers in this analysis given well-documented teacher shortages in this area (e.g., Mason-Williams et al., 2020). However, prior research in Washington (Goldhaber et al., 2015) suggests that special education shortages are primarily due to disproportionate attrition, not lack of production as is the case for STEM.
[14] TELC data were merged by first name, last name, and birth year to the state's UI records. Over 97% of candidates matched to a single record in the UI data, while the remaining <3% were hand matched using middle names (where available) and other variables (John Sabel, personal communication, February 2, 2021).
[15] See https://fred.stlouisfed.org/series/CPIAUCSL

To create the analytic data file for this analysis, we first collapse the quarterly earnings data to the school year level by summing earnings within school year; to measure earnings for the 2009–10 school year, for example, we use quarters 3 and 4 of 2009 and quarters 1 and 2 of 2010. For candidates who are employed in more than one employment sector in a given school year, we keep the employment sector for which the candidates receive the highest wages within a given school year.[16] For candidates who are *not* employed in K–12 public schools in a given year (i.e., as a "Public K–12 Teacher", "Public K–12 Administrator, or "Public K–12 Other Certificated Employee") but *are* observed in the UI data, we follow Chingos and West (2012) and map the employment sectors into six mutually exclusive categories: Other Educational Services (including substitute teachers, private school teachers, early childhood teachers, and childcare providers, none of whom are tracked in the OSPI data); "Health Care"; "Professional Services"; "Public Administration"; "Other Services"; and "Other".[17] Finally, any candidates who are not observed in the UI data in a given year are placed into a separate category, "Not in UI Data." This category consists of individuals who are teacher candidates in Washington but subsequently leave the state, teacher candidates who remain in the state but are not employed at all, or those who are employed but not covered by unemployment insurance.[18]

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[16] Across the years of data, the percentage of candidates employed in more than one sector ranges from 7% to 33%.
[17] "Educational Services," "Health Care," and "Public Administration" represent one-to-one mappings to NAICS employment sectors. "Professional Services" include Administrative and Support and Waste Management and Remediation Services, Finance and Insurance, Information, Management of Companies and Enterprises, and Real Estate and Rental and Leasing. "Other Services" include Accommodation and Food Services, Arts/Entertainment and Recreation, and Other Services (except Public Administration). All other sectors—Agriculture/Forestry/Fishing and Hunting, Construction, Manufacturing, Mining/Quarrying and Oil and Gas Extraction, Professional/Scientific and Technical Services, Retail Trade, Transportation and Warehousing, Utilities, and Wholesale Trade—are included in "Other."
[18] For a list of uncovered occupations in Washington, see: https://esdorchardstorage.blob.core.windows.net/esdwa/Default/ESDWAGOV/employer-Taxes/ESD-exempt-professions-chart.pdf.

The final merged dataset includes 14,020 teacher candidates who student taught in 2014–15 or earlier and can therefore be observed for at least 3 years after the year they student taught (i.e., through the end of the 2017–18 school year). For subsets of the analysis, we focus only on the 12,546 candidates who student taught in 2012–13 or earlier (and thus can be observed for at least 5 years after student teaching) or the 5,726 candidates who student taught in 2007–08 or earlier (and thus can be observed for at least 10 years after student teaching).

Our analytic approach to the research questions outlined in Section 1 is entirely descriptive. To answer research question (RQ) 1 on employment outcomes for different types of candidates the year after student teaching, we present summary statistics and t-tests of differences in outcomes between different types of candidates. To investigate transitions between different types of employment outcomes for RQ 2, we present Sankey plots that track the distribution of employment outcomes in each year after student teaching and also the frequency of transitions between these different outcomes across different years. Finally, for RQ 3, we present histograms and kernel density plots of candidate earnings in different years since student teaching.

4. Results

We begin in Section 4.1 by describing the characteristics of our sample by broad employment outcome in the school year after teacher candidates complete their student teaching (RQ 1). Following that, in Section 4.2, we examine transitions between different occupational categories using the Sankey plots described above, first for all candidates and then separately for different types of candidates (RQ 2). Finally, in Section 4.3 we describe earnings by employment outcome and year since student teaching, first for all candidates and then for different types of candidates (RQ 3).

4.1 Sample Statistics for Newly Credentialed Teacher Candidates

We first present descriptive information about employment outcomes, candidate characteristics, annual earnings, and student teaching years in **Table 1**. The table shows the means for all teacher candidates in column 1, and for candidates who end up in different UI categories in subsequent columns.[19] On average, across the cohorts and as shown in the header, the vast majority of teacher candidates are employed in either K–12 public school teaching positions (41%) or Other Educational Services (32%; e.g., substitute teacher, private school teacher, or early childhood educator) in the year after student teaching. A much smaller share either do not show up in the UI data (8%; e.g., because they moved out of the state, are not employed at all, or are employed in a position that does not pay UI), are employed in a non-teaching certificated position in K–12 schools (5%), or are distributed across the different categories described in Section 3.1 (14%).

Table 1 also reports the means of selected observable characteristics of candidates who are employed in different positions the year after student teaching; the t-tests in columns 3–6 test the difference in each variable between candidates in these employment categories and candidates employed as public K–12 teachers (column 2). Candidates hired immediately into public K–12 teaching positions earn considerably more on average (about $42,000 in their first year) than candidates hired into other certificated K–12 positions (about $38,000), Other

[19] The Health Care, Professional Services, Public Administration, Other Services, and Other categories described in Section 3 are collapsed into a single "Other" category in column 5.

Educational Services positions (about $18,000), and other positions outside of Educational Services (about $23,000).

We also compare three candidate characteristics observed in the teacher credential data—gender, race/ethnicity, and STEM endorsements—by employment outcome. We find no significant differences in initial employment outcomes by gender or race/ethnicity, and also (though not reported in Table 1) find few differences in employment sector in following years for these groups of candidates.[20] But in contrast to those results, we observe substantial differences in the sectors of employment depending on whether candidates have a STEM endorsement. In particular, teacher candidates holding a STEM endorsement are disproportionately likely to be employed in public schools the year after student teaching (either in teaching or non-teaching positions).

Finally, we divide these student teaching years into four time periods: Pre-Recession (2004–05 through 2006–07); Recession (2007–08 through 2008–10); Post-Recession 1 (2010–11 through 2012–13); and Post-Recession 2 (2013–14 through 2014–15). The two post-recession periods are important because, as shown in prior work (Goldhaber, Krieg, Theobald, & Goggins, 2020), rates of teacher hiring did not pick up until several years after the end of the Great Recession. Consistent with prior work, candidates who student taught during the recession are much less likely to be employed in public K–12 teaching positions, while candidates who student taught in the second post-recession period are much more likely to be employed in K–12 teaching positions. Our subsequent analyses of employment positions therefore break out results by these different time periods to better understand the patterns of employment over time.

4.2 Career Transitions of Teacher Candidates

[20] Results available upon request.

To visualize candidates' employment outcomes and transitions between these employment outcomes over time, we plot employment outcomes over the first 5 years of teaching for the 12,546 candidates who student taught in 2012–13 or earlier (and thus can be observed for at least 5 years after student teaching) in the Sankey plots in **Figure 1**. The stacked bar chart for each year represents the proportion of candidates in this sample who were observed in each category the first 5 years after student teaching, while the width of the path between each segment of the stacked bar plots in years *t* and *t+1* represents the proportion of candidates who transitioned between the different UI categories between these years.

There are a number of interesting patterns that emerge in Figure 1. First, as has been documented in prior work on the K–12 teacher labor market (e.g., Goldhaber et al., 2014; Goldhaber, Krieg, Theobald, & Goggins, 2020); rates of employment as a public K–12 teacher increase substantially over the first several years after student teaching. Combining rates of entry with rates of early-career attrition, Figure 1 shows that a little more than half of all teacher candidates are employed as in-state public K–12 teachers 3–5 years after student teaching; this is substantially more—about 25% more—than is observed simply looking at the first year after student teaching. As we discuss in Section 5, this has important implications for how we think about the extent to which the supply of new prospective teachers will meet the demand for new teachers (Goldhaber & Theobald, 2016).

What has not been shown in prior work is the employment outcomes for teacher candidates with delayed entries into the public K–12 teacher labor market; Figure 1 illustrates that the majority of candidates who enter public K–12 teaching 2–5 years after student teaching transition from employment in other Educational Services (e.g., substitute teaching, private school teaching). In fact, roughly a third of all teacher candidates who are employed in public K–

12 teaching positions 5 years after student teaching are employed in these "other Educational Services" positions the first year after student teaching. There is also notable movement into public K–12 teaching from other certificated employment in K–12 public schools (e.g., teacher's aide), but quite little movement into K–12 public teaching for individuals employed in areas outside of education immediately after graduation or who are not observed in the UI data. For example, while about 60% of candidates who initially find employment in education positions outside of public schools eventually transition into public K–12 teaching positions in their next 4 years after student teaching, less than 30% of candidates who are not initially employed in an education position (because they are employed outside of education or are not in the UI data) eventually transition to K–12 public teaching positions in the next 4 years.

Figure 1 also illustrates some movement out of K–12 public teaching positions in the first 5 years after student teaching. The most common types of moves are to other K–12 certificated employment and other Educational Services. As with movement into public K–12 teaching, it is relatively rare for candidates to leave K–12 public teaching directly for employment in a field outside of education ("Other" in Figure 1). Finally, while the "Not in UI Data" group does grow over the first 5 years, it is quite rare for teachers to move directly from K–12 teaching to this category (i.e., disappear from the UI data altogether).

One of the notable findings in Table 1 is the relatively high rate of public school teaching employment for teacher candidates with STEM endorsements. In **Figure 2**, we present Sankey plots for the first 3 years after student teaching, separating the sample by candidates with STEM endorsements (Panel A) and without STEM endorsements (Panel B). Figure 2 illustrates two key differences between the early career paths of STEM and non-STEM candidates. First, consistent with Table 1, STEM candidates are hired into public K–12 positions more quickly than non-

STEM candidates; specifically, almost half of STEM candidates are employed as public K–12 teachers the year after student teaching, compared to less than 40% of non-STEM candidates. Secondly, STEM candidates are between 5 and 10 percentage points more likely to be employed in education—either in public schools or in positions outside of public schools—than non-STEM candidates in each of the first 3 years after student teaching. This is primarily due to STEM candidates being *less* likely to be employed outside of education ("Other"), as opposed to not being observed in the UI data at all.

We next divide the sample into two of the four periods summarized in Table 1—the "Recession" group (student taught 2007–08 through 2009–10) and the "Post-Recession 2" group (student taught 2013–14 through 2014–15)—and present Sankey plots for these groups in **Figure 3**. As with STEM and non-STEM candidates, the most notable difference between these time periods is the rate of initial employment as public K–12 teachers. Specifically, candidates who student taught in the post-recession period are more than twice as likely to be hired into a public K–12 teaching position (65%) compared with candidates who student taught during the Great Recession (30%). Most of this difference can be explained by employment in other Educational Services and outside of education altogether; for example, candidates from the "Recession" period are considerably more likely to be employed in Other Educational Services for several years after student teaching and then transition into public K–12 teaching.

There are also some interesting differences in patterns of teacher mobility between these time periods. As one notable example, the proportion of candidates who start in public K–12 positions who transition to other education employment after their first year of teaching is considerably higher for the recession group than for the post-recession group. One potential explanation for this is that extensive Reduction-in-Force (RIF) notices were given to early-career teachers in 2008–09 and 2009–10 (Goldhaber & Theobald, 2013), and while few of these teachers were ultimately laid off, there is some evidence of RIF-induced early-career attrition from the teacher workforce (Goldhaber et al., 2016). Finally, it is notable that rates of "Not in UI Data" do *not* vary by more than a few percentage points between the two groups; this is important as it suggests that the recession primarily influenced the *type* of employment teacher candidates found after student teaching, not whether they found employment in Washington at all.

Finally, in **Figure 4** we focus on the 4,537 candidates who student taught in 2007–08 or earlier and highlight their employment outcomes 1, 3, 5, and 10 years after student teaching. Notably, only about 45% of these candidates are employed as public K–12 teachers 10 years after student teaching, while another 2% are in public K–12 administration positions (e.g., assistant principal or principal) in their 10th year after student teaching. Unlike in the first 5 years, there is also some notable movement from K–12 public teaching positions into the "Not in UI Data" category between years 5 and 10; unfortunately, we cannot know from the available data whether this represents teachers leaving the state or teachers staying in Washington but leaving the UI-paying workforce.

4.3 Teacher Candidate Earnings

To investigate earnings of teacher candidates over time, we first plot average earnings for candidates in the four employment outcomes from Figures 1–4 for which we can observe earnings (i.e., all candidates in the UI data) in **Figure 5**. We focus on the group of 4,537 candidates who student taught in 2007–08 or earlier (i.e., from Figure 4) and who we can track for 10 years after student teaching, though patterns of early-career earnings look very similar for candidates from later cohorts.

The mean differences in earnings between public school teachers and non-public school teachers persist over the first 5 years after student teaching. Teacher candidates employed in K–12 public teaching positions average a few thousand dollars more per year than those employed in the "other certificated public school employees" category to $20,000–$25,000 more per year compared to those employed outside of education. That said, around 6 years after student teaching, the average earnings of candidates employed in non-teaching public school positions passes the average earnings of K–12 teachers; this likely reflects movement of teachers into school administration positions shown in Figure 4. Importantly, though, both groups make considerably more (on average) than candidates employed outside of public schools, even 10 years after student teaching.

As discussed in Section 2, there are reasons to believe that the earnings potential outside of public education may be better for STEM candidates than non-STEM candidates. In **Figure 6**, we construct the earning of STEM and non-STEM candidates employed 5 years after student teaching in public K–12 teaching positions (Panel A) and other positions (Panel B). As shown in Panel A, STEM candidates K–12 teaching positions earn slightly more on average than non-STEM candidates in K–12 teaching positions. The differences in mean earnings between these endorsement areas is partially related to the fact that STEM candidates tend to be hired more quickly than non-STEM candidates (as shown in Figure 2, and consistent with findings in Goldhaber et al., 2014) and thus have accrued more teaching experience by 5 years after student teaching. But we also find that STEM candidates actually earn slightly more, $2,500, even after a year. This appears to be related to differences by endorsement area in the initial placement on the salary schedule, as STEM candidates are both more likely to begin their careers with a master's degree (42% vs. 25% for non-STEM candidates) and be credited with at least half a year of prior teaching experience when they start (11% of STEM candidates vs. 7% of non-STEM candidates). This latter difference may be related to the fact that school systems have some latitude over the prior experience they credit when teachers begin their careers, and may therefore be more willing to credit prior experience for teachers in high-demand areas like STEM.

Not surprisingly, since all school systems in Washington state utilized the single salary schedule during the period we investigate (Goldhaber et al., 2015), we see little difference in the variation in salaries for STEM and non-STEM teacher candidates who become public school teachers. By contrast, the variation in salaries for those observed with employment outside of public K–12 teaching positions is considerably larger, with a standard deviation of earnings over twice as large as candidates employed in public K–12 teaching positions. These trends are especially pronounced for teacher candidates with a STEM endorsement, for whom the standard deviation of earnings outside of teaching ($33,462) is almost three times larger than within teaching ($13,135). Thus, while we observe relatively few non-STEM candidates employed outside of public school teaching who earn more than the average public school teacher (14%), a larger share of STEM candidates employed outside of public school teaching earn more than those STEM candidates with teaching positions (27%).

Another question related to the Sankey plots in Figures 1–4 is whether candidates earn more money as they transition into and out of public K–12 teaching positions over their first 5 years after student teaching. We therefore isolate these types of moves, calculate the change in earnings associated with these moves, and plot the distribution of these changes in earnings for candidates who enter teaching (black) and leave teaching (gray) during this time period. Over 90% of candidates who transition from a position outside of public K–12 teaching to a public K–

12 teaching position during these 5 years earn more after the move; this strongly suggests that public K–12 teaching is a desirable employment outcome for those candidates who appear in other positions immediately after student teaching. On the other hand, only about 31% of candidates who leave teaching and appear in the UI data in the following year earn more in this following year.

Finally, to relate these findings to prior work by Chingos and West (2012), we present histograms of earnings by employment outcome (disaggregated into the separate groups from Chingos and West, 2012) for all candidates observed 1, 3, 5 and 10 years after student teaching in **Figure 8**. The vertical dashed red line in each histogram is the mean within that employment outcome, and again illustrates that mean earnings for candidates in public schools are higher than in other employment outcomes at each time point. But earnings are much more variable in areas outside of public schools, so that many candidates in areas like Health Care, Professional Services, Public Administration, and Other earn more than the highest paid public K–12 teacher, let alone the average public K–12 teacher.

5. Discussion and Conclusions

As we described above, the past decade has seen a large increase in quantitative research connecting preservice teacher education experiences, particularly student teaching, to inservice teacher outcomes. But, to our knowledge, this is the first study to document employment outcomes for a large sample of credentialed teacher candidates who never enter the teaching workforce. We find that many teacher candidates end up immediately (a year out) employed in sectors of the economy that might be seen as adjacent to public school teaching, and that many of these end up in the teacher labor market in later years.

While we cannot know whether the career transitions of teacher candidates reflect supply- or demand-side factors in the labor market (because we do not observe job applications or offers), the patterns we observe support prior claims (e.g., Cowan et al., 2016; Goldhaber et al., 2015) that entry into the labor market is driven more by demand than supply. In particular, we document large differences in the likelihood of observing teacher candidates in public school teaching positions that correspond to the economic cycle, which corresponds with the number of teaching slots available. Were the changes in workforce entry driven mainly by the preferences of teacher candidates, we might expect that probability of entry to drop as the broader labor market becomes tighter. Instead, we see the opposite.

Moreover, it is clear that a significant share of those who move into teaching positions in later years (more than a year after student teaching) do so from employment "bench" positions, like teacher's aide, which are relatively low-paying positions that keep individuals involved in public schooling. Indeed, as is apparent from Figure 7, over 90% of those teacher candidates who enter teaching after at least a 1-year stint in another sector of the economy increase their earnings when they become a public school teacher. This lends credence to the unsurprising conclusion that a high share of those who train to become a teacher but don't immediately enter a teaching position are outside of the teacher labor market not because it reflects their preferences, but rather because they cannot find a position.

The results also have important implications for how policymakers should think about the "bench" of potential K–12 teachers, and, in turn, the prospect of future "teacher shortages." In particular, our results suggest that the bench of potential K–12 teachers is quite large, as almost half of all credentialed teacher candidates are not teaching in K–12 public schools in any given year, but many of these end up in the teacher workforce in later years. Clearly then, for accuracy, it is important for teacher supply and demand estimates to consider the dynamic nature of entry of teacher candidates into the teacher workforce (e.g., Lindsay et al., 2016; Sutcher et al., 2016).[21]

That said, the bench of individuals who could serve as teachers is less robust when we drill down to examine the transitions of STEM teacher candidates. Indeed, our study, from a different angle, is just the latest of many to document or raise concerns (e.g., American Association for Employment in Education, 2008) about the challenge the country faces in increasing the front-end of the STEM teacher pipeline. Indeed, when we dig into the bench of potential teachers, we see vast differences according to whether a teacher candidate has STEM preparation. This is likely related to the supply and demand for STEM teachers in the state. For example, using data on all teachers and initial credentials in Washington (i.e., not just limited to the 15 TEPs participating in TELC) for the same years of data we use for this study (2004–05 through 2014–15), we find that the state granted fewer initial STEM teaching credentials (7,139) than the number of teachers with STEM credentials who left the workforce (7,235).

On the other hand, over this same period, the state granted almost 25,000 new elementary credentials (24,838), while only about 20,000 teachers with this endorsement left the state's teaching workforce (20,066). Not surprisingly, then, when we dig into the bench further we find that it is dominated by candidates with an elementary endorsement. For example, while only 41% of candidates hired immediately after student teaching have an elementary endorsement, over half (55%) of candidates employed in "Other Educational Services"—and thus appear to be "on the bench" waiting for a public school position to open—have an elementary endorsement.

[21] Notably, supply and demand estimates often include considerations of newly credentialed teacher candidates and the proportion of prior teachers who may return to the labor market, but do not factor in the dynamic nature of teacher candidates entering the teacher workforce years after completing their student teaching.

This has important implications for how we think about the pool of potential public school teachers and the misalignment between the supply and demand for K–12 public teachers.

Our analysis of teacher earnings inside and outside of public school teaching also has important implications. There are considerable debates about how the compensation of public school teachers compares to compensation outside of teaching, and what this portends for the desirability of teaching as a profession. Most of this focuses on comparisons between teachers and non-teachers in terms of current compensation with adjustments for the amount of time spent in the classroom and background characteristics of individuals. Which adjustments are appropriate and what analyses suggest about the relative compensation of teachers is a matter of much debate (e.g., Alegretto & Mishel., 2018; Richwine & Biggs, 2011).

Our analysis is different, and narrower, in that it focuses on individuals who are trained as teachers. But it is also a unique contribution in that we are able to consider earnings for individuals who have the right credentials to teach in K–12 schools but never enter these positions. We clearly find that individuals employed as public school teachers earn more than those employed in non-public school teaching positions. But this finding is less consistently true for the subset of STEM teacher candidates. Specifically, we observe greater variation in the earnings of STEM teacher candidates who do not become public school teachers than non-STEM teacher candidates who do not become public school teachers, and a much higher share of those STEM teacher candidates who do not become public school teachers earn more than the average public school STEM teacher. This too lends credence to the idea that STEM teachers (or prospective STEM teachers) likely face greater opportunity costs to being public school teachers than teachers generally.

Finally, this analysis may be helpful in pointing policymakers toward places to look (or advertise) for teachers when labor markets are tight. Transitions within education employment (e.g., from other Educational Services like substitute teaching, private school teaching, and early childhood education to public K–12 teaching) are much more common than transitions to K–12 teaching from employment outside of education. This suggests that, even in times of slack labor markets, states and school systems may want to find ways to keep candidates who do not find immediate K–12 teaching employment engaged with the education system. This could be as simple as encouraging candidates to apply for substitute teaching credentials or finding other ways of employing these candidates within the public school system. By doing this, states and districts could plausibly increase their bench of potential K–12 teachers for times when labor markets tighten again.

References

Allegretto, S., & Mishel, L. (2018). The Teacher Pay Penalty Has Hit a New High: Trends in the Teacher Wage and Compensation Gaps through 2017. Economic Policy Institute.

American Association for Employment in Education. (2008). *Educator supply and demand in the United States*.

Angrist, J. D., & Guryan, J. (2008). Does teacher testing raise teacher quality? Evidence from state certification requirements. *Economics of Education Review*, *27*(5), 483–503.

Atteberry, A., Loeb, S., & Wyckoff, J. (2015). Do first impressions matter? Predicting early career teacher effectiveness. *AERA Open*, *1*(4), https://doi.org/10.1177%2F2332858415607834

Bacolod, M. P. (2007). Do alternative opportunities matter? The role of female labor markets in the decline of teacher quality. *The Review of Economics and Statistics*, *89*(4), 737–751.

Ballou, D. (1996). Do public schools hire the best applicants? *The Quarterly Journal of Economics*, *111*(1), 97–133.

Bastian, K. C., Patterson, K. M., & Carpenter, D. (2020). Placed for success: Which teachers benefit from high-quality student teaching placements? *Educational Policy*, https://doi.org/10.1177%2F0895904820951126

Bartanen, B., & Kwok, A. (2021). Examining clinical teaching observation scores as a measure of preservice teacher quality. *American Educational Research Journal*, https://doi.org/10.3102%2F0002831221990359.

Boyd, D., Lankford, H., Loeb, S., & Wyckoff, J. (2005). The draw of home: How teachers' preferences for proximity disadvantage urban schools. *Journal of Policy Analysis and Management*, *24*(1), 113–132.

Boyd, D., Lankford, H., Loeb, S., Ronfeldt, M., & Wyckoff, J. (2011). The role of teacher quality in retention and hiring: Using applications to transfer to uncover preferences of teachers and schools. *Journal of Policy Analysis and Management*, *30*(1), 88–110.

Boyd, D., Lankford, H., Loeb, S., & Wyckoff, J. (2013). Analyzing the determinants of the matching of public school teachers to jobs: Disentangling the preferences of teachers and employers. *Journal of Labor Economics*, *31*(1), 83–117.

Chakrabarti, R., & Livingston, M. (2013). *The long road to recovery: New York schools in the aftermath of the Great Recession* (No. 631). Staff Report.

Chamberlain, G. E. (2013). Predictive effects of teachers and schools on test scores, college attendance, and earnings. *Proceedings of the National Academy of Sciences*, *110*(43), 17176–17182.

Chetty, R., Friedman, J. N., & Rockoff, J. E. (2014). Measuring the impacts of teachers II: Teacher value-added and student outcomes in adulthood. *American Economic Review, 31*(4), 2633–2679.

Chingos, M. M., & West, M. R. (2012). Do more effective teachers earn more outside the classroom? *Education Finance and Policy*, *7*(1), 8–43.

Corcoran, S. P., Evans, W. N., & Schwab, R. M. (2004). Changing labor-market opportunities for women and the quality of teachers, 1957–2000. *American Economic Review*, *94*(2), 230–235.

Cowan, J., Goldhaber, D., Hayes, K., & Theobald, R. (2016). Missing elements in the discussion of teacher shortages. *Educational Researcher*, *45*(8), 460–462.

Cowan, J., Goldhaber, D., Jin, Z., & Theobald, R. (2020). *Teacher Licensure Tests: Barrier or Predictive Tool?* CALDER Working Paper No. 245-1020.

Dee, T. S., & Goldhaber, D. (2017). *Understanding and addressing teacher shortages in the United States.* Brookings. https://www.brookings.edu/research/understanding-and-addressing-teacher-shortages-in-the-united-states/

Evans, W. N., Schwab, R. M., & Wagner, K. L. (2019). The Great Recession and public education. *Education Finance and Policy*, *14*(2), 298–326.

Gershenson, S. (2016). Linking teacher quality, student attendance, and student achievement. *Education Finance and Policy*, *11*(2), 125–149.

Gershenson, S., Hansen, M., & Lindsay, C. A. (2021). *Teacher diversity and student success: Why racial representation matters in the classroom*. Harvard Education Press.

Goldhaber, D. (2011). Chapter 6 - licensure: Exploring the value of this gateway to the teacher workforce. In E. A. Hanushek, S. Machin, & L. Woessmann (Eds.), *Handbook of the Economics of Education* (Vol. 3, pp. 315–339). Elsevier.

Goldhaber, D., & Liu, A. (2003). Occupational choices and the academic proficiency of the teacher workforce. In W. Fowler (Ed.), *Developments in School Finance 2001–02* (pp. 53–75). U.S. Department of Education, National Center for Education Statistics.

Goldhaber, D., Krieg, J., & Theobald, R. (2014). Knocking on the door to the teaching profession? Modeling the entry of prospective teachers into the workforce. *Economics of Education Review*, *42*, 106–124.

Goldhaber, D., Krieg, J., Theobald, R., & Brown, N. (2015). Refueling the STEM and special education teacher pipelines. *Phi Delta Kappan*, *97*(4), 56–62.

Goldhaber, D., Krieg, J. M., & Theobald, R. (2017). Does the match matter? Exploring whether student teaching experiences affect teacher effectiveness. *American Educational Research Journal*, *54*(2), 325–359.

Goldhaber, D., Krieg, J., & Theobald, R. (2020). Effective like me? Does having a more productive mentor improve the productivity of mentees? *Labour Economics, 63,* 101792.

Goldhaber, D., Krieg, J., Theobald, R., & Goggins, M. (2020). *Front end to back end: Teacher preparation, workforce entry, and attrition*. CALDER Working Paper No. 246-1220.

Goldhaber, D., & Player, D. (2005). What different benchmarks suggest about how financially attractive it is to teach in public schools. *Journal of Education Finance*, *30*(3), 211–230.

Goldhaber, D., Strunk, K. O., Brown, N., & Knight, D. S. (2016). Lessons learned from the Great Recession: Layoffs and the RIF-induced teacher shuffle. *Educational Evaluation and Policy Analysis*, *38*(3), 517–548.

Goldhaber, D., & Theobald, R. (2013). Managing the teacher workforce in austere times: The determinants and implications of teacher layoffs. *Education Finance and Policy*, *8*(4), 494–527.

Goldhaber, D., & Theobald, R. (2016). Sorting out the issues in the teacher shortage crisis. *The 74 Million,* September 22, 2016. https://www.the74million.org/article/article-opinion-sorting-out-the-issues-in-the-teacher-shortage-crisis/

Goldhaber, D., Theobald, R., & Tien, C. (2019). Why we need a diverse teacher workforce. *Phi Delta Kappan*. https://kappanonline.org/why-we-need-diverse-teacher-workforce-segregation-goldhaber-theobald-tien/

Goldhaber, D., & Walch, J. (2013). Gains in teacher quality. *Education Next*. https://www.educationnext.org/gains-in-teacher-quality/

Grogger, J., & Eide, E. (1995). Changes in college skills and the rise in the college wage premium. *Journal of Human Resources*, *30*(2), 280–310.

Han, E. S. (2020). Teacher wage penalty and decrease in teacher quality: Evidence from career-changers. *Labor Studies Journal*. https://doi.org/10.1177%2F0160449X20929083

Hanushek, E. A., & Pace, R. R. (1995). Who chooses to teach (and why)? *Economics of Education Review*, *14*(2), 101–117.

Henke, R. R., Choy, S. P., Geis, S., & Broughman, S. P. (1996). *Schools and staffing in the U.S.: A statistical profile, 1993–94*. Department of Education, National Center for Education Statistics.

Hinrichs, P. (2014). *What kind of teachers are schools looking for? Evidence from a randomized field experiment* (Working Papers (Old Series) No. 1436). Federal Reserve Bank of Cleveland.

Hoxby, C. M., & Leigh, A. (2004). Pulled away or pushed out? Explaining the decline of teacher aptitude in the United States. *American Economic Review, 94*(2), 236–240.

Ingersoll, R. M., & Perda, D. (2010). Is the supply of mathematics and science teachers sufficient? *American Educational Research Journal*, *47*(3), 563–594.

Jackson, C. K. (2018). What do test scores miss? The importance of teacher effects on non–test score outcomes. *Journal of Political Economy*, *126*(5), 2072–2107.

Jacob, B. A., Lefgren, L., & Sims, D. P. (2010). The persistence of teacher-induced learning. *Journal of Human Resources*, *45*(4), 915–943.

Kane, T. J., McCaffrey, D. F., Miller, T., & Staiger, D. O. (2013). *Have we identified effective teachers? Validating measures of effective teaching using random assignment*. Bill & Melinda Gates Foundation. https://eric.ed.gov/?id=ED540959

Kraft, M. A. (2019). Teacher effects on complex cognitive skills and social-emotional competencies. *Journal of Human Resources*, *54*(1), 1–36.

Krieg, J., Goldhaber, D., & Theobald, R. (2020). *Disconnected development: The importance of specific human capital in the transition from student teaching to the classroom*. CALDER Working Paper No. 236-0520.

Krieg, J. M., Theobald, R., & Goldhaber, D. (2016). A foot in the door: Exploring the role of student teaching assignments in teachers' initial job placements. *Educational Evaluation and Policy Analysis*, *38*(2), 364–388.

Lankford, H., Loeb, S., McEachin, A., Miller, L. C., & Wyckoff, J. (2014). Who enters teaching? Encouraging evidence that the status of teaching is improving. *Educational Researcher*, *43*(9), 444–453.

Larsen, B., Ju, Z., Kapor, A., & Yu, C. (2020). *The effect of occupational licensing stringency on the teacher quality distribution* (No. w28158). National Bureau of Economic Research. https://www.nber.org/papers/w28158 .

Leachman, M., & Mai, C. (2014). Most states still funding schools less than before the recession. *Center on Budget and Policy Priorities*, 16, 1-12.

Lee, S. W. (2018). Pulling back the curtain: Revealing the cumulative importance of high-performing, highly qualified teachers on students' educational outcome. *Educational Evaluation and Policy Analysis*, *40*(3), 359–381.

Lindsay, J., Wan, Y., Berg-Jacobson, A., Walston, J., & Redford, J. (2016). *Strategies for estimating teacher supply and demand using student and teacher data*. REL 2017-197. Regional Educational Laboratory Midwest.

Mason-Williams, L., Bettini, E., Peyton, D., Harvey, A., Rosenberg, M., & Sindelar, P. T. (2020). Rethinking shortages in special education: Making good on the promise of an equal opportunity for students with disabilities. *Teacher Education and Special Education*, *43*(1), 45–62.

McCaffrey, D. F., Sass, T. R., Lockwood, J. R., & Mihaly, K. (2009). The intertemporal variability of teacher effect estimates. *Education Finance and Policy*, *4*(4), 572–606.

National Academies of Sciences, Engineering, and Medicine. (2020). *Changing expectations for the K–12 teacher workforce: Policies, preservice education, professional development, and the workplace*. https://www.nap.edu/catalog/25603/changing-expectations-for-the-k-12-teacher-workforce-policies-preservice.

NCES. (2020). *Characteristics of public school teachers*. Retrieved from https://nces.ed.gov/programs/coe/indicator_clr.asp

Podgursky, M., Monroe R., & Watson D. (2004). The academic quality of public school teachers: An analysis of entry and exit behavior. *Economics of Education Review, 23*(5), 507–518.

Reininger, M. (2012). Hometown disadvantage? It depends on where you're from: Teachers' location preferences and the implications for staffing schools. *Educational Evaluation and Policy Analysis*, *34*(2), 127–145.

Richwine, J., & Biggs, A. G. (2011). Assessing the compensation of public-school teachers. Center for Data Analysis Report, 11(03).

Rivkin, S. G., Hanushek, E. A., & Kain, J. F. (2005). Teachers, schools, and academic achievement. *Econometrica*, *73*(2), 417–458.

Ronfeldt, M. (2012). Where should student teachers learn to teach? Effects of field placement school characteristics on teacher retention and effectiveness. *Educational Evaluation and Policy Analysis*, *34*(1), 3–26.

Ronfeldt, M. (2015). Field placement schools and instructional effectiveness. *Journal of Teacher Education*, *66*(4), 304–320.

Ronfeldt, M., Brockman, S., & Campbell, S. (2018). Does cooperating teachers' instructional effectiveness improve preservice teachers' future performance? *Educational Researcher*, *47*(7).

Rucinski, M., & Goodman, J. (2019). *Racial diversity in the teacher pipeline*. Harvard Kennedy School Rappaport Institute. https://www.hks.harvard.edu/centers/rappaport/research-and-publications/policy-briefs/racial-diversity-in-the-teacher-pipline

Sleeter, C. E., Neal, L. V. I., & Kumashiro, K. K. (Eds.). (2014). *Diversifying the teacher workforce: Preparing and retaining highly effective teachers*. Routledge.

Sutcher, L., Darling-Hammond, L., & Carver-Thomas, D. (2016). *A coming crisis in teaching? Teacher supply, demand, and shortages in the U.S.* Learning Policy Institute. https://eric.ed.gov/?id=ED606665

Theobald, R., Goldhaber, D., Naito, N., & Stein, M. (2020). *The special education teacher pipeline: Teacher preparation, workforce entry, and retention*. CALDER Working Paper 231-0220.

Vagi, R., Pivovarova, M., & Miedel Barnard, W. (2019). Keeping our best? A survival analysis examining a measure of preservice teacher quality and teacher attrition. *Journal of Teacher Education*, *70*(2), 115–127.

Winston, G. C. (1999). Subsidies, hierarchy and peers: The awkward economics of higher education. *Journal of Economic Perspectives*, *13*(1), 13–36.

Zumeta, W. (2001). State policy and private higher education: Past, present, and future. *The finance of higher education: Theory, research, policy, and practice*. Algora Publishing.

Table 1. Summary Statistics, One Year After Student Teaching

	(1)	(2)	(3)	(4)	(5)	(6)
Collapsed Employment Categories:	**All**	**Public K–12 Teacher (41.0%)**	**Public K–12 Other Cert (4.6%)**	**Other Ed Services (31.9%)**	**Other (14.4%)**	**Not in UI Data (8.1%)**
Panel A: Earning Outcomes						
Annual Earnings	$30,683 ($17,489)	$42,293 ($9,765)	$38,405*** ($13,529)	$18,129*** ($11,848)	$22,981*** ($22,342)	
Panel B: Candidate Characteristics						
Female	0.755	0.751	0.759	0.757	0.757	0.757
Non-White	0.129	0.132	0.171	0.116	0.125	0.137
STEM Endorsed	0.157	0.204	0.206	0.116***	0.102***	0.149***
Panel C: Student Teaching Year						
Pre-Recession (ST 2004–05 – 2006–07)	0.220	0.225	0.281**	0.207*	0.203*	0.243
Recession (ST 2007–08 – 2008–10)	0.291	0.215	0.295***	0.358***	0.354***	0.300***
Post-Recession 1 (ST 2010–11 – 2012–13)	0.295	0.252	0.242	0.331***	0.345***	0.309***
Post-Recession 2 (ST 2013–14 – 2014–15)	0.194	0.309	0.181***	0.104***	0.097***	0.148***
N	14020	5751	640	4469	2026	1134

Note. In Panels B–D, p-values from two-sided t-test against Column 2. *p<.05; **p<.01; ***p<.001.

Figure 1. Employment Outcomes and Transitions, First 5 Years (All Candidates Student Teaching 2012–13 or Earlier)

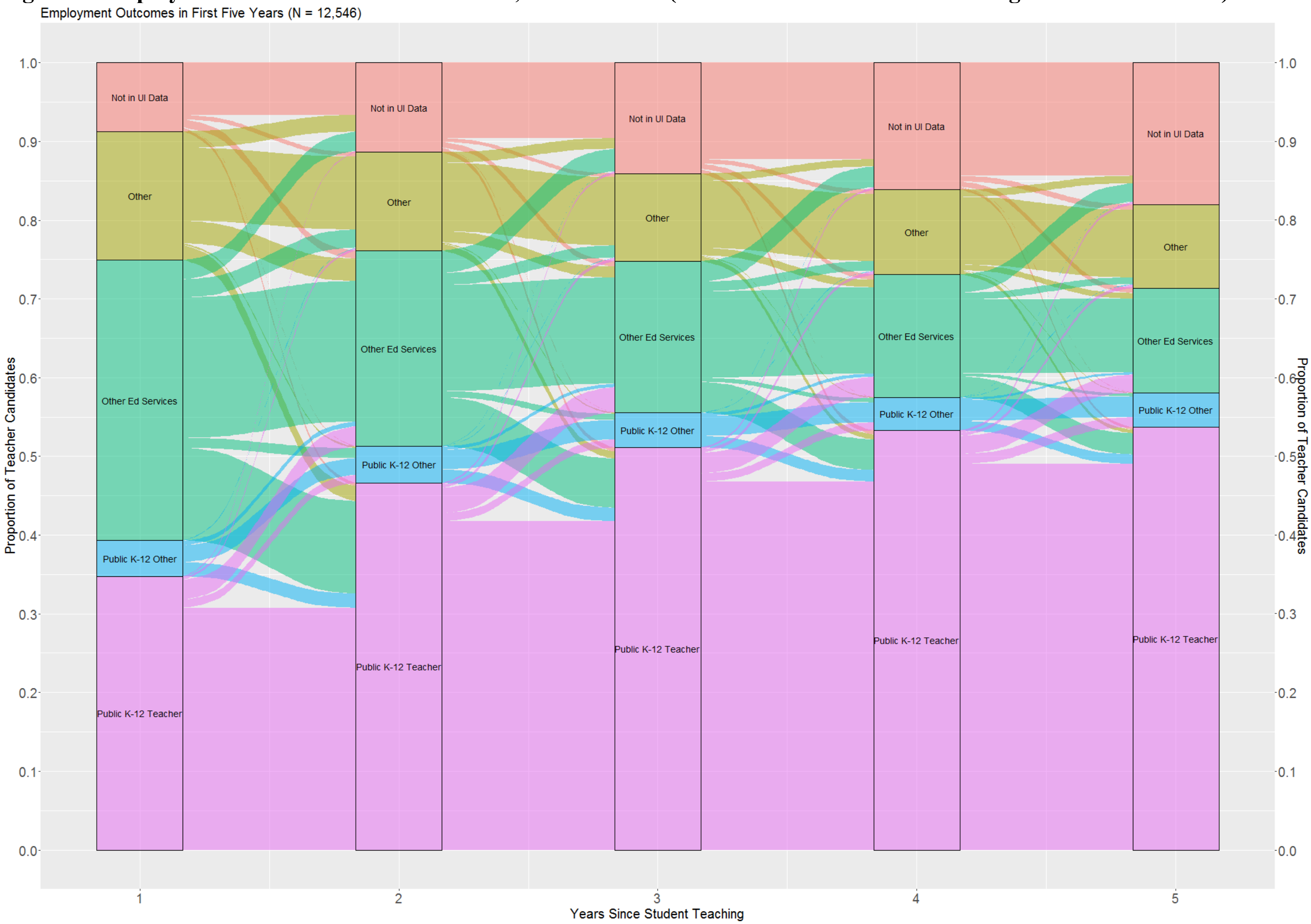
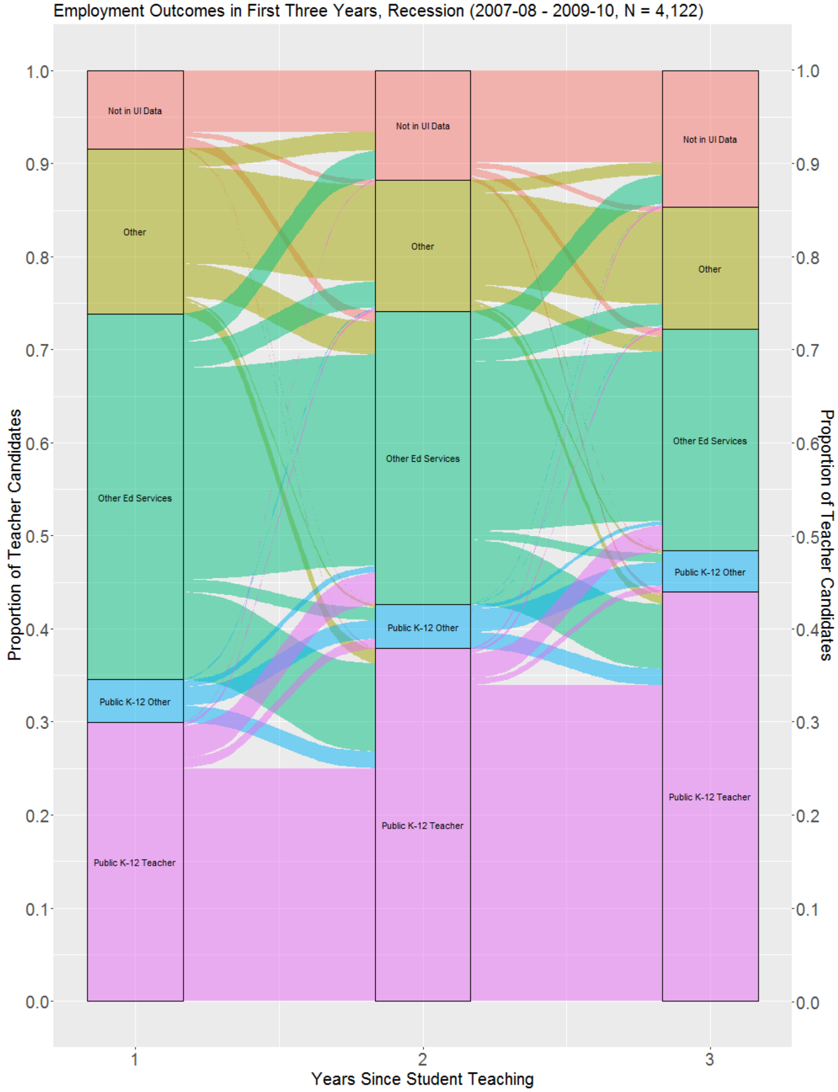


Figure 2. Employment Outcomes and Transitions, First 3 Years (Recession and Post-Recession Student Teachers)

Panel A. Recession Student Teachers (2007–08 – 2009–10)



Panel B. Post-Recession Student Teachers (2013–14 – 2014–15)

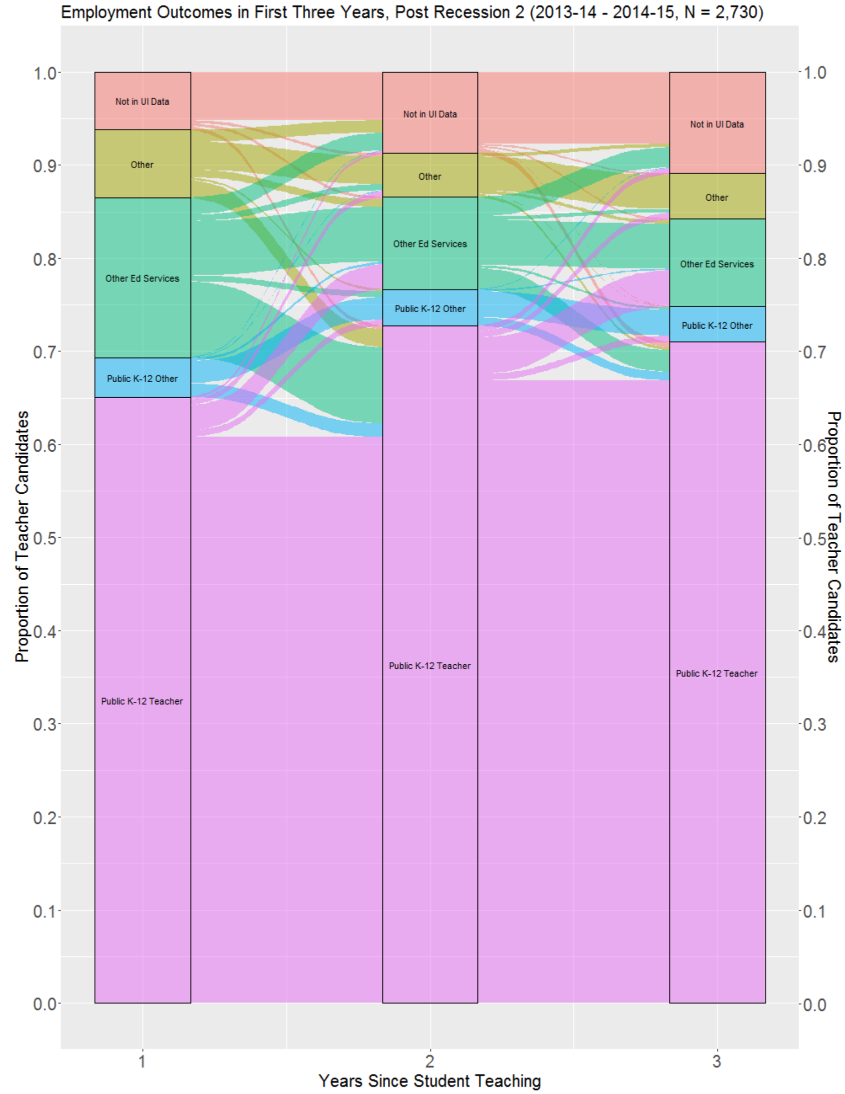
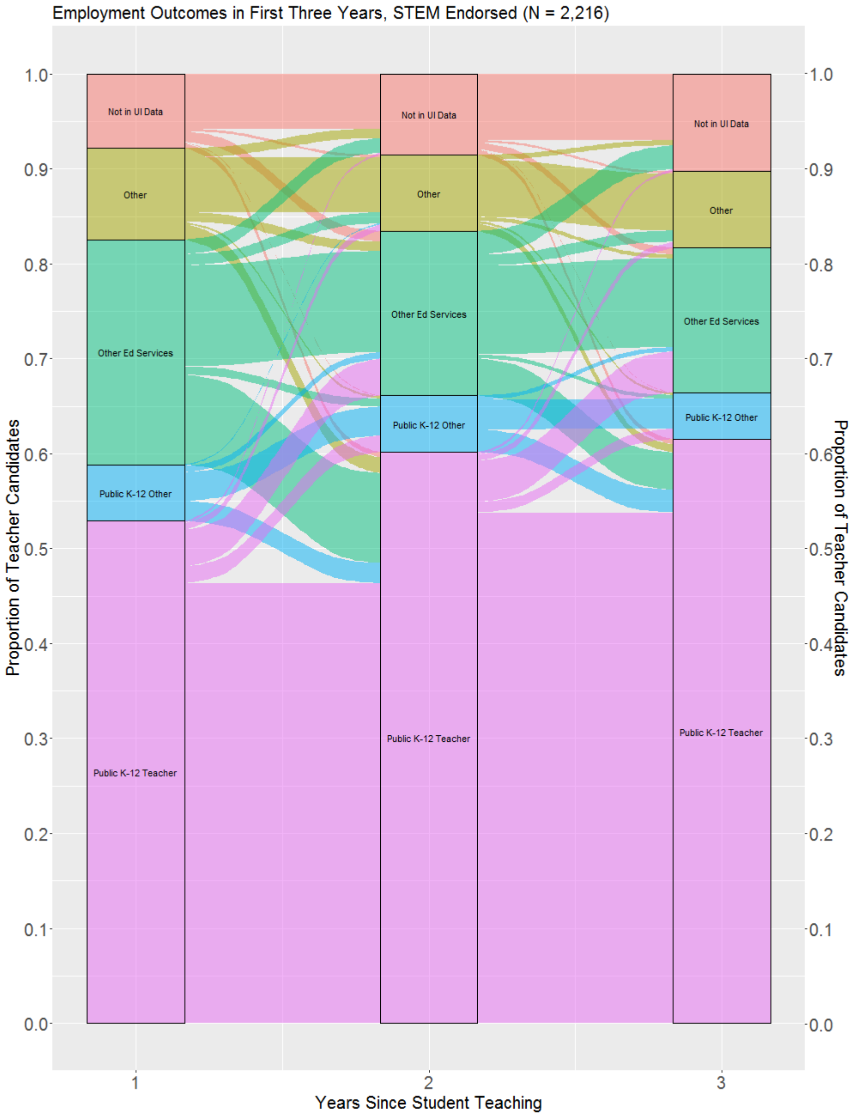


Figure 3. Employment Outcomes and Transitions, 3 Three Years (STEM and Non-STEM Student Teachers)

Panel A. STEM Endorsed Student Teachers



Panel B. Non-STEM Endorsed Student Teachers

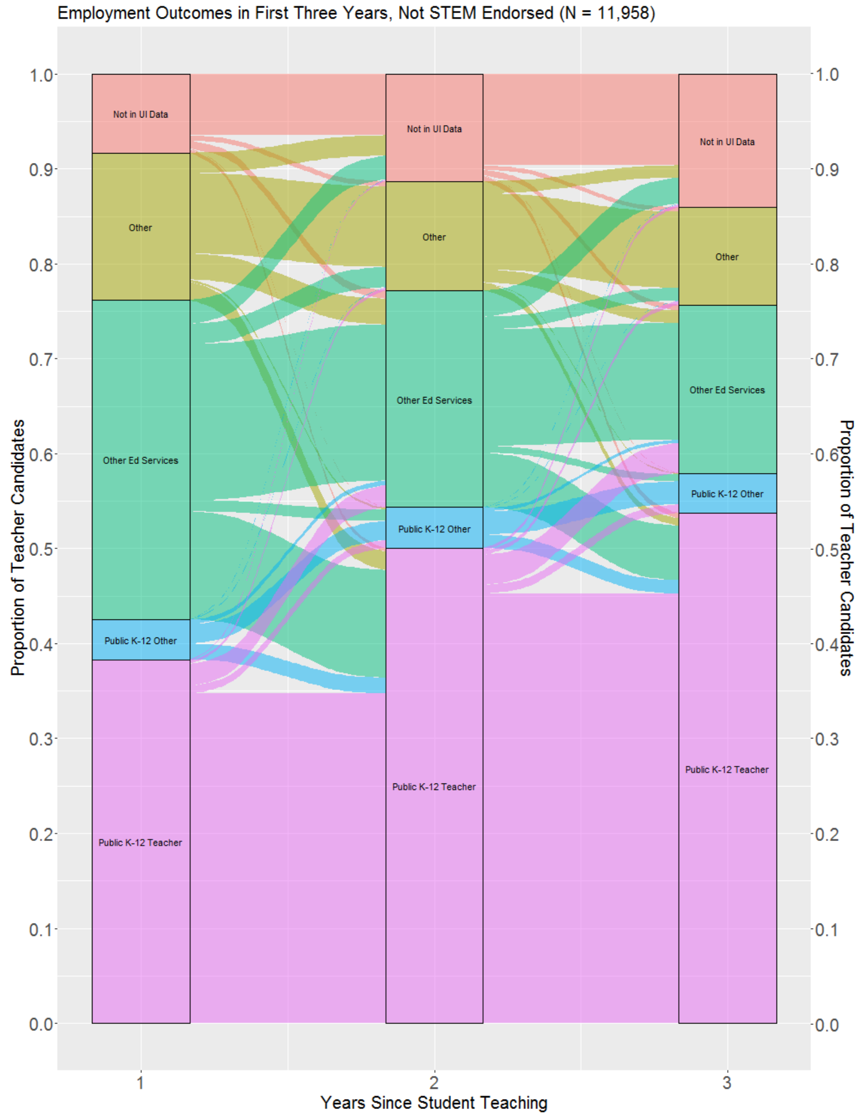


Figure 4. Employment Outcomes and Transitions, First 10 Years (All Candidates Student Teaching 2007–08 or Earlier)

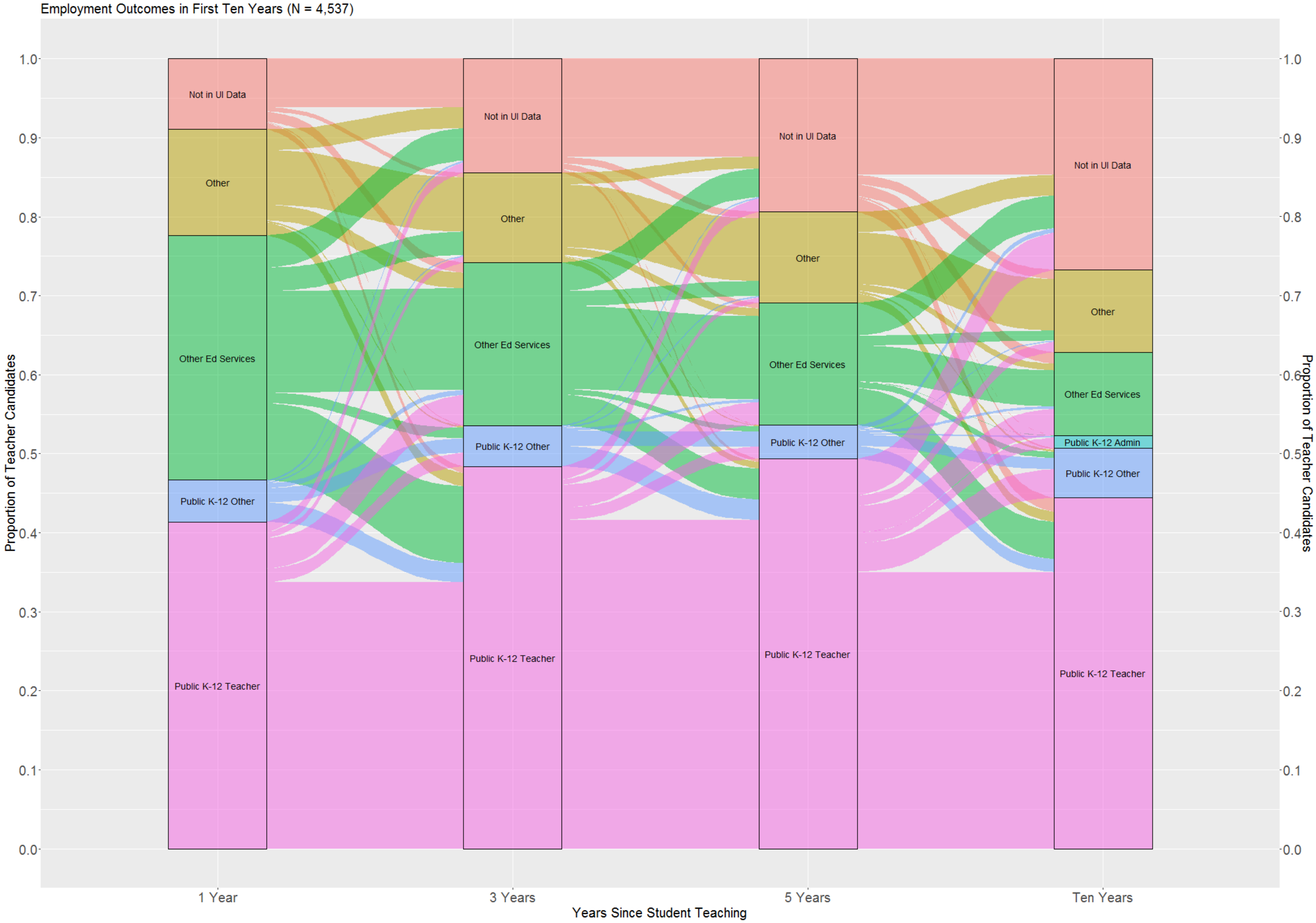


Figure 5. Average Annual Earnings by Sector, First 10 Years (All Candidates Student Teaching 2007–08 or Earlier)

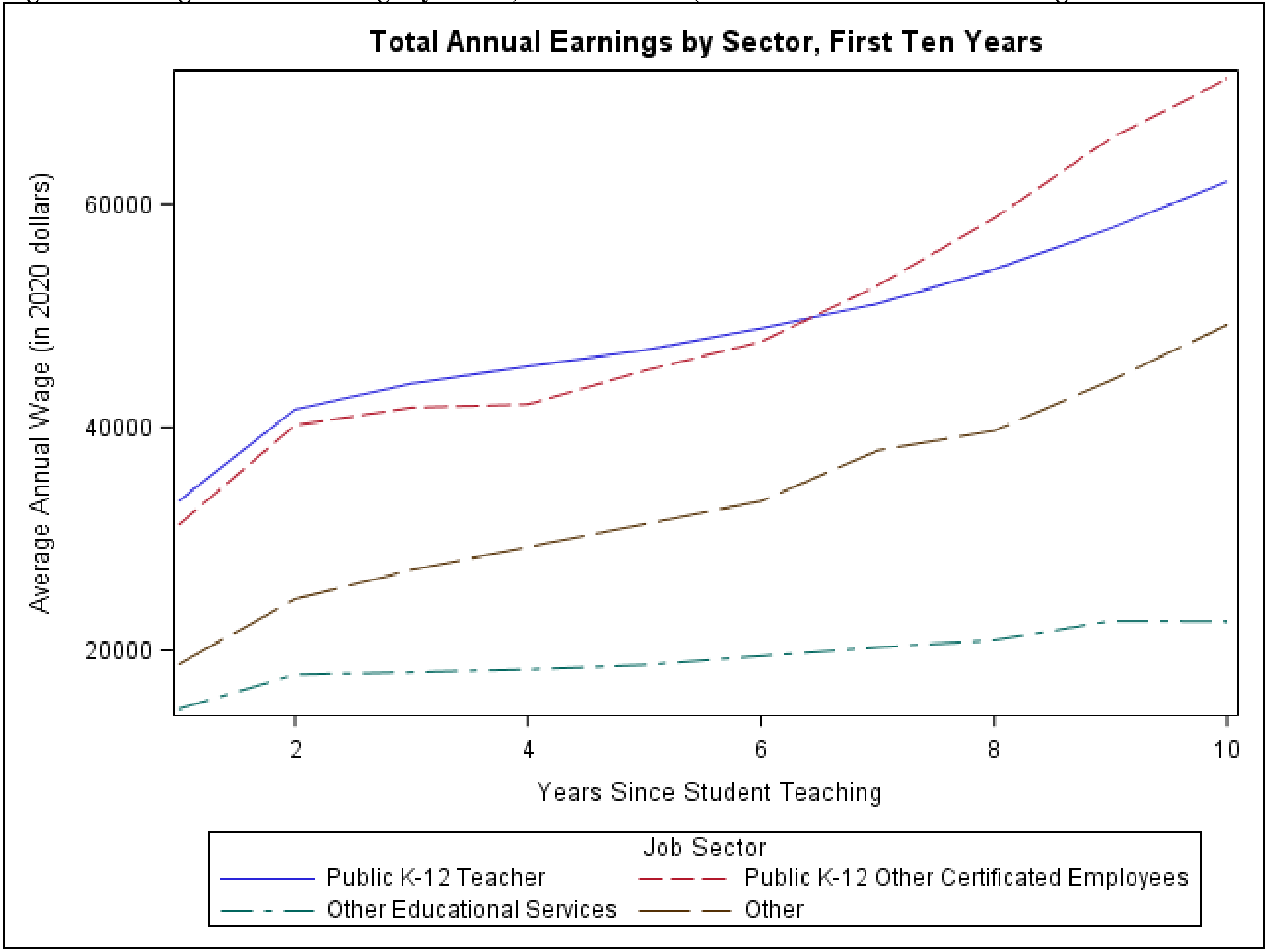


Figure 6. Kernel Density Plots of Earnings by Outcome and STEM Endorsement

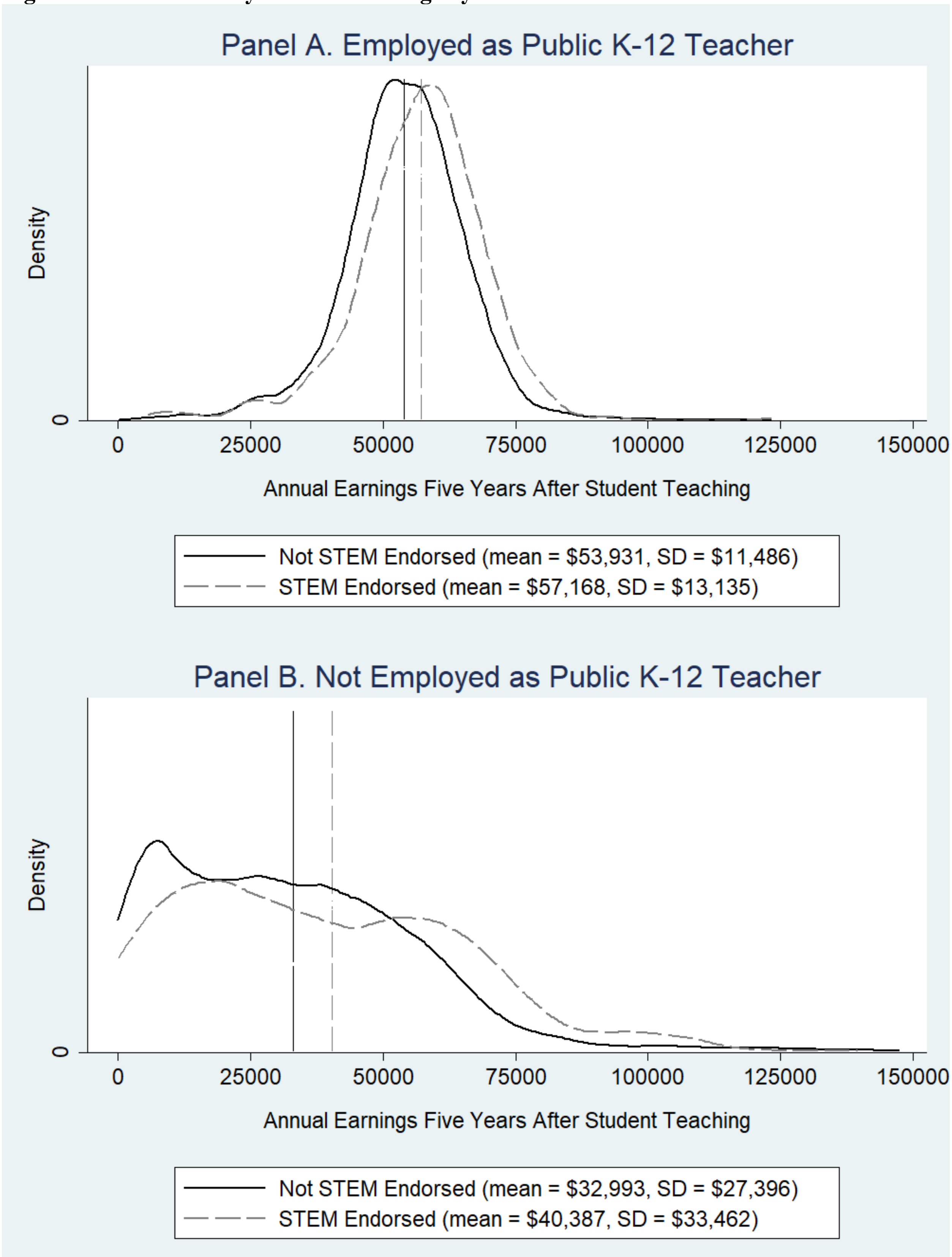


Figure 7. Changes in Earnings by Type of Transition

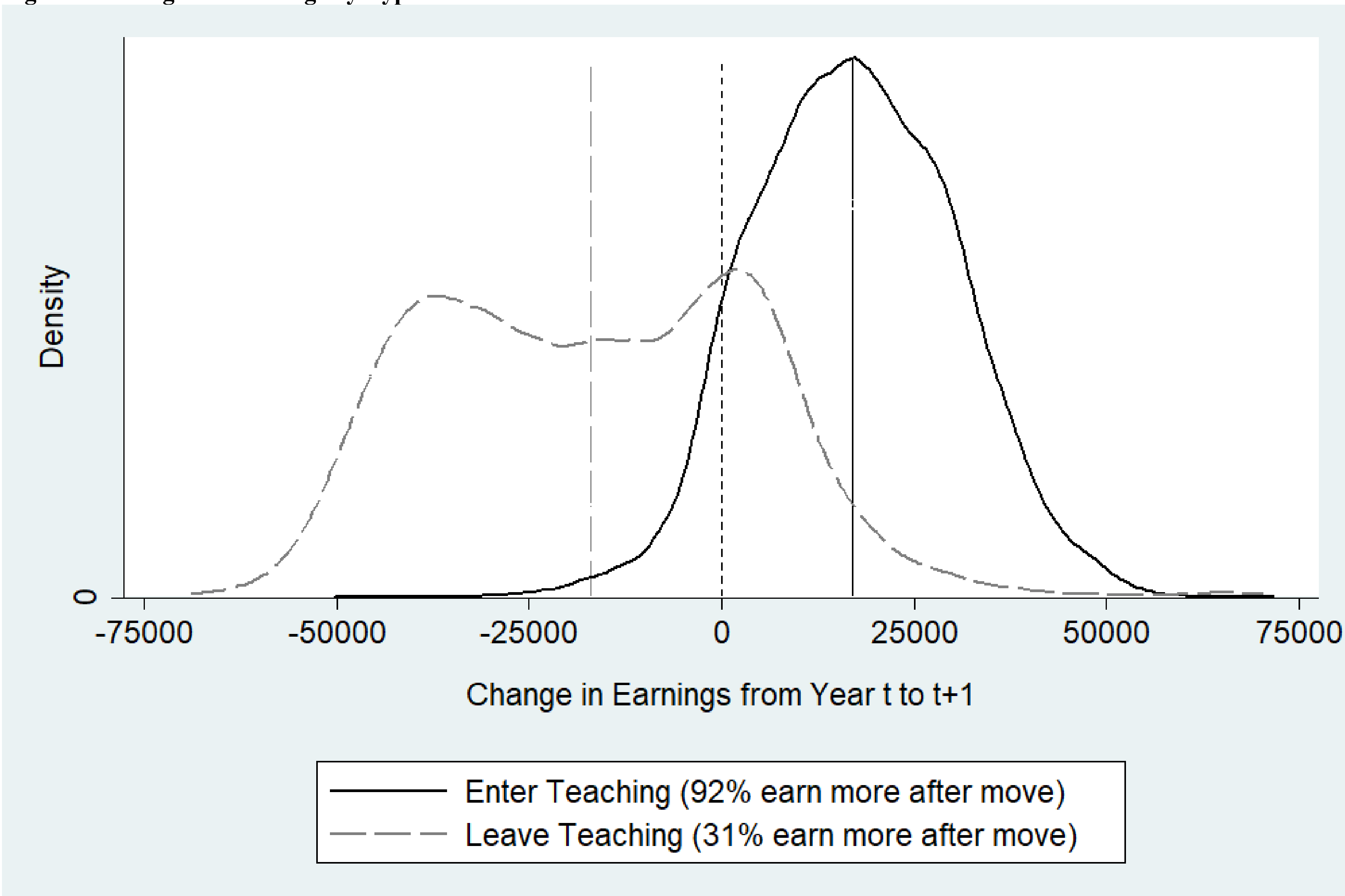


Figure 8. Total Annual Earnings by Employment Outcome and Years Since Graduation