# Do Mid-Career Teacher Trainees Enter and Persist Like Their Younger Peers?

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In the context of an ongoing national conversation about teacher shortages, we build on prior literature on the efficacy of teacher certification pathways by comparing entry and exit patterns based on age at the time of certification. All trainees who complete a state certification process have invested substantial time and resources into entering teaching. Competing employment opportunities and expectations might vary with age. We use both linear regression and discrete-time hazard models to examine employment and subsequent exit of newly certified teacher trainees in Michigan from 2011 to 2023. We find that while mid-career entrants in their 30s and 40s compose a small share of new certificates, they are more likely to enter a teaching position and no more likely to subsequently exit than counterparts who were certified in their early 20s. Mid-career pathways also contribute to teacher diversity by attracting more Black and male teachers who enter and persist.

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**Abstract**

In the context of an ongoing national conversation about teacher shortages, we build on prior literature on the efficacy of teacher certification pathways by comparing entry and exit patterns based on age at the time of certification. All trainees who complete a state certification process have invested substantial time and resources into entering teaching. Competing employment opportunities and expectations might vary with age. We use both linear regression and discrete-time hazard models to examine employment and subsequent exit of newly certified teacher trainees in Michigan from 2011 to 2023. We find that while mid-career entrants in their 30s and 40s compose a small share of new certificates, they are more likely to enter a teaching position and no more likely to subsequently exit than counterparts who were certified in their early 20s. Mid-career pathways also contribute to teacher diversity by attracting more Black and male teachers who enter and persist.

## 1. Introduction

Nationwide teacher shortages have highlighted gaps in the teacher preparation pipeline and the need to recruit more future teachers. While much discussion has centered on the need to build more robust educator preparation programs (EPPs), states can choose from many policy options when investing in the pipeline. Ideally, public investments will result in long and productive teaching careers for the beneficiaries of these investments and substantial returns to public education. While most teachers still come through undergraduate education programs at universities, evidence suggests that traditional bachelor's degree programs might not be the most efficient target for further expansion. In many states, a large share of undergraduate education majors never enter teaching (Cowan et al., 2016; Goldhaber et al., 2022), and universities are seeing declining interest in education majors and teacher career preparation among first-time college students (Bartanen & Kwok, 2023). Policy innovations in teacher training often include efforts to bring mid-career professionals into teaching through alternative pathways such as graduate-level university programs, fellowship programs, and other accelerated routes for those who already have a bachelor's degree. Prior research suggests that students of alternative route teachers perform as well as students of graduates of undergraduate pathways (e.g., Goldhaber, 2000; Glazerman et al., 2006), but less attention has been paid to the entry and exit behavior of post-baccalaureate program completers (see Zhang & Zeller, 2016 for a notable exception). Job entry and persistence rates of EPP completers are critical factors in determining which pathways should be expanded to bolster the teacher workforce in the long run.

In this study, we focus on the relatively understudied influence of teacher age at career entry. Using the framework for EPP typologies in Lincove et al. (2015), we differentiate university-based programs for undergraduates ("traditional" certificate pathways) from programs

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for individuals who have already completed a bachelor's degree ("alternative" certificate pathways), which may be offered by many types of organizations including universities, community colleges, school districts, and private for-profit and non-for-profit organizations. A key characteristic of most alternative certification pathways is that they require a completed bachelor's degree and sometimes additional work experience. Relative to undergrad programs, alternative programs attract older, mid-career teacher candidates. While mid-career professionals might provide an attractive new pool of potential teachers, it is unclear whether older teacher trainees will be more or less likely than typical undergraduates to complete the training, enter a teaching job, and persist in a long-term teaching career. It is possible that trainees who enter mid-career have a stronger commitment to teaching and are therefore more likely to be employed as teachers in the long run. Alternately, mid-career trainees might have higher opportunity costs in other industries that make them less likely to eventually enter and persist in a public-school teaching position.

Using data from Michigan, we examine the relationship between age at initial certification and entry and persistence in public school teaching. Certification is a critical step to teacher employment in all public schools in Michigan (both traditional public and charter schools) that requires completion of multiple years of coursework and student teaching. Thus, certification signals a substantial commitment to future teacher employment. However, over the ten-year period of this study, only 45% of those who completed EPP training and received a Michigan teacher certificate entered teaching in the year following certification, and 32% never taught in a Michigan public school across the length of our panel. This suggests that substantial public and private investments in teacher training do not deliver the intended benefits for public education.

To investigate the role of age in entry and persistence, we follow six cohorts of newly certified EPP completers and track them forward for up to nine years from initial certification through employment in the Michigan public school system. To understand the role of macro labor market conditions, the time-period studied ranges from 2011 to 2023, which includes periods of over-supply of teachers and periods of teacher shortages. We use linear probability models and hazard/survival analysis to estimate differences in entry/exit probabilities across teacher age groups, controlling for other characteristics such as demographics and performance on pre-service exams. We also investigate differential age effects for high-demand teaching specializations such as STEM, special education, and English as a Second Language (ESL) endorsements. Finally, we examine how age interacts with race and gender to inform efforts to diversify the teacher workforce.

The results provide several insights into the efficacy of public investments in recruiting mid-career professionals into teaching. While most teachers were certified in their early 20s, rates of entry into teaching jobs were higher for those who entered in their 30s or 40s, both in unconditioned regressions and when conditioning on teacher characteristics associated with sorting into EPPs and teaching positions. After entry, we find that older entrants are no more likely to exit teaching within the first three years of teaching than younger entrants. Gaps in entry probabilities by age are larger for male teachers, and older Black teacher entrants were significantly less likely to exit than those certified in their early 20s. This suggests that investments in recruiting older teacher trainees might both increase and diversify the pool of potential teachers with greater efficacy in terms of long-term persistence in the profession.

## 2. Framework and Prior Literature

In this study, we build on three overlapping streams in the literature on teacher training and employment. First, we add to the large and broad literature on factors that influence entry into and exit from public school teaching. The extant literature documents both low rates of entry into the profession after certification and high rates of exit after entry (Goldhaber et al., 2022). Past studies highlight several factors that influence entry and exit behavior. Novice teachers are more likely to exit, with 14 percent leaving within one year and 33 percent within three years (Ingersoll, 2003). High ability college students are both less likely to enter the profession and more likely to exit (Podursky et al., 2004). Once employed, more effective teachers are more likely to remain in the classroom, while additional training, such as National Board Certifications, can predict exit instead of persistence or quality improvement (Goldhaber & Hansen, 2009; Goldhaber et al., 2010). We add to this literature by investigating the effects of teacher age, highlighting that age can serve as a proxy for the unexamined effects of entering teaching as a second career with opportunity costs in other employment sectors.

Second, we contribute to literature that investigates the implementation and effects of alternative pathways into teaching. While the overall objective is to understand effects of alternative pathways in general on the teacher supply and teacher quality, the literature highlights that alternative routes differ substantially both across and within states. Alternative routes generically refer to programs that enroll individuals who already have a bachelor's degree, most likely in a non-education field, and provide only the coursework and student teaching experiences specifically required for teacher certification. Importantly for this study, alternative EPPs generically encompass both programs that target recent college graduates with no work experience (such as Teach for America) and programs that target older workers who may have

had long careers in another sector (such as mid-career teaching fellowships). Like alternative EPPs themselves, findings regarding the efficacy of alternative EPPs are heterogeneous, with some finding that alternative route options decrease teacher qualifications, while others find that the least restrictive alternative routes attract the most qualified prospective teachers (Shen, 1997; Boyd et al., 2011; Sass, 2015). Looking at the value-added effects of different program types in Texas on the standardized test performance of students of program graduates, Lincove et al. (2015) find that alternative programs produce teachers of similar quality to traditional, university programs and can be a critical source of teachers in communities that are not located near a large university. Despite the likely age differences between the typical university undergraduate and candidates targeted by many alternative programs, there is little information in the extant literature about whether alternative training programs that target older applicants have similar success to those that target new college graduates. Although our focus is on age rather than EPP pathways, we add to this literature by examining age as a unique mechanism. Further, because we are able to observe all certified trainees and not just employed teachers, we can focus on the relatively neglected step of initial entry for certified EPP completers, as well as the decision to persist or exit once employed.

Finally, we draw on occupational change literature within the broader study of labor markets in general. These studies look at the propensity of workers to switch occupations and their reasons for doing so, noting that workers are drawn to a second profession in pursuit of both economic and intrinsic rewards (Chambers, 2002; Serow and Forrest, 1994; Zimmerman et al., 2020). This literature suggests that mid-career trainees might have higher commitment to enter and persist in teaching than younger peers. However, low entry salaries that typically do not reward work experience outside teaching and the steep learning curve for novice teachers might

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reduce both economic and intrinsic benefits for mid-career teachers with outside options. The literature provides little evidence on outcomes for workers who switch careers. We begin to resolve this ambiguity by examining whether older individuals who complete certification for an intended new career in teaching enter and persist in that career at a differential rate than their first-career peers.

### 3. Michigan Context and Data

Michigan offers a compelling context in which to study the entry and exit behavior of career-switchers. All teachers at publicly funded K-12 schools (including charter schools) must be certified by the state. EPP providers are approved and regulated by the Michigan State Board of Education (SBE), which since 2005, has restricted the entry of new EPP providers to only those that target specific needs in the state. Currently, nine non-university EPP providers train less than 3% of newly certified teacher candidates each year. Most new teachers of all ages are trained by universities whether they pursue traditional undergraduate or alternative post-graduate pathways. Michigan's EPP market includes 31 university-based providers that offer a total of 31 programs that target undergraduates and 29 alternative programs that offer post-baccalaureate training. Since the same universities are training traditional and alternative pathway teachers, the variation in content and quality between the two pathways is likely smaller in Michigan than in other settings with a more diverse market of alternative EPPs (Lincove et al., 2015).

Historically, the number of initial certificates in Michigan has exceeded the number of newly hired teachers, but after 2013-14, the state began to experience a shortage (Stackhouse, 2017). In addition to the low rates of entry for newly certified trainees reported above, the pool of applicants was substantially reduced, with the number of new certificates falling by 48% between 2012 and 2020. Like many states, Michigan also experiences a mismatch between

teacher and student demographics. While 64% of students are white, 18% Black, and 9% Hispanic, the population of Michigan teachers is 92% white and 78% female. Given the growing literature that highlights the importance of gender, race, and ethnicity-matched teachers for students of color (Dee, 2007; Todd and Wolpin, 2007; Reardon and Galindo, 2009; Fryer and Levitt, 2013; McGrath & Sinclair, 2013; Lindsay and Hart, 2017; Harbatkin, 2021), it is important to understand which pathways are most accessible and attractive for male trainees and trainees of color. Since 2020, Michigan has invested over $1 billion in new teacher recruitment efforts including expanding alternative pathways, such as "grow your own" district-run EPPs and mid-career fellowships, and increasing undergraduate EPP enrollment (Ackley, 2023). It is against this backdrop that we examine the historic entry and exit behavior of newly certified teachers by age group, with a special focus on differential effects among Black and male teacher trainees.

Our analysis employs data from administrative certification, testing, and employment records provided by the Michigan Department of Education (MDE) and the state's Center for Educational Performance Information (CEPI). Certification records are available from 2011-12 school year to 2022-23, and contain information on EPP, certificate type, and special teaching endorsements. We merged this information with teacher employment records from 2012-2013 through 2022-23 to observe post-certification employment in Michigan public schools. These records contain employee demographic information, employer information, job assignments, and scores on the Michigan Test for Teacher Certification (MTTC), which is required for Michigan teacher certification.[3]

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[3] Until 2013, the MTTC was based on the Basic Skills Test (BST) in reading and math. Starting in 2014, the BST was replaced by the Professional Readiness Exam (PRE). To address the change in tests, we standardized scores within test and year to a mean of 0 and standard deviation of 1. Starting in 2018, candidates could also substitute

To create our sample, we begin with all individuals who completed a Michigan EPP program, received passing scores on MTTC exams in reading and math, and were issued their first Michigan teaching certificate between 2012-13 and 2017-18.[4] To focus on newly certified trainees, we exclude those who had a teaching certificate in a prior period, those with a first certificate that required prior teaching experience, and those with work history in a teaching role in a Michigan public school in a prior period (dating back to 2003).

Importantly, the job market for teachers in Michigan changed substantially during the period studied, and macro labor market conditions might interact with age in determining entry and exit. Some experienced a relatively tight market for candidates in the early 2010s, when overall public-school enrollment was declining, and the number of teacher candidates was growing. Others entered during periods of unmet demand, and some also faced classroom disruptions related to COVID beginning in 2019-20. For this reason, we group trainees into cohorts based on the first full school year for which they were eligible for teacher employment. For example, trainees issued an initial certificate from Sept 1, 2012 to August 31, 2013, would be assigned to the 2013-14 cohort. We then follow each cohort for at least five years (up to ten years for earlier cohorts) to observe: 1) if and when they enter a teaching job in Michigan, and 2) conditioned on entry, if and when they exit. We report both aggregate results and results by cohort to observe how broader labor market conditions are a moderating influence on entry age.

Our primary independent variable is age at certification, which we identify through the individual's birth year and initial certificate date. There is no set age for completing

recent SAT or ACT scores, and in these cases, we are missing data for MTTC. This is the case of approximately 4% of new certificates during the period studied. We discuss the impact of missing test data in the results section.
[4] We include those issued a Standard, Standard CTE, or Interim Certificate. This excludes those issued Temporary Teaching Certificates, which are issued to teacher who were prepared at out of state EPPs.

undergraduate education, and we don't observe employment history outside of Michigan public schools. To safely differentiate those who are most likely entering soon after undergrad and those who are likely changing careers, we place those aged 22–25 years into the "20s" age group and those aged 30-49 in the "30s and 40s" age group.[5] Anyone outside of these two age groups at initial certification is omitted from our core analyses, with robustness checks offered in Section 5.[6] We also use administrative data to identify other characteristics that might be associated both with employment outcomes and age at certification. From MTTC records, we create within-cohort z-scores (mean=0, standard deviation=1) for reading and math exams. From demographic records, we create indicators for Black, Hispanic, white, other races, and male. Finally, from certification records, we identify whether teachers have additional Michigan endorsements in hard-to-staff areas (STEM, Special Education, and ESL) that might increase the probability of employment and persistence.

## 4. Summary Statistics

Table 1 describes characteristics and job entry rates for newly certified teacher trainees by certificate year and age group for our analytic sample, which includes those initially certified at 22-25 years old (Panel A) or 30-49 years old (Panel B). Across certificate year cohorts, 11-13% of the analytic sample were in the older group. Older teachers across all cohorts have higher MTTC reading scores by approximately 0.25 standard deviations but slightly lower or comparable MTTC math scores. Older teachers also reflect substantially greater diversity by race

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[5] In section 5, we show that our results are robust to and not driven by different age classifications. See Figure A1 for the full distribution of certificates by age. The vast majority of those certified in their 20s are certified by age 25.

[6] In some contexts, there might be concerns that mid-career switchers are often current school employees, such as instructional aides, who are seeking promotions to teaching. We found this to be quite rare in the Michigan context. Fewer than 4% of those certified in their 30s and 40s and fewer than 1% of our whole sample have any prior paraprofessional work history in Michigan public schools before licensure.

and gender. For example, 2012-13 cohort members in their 20s were only 2% Black and 23% male, while older members were 9% Black and 34% male. The two age groups have similar rates of additional endorsement in STEM, special education, and ESL. We also note important differences between cohorts over time. In 2012-13, when Michigan had an over-supply of trainees, mean MTTC scores, as a proxy for academic aptitude, are highest in that year and decline substantially through 2017-2018 when teacher hiring was a greater challenge. Similarly, the number of newly certified trainees is substantially higher in the early 2010s, as is the racial and gender diversity within both age groups. Table 1 also reports rates of entry into teaching positions within three and five years by certification cohort and age group. Over time, 3-year entry rates increase substantially from approximately 55% to over 70%, as the teacher labor market shifted from an over-supply to the beginning of the current shortage. For every certification year, rates of both 3- and 5-year entry are higher for older teachers by as much as 8 percentage points.

We further illustrate the first five years of employment outcomes over time by age group in Sankey plots displayed in Figure 1. To illustrate five full years of outcomes, we include members of the 2012 to 2017 cohorts, with those certified in their early 20s displayed in Panel 1A and those certified in their 30s and 40s in Panel 1B. We divide employment outcomes into three categories: teaching, other, and not observed. The teaching category contains those employed in a teaching position in any Michigan K-12 public school, including charter schools. Other refers to employment in a public school or district office but in a non-teaching position. This category includes primarily substitute teachers, aides, and support staff.[7] The not observed

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[7] Due to small numbers, we also count administrative and principal positions as "other." Moving to a principal position might be considered a positive outcome for a teacher, compared to, for example, working as an aide because a teacher position as not available. However, only 0.31% of our sample is observed in the role of principal during the length of the panel.

category contains those not employed in a Michigan public school who might be employed in another state or another sector. We construct these categories to be mutually exclusive, giving preference to counting an individual as a teacher. For example, someone who is employed as a teacher, a substitute, and an athletic director in the same year is counted in the teaching category only. Data labels show the percent of the age group in each Sankey bar.

Several interesting trends emerge in these figures. During the first post-certification year, the proportion of newly certified trainees in teaching positions is about 45% in both age groups. After year one, the proportion in teaching positions rises in both groups but is always higher for those certified in their 30s or 40s. By year 5, 49% of the younger group is teaching, compared to 54% of the older group. Over time, 4-5% of those employed as teachers exit each year in both age groups. We also observe continued entry each year that comes mostly through trainees who were employed in the "other" category in the prior year. This suggests that many newly certified teachers accept other school district jobs first, including substitute and aide positions, while they wait for a teaching position, and they might use non-teaching roles to increase the likelihood of being hired for future teaching openings. There is very little inflow from the "not observed" category to teaching, suggesting that if newly certified teachers are not connected with public school employment within their first year, they are unlikely to ever enter. Finally, we observe that continued inflow from other employment is more common in the older age group than those certified in their 20s.

The Sankey plots and summary statistics provide several insights into the teacher pipeline. First, a large portion of Michigan trainees who complete certification never teach in the state's public schools. Second, entry into public school employment soon after certification is

critical for future teacher employment. And third, both initial and subsequent entry rates are higher among those who enter older.

## 5. Regression Analysis and Results

### *Entry into Teaching*

Our first empirical objective is to estimate age group differences in the probability of entering a teaching position after initial certification. We do this first by sequential linear estimation for being employed as a teacher in the first, second, and third years after certification. We estimate for trainee *i,* in year *t,* who was initially certified with cohort *j*:

$$Entry_{ijt} = \alpha + \boldsymbol{\beta_1 X_i} + \beta_2 Older_i + \beta_3(Older_i \cdot Black_i) + \beta_3(Older_i \cdot Male_i) + \delta_j + \varepsilon \ (1)$$

where $Entry$ is a binary variable equal to 1 if individual $i$ has entered a teaching job in a Michigan public school prior to year $t$, and equal to 0 otherwise. $X$ is a matrix of time-invariant individual characteristics including race/ethnicity, gender, MTTC scores, and extra pre-service endorsements in STEM, special education, or ESL that indicate preparation for harder-to-staff positions. These variables are selected to control for differential characteristics that might be associated with both teacher age and employment outcomes. *Older* is equal to one if the teacher was 30-49 years old at initial certification and equal to zero otherwise (i.e. age 22-25 years). We estimate both the average difference by age group ($\beta_2$) and interactions between age group and race and gender ($\beta_3$ and $\beta_4$, respectively) to identify any differences specific to critical areas of teacher diversity.[8] $\delta_j$ controls for macro labor market conditions as a certification cohort fixed-

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[8] Other racial subgroups in the sample are too small to test interaction terms.

effect, and $\varepsilon$ is random error. For ease of interpretation of coefficients, we estimate (1) as a linear probability model through OLS.

Estimates of equation (1) are presented in Table 2, where column (1) displays the probability of entering by year 1, column (2) by year 2, and column (3) by year 3. The omitted group in these estimates is a white, non-Hispanic female who is 22-25 years old and has no extra endorsements at initial certification. On average overall, the two age groups are equally likely to enter in year 1. Teachers who are Black and with special endorsements are more likely to enter, and males are slightly less likely to enter, though not significantly so. However, the interaction term for age x male suggests that older males are significantly more likely enter. Combining the relevant coefficients and interactions, white males in their 30-40's are more likely to enter the Michigan public teacher workforce than younger white females by about 3 percentage points by the first year after certification. Over time, we see a growing gap in entry rates where older teachers are more likely to enter by 4.4 percentage points by year 2, and by 6.4 percentage points by year 3. Black trainees across all three years are also more likely to have entered than white trainees. Male trainees are always less likely to enter than female trainees in the younger age group, but the interaction term between age x male suggests that males in their 30-40s are either more likely or similarly likely to enter than females in that age group.

We acknowledge that this descriptive evidence might be influenced by sample selection decisions. One concern is that the somewhat arbitrary cut-points that we selected for age groups influence our results. In appendix Table A1, we show that these results are robust to expanding the 20s age group to including those certified ages 21-29. A second concern is, as noted above, that we excluded those without pre-service MTTC scores from our sample, this eliminated 2.5% of those certified in their 30s and 40s and 5% of those certified in their 20s. As trainees who do

not go on to be employed are less likely to be associated with their test scores in the data set, those eliminated from the sample were less likely to enter teaching. The higher rate of missingness among the 20s groups likely biases our entry results downward, meaning the true effect of being older when certified on entry is likely higher than 6.4 percentage points.

We next use a discrete Cox proportionate hazard model to also consider the issue of *time-to-entry*. Cox proportionate hazard models predict the likelihood of an event, in this case becoming an actively employed public school teacher, occurring across multiple observations of an individual. This approach considers not only whether a certified individual enters teaching each year, but also the influence of time on entry probabilities. In this case, it is likely that the probability of entering teaching diminishes over time for individuals who are not employed soon after certification, as many are likely employed in other sectors. The hazard model requires multiple observations of individuals over time, with each trainee remaining in the longitudinal data until they are first employed as a teacher. We follow trainees for five to ten years, depending on the certificate year relative to the end of the panel. The discrete Cox proportionate hazard without controls variables is:

$$h(entry|X, Age\ Group) = k(t) + exp(\gamma_2 Older) + \varepsilon\ (2)$$

where $k(t)$ is the discrete baseline hazard function, which accounts for time. Results from three different specifications of equation (2) are presented in Table 3. The simple bivariate relationship between age groups is presented in column (1), certificate-year cohort fixed effects are added in column (2), and in column (3) we add full controls for sex, race/ethnicity, specialized endorsements on initial certificate, and MTTC scores and interactions for age x Black and age x male. Across specifications, we estimate that older trainees have a significantly higher log entry hazard of 0.139-0.154, or approximately an 11% higher probability of entry than an otherwise

similar younger trainee. The estimated difference due to age gets larger not smaller when adding control variables, suggesting other teacher characteristics are not driving the findings regarding age. The hazard model further substantiates higher entry rates for Black and male trainees in their 30-40s, though neither is statistically significant.

The tabled results mask cohort differences in the macro labor market, so we explore disaggregated cohort effects in more detail in Figures 2 and 3. Figure 2 shows estimates including only cohort fixed effects (Table 3, column 2), and Figure 3 includes full controls (Table 3, column 3). Here we display the estimated difference in entry probabilities by age across certificate-year cohorts. The baseline hazard is for a white female in her 20s from the 2012 certificate-year cohort, and values on the y-axis are changes relative to that value. We see consistently higher entry rates over time, as the Michigan labor market provided more open positions for fewer candidates in the later 2010s. Across cohorts, we also see a consistently higher probability of entry for older trainees with larger gaps by age in the years when teaching jobs were more readily available. Figures 2 and 3 are quite similar suggesting these differences are not attributable to observable differences in characteristics other than age.

*Exit*

We now turn our attention to estimating the effects of age at certification on time to exit from teaching. Because a trainee cannot exit without entering, this analysis is conditional on having been employed in a teaching position after certification, and the selection tendencies described above apply to the subsample of trainees who can be included in analysis of exit. Specifically, trainees who entered are more likely to be Black or Hispanic, more likely to have extra endorsements, and more likely to be older, older and black, and older and male, than the full analytic sample described in Table 1.

After conditioning the sample on having been employed as a teacher, we estimate age group differences in employment persistence using the same methods described above. We first estimate the probability that a trainee has exited in years 1, 2, and 3 after initial employment as a linear probability model similar to equation (1), and then as a Cox hazard model similar to equation (2). In this case, the time variable $t$ is measured from initial employment rather than initial certification. We continue to control for the timing of first certification in models with certificate-year cohort fixed effects.

We present results for the exit version of equation (1) in Table 4. As above, the specifications include full controls, cohort fixed effects, and interactions for age x Black and age x male and follow employed trainees for three years after employment. We estimate that being certified in one's 30s or 40s instead of one's 20s is associated with no difference in exit one year after employment, but by year 3, older teachers are 2 percentage points less likely to have exited teaching than a similar younger teacher. However, this is not statistically significant at the 10% level, and we cannot rule out that the likelihood of exit is the same for both age groups. Black teachers and male teachers are more likely to exit overall. In the case of Black teachers, a large significant and negative coefficient on the interaction term suggests that older Black teachers are substantially less likely to exit than younger Black teachers and, summing up the coefficients on Black and age [x] Black, less likely to exit than older white teachers. The opposite is true of older male teachers, who are more likely to exit than all other demographic groups.

Turning to the hazard results for exit, being older is associated with a 0.245 decrease in the log exit hazard. Figures 4 and 5 illustrate exit probabilities as marginal differences due to age across cohorts. Unlike entry probabilities, exit probabilities decline as cohorts entered in friendlier labor market conditions. In the specifications with only cohort controls (Figure 4) we

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see only small differences in exit probabilities by age. Adding additional controls (Figure 5) substantially increases the difference by age for each cohort. Although these differences are not statistically significant, they suggest that the differential sorting into employment of trainees by age, gender, and race might also influence differential exits.

## 6. Discussion and Policy Implications

With nationwide concern about teacher shortages, it is critical for research to inform public investments in expanding and diversifying the teacher pipeline. States and districts have many policy options to increase the supply of teachers ranging from various pipeline expansions to raising salaries to improving working conditions. Part of making good investments in training is ensuring that EPP graduates enter and persist in successful teaching careers. Recognizing that teacher training might be useful in other settings as well, public investments in the teacher pipeline are intended to produce a stable supply of teachers for public schools. State-level investments might be viewed as less effective if a state's teacher trainees exit for other states, private schools, or other sectors. Losing nearly 50% of fully trained candidates each year from the teacher labor market is a substantial loss of public and private investment that might have benefited public schools.

Substantial prior research has investigated differences between alternative and traditional EPP pathways, but often with greater focus on quality and persistence of those who enter teaching jobs than on the rates of entry themselves. We learn from prior research that alternative pathways typically produce teachers of similar quality to traditional pathways on average (Goldhaber and Brewer, 2000). Further, Sass (2015) finds that EPPs vary substantially in selectivity and quality, and that the best candidates often prefer the most flexible programs. As undergraduate interest in teacher training and employment declines, older college graduates who

might pursue a career change might provide an untapped pool of future teachers. While prior work recognizes that alternative EPPs vary in the age of candidates they target and attract, prior research has not explored the direct relationship between age and teacher employment outcomes, despite competing hypotheses about the efficacy on investing in recruitment of older, mid-career teacher trainees. This study begins to fill this gap.

First, our descriptive analysis identifies that trainees often take several years to gain a teaching position, but an early connection to public school employment predicts future employment, consistent with Goldhaber et al. (2022). With a coinciding shortage of substitute teachers, districts might improve employment and retention through programs that onboard teachers through substitute teaching or other positions designed to feed into permanent employment. Second, the large pool of certified but not employed trainees is a potential source for outreach during times of teacher shortages. Qualitative research in Michigan points to low salaries and a lack of career growth opportunities as the most common reasons why certificated candidates leave teacher employment (REL Midwest, 2021). Further research is needed to see what might induce these qualified individuals to enter teaching.

Our findings regarding trainee age suggest that while the pool of older teacher candidates in Michigan has been small, among those who show a strong enough commitment to complete certification requirements, older candidates are more likely to becomes public school teachers and potentially to persist in longer careers. Our findings further suggest that investments in alternative pathways that are attractive to older candidates might also meet the goal of increasing diversity in states like Michigan where the number of Black and male teachers leave many students without same-race or same-gender teacher role models. It is possible that Black males entering college in Michigan do not conceive of themselves as future teachers, because they have

been exposed to few Black male teachers in the K-12 system (Goings and Bianco, 2016). We note that Michigan has since 2005 restricted the entry of new EPP providers and thus the market of alternative programs is smaller than other states. In this setting, our sample of teachers who enter mid-career might be smaller and more motivated than in other states. As more states expand alternative pathways to overcome shortages, more research is needed on the relationship between age and outcomes as more older teachers are recruited (Moseley, 2023).

Acknowledging a potential benefit of recruiting older teachers, particularly older males and older Black males and females, suggests that it might be productive to invest in alterative EPPs that cater to mid-career switchers. Changes might range from recruitment strategies that target job searchers instead of undergrads to structural changes in the way coursework is delivered. For example, models that offer flexible schedules and nighttime or weekend coursework might be more effective than those that require full-time enrollment. Finally, we note that school districts can also make adjustments that would attract and retain older teachers who, in theory, are attracted both through commitment and rewards. For example, peer mentoring and professional development from other mid-career switchers might be more appropriate for older entrants, and signing bonuses or credit for non-teaching work in setting initial salaries might overcome the higher opportunity costs for those with other work experience. Overall, our results suggest further investigation and investment in mid-career switchers could improve the teacher pipeline in the future.

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**Table 1. Characteristics of Newly Certified Teachers in Michigan**

| Year | 2012-13 | 2013-14 | 2014-15 | 2015-16 | 2016-17 | 2017-18 |
|---|---|---|---|---|---|---|
| N | 3,715 | 3,529 | 3,039 | 2,749 | 2,284 | 1,619 |

**Panel A – Teachers Initially Certified in their 20s**

| | | | | | | |
|---|---|---|---|---|---|---|
| Percent of new certificates | 80.3 | 82.8 | 83.7 | 85.2 | 85.2 | 83.5 |
| MTTC reading z-score | 0.10 | 0.08 | 0.05 | 0.01 | -0.11 | -0.35 |
| MTTC math z-score | 0.35 | 0.35 | 0.31 | 0.21 | 0.06 | -0.47 |
| Percent Black | 1.8 | 2.3 | 2.1 | 2.1 | 1.9 | 1.8 |
| Percent Hispanic | 1.4 | 1.1 | 1.3 | 1.2 | 1.5 | 1.6 |
| Percent white | 94.0 | 93.6 | 93.4 | 92.7 | 92.3 | 93.4 |
| Percent other race | 2.8 | 3.0 | 3.1 | 4.0 | 4.3 | 3.2 |
| Percent male | 22.6 | 21.5 | 19.6 | 21.0 | 19.1 | 16.2 |
| Percent STEM certified | 15.8 | 16.8 | 16.5 | 17.2 | 15.5 | 15.2 |
| Percent SPECIAL ED certified | 5.6 | 5.2 | 5.9 | 6.2 | 6.6 | 9.5 |
| Percent ESL | 1.0 | 1.2 | 1.2 | 1.2 | 2.1 | 2.7 |
| Percent who enter within 5 years | 61.4 | 62.3 | 63.9 | 66.5 | 69.2 | 74.2 |
| Percent who enter within 3 years | 56.7 | 56.6 | 58.0 | 61.5 | 65.3 | 71.0 |
| Percent who exit within 3 years | 17.5 | 17.1 | 16.9 | 15.6 | 14.1 | 11.2 |

**Panel B – Teachers Initially Certified in their 30s or 40s**

| | | | | | | |
|---|---|---|---|---|---|---|
| Percent of newly certified | 19.7 | 17.2 | 16.3 | 14.8 | 14.8 | 16.5 |
| MTTC reading z-score | 0.27 | 0.21 | 0.29 | 0.15 | 0.22 | 0.12 |
| MTTC math z-score | 0.15 | 0.19 | 0.15 | 0.05 | -0.09 | -0.27 |
| Percent Black | 9.4 | 10.4 | 10.4 | 10.5 | 6.3 | 10.2 |
| Percent Hispanic | 2.5 | 1.1 | 2.7 | 2.2 | 1.7 | 3.0 |
| Percent white | 83.6 | 83.4 | 84.0 | 81.5 | 84.6 | 79.8 |
| Percent other race | 3.6 | 4.5 | 4.5 | 4.6 | 8.3 | 6.4 |
| Percent male | 34.8 | 32.6 | 38.7 | 31.3 | 31.1 | 36.0 |
| Percent STEM certified | 17.1 | 15.7 | 15.0 | 15.0 | 15.7 | 15.4 |
| Percent SPECIAL ED certified | 5.1 | 5.9 | 6.3 | 5.2 | 5.3 | 6.7 |
| Percent ESL | 0.4 | 0.8 | 0 | 1.0 | 1.2 | 1.1 |
| Percent who enter within 5 years | 67.0 | 72.8 | 70.2 | 77.3 | 75.7 | 79.4 |
| Percent who enter within 3 years | 58.7 | 67.1 | 64.2 | 73.2 | 71.9 | 77.2 |
| Percent who exit within 3 years | 19.3 | 16.9 | 15.7 | 14.7 | 18.7 | 11.7 |

Note: The "other race" category includes Asian, Native American, Native Hawaiian or Pacific Islander, and two or more races. We do not report these separately due to low Ns.

**Table 2. Linear Probability Model Estimates for Teacher Entry**

|  | Year 1 | Year 2 | Year 3 |
|---|---|---|---|
| Older | 0.006 | 0.044*** | 0.064*** |
|  | (0.003) | (0.000) | (0.000) |
| Black | 0.172*** | 0.115** | 0.076** |
|  | (0.001) | (0.002) | (0.002) |
| Hispanic | 0.051* | 0.027 | 0.013 |
|  | (0.005) | (0.006) | (0.016) |
| Other Non-white | -0.061 | -0.120 | -0.133 |
|  | (0.045) | (0.031) | (0.025) |
| Male | -0.012** | -0.037*** | -0.036** |
|  | (0.000) | (0.000) | (0.001) |
| Shortage Endorsement | 0.096*** | 0.072* | 0.055* |
|  | (0.001) | (0.007) | (0.008) |
| Older x Black | 0.039** | 0.049** | 0.037** |
|  | (0.001) | (0.001) | (0.002) |
| Older x Male | 0.032** | 0.031** | 0.017** |
|  | (0.001) | (0.001) | (0.001) |
|  |  |  |  |
| MTTC Controls | X | X | X |
|  |  |  |  |
| Cohort Controls | X | X | X |
|  |  |  |  |
| Observations | 16,935 | 16,935 | 16,935 |
| R-squared | 0.030 | 0.023 | 0.021 |

Note: Models include all certified teacher trainees in defined age group who were eligible to first enter teaching from 2012-13 through 2017-18. White is the reference category for race while the "other" category includes Asian, Native American, Native Hawaiian or Pacific Islander, and two or more races. We do not report these separately due to low Ns. Endorsement denotes a teaching certificate with a subject area endorsement in either English as a second language, special education, math, or science. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

**Table 3. Cox Proportional Hazard Estimates for Teacher Entry**

|  | (1) | (2) | (3) |
|---|---|---|---|
| Older | 0.139*** | 0.147*** | 0.154*** |
|  | (0.024) | (0.024) | (0.030) |
| Black |  |  | 0.162** |
|  |  |  | (0.069) |
| Hispanic |  |  | -0.008 |
|  |  |  | (0.077) |
| Other Race |  |  | -0.298*** |
|  |  |  | (0.054) |
| Male |  |  | -0.083*** |
|  |  |  | (0.026) |
| Shortage Endorsement |  |  | 0.108*** |
|  |  |  | (0.022) |
| Older x Black |  |  | 0.061 |
|  |  |  | (0.098) |
| Older x Male |  |  | -0.004 |
|  |  |  | (0.053) |
| MTTC Controls |  |  | X |
| Cohort Controls |  | X | X |
| Observations | 67,170 | 67,170 | 67,170 |

Notes: Hazard is defined as initial entry into teaching in a Michigan public school teacher. Cohorts able to initially enter from 2012-13 through 2017-18 are tracked through 2021-22. White is the reference category for race while the "other" category includes Asian, Native American, Native Hawaiian or Pacific Islander, and two or more races. We do not report these separately due to low Ns. Endorsement denotes a teaching certificate with a subject area endorsement in either English as a second language, special education, or STEM. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

**Table 4. Linear Probability Model Estimates for Exit after Employment as a Teacher**

|                        | Year 1      | Year 2      | Year 3      |
|------------------------|-------------|-------------|-------------|
| Older                  | 0.006       | 0.000       | -0.019      |
|                        | (0.001)     | (0.003)     | (0.004)     |
| Black                  | 0.009       | 0.011*      | 0.074**     |
|                        | (0.001)     | (0.002)     | (0.003)     |
| Hispanic               | -0.013      | -0.007      | -0.011      |
|                        | (0.006)     | (0.017)     | (0.014)     |
| Other Non-White        | 0.060       | 0.083       | 0.098       |
|                        | (0.012)     | (0.048)     | (0.056)     |
| Male                   | 0.003       | 0.013***    | 0.027**     |
|                        | (0.001)     | (0.000)     | (0.001)     |
| Shortage Endorsement   | -0.018**    | -0.025*     | -0.024      |
|                        | (0.000)     | (0.002)     | (0.006)     |
| Older x Black          | -0.051***   | -0.046**    | -0.083**    |
|                        | (0.000)     | (0.001)     | (0.002)     |
| Older x Male           | 0.018**     | 0.018**     | 0.024**     |
|                        | (0.001)     | (0.000)     | (0.001)     |
|                        |             |             |             |
| MTTC Controls          | X           | X           | X           |
|                        |             |             |             |
| Cohort Controls        | X           | X           | X           |
|                        |             |             |             |
|                        |             |             |             |
| Observations           | 11,380      | 11,380      | 11,380      |
| R-squared              | 0.005       | 0.007       | 0.008       |

Note: Models include all certified teacher trainees in defined age group who were eligible to first enter teaching from 2012-13 through 2017-18. White is the reference category for race while the "other" category includes Asian, Native American, Native Hawaiian or Pacific Islander, and two or more races. We do not report these separately due to low Ns. Endorsement denotes a teaching certificate with a subject area endorsement in either English as a second language, special education, math, or science. *** $p<0.01$, ** $p<0.05$, * $p<0.1$
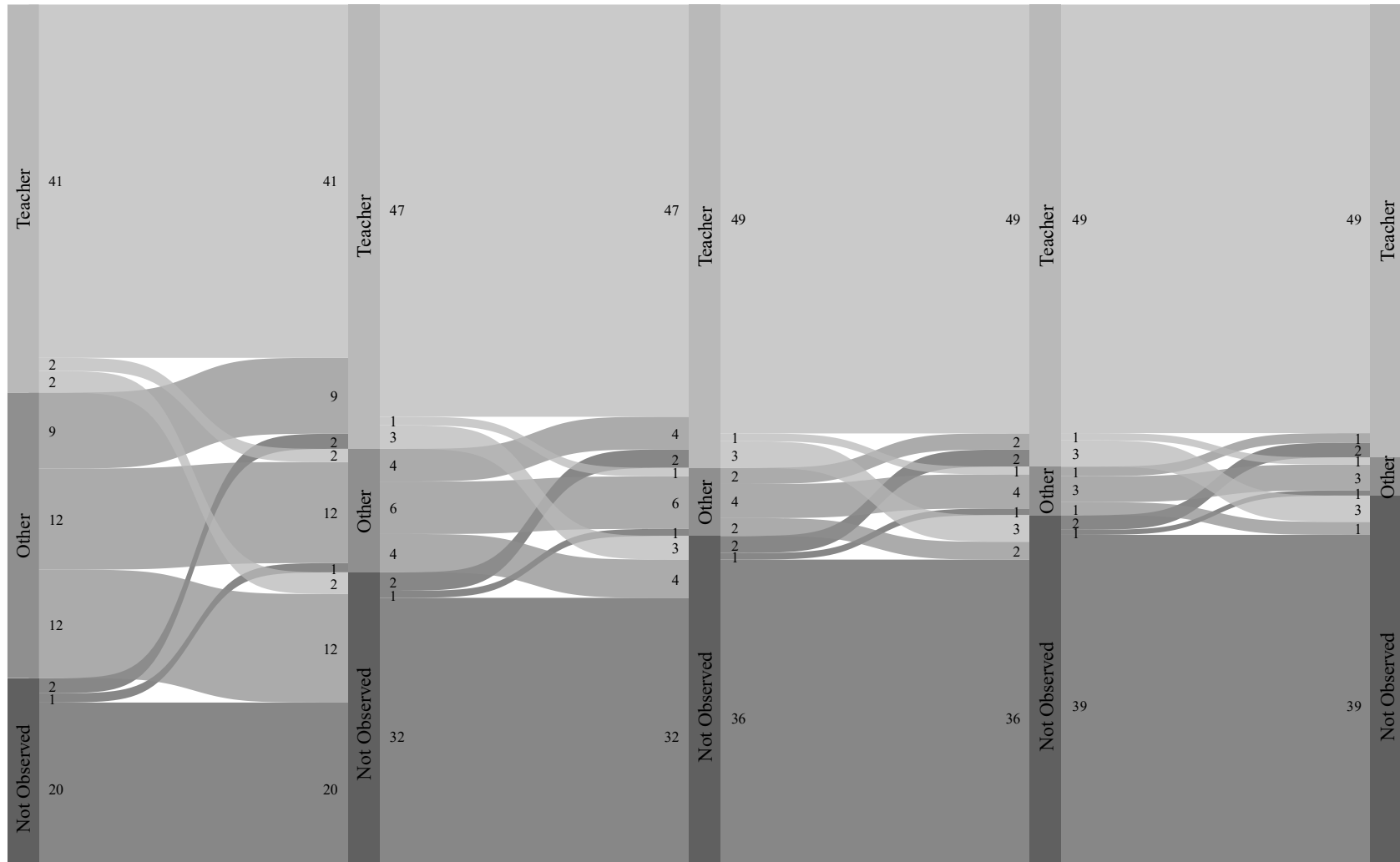
**Table 5. Cox Proportional Hazard Estimates for Exit after Teacher Employment**

| | (1) | (2) | (3) |
|---|---|---|---|
| Older | -0.129*** | -0.134*** | -0.245*** |
| | (0.049) | (0.049) | (0.066) |
| Black | | | 0.373*** |
| | | | (0.105) |
| Hispanic | | | 0.069 |
| | | | (0.143) |
| Other Race | | | 0.399*** |
| | | | (0.093) |
| Male | | | 0.021 |
| | | | (0.050) |
| Shortage Endorsement | | | -0.139*** |
| | | | (0.042) |
| Older x Black | | | -0.119 |
| | | | (0.161) |
| Older x Male | | | 0.120 |
| | | | (0.106) |
| MTTC Controls | | | X |
| Cohort Controls | | X | X |
| | | | |
| Observations | 45,102 | 45,102 | 45,102 |

Notes: Hazard is defined as exit from teacher in a Michigan public school teacher. Cohorts able to initially enter from 2012-13 through 2017-18 are tracked through 2022-23. White is the reference category for race while the "other" category includes Asian, Native American, Native Hawaiian or Pacific Islander, and two or more races. We do not report these separately due to low Ns.  Endorsement denotes a teaching certificate with a subject area endorsement in either English as a second language, special education, or STEM. *** $p<0.01$, ** $p<0.05$, * $p<0.1$
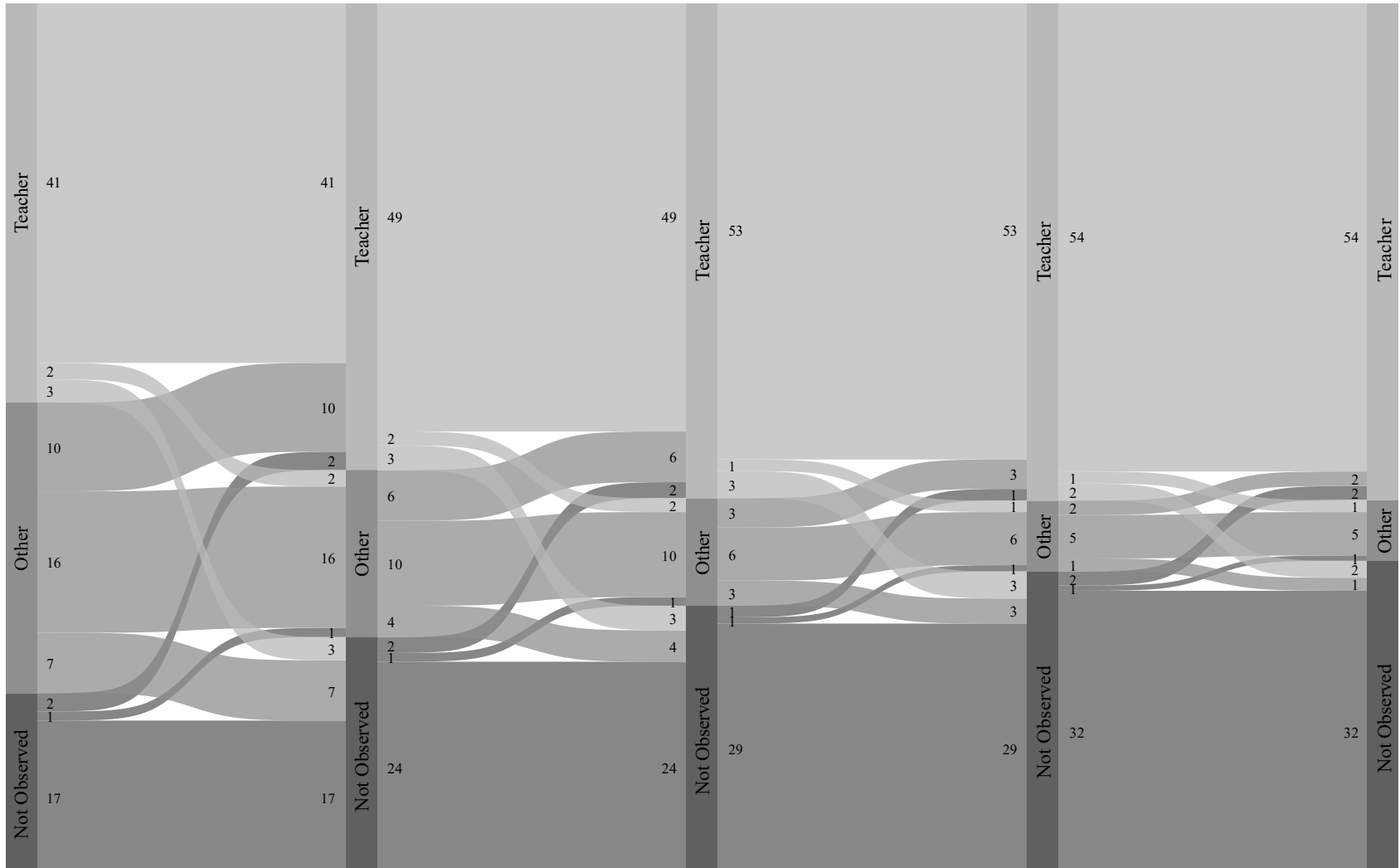
**Figure 1. Five Year Employment Outcomes for 2012-13 – 2017-18 Cohorts**



Note: Teaching = Employed in a teaching position on either the fall or spring count day in a Michigan K-12 public school. Other = Employed in a non-teaching position on either the fall or spring count day in a Michigan K-12 public school. While this category does include principals and other administrators, we note that only 0.31% of our sample is observed in the role of principal during the length of the panel. Not Observed = Not employed in a Michigan K-12 public school on either the fall or spring count day.

1B – Trainees Certified in their Thirties or Forties

Teacher 41 — 41 Teacher
Other 2 3 10 10 16 7 2 1 — Other
Not Observed 17 — 17 Not Observed

Teacher 49 — 49 Teacher
Other 2 3 6 10 4 2 1 — Other
Not Observed 24 — 24 Not Observed

Teacher 53 — 53 Teacher
Other 1 3 3 6 3 1 — Other
Not Observed 29 — 29 Not Observed

Teacher 54 — 54 Teacher
Other 1 2 2 5 1 2 1 — Other
Not Observed 32 — 32 Not Observed

Note: Teaching = Employed in a teaching position on either the fall or spring count day in a Michigan K-12 public school. Other = Employed in a non-teaching position on either the fall or spring count day in a Michigan K-12 public school. While this category does include principals and other administrators, we note that only 0.31% of our sample is observed in the role of principal during the length of the panel. Not Observed = Not employed in a Michigan K-12 public school on either the fall or spring count day.

2

**Figure 2. Hazard Model Estimates of Age Effect on Entry by Cohort (no additional controls)**
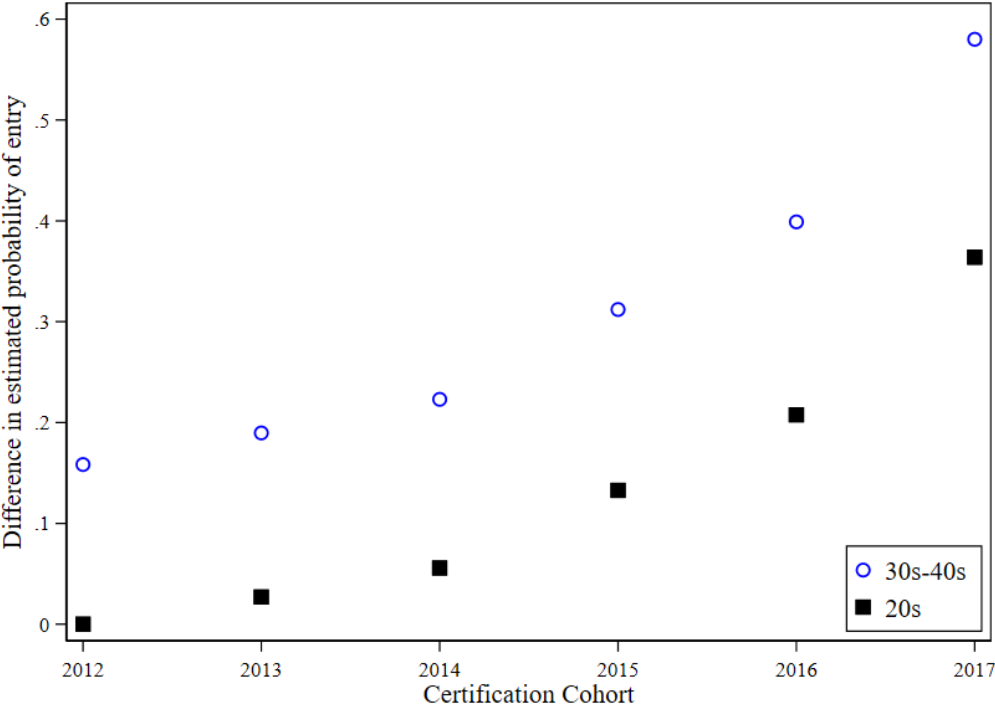


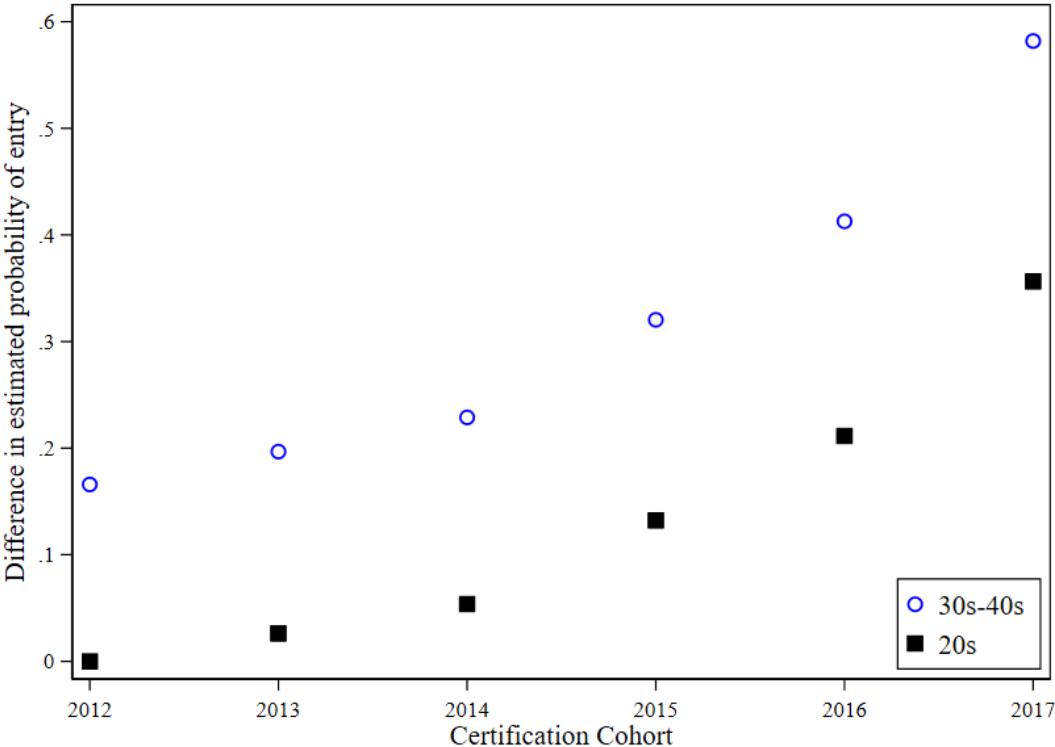**Figure 3. Hazard Model Estimates of Age Effects on Entry by Cohort (full controls)**

**Figure 4. Hazard Model Estimates of Age Effect on Exit by Certificate-Year Cohort (no additional controls)**
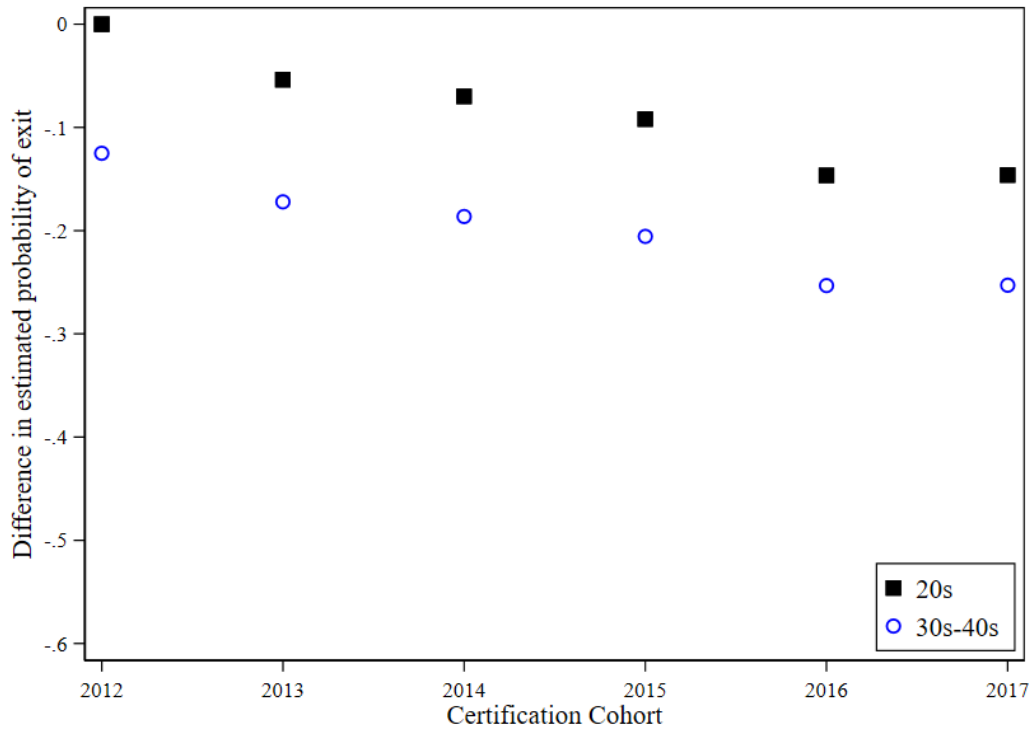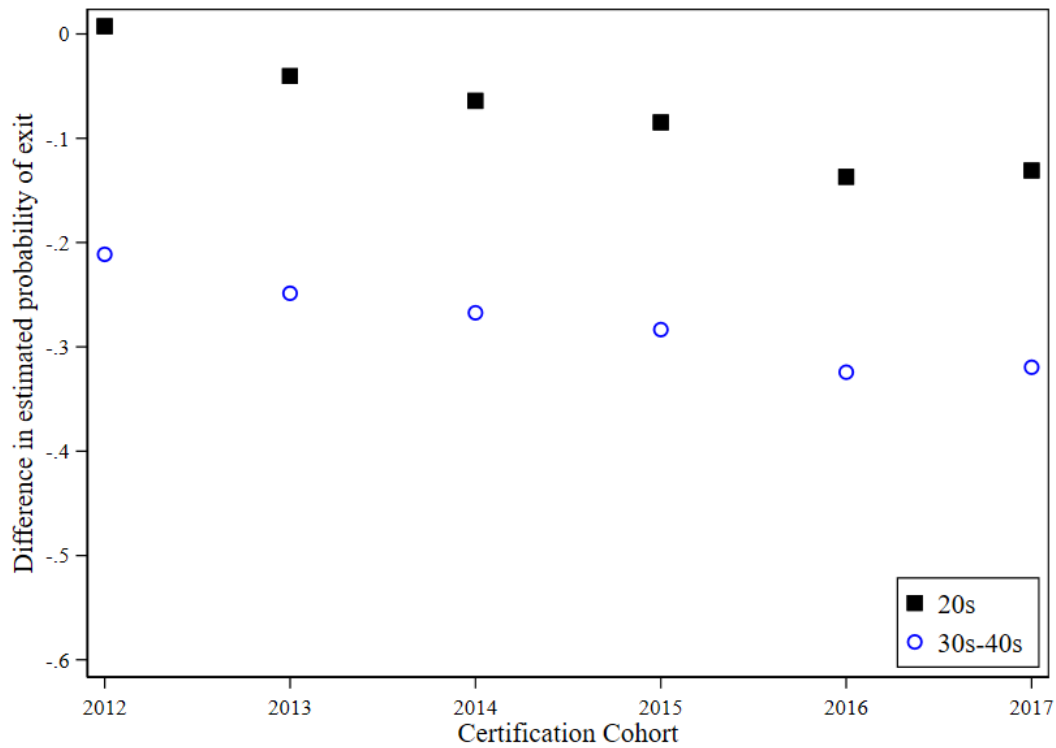


**Figure 5. Hazard Model Estimates of Age Effect on Exit by Cohort (full controls)**

**Appendix**

**Table A1. Linear Probability Model Estimates for Teacher Entry - Defining the 20s as 21-29**

|  | Year 1 | Year 2 | Year 3 |
|---|---|---|---|
| Older | 0.008 | 0.043*** | 0.064*** |
|  | (0.002) | (0.000) | (0.001) |
| Black | 0.195*** | 0.130*** | 0.0920** |
|  | (0.001) | (0.002) | (0.002) |
| Hispanic | 0.035 | 0.006 | -0.012 |
|  | (0.009) | (0.012) | (0.021) |
| Male | -0.054 | -0.109 | -0.120* |
|  | (0.034) | (0.021) | (0.015) |
| Shortage Endorsement | 0.098*** | 0.073* | 0.057* |
|  | (0.000) | (0.006) | (0.006) |
| Older x Black | 0.017** | 0.034** | 0.022** |
|  | (0.001) | (0.001) | (0.001) |
| Older x Male | 0.032*** | 0.028*** | 0.015** |
|  | (0.000) | (0.000) | (0.000) |
| MTTC Controls | X | X | X |
| Cohort Controls | X | X | X |
| Observations | 20,397 | 20,397 | 20,397 |
| R-squared | 0.031 | 0.024 | 0.021 |

Note: Models include all certified teacher trainees in defined age group who were eligible to first enter teaching from 2012-13 through 2017-18. White is the reference category for race while the "other" category includes Asian, Native American, Native Hawaiian or Pacific Islander, and two or more races. We do not report these separately due to low Ns. Endorsement denotes a teaching certificate with a subject area endorsement in either English as a second language, special education, math, or science. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

**Table A2. Cox Proportional Hazard Estimates for Teacher Entry - Defining the 20s as 21-29**

|  | (1) | (2) | (3) |
|---|---|---|---|
| Older | 0.133*** | 0.143*** | 0.150*** |
|  | (0.023) | (0.023) | (0.030) |
| Black |  |  | 0.201*** |
|  |  |  | (0.057) |
| Hispanic |  |  | -0.0290 |
|  |  |  | (0.066) |
| Other Race |  |  | -0.264*** |
|  |  |  | (0.048) |
| Male |  |  | -0.073*** |
|  |  |  | (0.022) |
| Shortage Endorsement |  |  | 0.114*** |
|  |  |  | (0.020) |
| Older x Black |  |  | 0.024 |
|  |  |  | (0.090) |
| Older x Male |  |  | -0.014 |
|  |  |  | (0.051) |
| MTTC Controls |  |  | X |
| Cohort Controls |  | X | X |
| Observations | 80,998 | 80,998 | 80,998 |

Notes: Hazard is defined as initial entry into teaching in a Michigan public school teacher. Cohorts able to initially enter from 2012-13 through 2017-18 are tracked through 2022-23. White is the reference category for race while the "other" category includes Asian, Native American, Native Hawaiian or Pacific Islander, and two or more races. We do not report these separately due to low Ns. Endorsement denotes a teaching certificate with a subject area endorsement in either English as a second language, special education, or STEM. *** p<0.01, ** p<0.05, * p<0.1

**Table A3. Linear Probability Model Estimates for Exit after Employment as a Teacher - Defining the 20s as 21-29**

|  | Year 1 | Year 2 | Year 3 |
|---|---|---|---|
| Older | 0.004 | -0.004 | -0.022* |
|  | (0.001) | (0.002) | (0.002) |
| Black | 0.012* | 0.018** | 0.076** |
|  | (0.002) | (0.001) | (0.002) |
| Hispanic | -0.024 | -0.023 | -0.017 |
|  | (0.009) | (0.006) | (0.00824) |
| Other Race | 0.071 | 0.089 | 0.103 |
|  | (0.014) | (0.040) | (0.046) |
| Male | -0.005 | 0.002* | 0.011** |
|  | (0.001) | (0.000) | (0.001) |
| Shortage Endorsement | -0.017*** | -0.022** | -0.021 |
|  | (0.000) | (0.001) | (0.005) |
| Older x Black | -0.053*** | -0.052** | -0.083** |
|  | (0.000) | (0.001) | (0.002) |
| Older x Male | 0.026** | 0.029*** | 0.039*** |
|  | (0.000) | (0.000) | (0.000) |
|  |  |  |  |
| MTTC Controls | X | X | X |
|  |  |  |  |
| Cohort Controls | X | X | X |
|  |  |  |  |
|  |  |  |  |
| Observations | 13,722 | 13,722 | 13,722 |
| R-squared | 0.005 | 0.006 | 0.007 |

Note: Models include all certified teacher trainees in defined age group who were eligible to first enter teaching from 2012-13 through 2017-18. White is the reference category for race while the "other" category includes Asian, Native American, Native Hawaiian or Pacific Islander, and two or more races. We do not report these separately due to low Ns. Endorsement denotes a teaching certificate with a subject area endorsement in either English as a second language, special education, math, or science. *** p<0.01, ** p<0.05, * p<0.1

**Table A4. Cox Proportional Hazard Estimates for Exit after Teacher Employment - Defining the 20s as 21-29**

|  | (1) | (2) | (3) |
|---|---|---|---|
| Older | -0.124** | -0.127*** | -0.234*** |
|  | (0.048) | (0.048) | (0.065) |
| Black |  |  | 0.402*** |
|  |  |  | (0.085) |
| Hispanic |  |  | 0.086 |
|  |  |  | (0.124) |
| Other Race |  |  | 0.355*** |
|  |  |  | (0.084) |
| Male |  |  | -0.022 |
|  |  |  | (0.043) |
| Shortage Endorsement |  |  | -0.120*** |
|  |  |  | (0.038) |
| Older x Black |  |  | -0.145 |
|  |  |  | (0.150) |
| Older x Male |  |  | 0.160 |
|  |  |  | (0.103) |
| MTTC Controls |  |  | X |
| Cohort Controls |  | X | X |
| Observations | 54,106 | 54,106 | 54,106 |

Notes: Hazard is defined as exit from teacher in a Michigan public school teacher. Cohorts able to initially enter from 2012-13 through 2017-18 are tracked through 2021-22. White is the reference category for race while the "other" category includes Asian, Native American, Native Hawaiian or Pacific Islander, and two or more races. We do not report these separately due to low Ns. Endorsement denotes a teaching certificate with a subject area endorsement in either English as a second language, special education, or STEM. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

**Figure A1. The Age Distribution of Newly Certified Individuals**