The Front End of the CTE Teacher Pipeline: Characterizing the Prior Work Experiences of CTE Teachers

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Abstract

Career and technical education (CTE) teachers are unique because they often enter teaching with previous workplace experience in industry. Understanding these prior work experiences and the financial benefits (or losses) they face when entering teaching can offer insight into how to attract and retain these educators, yet very little is known about this "front end" of the CTE teacher pipeline. In this paper, we link employment and earnings data from unemployment insurance records with data on staffing and certifications for incoming CTE teachers in Washington state to provide a descriptive look at CTE teachers' entry into the profession. We find that CTE teachers come from a wide range of industries, but that the proportion with prior work experience in the most high-demand CTE clusters is relatively low. We also find that previously employed CTE teachers see substantial pay increases, about $13,000 in annual earnings on average, upon first entering teaching. This increase is widely felt, with the median teacher from every industry group receiving increased annual earnings, but earnings increases were particularly large for CTE teachers entering through traditional pathways and, among teachers entering through the state's Business and Industry pathway, for CTE teachers coming from industries with lower average pay.

1. Introduction

While nearly 80% of recent completers of teacher preparation programs graduated from traditional programs run by colleges and universities (American Association of Colleges for Teacher Education, 2022), career and technical education (CTE) teachers are a unique subgroup of educators in that lateral transitions from positions in industry are seen as a valuable way to connect students with a CTE focus to teachers with prior workforce experience (e.g., Blazar et al., 2024; Chen et al., 2023; Nguyen et al., 2023). Alternative routes into CTE teaching have been used in 30 states to make these types of industry connections easier (Bonsu et al., 2013), but there is only limited information about the extent to which CTE teachers are drawn from different industries and whether the opportunity costs associated with leaving positions in industry for teaching make it challenging to recruit CTE teachers through these pathways.

Prior evidence from Tennessee has found that teacher *exits* to industry are greatest in the "high-growth" technical fields, namely health services, IT, and STEM (Kistler et al., 2024). However, while recent empirical evidence on the broader teacher workforce suggests that the average new teacher earns considerably more after entering teaching than prior to entry (Goldhaber et al., 2024), there is currently no empirical evidence about the unique "front end" of the CTE teacher pipeline and, specifically, where CTE teachers held prior employment and the extent to which they are taking substantial pay cuts (or, alternatively, experiencing considerable earnings gains) by transitioning into CTE teaching.

In this paper, we extend the work of Kistler et al. (2024) to investigate the prior work experiences of CTE teachers in Washington state, both overall and by pathway into the profession and CTE program cluster. Washington, like many states, has a lateral entry to the CTE teaching pathway (the "Business and Industry Pathway") designed to make it easier for individuals with relevant professional experience to enter CTE teaching laterally in lieu of obtaining a teaching credential through a traditional university-based teacher preparation program. We investigate the entry of individuals through this and the state's traditional CTE licensure pathway using unemployment insurance data to link CTE teachers' earnings as teachers to their *pre-teaching professional experiences* for different industry categories. This allows us to estimate changes in earnings when CTE teachers enter the profession and to characterize how the economic appeal of teaching might differ by industry.

1.1 Policy Context and Related Literature

The setting for this study, Washington state, is notable for several reasons. First, the state requires students to complete at least one CTE credit during high school as a graduation requirement, so CTE participation rates in the state are high relative to other states (Goldring et al., 2021). And given the state's large employers in technology (e.g., Amazon, Microsoft) and engineering (e.g., Boeing) and considerable agricultural economy, it is also not surprising to see that student participation in CTE courses naturally aligns with these industry areas. Specifically, the state has relatively high participation rates in industry groupings—"CTE clusters"—such as "Agriculture, Food, and Natural Resources" and "Science, Technology, Engineering, and Math" and relatively low participation rates in "Architecture and Construction," "Human Services," and "Transportation, Distribution, and Logistics."

The other key piece of context noted above is that Washington state offers two distinct pathways to becoming a CTE teacher. The state has a traditional pathway to CTE certification, akin to requirements for other teaching fields, in which prospective CTE teachers must obtain a bachelor's degree in teaching with a minimum of 45 quarter hours of study in a specific CTE specialty area. It also provides an alternative pathway that allows CTE teachers to enter the profession through a "Business and Industry" (B&I) pathway. The B&I pathway has no degree requirements but does require teachers to have at least 6,000 hours of relevant prior work experience and attend specific B&I CTE teacher training programs. This B&I pathway to certification is the more popular means of obtaining a CTE teaching credential, and prior work found that students taught by CTE teachers from the B&I pathway tend to have better high school non-test outcomes, all else equal, than students taught by CTE teachers from the traditional pathway (Theobald et al., 2024).

This study seeks to contribute to several strands of prior literature. First, in response to long-standing concerns about the competitiveness of teacher pay, several prior papers have sought to quantify the "teacher pay penalty," i.e., the difference in earnings associated with becoming a teacher relative to "comparable" alternative occupations. While conclusions from early work largely depended on the extent to which researchers accounted for teachers' summer months, with papers considering hourly wages finding little to no teacher pay penalty (Richwine & Biggs, 2011; West, 2014) and papers considering annual earnings finding penalties of 10% (Taylor, 2008) to 20% (Allegretto & Mishel, 2020), seminal work by Chingos and West (2012) and Feng (2014) leverages teacher exits from the workforce to quantify the opportunity costs of teaching more directly. These papers and recent findings from Brummet et al. (2024) suggest that the average former teacher earns no more, and sometimes less, than they earned as a public school teacher, but that the variance of post-teaching earnings is considerably larger than teaching earnings, which are typically very compressed.

This prior literature begs two important questions. The first is whether these trends hold for teacher entrants as well as exiters; i.e., do individuals entering teaching earn more or less than they made prior to entering the profession? And the second, previewed in the introduction above, is whether these trends hold for CTE teachers, who may have greater opportunity costs to teaching than other teachers given that (by definition) they are highly employable in other sectors of the economy. Two recent papers begin to address these questions. First, Goldhaber et al. (2024) link data on graduates of teacher education programs in Washington to unemployment insurance records in subsequent years. They find that individuals with teaching certificates earn considerably more, on average, in teaching positions than in other positions, and that the average individual in the sample experiences a substantial raise when entering teaching and a substantial decline in earnings upon exit.

Kistler et al. (2024) focus more narrowly on CTE teachers. Using unemployment insurance records in Tennessee, they find that CTE teachers with occupational licenses (comparable to B&I) leave teaching at higher rates than non-CTE teachers, especially in high-growth sectors (IT, STEM, health services). And in contrast with the prior evidence on *all* public school teachers discussed above, they find that the average exiting CTE teacher earns *more* in industry upon leaving than they did teaching, especially in high-growth sectors. These findings are consistent with predictions of economic theory; i.e., those with more financially attractive alternatives will be more likely to leave teaching.

This paper seeks to build on the Goldhaber et al. (2024) and Kistler et al. (2024) work by investigating three novel research questions:

1. What are the prior employment experiences of new CTE teachers in terms of employment rates and industries of employment?
2. For CTE teachers with prior employment experiences, how does their pay in industry compare to their earnings as a teacher?

2. Method

2.1 Data

Our data for this study come from two sources. The first is Washington's Office of Superintendent of Public Instruction (OSPI), which maintains data on all students and employed staff in Washington public schools. From OSPI, we use a combination of publicly available data on personnel staffing (known as the S-275) and confidential data (covered by a data sharing agreement with OSPI) on individual teachers' credentials and endorsements. The staffing data include information on whether an individual was employed in a Washington K-12 school district (as a teacher or other type of personnel) and the course(s) teachers taught each school year, including whether it was a CTE course and the CTE cluster (discussed in more detail below) it falls under. The OSPI data allow us to deduce the pathway through which each teacher entered the profession in Washington (i.e., traditional university or B&I) because each pathway has distinct credentialing requirements. These data also indicate whether a teacher has earned a CTE endorsement. Our OSPI data cover all individuals who taught in Washington public high schools from the 2010-2011 through the 2018-2019 school years (denoted going forward as 2011-2019). Our second source is Washington's Education Research and Data Center (ERDC), which provides data on unemployment insurance (UI) records.[1] The teacher personnel staffing and UI records can be linked at the individual level through unique educator IDs for all individuals.

The linked data span the period from 2010 through 2023 and contain information on quarterly employment (at the employer level), including industry, wages earned, and hours worked. An important limitation of UI records is that they only reflect employment where the employer is contributing to unemployment insurance; labor income earned off the books or through contingent (e.g., 1099 or gig work) or contract work is therefore not captured in our data.

[1] ERDC receives these records from the Washington Employment Security Department.

The UI records also only capture employed individuals, not those who are unemployed and receiving UI benefits.

The UI records indicate the North American Industry Classification System (NAICS) code(s) of the industry or industries in which individuals were employed. We assign each teacher with pre-service UI data to a prior industry of employment based on where they worked most recently in the observable years prior to their transition to teaching. We then map these industries to CTE clusters and meta clusters using the National Career Clusters Framework[2] to arrive at a set of eight CTE meta clusters in which teachers might previously have been employed: Agriculture, Energy, and Natural Resources; Arts, Design, and Hospitality; Construction, Manufacturing, and Transportation; Digital Technology, Management, and Marketing; Education; Financial Services; Healthcare, Human Services, and Public Service; and Uncategorized.

We use these same meta clusters to describe the CTE clusters in which in-service teachers teach following their transition into the profession. Specifically, we use the courses taught by teachers to identify the cluster(s) in which teachers first taught and then aggregate them to the meta cluster level. In the small number of cases[3] in which teachers teach courses that fall into multiple CTE clusters across multiple meta clusters, we assign them to the modal meta cluster in their first year in the classroom.

We examine several measures to describe teachers' pre-service employment experiences: a binary annual measure of employment (i.e., unemployed or employed), yearly earnings from wages, and yearly hours worked. We also examine individuals' effective wage rate, calculated as

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[2] See https://careertech.org/resource/framework-crosswalk/.

[3] Most teachers in our analytic sample (70%) start teaching CTE in classrooms that we can map to exactly one industry cluster. Nearly all (90%) have a unique modal industry cluster. We randomly pick an industry cluster for the 169 teachers who have multiple modal clusters. Finally, we aggregate industry clusters to meta clusters.

total annual earnings divided by annual hours worked. For all measures, we define a year as the period between July 1 and June 30 (so, for example, 2019 would refer to the period from July 1, 2018, to June 30, 2019) so that annual employment measures align with the K-12 school year. All dollar measures are adjusted for inflation and reflect dollar equivalent values from 2011.

Finally, one issue with our analysis is that the observed prior earnings of CTE teachers are endogenous to their decision to move into the teaching workforce (i.e., we might expect individuals with lower earnings to be more interested in making this career switch), and we do not have access to the statewide UI data, only UI data for individuals linked to the CTE teacher data described above. To address the question of whether CTE teachers tend to come from higher- or lower-paying industries, we therefore supplement this individual-level linked data with publicly available data from the Bureau of Labor Statistics (BLS) on occupations and wages in Washington state from 2011 through 2019.[4] We use two versions of these BLS data, one at the state level and one at the metropolitan statistical area (MSA) level, which we link to the individual teacher-level data using the county of teachers' pre-service employment according to their UI records. We specifically use data on average yearly and hourly earnings by occupation and the number of jobs in a given occupation per 1,000 people in the geographic region (i.e., state or MSA). We then map the BLS occupation codes to the CTE clusters defined in the National Career Clusters Framework so that we can link these average industry measures to individuals' pre-service employment industry clusters.

2.2 Samples and Summary Statistics

Using our linked data, we construct three analytic samples based on the year that an individual began teaching and the availability of UI data prior to that year. The first sample is

[4] https://www.bls.gov/oes/

restricted to individuals who began teaching as CTE teachers in 2011-2019 and who appear in the UI data at least once in pre-service years (n = 1,634). Because we can plausibly observe at least 1 year of employment data prior to teaching (i.e., 2010), we refer to this sample as our "1-year sample." Given that 2010 is the earliest year in our data, it is possible that this sample of individuals who appear to be new CTE teachers in fact taught for a period of time prior to 2010, or taught in a different state and only entered the Washington teacher workforce in 2011-2019, though evidence suggests that this type of switching between states among teachers is relatively rare (Goldhaber et al., 2015). We further define CTE teachers in this context as those who had a CTE endorsement in their starting year and who taught a CTE course at some point in our window of observation (excluding pre-service classroom experience).

The second sample is our "3-year sample," comprising CTE teachers for whom we can plausibly observe at least 3 years of employment data prior to teaching. Put differently, our "3-year sample" is a subset of the "1-year sample" that is further restricted to those teachers who began teaching in 2013 or later (n = 1,144). Similarly, our "5-year sample" is a subset of the "3-year sample" and is further restricted to teachers who started in 2015 or later (n = 759).

For each of our analytic samples, we determine teachers' prior industry meta cluster based on their most recent previous employment in the pre-service years that are plausibly observable for all individuals in the sample. For example, in the 3-year sample, we assign teachers to the most recent industry in which we observe them 3 years prior to their transition to teaching; if we observe them in multiple industries in that year, we assign them to the one with the most hours worked. Not included in any of these analytic samples are new CTE teachers (who began teaching between 2011 and 2019) for whom we do not observe any pre-service UI data records (n = 314). These excluded teachers may have previously worked as contingent workers, independent contractors, and/or been self-employed; may have worked off the books; may have worked in a different state; or simply may not have been previously employed at all.

Table 1 presents descriptive statistics of the teachers in the 1-year analytic sample in comparison to those excluded teachers who started as CTE teachers during the 2011-2019 time window but were not linked to any pre-service UI records (see Appendix Table A1 for additional descriptive statistics on the 3-year and 5-year analytic samples). For both groups, we show mean employment outcomes and teacher characteristics in the first year of teaching; for the 1-year sample, we additionally show employment outcomes 1 year before teachers' transition to teaching. Our requirement of observable pre-service UI data for the 1-year sample results in a relatively high employment rate in the year immediately prior to transition (94%). For the 1-year sample, average earnings were substantially higher in the first year of teaching relative to the year before, both in terms of total earnings ($42,579 versus $27,049) and effective wage rate ($28.93 versus $22.96). We explore this general finding in more depth in the next section. Meanwhile, new CTE teachers not included in our analytic samples have slightly lower total earnings in their first year on average than their included counterparts ($40,221) but slightly higher effective wage rates ($30.51).

Regarding general teacher characteristics, teachers without pre-service data on average started their teaching service slightly earlier than teachers in the analytic sample (about 0.6 years). They are more likely to have earned a master's degree or higher (0.48 compared to 0.31) and less likely to have no degree (0.16 compared to 0.33), perhaps indicating that their lack of pre-service employment data may reflect their status as a student prior to teaching. However, the proportion of teachers without pre-service data who went through the B&I pathway is nearly equivalent to the proportion of teachers in the 3-year sample (0.69 compared to 0.70), suggesting that excluded teachers still acquired some unobservable industry experience before their transition to teaching, potentially in years prior to the start of our observable data window or in another state.

2.3 Analytic Approach

To answer Research Question 1, we summarize CTE teachers' average employment rate, total earnings, and effective wage rates in the first year of teaching and in the years immediately prior to transition into teaching. We do so overall and separately by the prior industry cluster in which teachers were employed. For simplicity, we focus on findings from the 3-year analytic sample, though results for the 1-year and 5-year analytic samples, which are similar, can be found in Appendix Table A2.

In addition to examining teachers' employment and earnings measures, we also summarize the pathway through which CTE teachers enter teaching and the CTE cluster that they ultimately teach courses in, broken out by prior industry cluster. Doing so helps us to understand whether teachers with certain industry backgrounds are more prone to go through the traditional versus alternative (i.e., B&I) certification pathways and whether certain CTE clusters are more likely to have alignment between industry experience and course subject.

To answer Research Question 2, we compare CTE teachers' pay in industry pre-service to their earnings when they first become a teacher. First, we look at the unadjusted distributions of total earnings and of effective wage rates in the years leading up to and including teachers' transition into the profession, overall and broken out by teachers' prior industry cluster. Again, for simplicity, we focus on results for the 3-year analytic sample.

To estimate changes in earnings associated with the transition to teaching using a regression framework, we estimate the following model using panel data where each observation is at the teacher-year level:

$$Y_{it} = \beta_1 Tch_{it} + \beta_2 YrsPost_{it} + \beta_3(Tch_{it} * YrsPost_{it}) + \beta_4 LeaveTch_{it} + \beta_5(LeaveTch_{it} * YrsPost_{it}) + \beta_6 Emp_{it} + \delta_i + \lambda_t + \epsilon_{it} \quad (1)$$

In (1), Y_{it} is an employment outcome measure (total earnings or effective wage rate) for individual *i* in year *t*. Tch_{it} is a binary indicator for whether individual *i* was an in-service teacher in year *t*. $YrsPost_{it}$ is the year relative to starting teaching, or in other words, the number of years since individual *i* transitioned to teaching. In an individual's first year of teaching, $YrsPost_{it}$ is equal to 0. $Tch_{it} * YrsPost_{it}$ is an interaction term included to model how the difference in earnings (or effective wage rate) between pre-service and in-service years changes with each additional year of teaching.

$LeaveTch_{it}$ is a binary indicator for whether individual *i* was no longer teaching in year *t*, following their initial transition into the profession. We include this variable, along with the corresponding interaction term $LeaveTch_{it} * YrsPost_{it}$, to isolate the change in earnings between pre-service and in-service years from the change between in-service and post-service years. Emp_{it} is a binary indicator of employment for individual *i* in year *t*, which is only equal to zero in years that an individual is not teaching and is missing UI data. δ_i are individual teacher fixed effects. Finally, λ_t are year fixed effects, where a year goes from July 1 through June 30, and ϵ_{it} is an idiosyncratic error term, clustered at the individual teacher level. Our primary coefficient of interest is β_1, which corresponds to the jump in earnings that occurs in a teacher's first year teaching compared to the annual earnings of all employed pre-service years.

We also run versions of the model that include the terms $\gamma_1(Tch_{it} * Ind_i) + \gamma_2(Tch_{it} * YrsExp_{it} * Ind_i)$, where Ind_i is a categorical variable indicating the industry cluster of individual *i*'s pre-service employment. The addition of these interaction terms allows us to distinguish the differences in pre-service and in-service pay by prior industry cluster, as well as how those differences vary with each additional year of teaching. Finally, we estimate specifications that replace Ind_i in these interactions with a term Ind_Earn_i that represents the average earnings of individuals employed in this industry cluster across the state.

Lastly, to answer Research Question 3, we conduct the same analyses that we do for RQ2 but do so for the subsample of teachers who go through the traditional university pathway and, separately, for the subsample who go through the B&I pathway.

3. Results

3.1 RQ1. What are the prior employment experiences of new CTE teachers in terms of employment rates and industries of employment?

To describe the prior employment experiences of new CTE teachers, we first examine the full sample of teachers who started teaching with a CTE endorsement between 2011 and 2019, regardless of whether they appear in pre-service years in the UI data. Their overall employment rate in the 3 years leading up to their transition to teaching is shown in Figure 1, where we assume that teachers are unemployed in years that they do not have earnings data from UI records. Three years prior to starting teaching, 54% of teachers were employed; this rate steadily increased with each year before individuals became teachers. Given that teachers without earnings data may be employed in another state, self-employed, or employed off the books, this trend can be considered a lower bound on teachers' pre-service employment rates.

We turn next to our analytic sample of teachers for whom we have at least 1 year of pre-service earnings data (because we cannot observe earnings outside of Washington's UI system); for simplicity, we focus on the 3-year sample. Comparable to Figure 1, Figure 2 plots this sample's employment rate in the 3 years leading up to transition into teaching, overall (panel A) and by prior industry cluster (panel B). As described earlier, the analytic sample requirement of having earnings data in at least 1 pre-service year results in a dramatically higher average employment rate among included teachers—91% were employed 3 years prior to teaching. Even with such high overall employment, however, we can observe some variation in the pre-service years across prior industry clusters. For example, employment appears to be less stable in certain clusters (e.g. Agriculture; Arts, Entertainment, and Design; Construction; Digital Technology; Marketing and Sales; Supply Chain and Transportation) where employment rates decrease at points leading up to the first year of teaching. However, these clusters have relatively small numbers of future CTE teachers (n < 60), making observed trends in employment particularly vulnerable to noise.

The largest pre-service industry cluster by far is Education (n = 445, or 39% of the 3-year sample), for which employment rates are consistently high and stable. To some extent, the large proportion of pre-service teachers employed in the education sector is unsurprising. As we can see from their future choices, these are individuals who are interested in becoming educators, may be in the process of earning education-related degrees and/or certifications to support their entry into the profession, and/or may have been introduced to the field through their prior employment. However, it raises the question of whether their prior employment in the education field was in the Washington K-12 public school system itself or with other types of organizations classified as educational based on their NAICS code. Additionally, how common was pre-service employment with Washington public schools, and was it limited to those from the education industry or did pre-service teachers from other fields also work in some capacity with the school system?

To answer these questions, we plot employment rates specifically in the Washington K-12 public school system for teachers in the 3 years leading up to and including their transition to teaching, shown in Figure 3. Our indicator for employment in the school system is sourced from OSPI data, rather than from UI records. We separate out employment as a teacher and employment in any other role in the school system. Employment rates in "other K-12" roles are greatest among individuals from the Education industry cluster, and we observe that their employment rates increased over time as they approached their transition into teaching. Interestingly, however, pre-service teachers from other industries—such as Financial Services, Healthcare and Human Services, and Hospitality, Events and Tourism—also were employed to a lesser degree by the K-12 system in the years leading up to starting teaching. Though we cannot know with certainty what their employment situations were, it is possible that they were working part time in K-12 schools as a way to learn about or familiarize themselves with the education field or to earn credits toward an eventual teacher certification.

We next examine how the certification pathways used to enter teaching vary by prior industry of employment. Figure 4 shows the flow of teachers from pre-service industry cluster into either the traditional university pathway or the B&I pathway. In addition to the teachers in the 3-year sample, this figure also includes teachers who started teaching in the same time window as the 3-year sample but had no pre-service earnings data; these teachers are categorized as "not yet in the workforce." One obvious takeaway is that the number of CTE teachers using the B&I pathway is approximately twice as large as the number using the university pathway. While the exact proportion of teachers using each pathway varies across prior industry cluster, there are some teachers from each cluster who enter through each pathway. As mentioned earlier, a significant percentage (66% for this sample) of teachers categorized as "not yet in the workforce" (i.e., without prior UI records) enter the teaching profession through the B&I

pathway, suggesting that these teachers had unobservable work experience prior to teaching or had unpaid work experience that they were able to put toward their B&I certification.[5]

Finally, we summarize alignment between CTE teachers' prior industry of employment and the CTE cluster in which they teach, separately by pathway. Figure 5 shows the flow from pre-service industry meta cluster of employment to in-service CTE cluster taught for teachers who used the university pathway (panel A) and the B&I pathway (panel B). The teachers included in the sample shown are the same as those for Figure 4. Both panels illustrate considerable misalignment between prior work industry and cluster of teaching. To some extent, this may be a result of differences in the supply of teachers from certain industries and the popularity of CTE courses offered to students. For example, the most popular CTE clusters taught by teachers in each pathway—Digital Technology, Management, and Marketing; and Healthcare, Human Services and Public Service—correspond to relatively small pre-service industry clusters. CTE teachers from the Digital Technology cluster comprise only 7.5% of this sample, while only 15% of teachers who started in healthcare CTE came from the healthcare industry. Notably, these clusters also align to some extent with the clusters identified by Kistler et al. (2024) as high-growth and likely to have financially attractive employment opportunities outside teaching.[6] By necessity, teachers with different pre-service employment backgrounds end up teaching courses in those clusters. However, even teachers with pre-service employment experience in the most popular CTE clusters end up teaching in other CTE clusters, indicating that it is not simply a matter of filling teacher slots in the most popular CTE courses. Indeed,

[5] We test heterogeneity in these transitions across cohorts using Chi-squared tests and find little evidence that these trends vary across the different cohorts in this sample.
[6] Kistler et al. (2024) define high-growth as health services, IT, and STEM-related endorsements. In their study, Business endorsements make up their own category.

teachers from nearly all of the pre-service clusters teach across all the CTE clusters, and similarly, nearly all the CTE clusters are taught by representatives from each pre-service cluster.

The degree of (mis)alignment does vary across clusters. Across both the university and B&I pathways, the proportion of teachers who went on to teach in the same cluster as their pre-service industry of employment was highest in Agriculture, Energy, and Natural Resources (0.71). Following this cluster is Digital Technology, Management, and Marketing (0.46) and Healthcare, Human Services, and Public Service (0.43). It is possible that these are industry clusters in which having workplace experience is particularly valuable for classroom instruction. The industry clusters with the lowest level of alignment (outside of Uncategorized) are Financial Services (0.09) and Education (0.11).

When comparing overall alignment across the two pathways, we would expect alignment to be higher for teachers in the B&I pathway, given the intent of that pathway to allow industry professionals to apply their experience to classroom instruction. As expected, the overall proportion of teachers teaching in the same cluster as their pre-service industry is higher for B&I teachers than for university pathway teachers (0.28 compared to 0.19), but it is striking that nearly 75% of B&I teachers were not observably employed pre-service in the same industry cluster in which they ultimately teach.

3.2 RQ2. For CTE teachers with prior employment experiences, how does their pay in industry compare to their earnings as a teacher?

To understand how CTE teachers' earnings when starting to teach compare to their pre-teaching earnings, we first examine unadjusted average employment outcomes. Table 2 shows the mean employment rate, total earnings, and effective wage rate for CTE teachers in the 3-year sample in the first year of teaching, 1 year prior to teaching, and 3 years prior to teaching. Table

2 also includes the statewide industry average earnings and wages calculated from the statewide BLS data (averaged across 2013-19) that we use in subsequent regressions exploring heterogeneity in earnings by prior industry of employment; the highest-paying industries in Washington are Digital Technology and Energy and Natural Resources, while the lowest-paying are Hospitality, Events, and Tourism and Advanced Manufacturing.

The first row of Table 2 shows the mean values for all teachers in the analytic sample, and the following rows show mean values for each pre-service industry cluster. Overall, total earnings jumped dramatically between the year prior to teaching and the first year of teaching, on average by about $15,000 (from roughly $28,000 to $43,000). And this large increase is not merely an artifact of working additional hours as a teacher, as the average wage rate increased from $23.62 to $28.89. While there is some variation across pre-industry clusters, the pattern of increased earnings and wages is consistent.

As we show in Figure 6, which illustrates with box plots the distribution of total earnings from the first year of teaching and the 3 years leading up to it, overall (panel A) and by prior industry (panel B), teachers from every industry saw a sizable increase in their total earnings when they began teaching, and nearly every industry received an increase in effective wage rate as well. Consistent with the mean values shown in Table 2, the median total earnings jumps considerably from pre-service years to the first year of teaching. The distribution in total earnings also becomes notably tighter in the first year of teaching—demonstrating the relative consistency in teacher salaries compared to pre-service industry jobs—but even the 75th percentile of pre-service earnings (the upper edge of the box) falls below the median earnings in the first year of teaching for the sample overall. When we look at these yearly distributions separately by industry, there is certainly variation in the distribution of earnings in pre-service years, but the general findings remain consistently true. CTE teachers from all industries increased their earnings substantially—in many cases, approximately doubling their median pre-service earnings—when they entered the teaching profession.

Figure 7 is comparable to Figure 6 but instead plots the yearly distributions of effective wage rate for teachers in the 3-year sample, overall and by prior industry. Again, our findings are broadly consistent with what we observe from the mean values shown in Table 2; the median wage rate increased from pre-service years to the first year of teaching, overall and in every prior industry with the exception of Construction.

To further explore patterns of changed compensation as individuals transition into teaching, we next estimate the change in CTE teachers' earnings and wages when they enter teaching using regression models. Table 3 presents the results of these models, the first set of which uses earnings as the outcome (columns 1-4) and the second set of which uses effective wage rate as the outcome (columns 5-8). Each set of specifications is structured as follows: we first estimate models that control for teacher characteristics, then add district fixed effects so teachers are compared to other teachers within the same district, and then replace these teacher characteristics and district fixed effects with teacher fixed effects (our preferred specification) in which teachers are compared to themselves over time. Finally, while we show interactions with specific prior industries graphically in Figure 8, we also add one final specification to Table 3 that interacts the teaching transition variable with the average prior earnings within the teacher's prior industry of employment.

The first row of Table 3 (repeated in the first estimate in Figure 8, panel A) shows the estimated change in earnings for all teachers in the 3-year sample, which corresponds to the estimated coefficient β_1 in equation 1 described above. Focusing on our preferred specification with teacher fixed effects (column 3), we find that, overall, CTE teachers' total earnings increased by $13,604 in the year they began teaching compared to all prior employed years in which they earned wages. The following estimates in Figure 8, panel A, show the estimated jump in earnings for each pre-service industry subgroup. We find that teachers from nearly all industry clusters saw an increase in annual earnings when they began teaching. A handful of industry clusters had changes in earnings that were significantly less than those for the Education cluster (which serves as the reference group in our regression model) but were still statistically greater than $0 (Construction) or statistically indistinguishable from $0 (Advanced Manufacturing; Financial Services; Marketing and Sales). The Digital Technology cluster saw the largest decrease in earnings of about $12,000, though the marginal effect is not statistically significant. Finally, the interaction in column 4 of Table 3 shows that, as hypothesized, the increase in earnings was lower for new CTE teachers coming from industries with higher average earnings, with each additional $100 of prior industry average earnings predicting a lower salary increase of $25, on average.

Columns 5-8 of Table 3 and Figure 8, panel B, show comparable results from models where the outcome is effective wage rate. Our findings are broadly consistent with those for total earnings. Overall, we find that CTE teachers' wage rates increased by $5.34 in their first year of teaching. Most industry cluster subgroups saw increased wages in their first year, though a larger proportion of these increases are not statistically significant compared to those found for total earnings. Here, Digital Technology is the one pre-service industry cluster for which we find a statistically significant decrease in the effective wage rate of $10.82. Finally, each additional $1 of average wages within a CTE teacher's prior industry predicts a $0.51 lower salary increase upon entering teaching.[7]

3.3 RQ 3: How do these trends vary across CTE licensure pathways (i.e., Business and Industry relative to traditionally prepared CTE teachers)?

To understand how changes in pay when starting teaching vary by CTE pathway, we plot comparable figures and estimate comparable regression models as those described for RQ2, separating out teachers who used the traditional university pathway from those who used B&I. First, Figure 9 presents the distribution of total earnings for these two groups, where the traditional university pathway is shown in blue and B&I in red. Overall, we can clearly observe that the distribution of earnings in pre-service years is considerably wider for B&I teachers; their median earnings in pre-service years are also greater than those of their university pathway counterparts. However, upon entering teaching, the two groups have much more similar total earnings both in terms of distribution and median values, reflecting the relative consistency of first-year teacher salaries compared to those for industry employment. Interestingly, even though B&I teachers have higher earnings in pre-service years than traditionally prepared teachers, both groups have a higher median earnings level in their first year compared to all pre-service years observed.

[7] In supplemental regression models (not shown), we estimate the changes in earnings and wage rates separately for teachers who enter teaching in a city, suburban, town, or rural school district. Our interest in heterogeneity by district urbanicity stems from the fact that the industry composition of the local economy, as well as the alternative employment opportunities, can vary significantly by the urbanicity of a region. Overall, we find that there is slight variation in the change in earnings upon entering teaching depending on urbanicity, with the greatest increase for teachers entering rural districts ($14,512), followed by city districts ($14,044), suburban ($13,458), and towns ($12,550); however, the differences between these settings are not statistically significant. We also generally do not find statistically significant differences by urbanicity of industry-level changes in earnings or wages upon entering teaching, though for some industries the variation is substantial (though statistically insignificant). For example, teachers coming from Digital Technology, on average, saw reductions in pay when they started teaching in city or suburban districts, but saw slight increases in pay when starting in a town or rural district. Teachers from Financial Services, on average, had reduced earnings when starting teaching in a suburban district, but increased earnings in the three other types of districts. By and large, however, we do not detect systematic differences in our overall findings by district urbanicity. We also see little heterogeneity in these results by teaching cohort.

Figure 9, panel B, breaks out these earnings comparisons by pre-service industry cluster. The general pattern found in the overall earnings distributions applies to most, but not all, industry clusters. For example, B&I teachers coming from the Financial Services industry had similar or slightly higher median total earnings in years −3 and −2 compared to their earnings in their first year of teaching; however, in the year immediately prior to transition, their median earnings decreased. This could potentially reflect a shift to part-time work as individuals prepare to enter teaching or, alternatively, could reflect a non-voluntary reduction in earnings that might motivate individuals to shift professions. Across all the prior industries, it is notable that there is no industry in which pre-service median earnings were consistently higher than median earnings in the first year of teaching for either pathway, though the distributions of earnings suggest that some individuals (e.g., university pathway teachers from the Construction sector and B&I teachers from the Financial Services sector) likely took a pay cut when transitioning to teach.

Figure 10 presents the same distributions as Figure 9, but for effective wage rates rather than total earnings. The patterns observed overall are very similar to those observed for total earnings, with higher and more dispersed pre-service wage rates among B&I teachers and median wage rates upon transitioning to teaching that exceed pre-service wage rates for teachers from both pathways. This general pattern applies to many pre-service industry clusters, though, again, there are exceptions. For example, the effective wage rate for teachers coming from the Construction sector is relatively consistent across all years for both pathways, suggesting that the increase in median earnings for these teachers in their first year of teaching is more a function of hours worked than of hourly pay. Additionally, there are a handful of industry clusters, such as Healthcare and Human Services, Marketing and Sales, and Supply Chain and Transportation, where the pre-service distribution of both total earnings and wage rates is greater for B&I

teachers than for those in the traditional university pathway. This variation in distribution by pathway suggests that, depending on the industry cluster from which they came, some B&I teachers likely faced a greater opportunity cost (or a reduced financial benefit) to transitioning to the teaching profession compared to their counterparts in the university pathway, though perhaps in exchange for greater earnings stability. The reverse pattern—wider pre-service pay distributions for university compared to B&I pathways—appears to be less common, though it is seen in Construction and in some pre-service years in Digital Technology, and Marketing and Sales.

Lastly, we estimate the same regression models described earlier for RQ2, now separately for the subgroup of CTE teachers in either pathway. Tables 4 and 5 present the results of the same model specifications described for Table 3 (for university and B&I pathways, respectively), while marginal effects by prior industry are shown in Figure 11. Focusing again on the preferred teacher fixed effect specification, we find that university pathway teachers had a greater increase in earnings ($21,208 versus $10,409) and effective wage rate ($7.48 versus $4.38) than B&I teachers in their first year of teaching, though the difference between pathways is only statistically significant for total earnings. At the pre-service industry cluster level, this general pattern typically holds, though there are only a few instances where the difference in pay between the two pathways is statistically significant (e.g., total earnings for teachers from Financial Services; effective wage rates for teachers from Healthcare and Human Services). Generally, however, our regression findings are consistent with our unadjusted descriptive findings—on average, both traditionally prepared CTE teachers and B&I teachers received pay increases when first entering teaching compared to their pre-service earnings in industry, though the pay increases were greater for teachers from the university pathway. Finally, and as might be expected, the interaction with prior industry average earnings is only statistically significant for CTE teachers entering through the B&I pathway, suggesting it is only those CTE teachers coming through the B&I pathway who sacrifice some earnings and wage increases if they are coming from higher-paying industries.

4. Conclusions

This study is the first to our knowledge to describe the unique front end of the CTE teacher pipeline. Taking steps towards understanding the backgrounds and potential motivations of these teachers can help inform strategies for recruiting and retaining CTE teachers and eventually help identify the mechanisms through which teachers' prior experiences impact students in the classroom. Our paper examines which industries new CTE teachers come from, how their prior workplace experience aligns with their teaching subject matter, how their pay from their industry work compares to their compensation while teaching, and how these trends differ depending on the pathway through which they entered teaching. This descriptive analysis alone cannot comprehensively fill our gaps in understanding, but it puts us a step in the right direction.

We have several key findings worth highlighting. First, CTE teachers come from a wide range of industry backgrounds, but the most common by far is Education. Our methodology for identifying teachers' prior industry is to privilege their most recent employment, so it is possible that our estimate of the proportion coming from Education (about 32%) is an overestimate if individuals transitioned from other industries into Education before beginning teaching. It is also possible that the nature of UI data and the types of employment that it can and cannot capture may limit our ability to observe pre-service work and earnings more in some industries than others, leading us to underestimate pre-service participation in non-Education industries. For example, using evidence from tax filings, Garin and Koustas (2021) report that the proportion of workers who are primarily self-employed is particularly high in construction (among men), and to a lesser extent, real estate, administrative, professional, and health care services (among women).[8] Those caveats notwithstanding, the overrepresentation of teachers from the Education sector helps to highlight a related finding—the proportion of teachers coming from many industries that are in high demand for instruction (particularly in Washington state) are relatively small. Only 1% of CTE teachers in our sample depicted in Figures 4 and 5 come from the Agriculture, Energy, and Natural Resources meta cluster; 7% come from Digital Technology, Management, and Marketing; and 15% come from Healthcare, Human Services, and Public Service.

Additionally, we find that there is considerable mismatch between CTE teachers' industry of prior employment and the cluster in which they ultimately teach. This is partly a function of the aforementioned proportions of teachers coming from industries corresponding to the most popular CTE clusters, but not entirely. Generally speaking, there is a high level of movement from one industry area to another when teachers transition into classroom instruction. We find that alignment between prior industry and CTE cluster is greater among B&I teachers compared to traditional university pathway teachers, but still, 75% of CTE teachers teach courses in a different meta cluster than their most recent industry of employment. It is currently unclear to us whether this high level of misalignment is driven by the endorsements that CTE teachers choose to earn or because of school staffing needs, though we hope to explore this further in future work.

[8] Among men ages 18-61, the incidence of primary self-employment in construction ranges from 9.8% to 13.0% depending on age group. Among women ages 18-61, the incidence of primary self-employment in real estate ranges from 2.4% to 6.3%; in professional services ranges from 4.9% to 7.7%; in administrative services ranges from 4.3% to 5.7%; and in health care ranges from 4.0% to 5.9%.

Regarding the question of how compensation compares for CTE teachers before and after they start teaching, we find that pay for new CTE teachers is significantly higher than it was in their pre-service employment in industry. Though we do find some variation in the distribution of pre-service pay by industry cluster, the median teacher from all clusters received a pay bump when starting teaching. For high-demand CTE clusters, our regression results indicate that teachers from Agriculture and from Healthcare and Human Services saw significant increases in both total earnings and wage rate when they transitioned into teaching, whereas teachers from Digital Technology were the one group who saw a marginally significant decrease in total earnings and a statistically significant decrease in wage rate. Teachers' pre-service pay in several industry clusters (including Digital Technology) also had much wider distributions than their in-service pay in their first year of teaching, suggesting that the volatility or uncertainty of earnings in industry might also factor into the decision to enter teaching.

It is worth considering that, in this study, we only observe individuals who do enter the teaching workforce. Our analysis cannot speak to individuals who might have considered teaching but decided to stay in their industry, and it is likely that those who actually did choose to teach were more likely to have been less successful in their industry work and faced lower opportunity costs to switching professions. As we note at the start of our paper, Goldhaber et al. (2024) find that student teachers who consider teaching and do not ultimately do so earn less than their counterparts who do enter teaching, but the calculus is likely to be very different for individuals who already have workplace experience and potentially a career trajectory in another industry.

Finally, when we compare the patterns of pre-service and in-service compensation for new CTE teachers from university and B&I pathways, we find that overall, patterns are quite similar. As expected, the pay increase for CTE teachers entering teaching from the university pathway ($21,208 in total earnings) is larger than for B&I ($10,409 in total earnings), but the pay bump for B&I teachers is still substantial and statistically significant. This is an interesting bookend to the findings by Kistler et al. (2024) that CTE teachers with occupational certifications (i.e., B&I teachers) earn higher pay after leaving teaching. Both sets of findings point to the conclusion that, despite often idealistic views of teachers' motivations, individuals' decisions about entering or exiting teaching are not based purely on altruistic reasons or lifestyle preferences, but that financial reasons—and the availability of well-paying alternatives—play a significant role.

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Tables and Figures

Table 1. Descriptive Statistics for 1-Year Analytic Sample and Excluded Teachers

	1-Year Sample (n = 1634)		**No pre-service data (n = 314)**
	Year before teaching	**First year teaching**	**First year teaching**
	mean	*mean*	*mean*
Employment outcomes			
Employed	0.94	1.00	1.00
Total earnings ($)	$27,049.20	$42,579.03	$40,220.61
Total hours worked	1045.66	1487.53	1313.00
Effective wage rate ($)	$22.96	$28.93	$30.51
	1-Year Sample (n = 1634)		**No pre-service data (n = 314)**
	mean		*mean*
Teacher characteristics			
First school year of teaching service	2015.41		2014.77
Birth decade			
< 1960s	0.08		0.11
1960s	0.10		0.13
1970s	0.12		0.17
1980s	0.18		0.16
1990s	0.03		0.03
Missing	0.51		0.41
Sex			
Male	0.46		0.49
Female	0.54		0.51
Race and ethnicity			
Hispanic	0.04		0.04
White, non-Hispanic	0.88		0.89
Black, non-Hispanic	0.03		0.02
Asian/Pacific Islander	0.02		0.03
American Indian/Alaskan Native	0.01		0.01
Missing	0.01		0.00
Education			
No degree	0.33		0.16
Bachelor’s	0.36		0.35
Master’s or higher	0.31		0.48
CTE certification			
Full CTE certification	0.26		0.23
Temporary CTE certification	0.65		0.69
No CTE certification	0.04		0.05
No certification	0.04		0.04
CTE pathway			
University	0.30		0.31
Business & Industry	0.70		0.69

Notes: Teachers with no pre-service data include CTE teachers who began teaching between 2011 and 2019 whom we do not observe in the UI data at any point prior to teaching. These teachers are excluded from our 1-year, 3-year, and 5-year analytic samples. CTE certification and pathway shown reflect teachers' recorded certification and pathway status in their first year of teaching.

Table 2. Mean Earnings by Prior Industry Among CTE Teachers in Analytic Sample

	3-Year Analytic Sample (start teaching ≥ 2013), n = 1144							**Statewide Industry Averages (2013-19)**		
	First Year Teaching		**1 Year Before Teaching**		**3 Years Before Teaching**					
	Earnings (mean)	Wage (mean)	Earnings (mean)	Wage (mean)	Earnings (mean)	Wage (mean)	% of sample	Earnings (mean)	Wage (mean)	Percent of jobs*
Advanced Manufacturing	$42,085	$27.80	$36,184	$29.21	$49,194	$33.86	5.7%	$43,678	$21.00	7.5%
Agriculture	$37,315	$23.90	$17,922	$17.46	$9,307	$14.47	1.2%	$50,253	$24.16	1.4%
Arts, Entertainment, and Design	$37,995	$27.95	$16,870	$19.82	$13,417	$17.78	3.1%	$54,080	$25.99	1.1%
Construction	$36,245	$26.48	$22,240	$27.53	$25,558	$26.84	1.9%	$51,923	$24.96	6.8%
Digital Technology	$51,135	$34.06	$42,870	$44.25	$64,876	$41.98	4.8%	$88,824	$42.70	4.7%
Education	$43,260	$29.78	$28,862	$22.97	$23,369	$21.64	38.9%	$63,072	$25.08	5.9%
Energy and Natural Resources	n/a	n/a	n/a	n/a	n/a	n/a	0.0%	$83,919	$40.35	1.8%
Financial Services	$41,837	$28.10	$29,921	$28.09	$39,010	$24.28	2.9%	$63,254	$30.41	3.5%
Healthcare and Human Services	$41,558	$28.33	$27,720	$22.01	$25,755	$19.97	11.9%	$67,546	$32.58	11.5%
Hospitality, Events, and Tourism	$40,143	$26.68	$20,984	$19.15	$17,680	$16.36	14.9%	$32,224	$15.04	12.0%
Marketing and Sales	$42,543	$30.36	$23,097	$24.41	$36,219	$28.95	4.2%	$61,147	$29.40	15.8%
Public Service and Safety	$44,020	$27.99	$29,065	$22.98	$29,798	$22.11	6.3%	$62,001	$29.81	11.1%
Supply Chain and Transportation	$45,012	$29.51	$28,127	$23.38	$31,207	$24.38	3.8%	$61,087	$29.23	3.8%
Missing	$41,255	$27.22	$25,765	$21.03	$28,280	$21.31	0.5%	$50,443	$22.86	8.2%

Notes: All dollar amounts shown in 2011 dollars.

Table 3. Estimated Changes in Earnings and Wages Upon Transition into Teaching, 3-Year Sample (Start Teaching ≥ 2013)

	Total Earnings ($)				Effective Wage Rate ($)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Teacher Chars	Teacher Chars & District FE	Teacher FE	Teacher FE & Avg Industry Earnings Interaction	Teacher Chars	Teacher Chars & District FE	Teacher FE	Teacher FE & Avg Industry Earnings Interaction
	b / (se)	*b / (se)*	*b / (se)*	*b / (se)*	*b / (se)*	*b / (se)*	*b / (se)*	*b / (se)*
Teach this year	13155.86***	12623.43***	13603.52***	12340.92***	5.47***	5.13***	5.34***	5.35***
	(1426.97)	(1416.53)	(953.14)	(1160.54)	(0.90)	(0.93)	(0.57)	(0.61)
Years post transition to teach	-1357.99*	-1345.68*	-0.78	-88.56	-0.63	-0.37	0.62***	0.60***
	(601.74)	(632.79)	(237.31)	(237.77)	(0.40)	(0.39)	(0.15)	(0.15)
(Teach this year) x (Years post transition)	2982.16***	2794.96***	2968.72***	3052.60***	1.95***	1.81***	1.85***	1.92***
	(424.62)	(416.80)	(384.50)	(400.21)	(0.27)	(0.28)	(0.25)	(0.25)
(Teach this year) x (Avg industry earnings)				-0.25**				-0.51***
				(0.089)				(0.12)
Additional controls								
Teacher characteristics	X	X			X	X		
District fixed effects		X				X		
Teacher fixed effects			X	X			X	X
Year fixed effects	X	X	X	X	X	X	X	X
Employed	X	X	X	X	X	X	X	X
LeaveTch	X	X	X	X	X	X	X	X
LeaveTch * YrsPost	X	X	X	X	X	X	X	X
LeaveTch * Avg Industry Earnings				X				X
LeaveTch * YrsPost * Avg Industry Earnings				X				X

Notes: * p < 0.05 ** p < 0.01 *** p < 0.001. Standard errors for all models are clustered at the individual teacher level.

Table 4. Estimated Changes in Earnings and Wages Upon Transition into Teaching, 3-Year Sample (Start Teaching ≥ 2013), Traditional Pathway

	Total Earnings ($)				Effective Wage Rate ($)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Teacher Chars	Teacher Chars & District FE	Teacher FE	Teacher FE & Avg Industry Earnings Interaction	Teacher Chars	Teacher Chars & District FE	Teacher FE	Teacher FE & Avg Industry Earnings Interaction
	b / (se)	*b / (se)*	*b / (se)*	*b / (se)*	*b / (se)*	*b / (se)*	*b / (se)*	*b / (se)*
Teach this year	17951.01***	18100.90***	21208.26***	21191.45***	7.48***	6.28***	7.48***	7.40***
	(2473.58)	(2290.91)	(1643.71)	(1917.22)	(1.49)	(1.82)	(1.13)	(1.25)
Years post transition to teach	-1856.49	-2022.42	-399.36	-420.90	-1.86*	-1.15	0.46	0.48
	(1211.01)	(1467.99)	(493.00)	(489.54)	(0.92)	(0.83)	(0.34)	(0.36)
(Teach this year) x (Years post transition)	3566.79***	3342.64***	3059.52***	2834.97***	2.64***	2.53***	2.07***	2.08***
	(770.02)	(777.38)	(723.65)	(755.18)	(0.62)	(0.64)	(0.56)	(0.63)
(Teach this year) x (Avg industry earnings)				-0.083				-0.21
				(0.089)				(0.12)
Additional controls								
Teacher characteristics	X	X			X	X		
District fixed effects		X				X		
Teacher fixed effects			X	X			X	X
Year fixed effects	X	X	X	X	X	X	X	X
Employed	X	X	X	X	X	X	X	X
LeaveTch	X	X	X	X	X	X	X	X
LeaveTch * YrsPost	X	X	X	X	X	X	X	X
LeaveTch * Avg Industry Earnings				X				X
LeaveTch * YrsPost * Avg Industry Earnings				X				X

Notes: * p < 0.05 ** p < 0.01 *** p < 0.001. Standard errors for all models are clustered at the individual teacher level.

Table 5. Estimated Changes in Earnings and Wages Upon Transition into Teaching, 3-Year Sample (Start Teaching ≥ 2013), B&I Pathway

	Total Earnings ($)				**Effective Wage Rate ($)**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Teacher Chars	Teacher Chars & District FE	Teacher FE	Teacher FE & Avg Industry Earnings Interaction	Teacher Chars	Teacher Chars & District FE	Teacher FE	Teacher FE & Avg Industry Earnings Interaction
	b / (se)	*b / (se)*	*b / (se)*	*b / (se)*	*b / (se)*	*b / (se)*	*b / (se)*	*b / (se)*
Teach this year	11110.13***	9894.96***	10409.02***	9094.91***	4.74***	4.41***	4.38***	4.63***
	(1765.39)	(1812.17)	(1162.45)	(1388.37)	(1.14)	(1.15)	(0.66)	(0.68)
Years post transition to teach	-959.90	-977.48	214.40	89.68	0.02	-0.07	0.71***	0.67***
	(696.96)	(774.31)	(269.15)	(271.37)	(0.43)	(0.49)	(0.17)	(0.16)
(Teach this year) x (Years post transition)	2624.05***	2450.19***	2826.93***	3045.15***	1.68***	1.55***	1.72***	1.83***
	(511.77)	(506.62)	(450.95)	(469.87)	(0.32)	(0.32)	(0.26)	(0.26)
(Teach this year) x (Avg industry earnings)				-0.31**				-0.59***
				(0.12)				(0.16)
Additional controls								
Teacher characteristics	X	X			X	X		
District fixed effects		X				X		
Teacher fixed effects			X	X			X	X
Year fixed effects	X	X	X	X	X	X	X	X
Employed	X	X	X	X	X	X	X	X
LeaveTch	X	X	X	X	X	X	X	X
LeaveTch * YrsPost	X	X	X	X	X	X	X	X
LeaveTch * Avg Industry Earnings				X				X
LeaveTch * YrsPost * Avg Industry Earnings				X				X

Notes: * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$. Standard errors for all models are clustered at the individual teacher level.

Figure 1. Pre-service employment rate for all CTE teachers starting 2011-2019

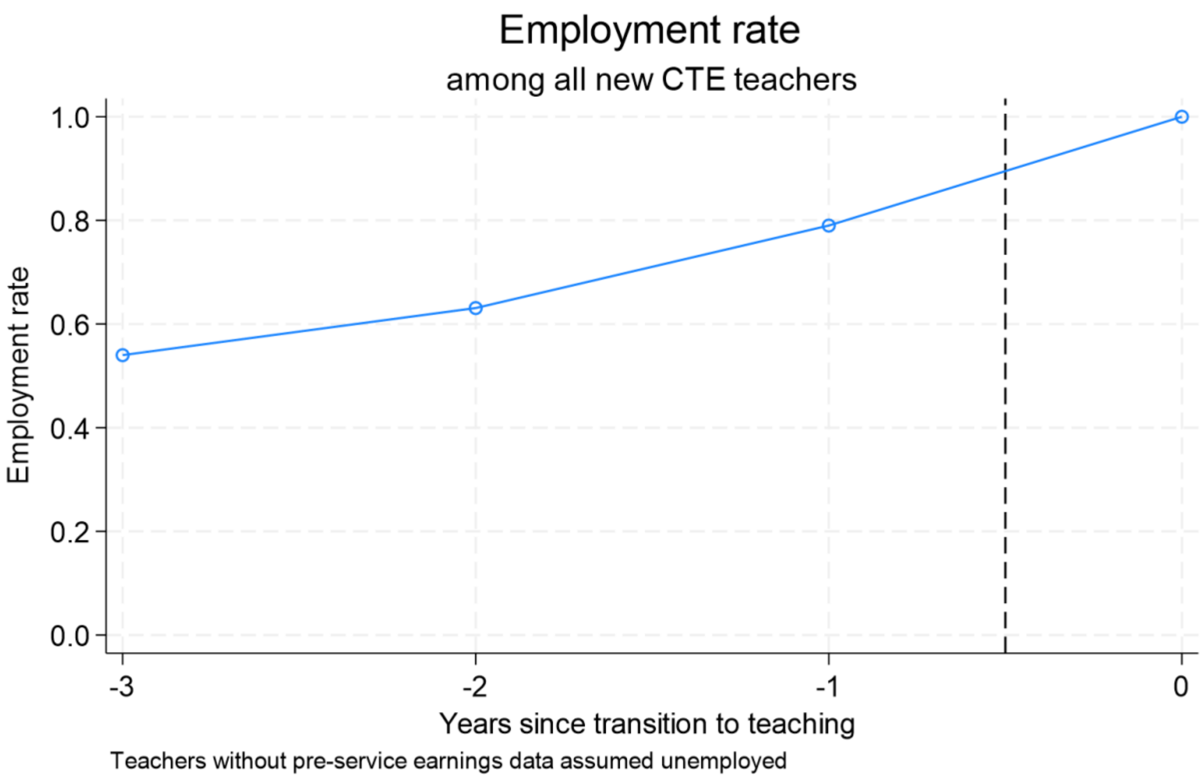
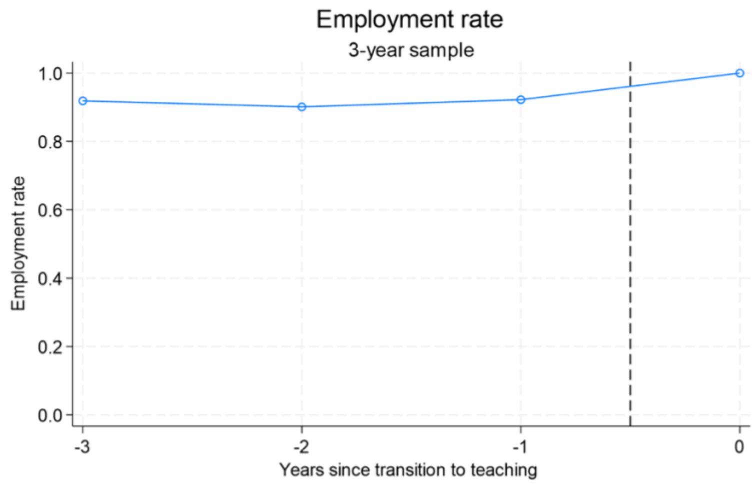
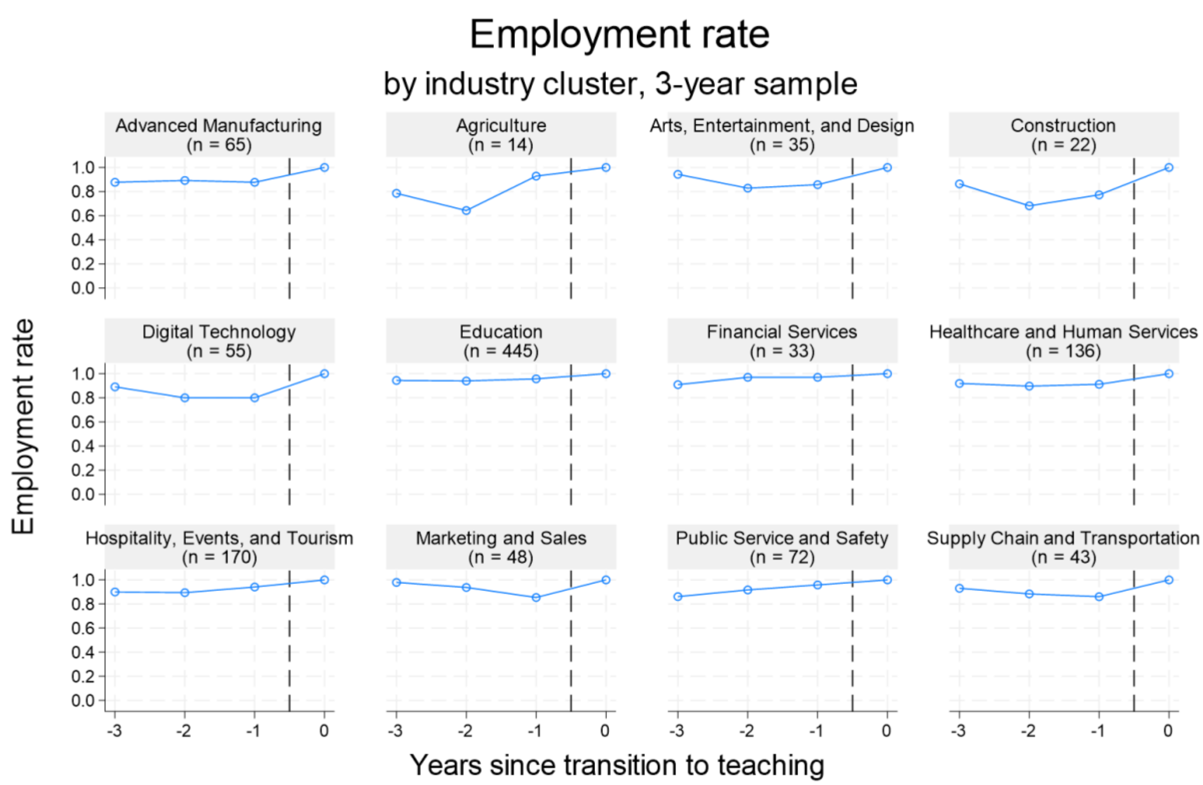


Figure 2. Pre-service employment rate for CTE teachers in the 3-year analytic sample

A. Overall



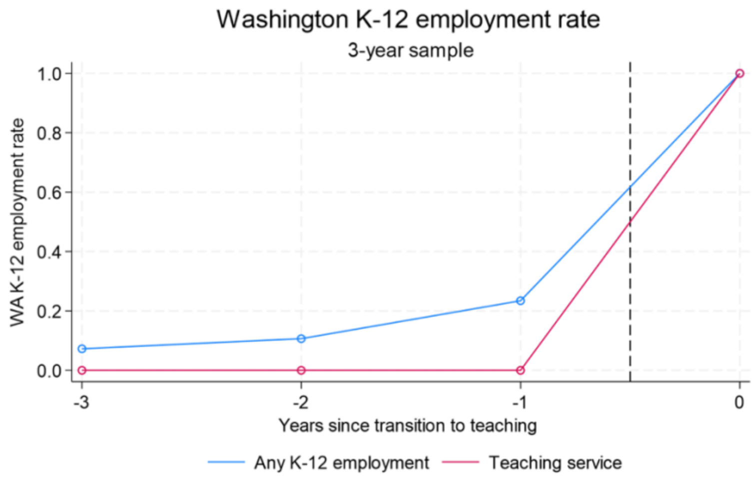
B. By prior industry



Notes: 3-year analytic sample includes all CTE teachers who started between 2013 and 2019 and have pre-service earnings data.

Figure 3. Pre-service employment in Washington K-12 school system

A. Overall



B. By prior industry

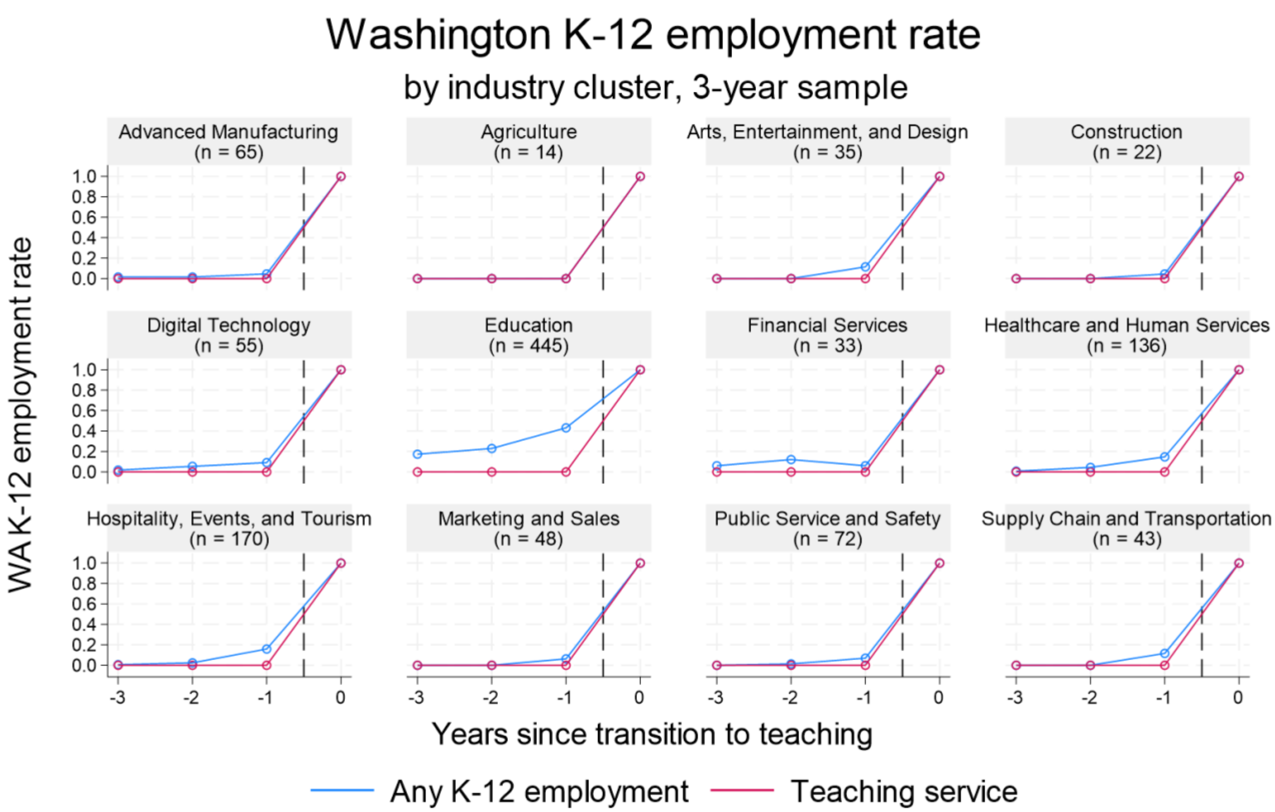


Figure 4. CTE pathways used to enter teaching, by industry meta cluster of pre-service employment

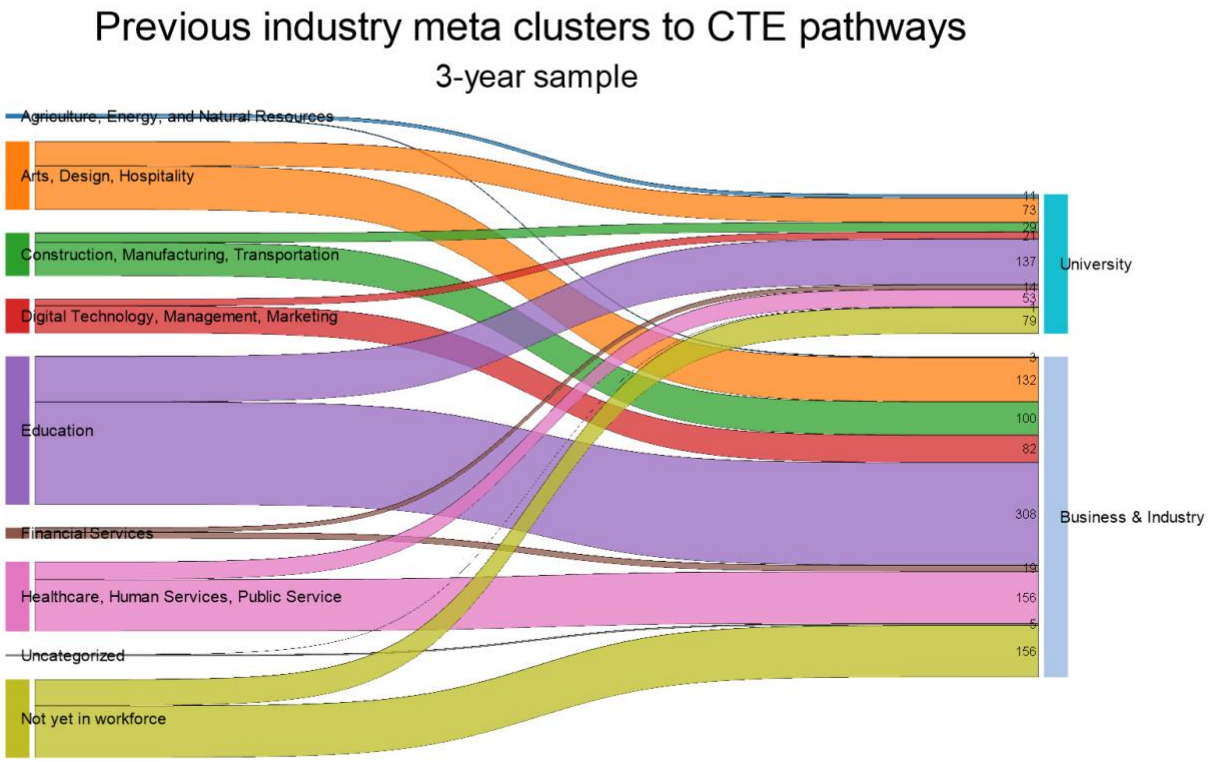
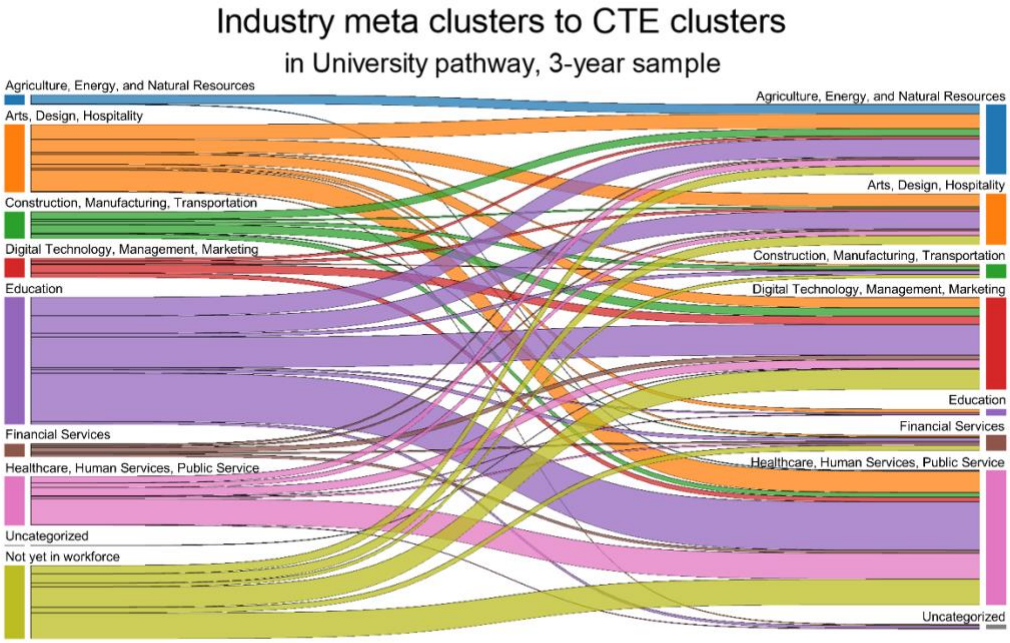


Figure 5. Alignment between prior industry of employment and CTE cluster, by pathway

A. University pathway



B. Business & Industry pathway

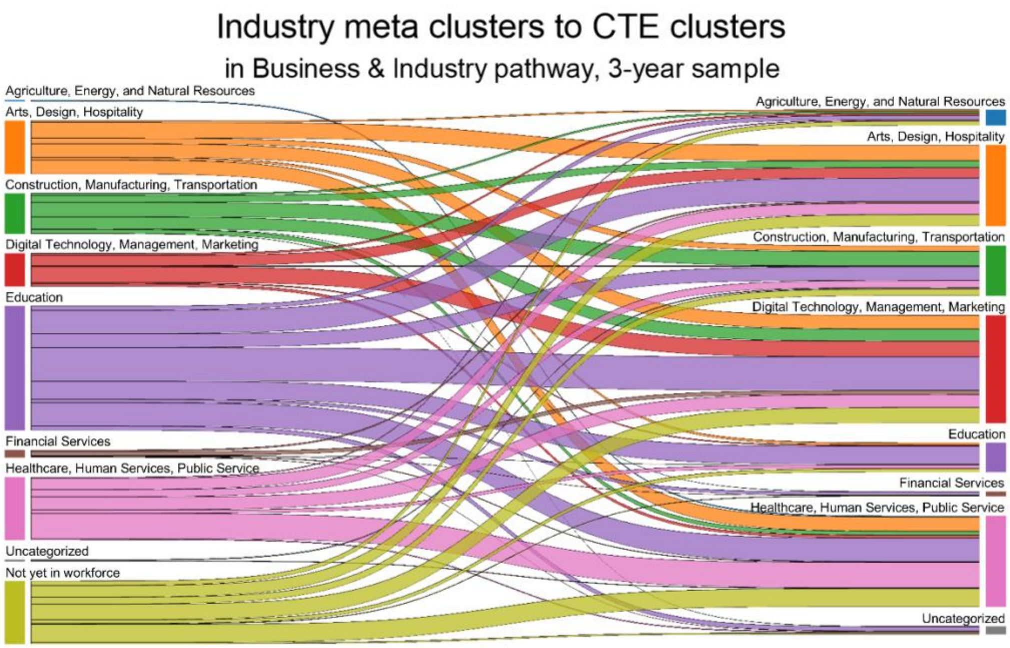
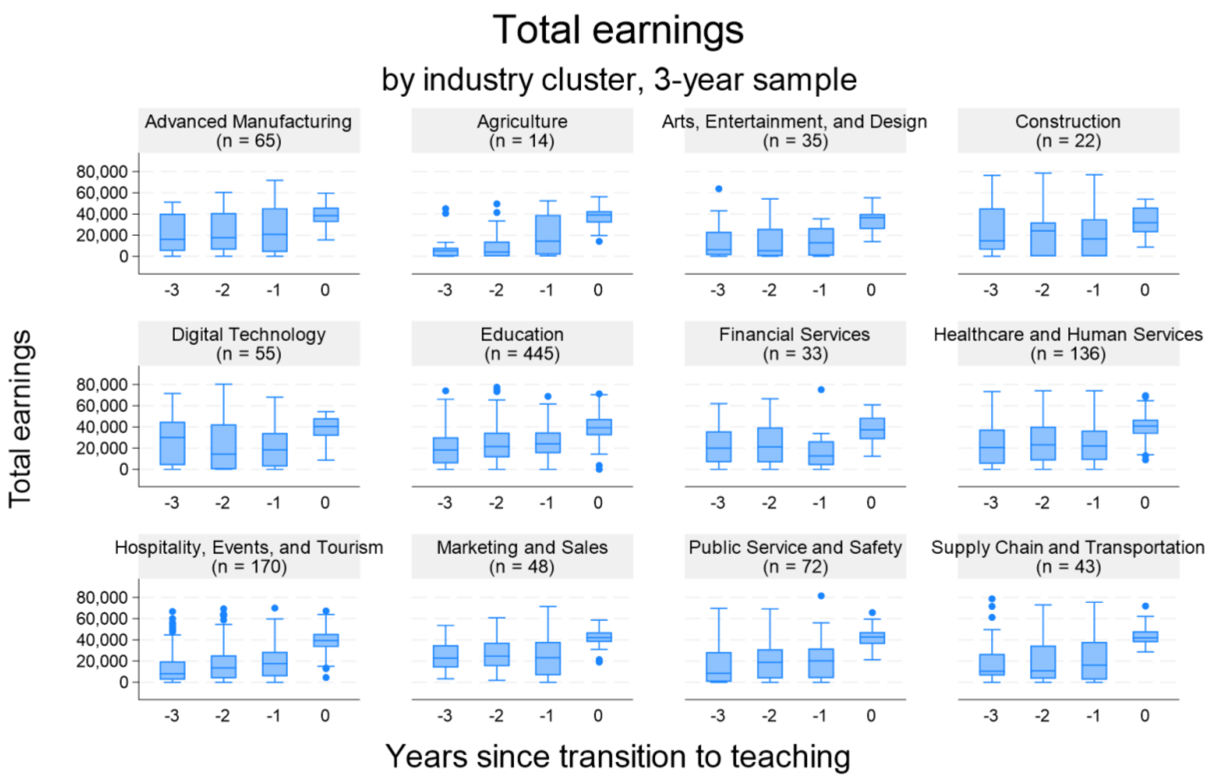
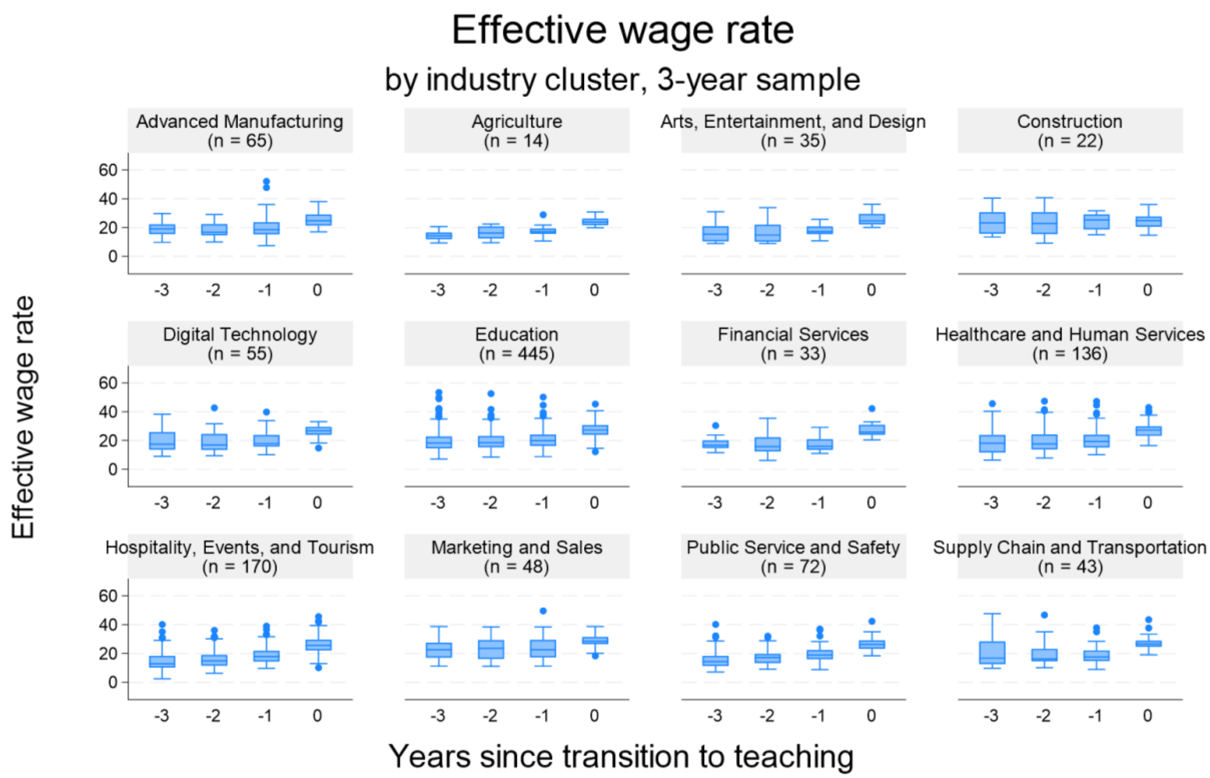


Figure 6. Distribution of total earnings in years leading up to transition to teaching, by prior industry



Notes: The box plots shown indicate the median earnings (horizontal line within box), 25th percentile and 75th percentile (edges of box), and upper and lower adjacent values (whiskers outside box). Dots outside the whiskers represent outlier data points.

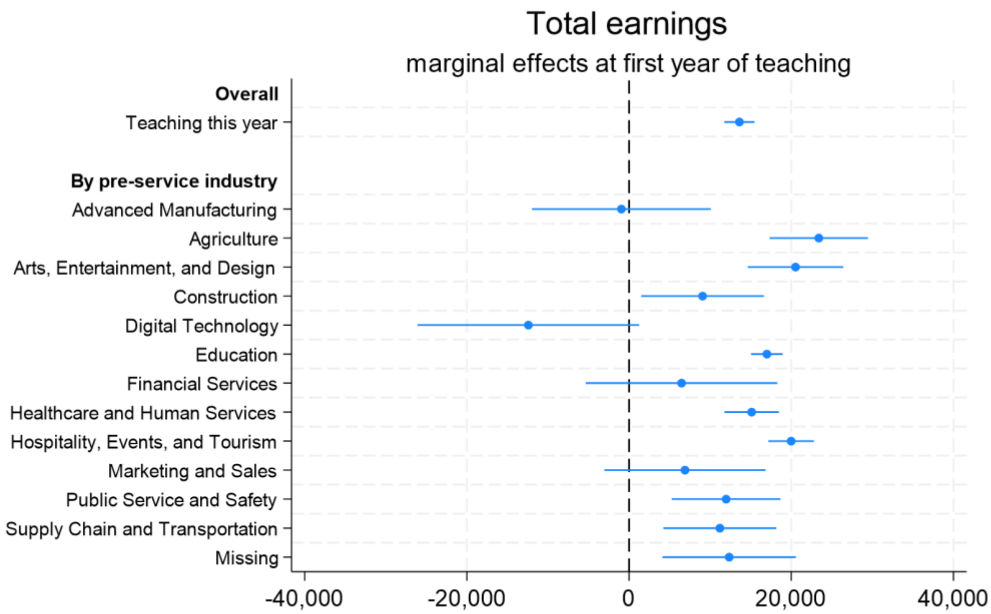
Figure 7. Distribution of effective wage rate in years leading up to transition to teaching, by prior industry



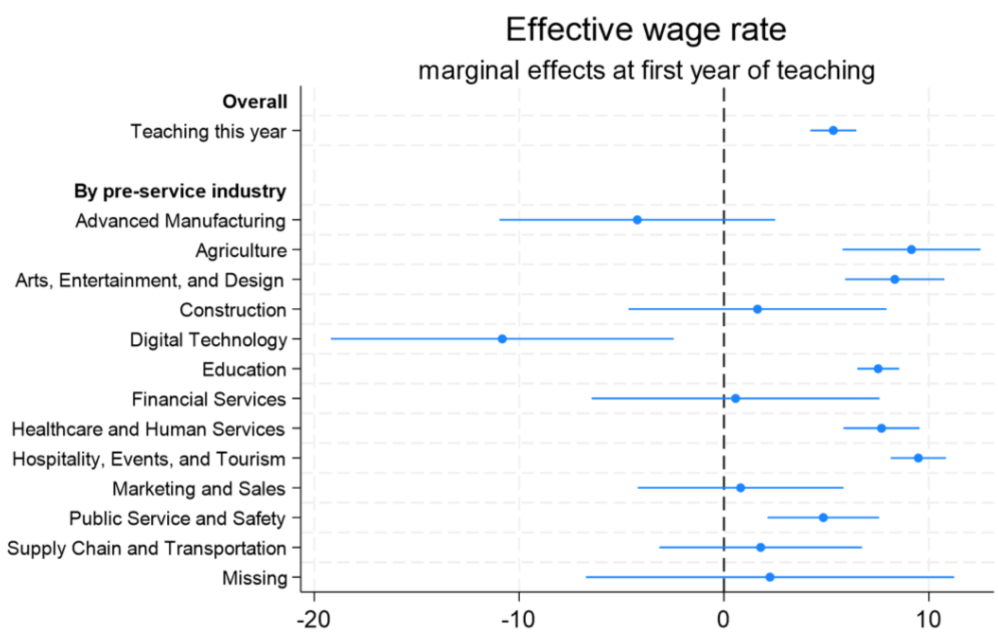
Notes: The box plots shown indicate the median earnings (horizontal line within box), 25th percentile and 75th percentile (edges of box), and upper and lower adjacent values (whiskers outside box). Dots outside the whiskers represent outlier data points.

Figure 8. Changes in earnings upon transition into teaching, overall and by prior industry

A. Total earnings



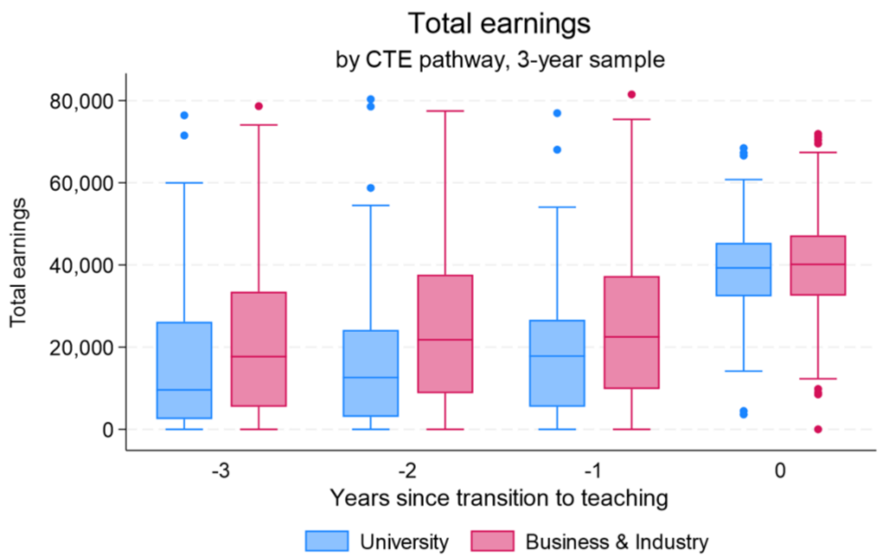
B. Effective wage rate



Notes: Blue lines represent 95% confidence intervals. Results are from regression models with individual fixed effects.

Figure 9. Distribution of total earnings in years leading up to transition to teaching, by pathway and prior industry

A. Overall



B. By prior industry

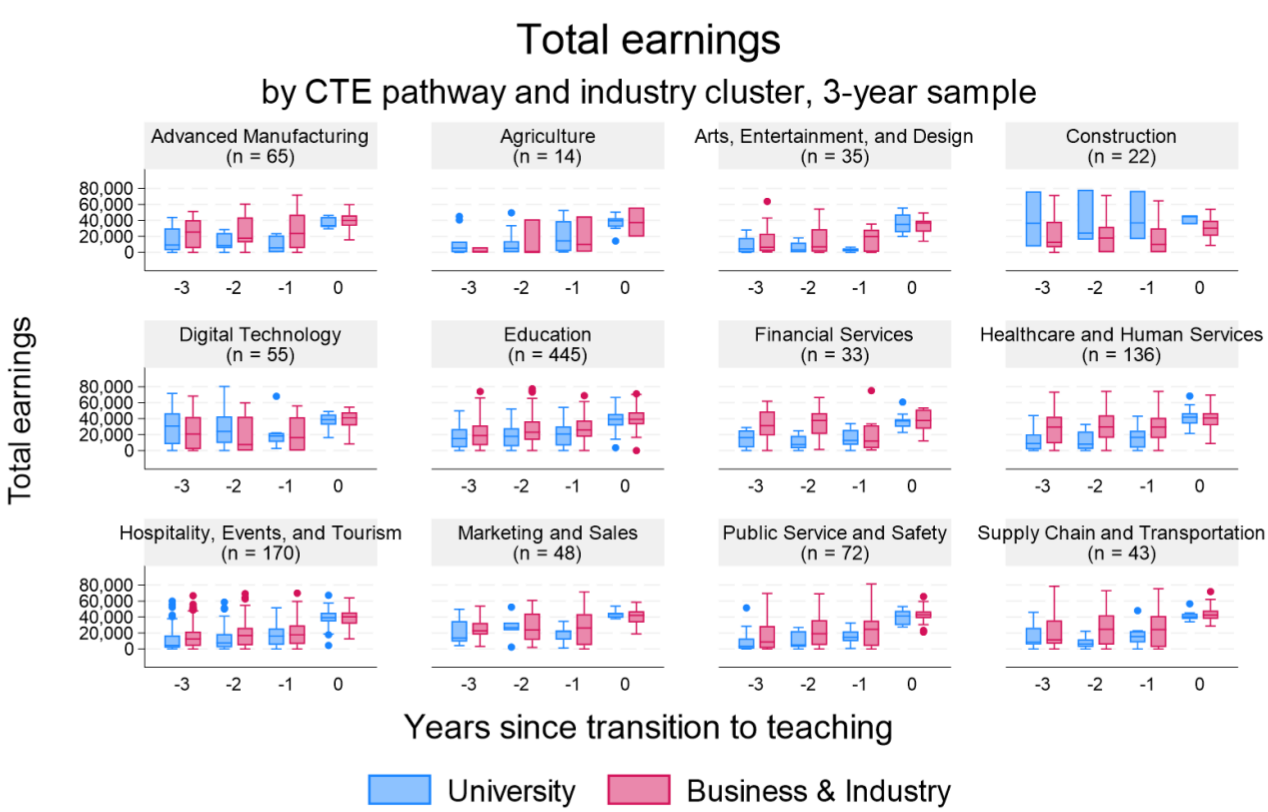
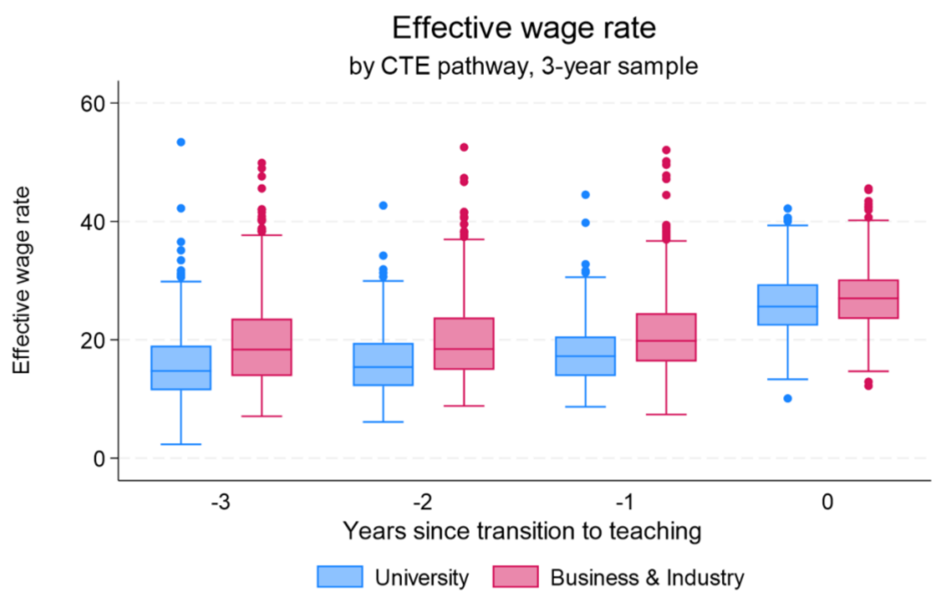


Figure 10. Distribution of effective wage rate in years leading up to transition to teaching, by pathway and prior industry

A. Overall



B. By prior industry

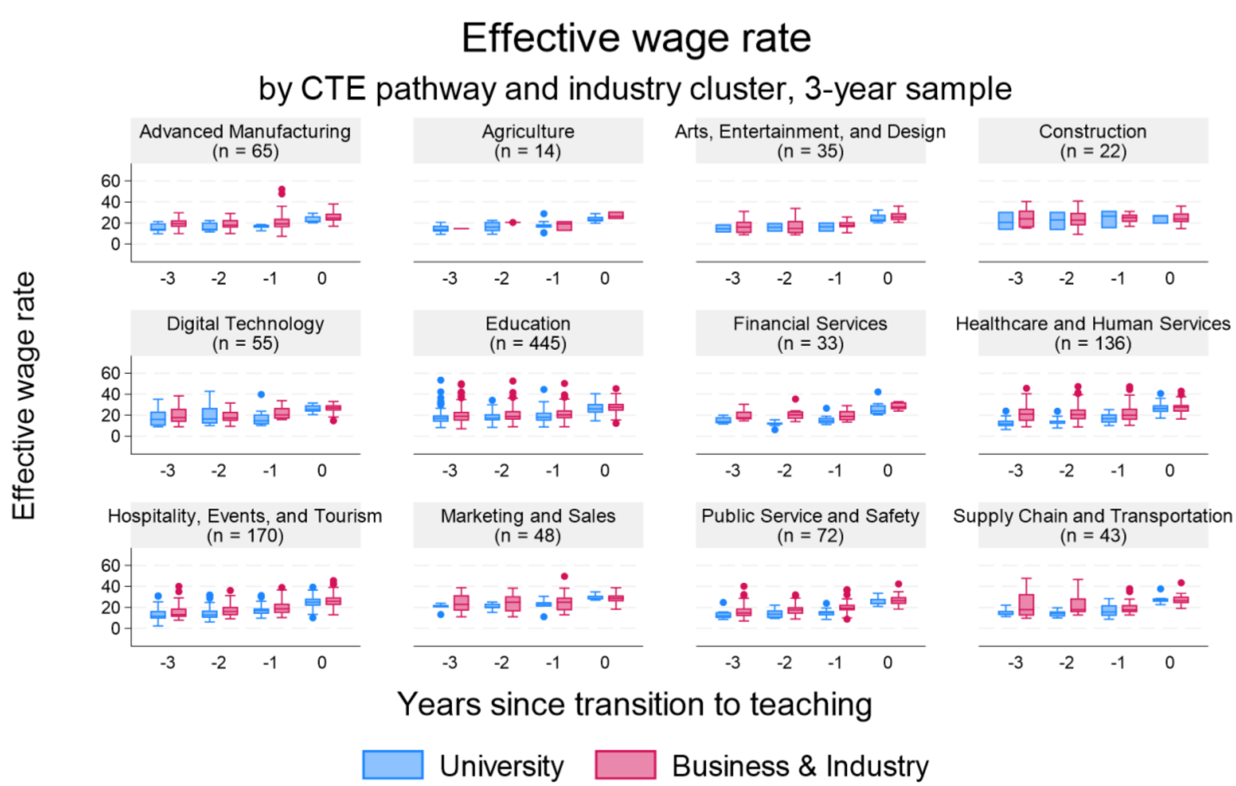
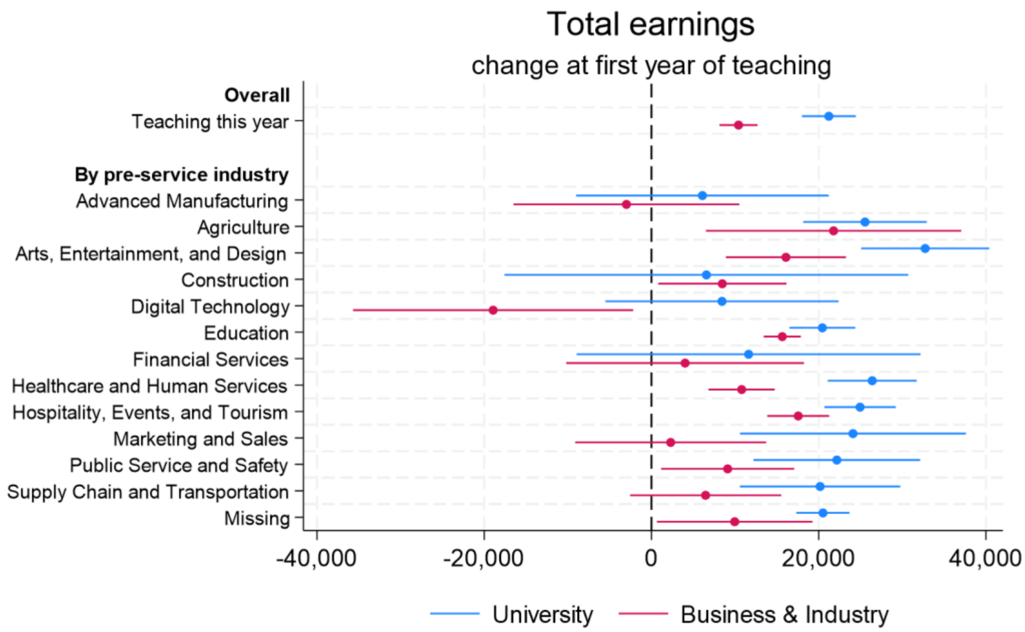
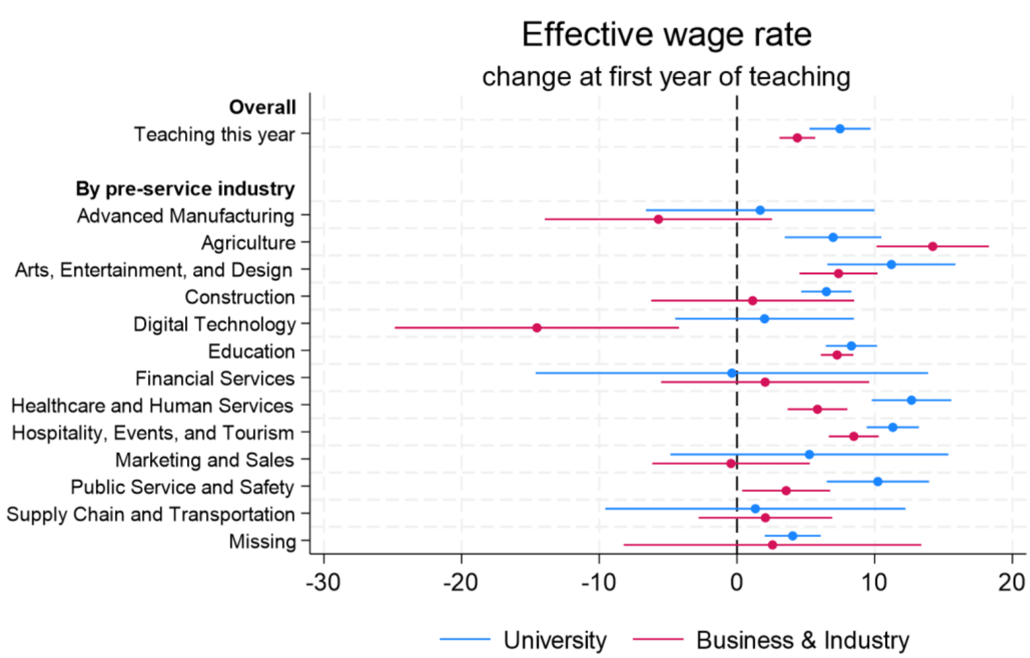


Figure 11. Changes in earnings upon transition into teaching by pathway, overall and by prior industry

A. Total earnings



B. Effective wage rate



Notes: Blue lines represent 95% confidence intervals. Results are from regression models with individual fixed effects.

Appendix

Appendix Table A1. Descriptive Statistics for All Analytic Samples

	1-Year Sample (n = 1634)		**3-Year Sample (n = 1144)**		**5-Year Sample (n = 759)**		**No pre-service data (n = 314)**
	Year before teaching	**First year teaching**	**Year before teaching**	**First year teaching**	**Year before teaching**	**First year teaching**	**First year teaching**
	mean	*mean*	*mean*	*mean*	*mean*	*mean*	*mean*
Employment outcomes							
Employed	0.94	1.00	0.92	1.00	0.92	1.00	1.00
Total earnings ($)	$27,049.20	$42,579.03	$30,464.02	$42,719.32	$31,880.70	$43,995.61	$40,220.61
Total hours worked	1045.66	1487.53	1125.15	1492.77	1156.23	1503.24	1313.00
Effective wage rate ($)	$22.96	$28.93	$23.62	$28.89	$24.24	$29.53	$30.51

	1-Year Sample (n = 1634)	**3-Year Sample (n = 1144)**	**5-Year Sample (n = 759)**	**No pre-service data (n = 314)**
	mean	*mean*	*mean*	*mean*
Teacher characteristics				
First teaching year	2015.41	2016.26	2017.12	2014.77
Birth decade				
< 1960s	0.08	0.05	0.02	0.11
1960s	0.10	0.08	0.04	0.13
1970s	0.12	0.08	0.04	0.17
1980s	0.18	0.14	0.06	0.16
1990s	0.03	0.03	0.01	0.03
Missing	0.51	0.63	0.83	0.41
Sex				
Male	0.46	0.47	0.49	0.49
Female	0.54	0.53	0.51	0.51
Race and ethnicity				
Hispanic	0.04	0.05	0.06	0.04
White, non-Hispanic	0.88	0.88	0.87	0.89
Black, non-Hispanic	0.03	0.03	0.02	0.02
Asian/Pacific Islander	0.02	0.02	0.02	0.03
Am Indian/Al Native	0.01	0.01	0.02	0.01
Missing	0.01	0.01	0.01	0.00
Education				
No degree	0.33	0.36	0.39	0.16
Bachelor’s	0.36	0.35	0.32	0.35
Master’s or higher	0.31	0.29	0.28	0.48
Teaching experience	2.95	2.68	2.67	5.06
Teaching experience cat				
< 5 years	0.74	0.76	0.76	0.56
5-10 years	0.18	0.18	0.18	0.25
11-20 years	0.05	0.04	0.04	0.16
> 20 years	0.02	0.02	0.02	0.03
CTE cert				
Full CTE cert	0.26	0.25	0.22	0.23
Temporary CTE cert	0.65	0.65	0.66	0.69
No CTE cert	0.04	0.05	0.05	0.05
No cert	0.04	0.05	0.07	0.04
CTE pathway				
University	0.30	0.30	0.30	0.31
Business & Industry	0.70	0.70	0.70	0.69

Notes: Teachers with no pre-service data include CTE teachers who began teaching between 2011 and 2019 whom we do not observe in the UI data at any point prior to teaching. These teachers are excluded from our 1-year, 3-year, and 5-year analytic samples. CTE certification and pathway shown reflect teachers' recorded certification and pathway status in their first year of teaching.

Appendix Table A2. Prior Employment and Earnings of CTE Teachers By Industry of Prior Employment, All Analytic Samples

	First Year Teaching			1 Year Before Teaching			3 Years Before Teaching			5 Years Before Teaching			
						1-year sample, start ≥ 2011							
Industry cluster	Employed	Earnings	Wage	Employed	Earnings	Wage	Employed	Earnings	Wage	Employed	Earnings	Wage	N
Overall	1.00	$42,449	$28.93	0.94	$25,261	$22.96							1634
Advanced Manufacturing	1.00	$43,743	$27.67	0.87	$47,513	$32.16							55
Agriculture	1.00	$41,653	$26.23	1.00	$16,182	$13.81							10
Arts, Entertainment, and Design	1.00	$39,442	$26.84	0.87	$11,739	$18.72							31
Construction	1.00	$37,729	$27.34	0.83	$21,612	$23.91							23
Digital Technology	1.00	$56,817	$35.42	0.77	$50,331	$44.16							44
Education	1.00	$42,103	$29.64	0.98	$22,897	$22.29							1024
Energy and Natural Resources	1.00	$47,063	$27.62	1.00	$56,465	$29.35							1
Financial Services	1.00	$42,478	$26.79	0.97	$34,978	$29.57							30
Healthcare and Human Services	1.00	$42,473	$26.88	0.91	$27,628	$21.14							145
Hospitality, Events, and Tourism	1.00	$40,094	$26.15	0.89	$20,124	$18.31							133
Marketing and Sales	1.00	$42,150	$29.24	0.82	$28,632	$29.15							38
Public Service and Safety	1.00	$44,168	$27.15	0.95	$30,429	$23.52							62
Supply Chain and Transportation	1.00	$44,719	$29.42	0.76	$31,892	$27.10							33
Missing	1.00	$41,290	$27.24	0.80	$32,920	$19.61							5
						3-year sample, start ≥ 2013							
Industry cluster	Employed	Earnings	Wage	Employed	Earnings	Wage	Employed	Earnings	Wage	Employed	Earnings	Wage	N
Overall	1.00	$42,570	$28.89	0.92	$27,774	$23.62	0.92	$27,551	$22.68				1144
Advanced Manufacturing	1.00	$42,085	$27.80	0.88	$36,184	$29.21	0.88	$49,194	$33.86				65
Agriculture	1.00	$37,315	$23.90	0.93	$17,922	$17.46	0.79	$9,307	$14.47				14
Arts, Entertainment, and Design	1.00	$37,995	$27.95	0.86	$16,870	$19.82	0.94	$13,417	$17.78				35
Construction	1.00	$36,245	$26.48	0.77	$22,240	$27.53	0.86	$25,558	$26.84				22
Digital Technology	1.00	$51,135	$34.06	0.80	$42,870	$44.25	0.89	$64,876	$41.98				55
Education	1.00	$43,260	$29.78	0.96	$28,862	$22.97	0.94	$23,369	$21.64				445
Financial Services	1.00	$41,837	$28.10	0.97	$29,921	$28.09	0.91	$39,010	$24.28				33
Healthcare and Human Services	1.00	$41,558	$28.33	0.91	$27,720	$22.01	0.92	$25,755	$19.97				136
Hospitality, Events, and Tourism	1.00	$40,143	$26.68	0.94	$20,984	$19.15	0.90	$17,680	$16.36				170
Marketing and Sales	1.00	$42,543	$30.36	0.85	$23,097	$24.41	0.98	$36,219	$28.95				48
Public Service and Safety	1.00	$44,020	$27.99	0.96	$29,065	$22.98	0.86	$29,798	$22.11				72
Supply Chain and Transportation	1.00	$45,012	$29.51	0.86	$28,127	$23.38	0.93	$31,207	$24.38				43
Missing	1.00	$41,255	$27.22	0.83	$25,765	$21.03	0.83	$28,280	$21.31				6
						5-year sample, start ≥ 2015							
Industry cluster	Employed	Earnings	Wage	Employed	Earnings	Wage	Employed	Earnings	Wage	Employed	Earnings	Wage	N
Overall	1.00	$43,822	$29.53	0.92	$28,898	$24.24	0.90	$31,313	$23.75	0.93	$26,828	$22.32	759
Advanced Manufacturing	1.00	$44,985	$29.08	0.90	$44,622	$32.99	0.88	$65,516	$42.16	0.90	$53,387	$36.25	42
Agriculture	1.00	$39,828	$25.16	1.00	$21,902	$17.11	0.92	$16,452	$15.17	1.00	$13,640	$13.26	13
Arts, Entertainment, and Design	1.00	$40,043	$28.45	0.84	$17,976	$18.91	0.88	$13,787	$18.12	0.84	$11,828	$16.08	32
Construction	1.00	$41,357	$27.40	0.84	$18,572	$25.03	0.80	$24,806	$27.43	0.84	$17,935	$23.48	25
Digital Technology	1.00	$58,355	$38.16	0.85	$53,629	$52.23	0.88	$85,201	$49.61	0.94	$69,113	$44.28	33
Education	1.00	$44,105	$30.31	0.95	$29,099	$23.17	0.93	$27,106	$21.82	0.96	$23,277	$20.96	244
Financial Services	1.00	$42,722	$28.50	0.96	$33,546	$30.89	0.85	$43,966	$27.31	0.93	$37,666	$23.55	27
Healthcare and Human Services	1.00	$41,385	$28.65	0.93	$26,813	$22.24	0.93	$27,226	$19.85	0.94	$21,377	$19.34	100
Hospitality, Events, and Tourism	1.00	$42,526	$27.83	0.91	$21,556	$19.41	0.86	$19,683	$17.88	0.87	$15,373	$14.63	129
Marketing and Sales	1.00	$44,255	$30.32	0.86	$22,216	$20.95	1.00	$32,878	$25.13	1.00	$34,832	$27.36	29
Public Service and Safety	1.00	$44,609	$29.35	0.95	$35,288	$23.62	0.89	$35,065	$24.06	0.93	$34,974	$25.08	56
Supply Chain and Transportation	1.00	$44,482	$29.89	0.80	$31,132	$27.28	0.84	$37,029	$28.21	1.00	$41,210	$29.04	25
Missing	1.00	$44,881	$30.40	1.00	$24,781	$22.17	0.50	$5,617	$25.77	0.50	$4,764	$35.04	4