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ABSTRACT

The Labor Market Returns to Very Short Postsecondary Certificates*

Major policy initiatives and high award rates have led to questions about the value of short-term postsecondary credentials. We examine the labor market returns to very short certificates, including those that require only a few credits to complete, using data from a state that has among the highest awarding rates of such credentials. We do not find strong evidence that rapid certificates (those that require 6 credits or fewer) have lower immediate labor market returns than longer but still short-term certificates (7-36 credits). For health students, rapid certificates yield the greatest immediate earnings and employment gains, though these benefits appear to fade out. We also find that, compared to pre-enrollment, health and skilled trades students who earned a rapid certificate are most likely to switch into an establishment whose industry aligns with the field of study.

JEL Classification: I26, J24, J38

Keywords: returns to education, postsecondary certificates

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1. Introduction

Spurred by prominent policy initiatives and student demand, the number of sub-baccalaureate certificates awarded in the United States has grown precipitously. The expansion has been most dramatic among public higher education institutions, where certificate awards increased at a rate that far outpaced the growth in associate and bachelor’s degree awards. Notably, “short-term” certificates—commonly defined as those that require fewer than about 30 credits or take less than one year to complete—have emerged as the most popular type of certificates in recent years. It is likely that their popularity will continue to escalate given favorable trends in student demand, institutional supply, and public financial support for such programs. For example, in many states, there has been a growing policy and funding emphasis to align higher education more directly to vocational needs on pathways that do not necessarily lead to degrees.¹ Among certificates, there has been growing policy attention given to very short certificates, which we define as those that require fewer than about 16 credits or take less than half a year to complete. Most prominently at the federal level, policymakers are debating whether students should be eligible for Pell Grants if they attend very short programs requiring less than 16 credit hours.²

¹ An example of this focus is a quote by Florida Governor DeSantis as part of a request to use federal stimulus funds for vocational education: “The fact is, in this last generation, you have a lot of people who’ve gone deep into debt to go to these traditional universities to study things that don’t have as much application in the real world. Those four-year brick and ivy universities, while one way to potentially advance yourself, are not the only way and for many students, certainly not the best way. You’re not any better because you’re going to a university. A lot of these folks who are doing it the career way and getting the vocational skills are doing financially well.” (NBC 6 South Florida, 2021).

² See, for example the JOBS Act of 2019 (S.839—116th Congress) that proposed Pell Grant eligibility for programs as few as 150 clock hours over eight weeks of instruction. Recently, lawmakers introduced H.R. 496, the Promoting Employment and Lifelong Learning (PELL) Act, and the Jobs to Compete Act with similar eligibility requirements. Currently, Pell Grants can be used at programs as short as 600 clock hours or 16 semester credit hours over a minimum of 15 weeks of instructional time. Clock hours are intended to reflect actual hours a student attends class or other instructional activities. Programs must also be offered for credit, which means that the courses are subject to accreditor oversight.

There are a number of factors that have affected the demand and supply for short- and very short-term certificates. Short-term programs are attractive to many students, including those who have not traditionally been served well by higher education institutions. Going to college can represent a risky investment for some students, compounded by stoked fears of accruing burdensome student debt. Therefore, shorter programs offer a low-cost way for students to acquire practical, job-relevant skills and try out higher education without committing to a longer degree program. In this way, certificate programs have been characterized as an “on-ramp” or “gateway” into higher education that might lead students—especially those who are risk averse or resource-constrained—to continue on to more lucrative degree pathways (e.g., Carnevale, Rose, & Hanson, 2012; Fain, 2018). The evidence based on the returns to certificates generally indicates that certificates have modest, positive returns on earnings and employment, though at magnitude less than associate and bachelor’s degrees (e.g., Liu, Belfield, & Trimble, 2015; Minaya & Scott-Clayton, 2022). However, these democratizing, on-ramp benefits may also lead to diversion, namely making it easy for students to take “off-ramps” away from higher education.³ The concern is that students may not fully realize the benefits of higher education, which are often associated with degree programs.

Moreover, prominent funding initiatives, particularly at the state level, have intentionally or indirectly encouraged students to seek these certificates and motivated institutions to expand programs that offer them. For example, many states have placed a growing emphasis on publicly funding programs that focus only on certifiable skills in order to align higher education with high

³ For example, Rouse (1995) investigated democratization and diversion in the context of associate and bachelor’s degrees.

demand jobs.⁴ These efforts also often correspond to statewide initiatives that promote postsecondary education credentialing among the population, with many of these initiatives counting postsecondary attainment as credentials of any type, not just degrees.⁵ This provides incentives for institutions to develop and offer a greater number of shorter credential programs.

The proliferation of short-term and very short-term certificate awards has given rise to policy debates about the extent to which public funds should be used to subsidize enrollment and how to ensure that investment is directed towards programs that yield values. To inform these discussions, we estimate the earnings and employment returns to very short certificates with administrative educational and workforce data using a matched comparison group difference-in-differences design to compare the within-student post- vs. pre-program labor market outcomes of those who earned a certificate with those who pursued but did not complete a credential. The setting of our study is the state of Kentucky, which is an important context to study due to the considerable role of short-term certificates in the state’s higher education landscape.

Postsecondary institutions in Kentucky are collectively the national leaders in short-term certificate awards: the state has the highest rate in the country of less-than-1-year certificates awarded per capita and per associate degree (over three times the national average).⁶ The state has also implemented numerous policies that have promoted the supply and demand for short and very short credentials, including features of the state’s recently enacted performance-based

⁴ Some examples include the Workforce Development Scholarship Program in Minnesota, the Skilled Workforce Student Grant Program in North Dakota, the West Virginia Invests Grant Program, the Work Ready Kentucky Scholarship, and the “Get There Faster” Initiative in Florida.

⁵ Examples of statewide educational attainment plans include the Drive to 55 in Tennessee, 60×30 goals in Texas and Kentucky, the 60 Forward attainment goal in Wisconsin, and the “55 by ‘25” goal in Hawaii.

⁶ Data from the U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), the 2020-2021 academic year.

funding system and funding for students dedicated towards certificate programs in “high-demand” workforce sectors.⁷

Standard human capital models suggest that more schooling should predict higher earnings, all else equal (e.g., Card, 1999; Mincer, 1974). Researchers have commonly found this positive relationship has been generally found among sub-baccalaureate programs, where estimated returns to associate degrees exceed returns to long-term certificates requiring one year or more of full-time study, and long-term certificates requiring one year or more of full-time study generate higher earnings compared to certificates which take less than one year to complete (e.g., Carruthers & Sanford, 2018; Jepsen, Troske, & Coomes, 2014; Xu & Trimble, 2016). However, there is limited research on certificate programs at the heart of many current policy debates: those that require fewer than 16 credits, including certificate programs that are prominently emerging in some states that require only a few credits to complete.⁸ This is an important policy-relevant question because very short certificate programs have become increasingly popular as an alternative to traditional college degrees, especially among individuals seeking to enter the workforce quickly or change careers. These programs often come with a financial investment, both from students themselves and from public sources. Our research contributes to the assessment of whether potential benefits outweigh costs of these investments. We do not find strong evidence that what we term as “rapid” certificates (≤ 6 credits) have a

⁷ For example, Work Ready Kentucky Scholarship is designed to provide tuition assistance for students to obtain an industry-recognized certificate or associate degree in one of the five high-demand industry sectors: healthcare, advanced manufacturing, transportation/logistics, business services/IT, and construction.

⁸ For example, Bahr (2014) examined low-credit awards requiring less than 6 credits, and Stevens, Kurlaender, & Grosz (2019) investigated the returns to 6-17 credit certificates, both in the context of California. Bahr et al. (2015) studied the returns to certificates requiring less than 15 credit hours in Michigan. Liu, Belfield, & Trimble (2015) explored the returns to certificates with 12-18 semester-hour credits in North Carolina. See Table 1 for further detail.

lower return than longer but still short-term certificates (7-15 or 16-36 credits). For the most popular field of study in our setting, health, rapid certificates have the greatest immediate labor market benefits. The labor market benefits of rapid certificates tend to diminish over time, whereas returns for longer certificates steadily increase for four years after certificate completion.

We also investigate the extent to which students who complete short-term certificate programs find jobs within an industry that links to their field of study.⁹ The industry in which students choose to work can have a significant effect on their long-term career prospects. Among the different certificate lengths, students who earned a rapid certificate in health or skilled trades are most likely to switch into a business whose industry aligns with the field of study.

2. Background

About one out of every four undergraduate postsecondary credentials awarded each year in the United States are certificates, totaling nearly one million such credentials annually over the last decade.¹⁰ We display the national trend in the number of various types of certificates awarded in Figure 1. The number of awarded certificates of all types grew from the 2002-2003 through 2020-2021 academic years, with less-than-1-year certificates increasing by about 59%

⁹ Most pertinent to our paper with respect to the choice of industry is the research by Carruthers & Sanford (2018). They examined the effect of technical education on the linear probability of working in each of the defined industry groups. They showed that Tennessee Colleges of Applied Technology (TCAT) certificates increase the likelihood of employment in the industry of professional services, construction, transportation, and health. They also documented that students entering a new industry with a TCAT certificate attain \$459 per quarter higher earnings on average, compared to certificate holders whose primary industry does not change.

¹⁰ See Digest of Education Statistics 2021, Table 318.40. The data only include information from postsecondary institutions participating in Title IV federal financial aid programs. Therefore, the data do not include certificates conferred by non-Title IV institutions, such as those granted by coding boot camps or companies like Google which have gained significant attention in recent years. Moreover, the data do not include non-credit certificates, nor do they include industry certifications that are typically earned by passing a certification exam administered by a certifying organization.

and 1- to 4-year certificates increasing by 47%. Postbaccalaureate certificates increased nearly threefold, but this dramatic growth was on a relatively smaller base. In the most recent decade since the 2011-2012 academic year, the number of less-than-1-year certificates granted by institutions grew by about 17%. Conversely, the number of 1- to 4-year certificate awards declined by about 15%.

Historical national data on very short and rapid certificates are not available, since institutions were not required to report certificate data disaggregated on short-term certificates until recently. During the 2019-2020 and 2020-2021 academic years, certificate awards from programs of less than 12 weeks accounted for about 9% of all sub-baccalaureate certificates.¹¹ There was wide variation across states: programs of less than 12 weeks made up a substantial proportion of all sub-baccalaureate certificate awards in Kentucky (40%) and Kansas (35%), but were rare in states like Maryland, Wyoming, and Georgia.

The popularity of certificates has been particularly notable among public institutions, with public sector certificates accounting for about 70% of all certificates granted nationally in recent years (see Appendix Figure A1). The number of certificates awarded annually by public institutions has increased by about 127% over the past 25 years, outpacing the significant growth in associate (98%) and bachelor's degrees (76%).¹² For-profit institutions currently grant about a quarter of all certificates. Their share has decreased precipitously since their peak in the 2010-2011 academic year, following broader trends in the decline of the for-profit sector. Private nonprofit institutions have consistently granted less than 6% of certificates.

¹¹ Data from the U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), the 2019-2020 and 2020-2021 academic years.

¹² See Digest of Education Statistics 2021, Table 318.40.

The growth in short-term certificates is not restricted to the 2-year sector as many tend to believe. In Appendix Figure A2, we present the share of certificates awarded by 4-year institutions. Over the past two decades, the share of 1- to 4-year certificates granted by 4-year institutions grew from 6% to 15%. The share of less-than-1-year certificates increased from 3% to nearly 26% over the same period.

Because of differences in policy emphasis, public funding, and student demand across states, the popularity of certificates varies widely across geography. In Panel A of Figure 2, we display the ratio of sub-baccalaureate certificates (of all lengths) to associate degrees for each state. The vertical line represents the national average, which indicates that nationally there is about one certificate granted for every associate degree. Five states (Louisiana, Kentucky, Georgia, Wisconsin, and Indiana) have certificate to associate degree ratios at least twice as large as the national average, indicating that institutions grant at least two certificates for every associate degree in the state, while four states (New Hampshire, New York, Maryland, Hawaii) have ratios less than half of the national average. In Panel B, we present a corollary graph for less-than-1-year certificates, with a national average of about one less-than-1-year certificate awarded for every two associate degrees. Three states (Kentucky, Georgia, and Wisconsin) have less-than-1-year certificate to associate degree ratios three times that of the national average.

Discussed changes to federal financial policy may further amplify interest in short-term certificate programs. Some policy proposals would allow students to use Pell Grants for shorter programs, with proposed Pell Grant eligibility for programs as few as 150 clock hours over eight

weeks.¹³ The Pell Grant is the primary federal grant program, with disbursements totaling nearly \$30 billion annually in recent years (Ma & Pender, 2022). Students can currently obtain means-tested Pell Grant funds if they meet eligibility criteria, attend an eligible institution, and enroll in a program equivalent to at least 600 clock hours or about 16 semester credits.

Our work builds directly from several recent studies using more detailed and comprehensive administrative data to investigate longitudinal earnings and employment returns to certificates.¹⁴ Cellini & Turner (2019) used national administrative data and found that students who obtain certificates from for-profit institutions tend to experience lower post-college earnings and employment rates than their public sector counterparts. We summarize a set of studies that explore the returns to short- and long-term postsecondary certificates using state administrative data in Table 1. Overall, research findings indicate generally mixed estimates of returns to short-term certificates that vary across geography, field of study, and student gender. Bahr (2014), Carruthers & Sanford (2018), Jepsen, Troske, & Coomes (2014), and Minaya & Scott-Clayton (2021) documented earnings and employment gains in the context of California, Tennessee, Kentucky, and Ohio, respectively. However, Bahr et al. (2015), Dadgar & Trimble (2015), and Liu, Belfield, & Trimble (2015) found null or negative effects of earning short-term certificates in the states of Michigan, Washington, and North Carolina, respectively. Stevens, Kurlaender, & Grosz (2019) showed that a 6-17 credit certificate in information technology, for example, produced an earnings effect of approximately 10 percent, compared to an estimated

¹³ See, for example the JOBS Act of 2019 (S.839—116th Congress) that proposed Pell Grant eligibility for programs as few as 150 clock hours over eight weeks of instruction. Recently, lawmakers introduced H.R. 496, the Promoting Employment and Lifelong Learning (PELL) Act, and the Jobs to Compete Act with similar eligibility requirements.

¹⁴ There are also numerous earlier estimates of the returns to certificates use national survey data (e.g., Bailey, Kienzl, & Marcotte, 2004; Grubb, 1995; Hollenbeck, 1993; Kerckhoff & Bell, 1998; Marcotte et al., 2005). See Grubb (2002) for a partial summary.

return of 19 percent in business and management, and nearly 35 percent in fine and applied arts. Xu & Trimble (2016) found that in Virginia, short-term certificates in humanities and social sciences yielded the highest returns (\$618 increase in quarterly earnings on average) out of all short-term certificates, but for fields like business and marketing, engineering science, information science, nursing, and protective services, they found negative returns. However, they found a different pattern in North Carolina, with short-term certificates in protective services providing the highest returns (\$2,529 increase in quarterly earnings on average). Bettinger and Soliz (2016) did not find a short-term certificate earnings effect for women, but men benefitted through increased earnings.

3. Data and Descriptive Statistics

3.1. Data

The primary data we use in the paper are administrative postsecondary education system records for the state of Kentucky, including information for all students who attended eight public four-year institutions and 16 community colleges with more than 70 locations across the state. We merge the postsecondary education data with quarterly earnings and employment records from the state Unemployment Insurance (UI) program. See Appendix B for a detailed discussion of the data in this paper.

The focal group of this paper is short-term certificate earners who have a record of employment prior to pursuing their certificates.¹⁵ In this study, we define a short-term certificate

¹⁵ Though not the primary focus of our analysis, we also estimate the labor market returns to single 1–2-year certificates using a similar approach as described later. Generally, our findings are consistent with previous research which suggests that certificates requiring more than one year of study have higher labor market returns compared to those that are less than one year in duration (e.g., Carruthers & Sanford, 2018; Jepsen, Troske, & Coomes, 2014; Xu & Trimble, 2016). We present the results in Appendix Figure A3.

as a credential below the baccalaureate degree that is designed for completion in less than one academic year, which we approximate by using a 36 semester credit limit.¹⁶ We construct a sample of students who attended a Kentucky postsecondary institution since the 2010-2011 academic year and either (1) earned one short-term certificate in a community college (the treatment group) or (2) pursued a credential but left without completing the program (the comparison group) in or before the 2016-2017 academic year. This sampling frame allows us to observe at least two years of employment records prior to first observed enrollment and at least two years of post-program employment records for all entry cohorts. We exclude students who have no UI wage records during the analytical time frame or who were not within the age range of 20-60 years at the time of first observed enrollment.

We are primarily interested in quarterly earnings and employment rate as outcomes, though also examine log quarterly earnings and can provide those results upon request. Quarterly earnings include both earnings records for quarters when individuals are employed and zeros for quarters when individuals do not have earnings records in our data. This measure combines both the extensive and intensive margins of working for a quarter. All earnings are adjusted to 2019 dollars using the consumer price index to account for inflation. We present and discuss descriptive statistics for the full sample in Appendix C. As we describe later, we do not use this full data sample in the primary analysis, but instead use a matched sample to account for potential differences in characteristics and pre-program labor market experiences between completers of certificates with different lengths, and non-completers.

3.2. Descriptive Estimates

¹⁶ This accounts for 66% of certificate earners who completed one short-term certificate, regardless of the number of credential-specific credits, in the data.

In order to give a general picture of labor market experiences of our sample, we estimate the following descriptive regression of labor market outcomes for short-term certificate earners:

$$Y_{it} = \alpha + \beta Post_{it} + \varphi_a + \eta_i + \lambda_t + \varepsilon_{it}, \quad (1)$$

where i and t index individuals and quarters, respectively. Regarding the outcome variable Y_{it} , we separately estimate quarterly earnings and employment for certificate earner i in quarter t . $Post_{it}$ is equal to zero in the five quarters prior to the first observed enrollment in the program; this variable switches to one in the eight quarters (two years) after the certificate is attained. We exclude periods between the first observed enrollment and certificate completion from the estimation. φ_a denotes the age fixed effects in each time period, accounting for common labor market differences across the life cycle. η_i is the individual fixed effects. We include calendar year-quarter fixed effects, λ_t , to control for nation-wide macroeconomic shocks and other variations over time that are common and affect all individuals in the same quarter. We cluster standard errors at the student level.

The coefficient β is the average difference between post- and pre-program labor market performance for each person who earned a short-term certificate, conditional on a set of covariates. The estimated coefficient $\hat{\beta}$ captures any effect of attaining the certificate, but it is likely biased by other factors associated with credential completion that also affect labor market performance. For instance, underlying earnings trajectories of certificate earners may vary systematically due to unobserved time-varying confounding factors such as dynamic skill development or motivation that also correlate with credential attainment.

We present the results of our descriptive analysis on the average post- and pre-program labor market performance differences of short-term certificate earners in Table 2. Our findings show that, for the full sample of certificate earners, quarterly earnings do not significantly differ

on average in the eight quarters after certificate completion compared to the five quarters prior to first observed enrollment, while employment rates are about 3.8 percentage points higher (about a 6% higher than average pre-enrollment employment) during the post-program periods. When conducting separate analyses by certificate length, we find that students completing certificates with 1-6 credits have better post-certificate labor market outcomes (earnings about 12% higher than pre-enrollment earnings and employment about 14% higher than pre-enrollment employment). On the other hand, students earning certificates with 16-36 credits have lower post-certificate quarterly earnings. To address likely bias in these estimates, we turn next to our primary identification strategy.

4. Empirical Approach

4.1. Identification Strategy

Our main empirical strategy is to estimate a matched comparison group difference-in-differences design with individual fixed effects to compare the within-student post- vs. pre-program labor market outcomes of those who earned a short-term certificate with those who pursued but did not complete a credential. To explore whether completing short-term certificates improves award recipients' labor market outcomes, we estimate the following equation:¹⁷

¹⁷ In addition to our primary analysis that uses an event study framework, we also estimate a general difference-in-differences specification which replaces the set of indicators for pre- and post-treatment periods ($\mathbf{1}[\tau = j]$) with a single indicator for post-treatment periods ($Post_{it}$). We estimate the specification of the following form:

$$Y_{it\tau} = \alpha + \beta(Cert_i * Post_{it}) + \gamma Credit_{it} + \delta Enroll_{it} + \theta_{\tau} + \varphi_a + \eta_i + \lambda_t + \varepsilon_{it\tau}, \quad (3)$$

where $Post_{it}$ is equal to zero in the five quarters prior to the first observed enrollment in the program; this variable switches to one in the eight quarters (two years) after the individual earned the credential (for certificate earners) or dropped out of college (for non-completers). Therefore, the coefficient on the interaction between $Cert_i$ and $Post_{it}$, β , measures the average effect of earning short-term certificates on within-person post-program outcomes relative to pre-first observed enrollment outcomes, as compared to the differences in the pos vs. pre within-person outcome of the matched comparison group. We present the results in Table 4.

$$\begin{aligned}
Y_{it\tau} = & \alpha + \sum_{j=-5}^{-2} \beta_1^\tau (Cert_i * \mathbf{1}[\tau = j]) + \sum_{j=1}^8 \beta_2^\tau (Cert_i * \mathbf{1}[\tau = j]) \\
& + \gamma Credit_{it} + \delta Enroll_{it} + \theta_\tau + \varphi_a + \eta_i + \lambda_t + \varepsilon_{it\tau}.
\end{aligned} \tag{2}$$

$Cert_i$ is equal to one for students who earned short-term certificates and zero for those who did not. $\mathbf{1}[\tau = j]$ indicates the period j quarters before the first observed enrollment or after earning the credential (for certificate earners) or after dropping out of college (for non-completers). $Credit_{it}$ denotes the cumulative number of observed course credits completed by individual i as of the end of quarter t , which reflects human capital accumulation over time. $Enroll_{it}$ is an indicator for contemporaneous enrollment equal to one if the individual is enrolled in quarter t and zero otherwise. This variable accounts for the opportunity cost (in terms of earnings and employment) while students are enrolled.

We examine labor market outcomes in the eight quarters (two years) after completing the credential or dropping out of college. We set the omitted base quarter to be $\tau = -1$ (i.e., one quarter before the first observed enrollment) and do not include any quarters between students' first observed enrollment and their credential attainment/final observed enrollment. We include fixed effects for quarters before first observed enrollment or since credential attainment/final observed enrollment (θ_τ), ages (φ_a), individuals (η_i), and calendar year-quarters (λ_t). ε_{it} is the error term. We cluster standard errors at the student level. Our sample in this analysis includes those who earned a short-term certificate and a matched comparison group as described below.

The coefficients of interest are β_2^τ , which measure the earnings effect of the short-term certificate on within-person outcomes in post period τ relative to pre-first observed enrollment outcomes, as compared to the comparable post vs. pre within-person outcome

differences of the matched comparison group. An identifying assumption of this research design is that in the absence of the credential, earnings and employment trajectories would be similar between the treatment and control groups. An attractive feature of Equation (2) is that we can examine elements of the β_1^T -vector as a formal test of parallel pre-trends from the five quarters prior to the first observed enrollment. If components of the β_1^T -vector are precisely estimated zeros, then this provides supportive evidence that the parallel trends assumption is satisfied in our context.

4.2. Matched Sample

While the pre-first observed enrollment labor market trends appear to follow generally parallel paths between certificate earners and non-completers (see Appendix Figure C1), we employ coarsened exact matching (CEM) to further enhance the similarity of the treatment and comparison groups. Specifically, for each certificate length group separately, we match exactly on categories of gender, race, ethnicity, major fields, age at first observed enrollment, the number of total observed credits earned during the program, and average earnings and employment rate 1, 2, and 3-5 quarters prior to the first observed enrollment. We describe the matching procedure in detail in Appendix D. We calculate weights following Blackwell et al. (2009) and Iacus et al. (2012) to produce estimates of the average treatment effect on the treated.

We match about 84% of the treated individuals in the analytical sample. We display descriptive statistics for our matched treatment and control group samples in Table 3. We observe that the matched treatment and control groups exhibit nearly identical pre-enrollment observable characteristics. In addition, compared to the unmatched treatment samples (see Appendix Table C1), the matched treatment group has similar distributions of major fields and

student demographics, as well as similar labor market performance prior to the first observed enrollment.

While the similarity in pre-treatment observable characteristics provides some confidence in the comparability of the matched groups, we further test whether earnings and employment trends are parallel between treatment and control groups. As previously explained, we can conduct a test the parallel trends assumption by examining parameters in the β_1^T -vector from Equation (2). We will discuss the estimation results in more detail in Section 5. As a preview, our empirical tests confirm that the matched treatment and control groups follow similar pre-treatment labor market trajectories. The estimated coefficients in the β_1^T -vector are close to zero in magnitude and statistically indistinguishable from zero.

5. Findings

5.1. Estimated Returns to Short-Term and Very Short-Term Certificates

We first present main results for the full sample of short-term certificate earners of any length from our preferred regression specification (Equation 2) in Figure 3. We plot the estimated coefficients β_1^T and β_2^T using circle markers, with the coefficient for the first quarter prior to the first observed enrollment set to zero. The dashed lines denote the 95% confidence level for each point estimate.

We document significant positive effects of earning a short-term certificate on labor market outcomes during the first eight quarters after credential attainment. We observe that overall the earnings gains increase over time, with an immediate and rapid rise in the first two quarters. The employment rates reach their peak about five quarters since completion and then start to decrease gradually. We show the results from the general difference-in-differences model in Table 4. As we present in Panel A, the earnings effect is about \$320 per quarter on average (or

about 9.3% of the average pre-enrollment earnings). Employment rates are 6.2 percentage points higher (or about 9.5% of the average pre-enrollment employment).

To further explore the labor market returns across certificates of different lengths, we split the treatment sample into three groups: students who earned a certificate with 1-6 credential-specific credits, 7-15 credits, and 16-36 credits. We recalculate the CEM weights separately for each certificate length group and re-estimate the treatment effects based on Equation (2). We present the results from the event study analysis in Figure 4. Students completing a 1-6 credit certificate experience immediate and statistically significant earnings and employment gains in the first five quarters right after program completion (see Panel A). However, these labor market benefits gradually decrease over time. We observe opposite patterns among students earning a certificate with 7-15 credits and 16-36 credits, where estimated returns are lower initially but then rise, though point estimates are often not precisely estimated (see Panels B and C). When comparing the treatment effects across these three types of short-term certificates over time, we find that the magnitude of earnings and employment gains is larger in the first three quarters after completion among 1-6 credit certificates, but these positive effects fade out quickly over time and become lower than the longer certificates. In Panels B to D of Table 4, we do not find strong evidence that very short certificates (1-6 credits) have a lower return than longer but still short-term certificates (7-15 or 16-36 credits) on average.

In addition, we see in Figures 3 and 4 that all the pre-enrollment estimated coefficients are small in magnitude and not statistically significantly different from zero. This provides further support for the validity of the parallel trends assumption.

5.2. Effect Heterogeneity

We further examine how labor market benefits of earning a short-term certificate vary by gender, race, ethnicity, age at first observed enrollment, and major fields separately for each certificate length group. Following the general difference-in-differences model we described in Footnote 17, we include $Cert_i * Post_{it}$ (an interaction term between an indicator for whether earning a certificate and an indicator for post-program periods), $Credit_{it}$ (a continuous variable for cumulative number of observed course credits completed), and θ_τ (a set of indicators for pre-enrollment and post-program quarters), all interacted with student characteristics, in the specification.¹⁸ Our findings suggest that there are no significant differences in labor market returns across different demographic or major groups for the full sample of short-term certificate earners of any length. Given that a significant portion of short-term certificate earners are health majors, we restrict our sample to include only these students and investigate the treatment heterogeneity by certificate length. We document higher returns for 1-6 credit certificates compared to longer certificates on average for health majors, even though there are no significant differences across student characteristics within each certificate length group.

5.3. Returns to Certificate Length: Four Years After Completion

To understand the relatively longer-term labor market returns of earning a short-term certificate in a community college, we extend our analysis to four years of post-program periods. Specifically, we examine students who earned one short-term certificate in or before the 2014-2015 academic year, instead of the 2016-2017 academic year that we used in the main analysis.

¹⁸ For instance, we estimate the following model to study treatment heterogeneity by gender:

$$\begin{aligned}
 Y_{it\tau} = & \alpha + \beta(Cert_i * Post_{it}) + \gamma Credit_{it} + \theta_\tau \\
 & + \beta_{Females}(Cert_i * Post_{it} * Females) + \gamma_{Females} Credit_{it} * Females + \theta_\tau * Females \\
 & + \delta Enroll_{it} + \varphi_a + \eta_i + \lambda_t + \varepsilon_{it\tau}.
 \end{aligned}$$

Our findings reveal similar patterns to those observed and discussed in Section 5.1. Specifically, students with a 1-6 credit certificate experience significant and immediate earnings and employment gains upon program completion, but these benefits gradually decline over time. On the other hand, students who earned a certificate with 7-36 credits experience lower estimated returns initially but witness a steady increase in their returns over time.

5.4. Short-Term Certificates and Major-Industry Alignment

Are students obtaining a short-term certificate more likely to work in industries aligned with the field of study for their certificates? To answer this question, we examine whether the industry of students' post-program jobs align with their field of study for our two biggest fields, health and skilled trades, recognizing that there are well-articulated limitations in industry identifiers in UI data.¹⁹ Our analysis reveals that students earning a short-term certificate in health and skilled trades have a higher probability of being employed in a business whose industry aligns with their major after program completion than before entering the program. Across all lengths analyzed, students who earned a rapid certificate have the largest post- vs. pre-program increase in industry alignment.

5.5. Robustness Checks

5.5.1. Inclusion of Time Trends Interacted with Student Characteristics

To assess the robustness of the findings from our baseline event study approach, we add interaction terms of time trends with student characteristics to the model (Equation 2). These characteristics include gender, race, ethnicity, age at first observed enrollment, entry cohort

¹⁹ We code students as working in health if they worked in an establishment with the 2-digit NAICS code = 62, and in skilled trades if they worked in an establishment with the NAICS code = 21, 22, 23, 31-33, 42, 44-45, and 48-49. Industry data in the UI data file identify the industry code of the business establishment that employs the worker. However, it has limited information about the job role within that establishment.

indicators, and major fields. We present the estimated coefficients in Appendix Figure A4. We document very similar results on the labor market returns across certificates of different lengths compared to what we observe in Figure 4. Our main conclusions remain unchanged with the inclusion of time trend interaction terms.

5.5.2. Using the Sample of First-Time Students Only

In the main analysis, we restrict our sample to those who did not have any educational records for at least two years prior to their first observed enrollment. However, some of our analytical sample students may have earned a credential or taken classes before our analytical data period starts (i.e., prior to the 2008-2009 academic year). Therefore, we analyze a subsample of students who are identified in the data as never having enrolled in postsecondary education before entering our sample. We recalculate weights for this group and re-estimate the event study model (Equation 2). We display the results in Appendix Figure A5. Overall, first-time short-term certificate earners experience significant improvements in both earnings and employment rates (Panel A). These benefits are on average larger than the pooled sample of first-time and non-first-time short-term certificate earners, with earnings increasing by about \$555 per quarter (or about 18% of the average pre-enrollment earnings) and employment rates rising by approximately 6.9 percentage points (or about 11% of the average pre-enrollment employment). Our analysis further breaks down the treatment effects by certificate length (Panels B to D). We observe similar patterns compared to the pooled sample, even though the effect is less precisely estimated. The labor market benefits of first-time students with a 1-6 credit certificate decrease over time after an initial increase since certificate completion. Meanwhile, first-time students who earned a 16-36 credit certificate have lower returns in the short term, but the benefits continue to increase and become more persistent in the long run.

5.5.3. Returns to Certificate Length: Propensity Score Matching

As a further robustness check, we alternatively use propensity score matching methods to construct the matched comparison group. We estimate the propensity score using a probit specification with the same set of controls that we use in the CEM (i.e., gender, race, ethnicity, major fields, age at first observed enrollment, the number of total observed credits earned during the program, and average earnings and employment rate prior to the first observed enrollment). We then match treated students to the control group using kernel matching algorithm and implement the estimation (Equation 2) using these propensity score weights. We document that the initial CEM estimates are similar to those obtained from the propensity score matching method.

6. Discussion

In this paper we investigate the labor market returns to short and very short certificates using administrative postsecondary education and workforce data from the state of Kentucky. Overall, we do not find strong evidence that rapid certificates (1-6 credits) have a lower return than longer but still short-term certificates (7-15 or 16-36 credits). For health students, immediate earnings effects for students who earned rapid certificates were greater than for longer certificates but tended to fade within a few years. Conversely, we observe a steady increase in returns for certificates that required a greater number of credits. We also provide evidence on the alignment between field of study and job industry among students who pursued very short certificate programs. Among the different certificate lengths, health and skilled trades students who earned a rapid certificate are most likely to switch into an establishment whose industry corresponds with their field of study, but these field alignment benefits also appear to start to fade within a few years.

Students who earned rapid certificates had lower pre-enrollment earnings and employment rates than longer term certificate earners, and these programs necessitate relatively smaller education investment (in terms of both direct fees and cost).²⁰ Both of these factors might lead students with rapid certificates to have relatively low reservation wages. Therefore, while the rapid certificates appear to successfully enable students to find jobs quickly after their programs, students may be trading off longer-term earnings gains and stability for immediate employment.

²⁰ For example, a 3-credit certificate at a public community college in Kentucky would cost about \$600 in tuition and fees, and takes about half a year to complete. Source: Tuition + fees @KCTCS (current) = \$190/credit hour source: <https://ketcs.edu/affording-college/tuitioncosts/tuition-charges.aspx> accessed Sep 2022. Does not include program-specific fees, books and materials, or living expenses.

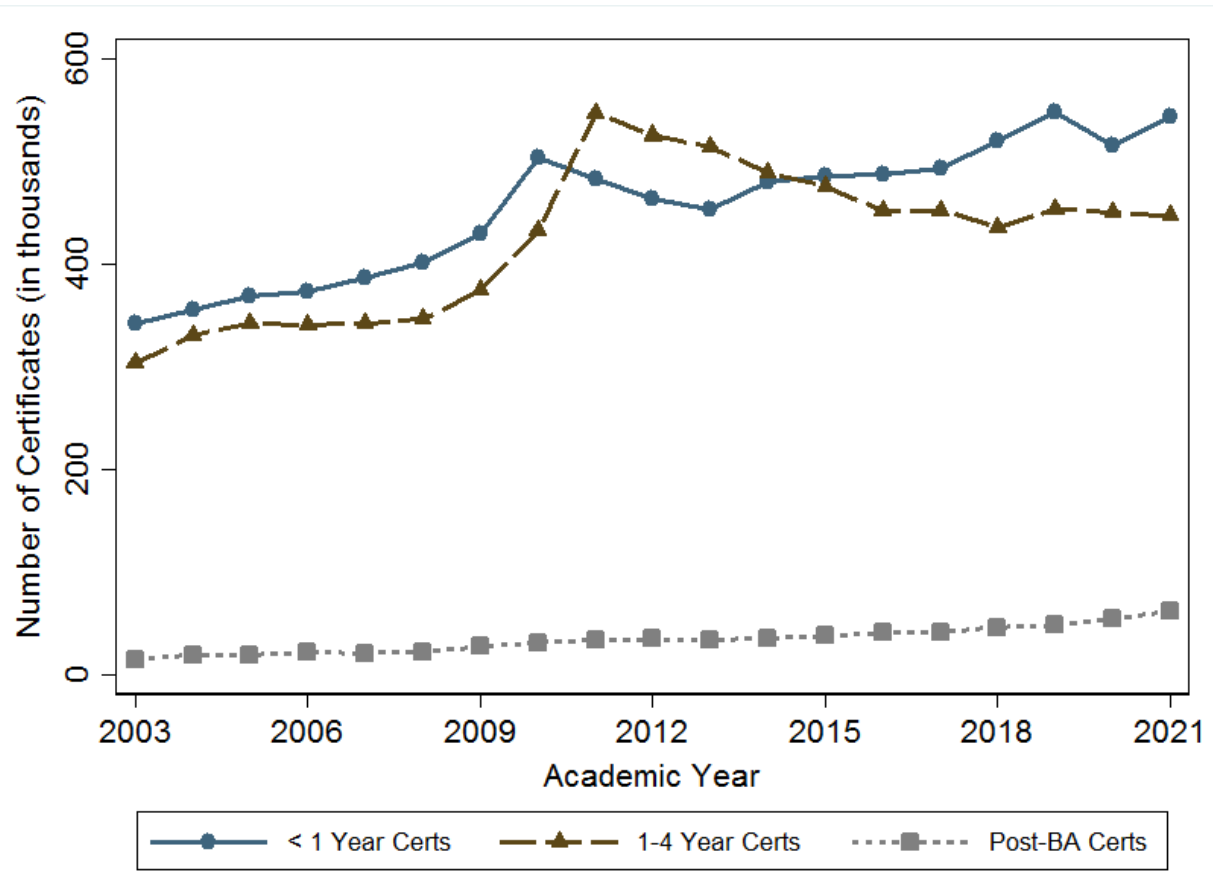
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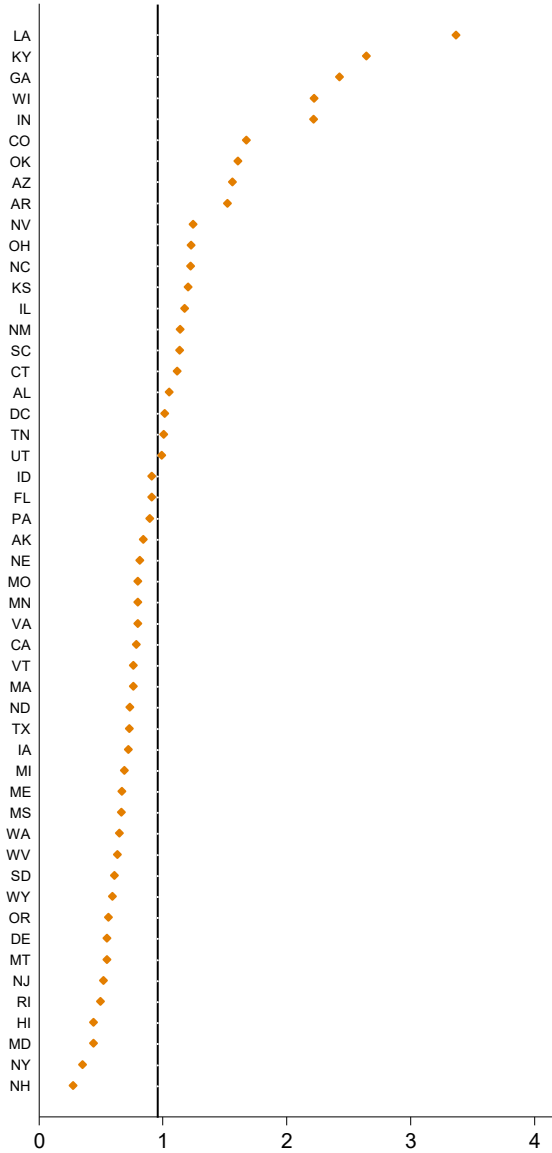
Figure 1: Number of Certificates Awarded in the United States, 2002-2003 to 2020-2021 Academic Years



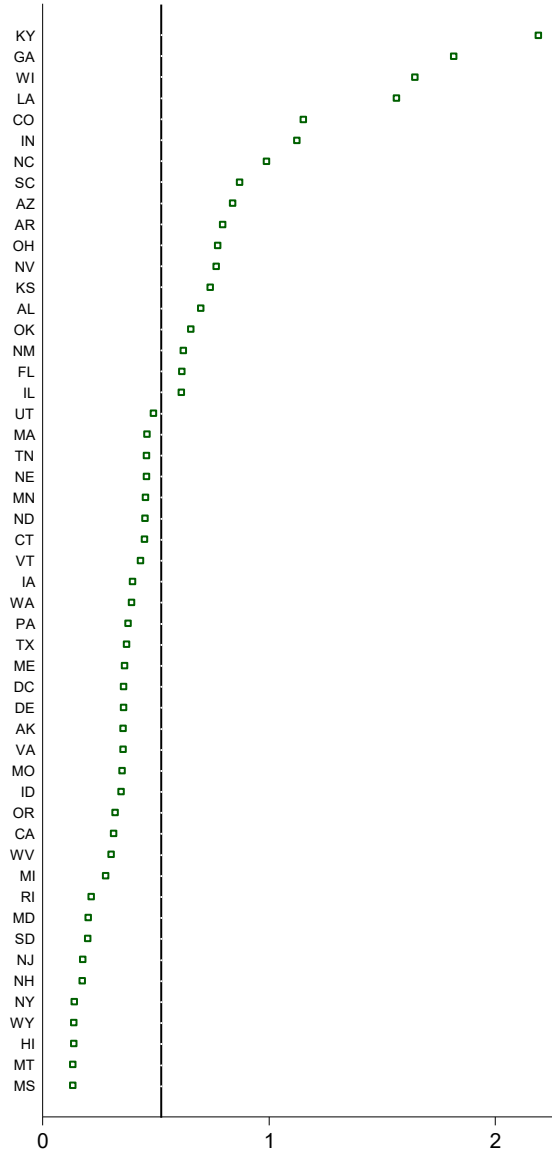
Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Completions component final data (2002-2003 to 2019-2020) and provisional data (2020-2021). Notes: This figure only includes certificates awarded from postsecondary institutions participating in Title IV federal financial aid programs. The x-axis represents the year corresponding to the spring semester of each academic year. For instance, the academic year 2021 refers to the 2020-2021 academic year.

Figure 2: Ratios of Certificates to Associate Degrees Granted by State, 2020-2021
Academic Year

(A) Certificates of All Lengths



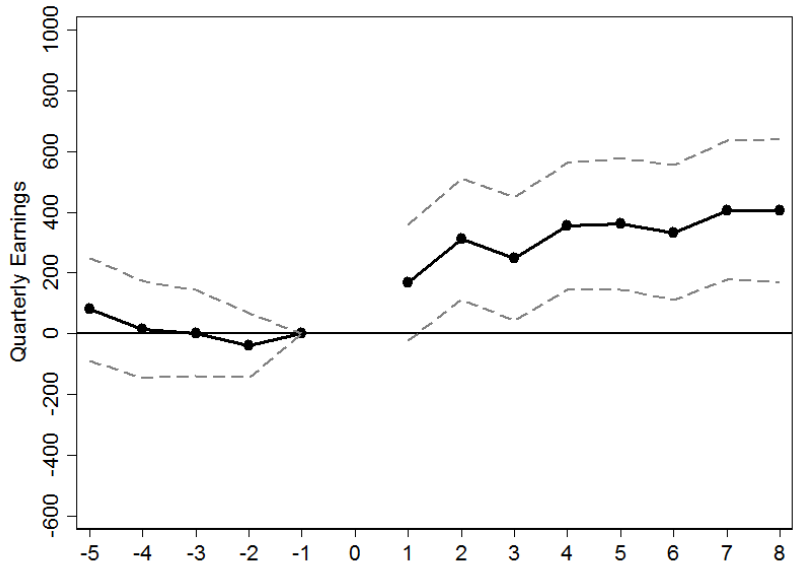
(B) Certificates of < 1 Academic Year



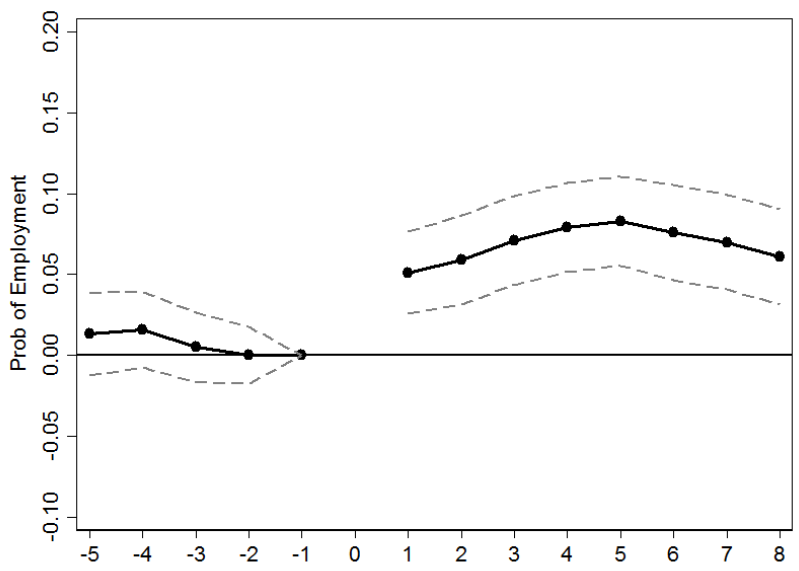
Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Completions component provisional data (2020-2021). Notes: These figures only include certificates awarded from postsecondary institutions participating in Title IV federal financial aid programs. Panel A includes sub-baccalaureate certificates (of all lengths). Panel B includes only less-than-1-year certificates. Vertical line represents the national average.

Figure 3: Effects of Short-Term Certificates on Quarterly Earnings and Employment (Full Sample)

(A) Quarterly Earnings



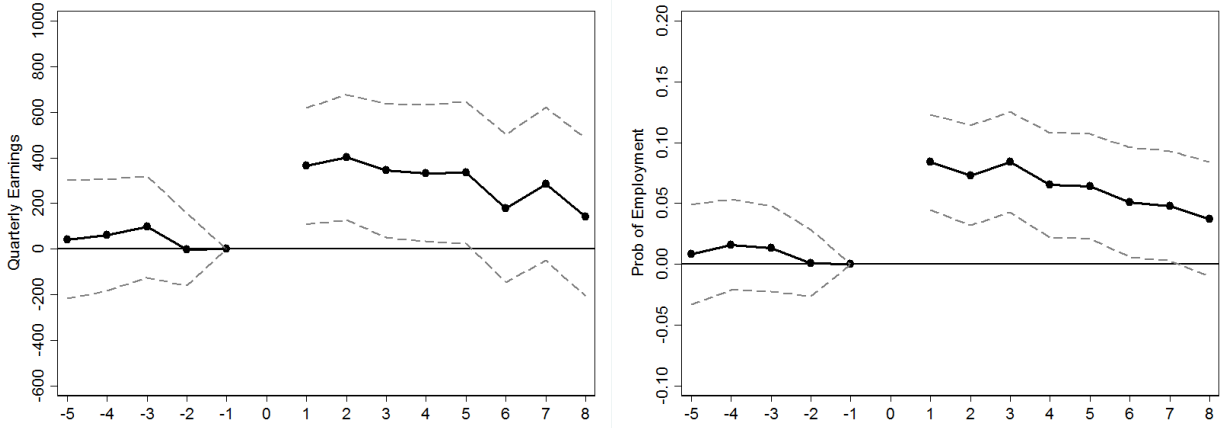
(B) Employment



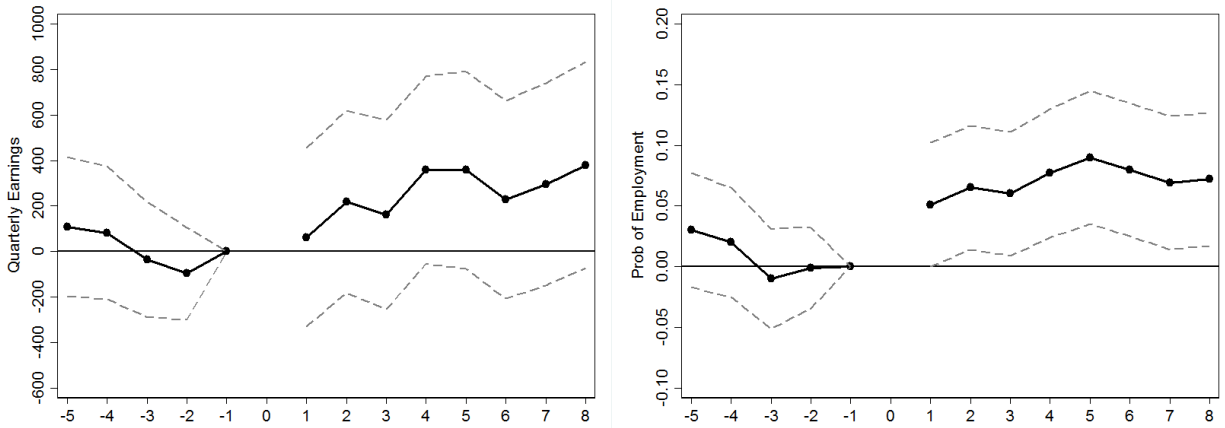
Notes: The horizontal axis represents quarters prior to the initial enrollment (if negative) or since earning the credential or the last observed enrollment (if positive). Marker reports the point estimate for the treatment effect for each quarter, and grey dashed lines are the 95% confidence interval.

Figure 4: Effects of Short-Term Certificates on Quarterly Earnings and Employment (By Certificate Length)

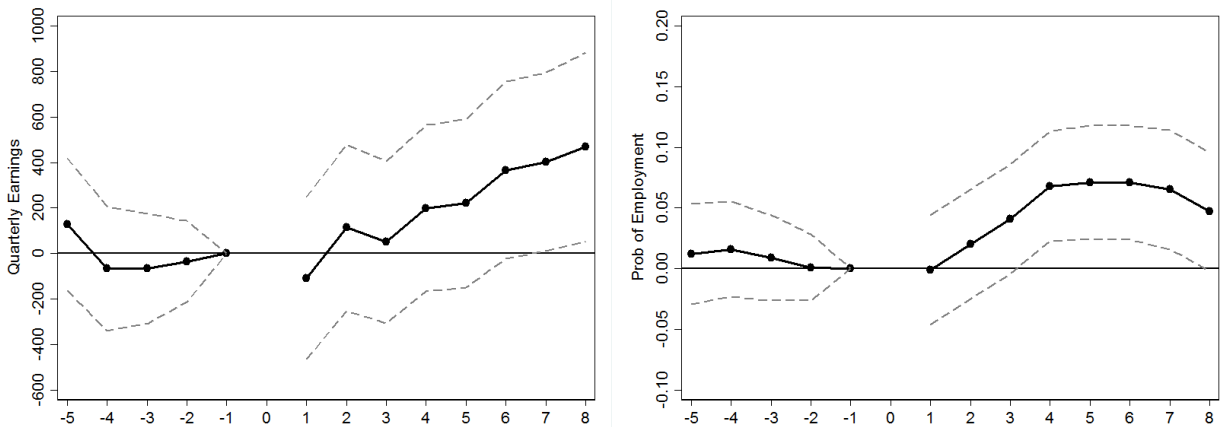
(A) Certificates with 1-6 Credits



(B) Certificates with 7-15 Credits



(C) Certificates with 16-36 Credits



Notes: The horizontal axis represents quarters prior to the initial enrollment (if negative) or since earning the credential or the last observed enrollment (if positive). Marker reports the point estimate for the treatment effect for each quarter, and grey dashed lines are the 95% confidence interval.

Table 1: Summary of Results from Selected Studies Related to Returns to Short- and Long-Term Certificates

Authors	Geography	Credential Length Examined	Cohorts Included	Earnings Gains for Certificates (Effects on Earnings Levels)	Earnings Gains for Certificates (Effects on Log Earnings)	Employment Gains for Certificates (Effects on Prob of Employment)	Fields in which <i>Short-Term</i> Certificates Yield Positive Earnings Gains at 0.1 Significance Level	Fields in which <i>Long-Term</i> Certificates Yield Positive Earnings Gains at 0.1 Significance Level
Bahr (2014)	California	Low-credit awards (< 6 credits), short-term certificates (6–29 credits), and long-term certificates (> 29 credits)	2002-2003 to 2005-2006 AY	NA	Low-credit awards: 11% ↑ . Short-term certificates: 13% ↑ . Long-term certificates: 17% ↑ .	NA	Low-credit awards: Business & Management; Health Short-term certificates: Biological Sciences; Business & Management; Health; Family & Consumer Sciences; Public & Protective Services; Commercial Services	Health; Public & Protective Services
Bahr, Dynarski, Jacob, Kreisman, Sosa, and Wiederspan (2015)	Michigan	Short-term certificates (< 15 credit hours), and long-term certificates (≥ 15 credit hours).	2003-2004 AY, and Fall 2004	Short-term certificates: no significant effects for females; \$1,345 ↑ for males. Long-term certificates: \$620 ↑ for females; \$918 ↑ for males.	Short-term certificates: no significant effects for both females and males. Long-term certificates: 14% ↑ for females; no significant effects for males.	NA	None	For females: Nursing; Business (non-finance) For males: None
Bettinger and Soliz (2016)	Ohio	Short-term certificates (less than one year of full-time study), and long-term certificates (at least one year of study, but less than two years).	1998, 1999, 2000	NA	Short-term certificates: no significant effects for females; 51% ↑ for males. Long-term certificates: 24% ↑ for females; no significant effects for males.	NA	Computer and Information Sciences and Support; Homeland Security, Law Enforcement, Firefighting; Social Sciences	Health Professions

Authors	Geography	Credential Length Examined	Cohorts Included	Earnings Gains for Certificates (Effects on Earnings Levels)	Earnings Gains for Certificates (Effects on Log Earnings)	Employment Gains for Certificates (Effects on Prob of Employment)	Fields in which <i>Short-Term</i> Certificates Yield Positive Earnings Gains at 0.1 Significance Level	Fields in which <i>Long-Term</i> Certificates Yield Positive Earnings Gains at 0.1 Significance Level
Carruthers and Sanford (2018)	Tennessee	Short-term certificates (one or two trimesters), and diplomas (one to two years).	2004-2008	Short-term certificates: \$166-292 ↑ . Diplomas: \$707-1034 ↑ .	Short-term certificates: 1-3% ↑ . Diplomas: 15-19% ↑ .	Short-term certificates: 4-5 percentage points ↑ . Diplomas: 9-11 percentage points ↑ .	NA	NA
Dadgar and Trimble (2015)	Washington	Short-term certificates (less than one year of full-time study), and long-term certificates (at least one year of study).	2001-2002 AY	Short-term certificates: no significant effects for both females and males. Long-term certificates: \$6,069 ↑ in annualized earnings for females; \$2,963 ↑ in annualized earnings for males.	Short-term certificates: 3% ↓ in hourly wages for females; no significant effects for males. Long-term certificates: 16% ↑ in hourly wages for females; no significant effects for males.	Short-term certificates: no significant effects for both females and males. Long-term certificates: 9 percentage points ↑ for females; 11 percentage points ↑ for males.	For females: Construction; Business and Marketing For males: Protective Services	For females: Allied Health; Nursing For males: Nursing; Transportation
Jepsen, Troske, and Coomes (2014)	Kentucky	Certificates (one or two semesters of course work), and diplomas (more than one year of study).	2002-2003 AY, 2003-2004 AY	Certificates: \$299 ↑ for females; \$297 ↑ for males. Diplomas: \$1,914 ↑ for females; \$1,265 ↑ for males.	NA	NA	For females: Health; Services For males: Vocational	For females: Health For males: Health; Vocational
Liu, Belfield, and Trimble (2015)	North Carolina	Certificates (12-18 semester-hour credits), and diplomas (36-48 semester-hour credits).	2002-2003 AY	Certificates: \$347 ↓ for females; \$279 ↓ for males. Diplomas: \$1,680 ↑ for females; \$545 ↓ for males.	NA	Certificates: no significant effects for both females and males. Diplomas: 6 percentage points ↓ in unemployment rate for females; no significant effects for males.	For females: Protective Services For males: Protective Services	For females: Nursing; Allied Health, Other CTE For males: None

Authors	Geography	Credential Length Examined	Cohorts Included	Earnings Gains for Certificates (Effects on Earnings Levels)	Earnings Gains for Certificates (Effects on Log Earnings)	Employment Gains for Certificates (Effects on Prob of Employment)	Fields in which <i>Short-Term</i> Certificates Yield Positive Earnings Gains at 0.1 Significance Level	Fields in which <i>Long-Term</i> Certificates Yield Positive Earnings Gains at 0.1 Significance Level
Minaya and Scott-Clayton (2021)	Ohio	Short-term certificates (less than one year of study), and long-term certificates (at least one year of study)	2001-2002 to 2003-2004 AY	Short-term certificates: \$404 ↑ for females; \$395 ↑ for males. Long-term certificates: \$1,871 ↑ for females; \$1,003 ↑ for males.	Short-term certificates: no significant effects for both females and males. Long-term certificates: 32% ↑ for females; no significant effects for males.	Short-term certificates: 8 percentage points ↑ for females; 12 percentage points ↑ for males. Long-term certificates: 16 percentage points ↑ for females; 9 percentage points ↑ for males.	For females: Health For males: None	For females: Health For males: Health
Stevens, Kurlaender, and Grosz (2019)	California	6-17 credit certificates, 18-29 credit certificates, and 30-59 credit certificates	Earning a certificate between 2003 and 2007	6-17 credit certificates: \$405-1,165 ↑ across different fields of study. 18-29 credit certificates: \$335-1,695 ↑ across different fields of study. 30-59 credit certificates: \$369-2,788 ↑ across different fields of study.	6-17 credit certificates: 10-35% ↑ across different fields of study. 18-29 credit certificates: 4-32% ↑ across different fields of study. 30-59 credit certificates: 7-49% ↑ across different fields of study.	6-17 credit certificates: 3-7 percentage points ↑ across different fields of study. 18-29 credit certificates: 3-8 percentage points ↑ across different fields of study. 30-59 credit certificates: 2-10 percentage points ↑ across different fields of study.	6-17 credit certificates: Health; Public/Protective; Business/Management; Family/Consumer; Engineering/Industrial; Fine/Applied Arts; Information Technology; Commercial Services 18-29 credit certificates: Health; Public/Protective; Business/Management; Family/Consumer; Engineering/Industrial; Commercial Services; Agriculture/Natural Resources	30-59 credit certificates: Health; Public/Protective; Business/Management; Family/Consumer; Engineering/Industrial; Fine/Applied Arts; Commercial Services; Agriculture/Natural Resources; Media/Communications

Authors	Geography	Credential Length Examined	Cohorts Included	Earnings Gains for Certificates (Effects on Earnings Levels)	Earnings Gains for Certificates (Effects on Log Earnings)	Employment Gains for Certificates (Effects on Prob of Employment)	Fields in which <i>Short-Term</i> Certificates Yield Positive Earnings Gains at 0.1 Significance Level	Fields in which <i>Long-Term</i> Certificates Yield Positive Earnings Gains at 0.1 Significance Level
Xu and Trimble (2016)	North Carolina, Virginia	Short-term certificates (less than one year of full-time study), and long-term certificates (at least one year of full-time study)	North Carolina: 2006-2007 AY, 2007-2008 AY. Virginia: 2006-2007 to 2008-2009 AY	Short-term certificates: North Carolina: \$278 ↑ ; Virginia: \$153 ↑ . Long-term certificates: North Carolina: \$953 ↑ ; Virginia: \$200 ↑ .	NA	Short-term certificates: North Carolina: 6 percentage points ↑ ; Virginia: 3 percentage points ↑ . Long-term certificates: North Carolina: 12 percentage points ↑ ; Virginia: 2 percentage points ↑ .	North Carolina: Construction; Humanities and Social Sciences; Protective Services Virginia: Allied Health; Humanities and Social Sciences; Mechanics, Repair, and Welding; Transportation	North Carolina: Allied Health; Mechanics, Repair, and Welding; Nursing Virginia: Allied Health; Mechanics, Repair, and Welding; Nursing; Protective Services

Notes: This table includes studies that examine labor market returns to short- and long-term certificates using state administrative data. In the “Cohorts Included” column, cohorts are defined based on the year of program enrollment, unless there are exceptions which we note separately. AY indicates academic year. Earnings refer to quarterly earnings, unless there are exceptions which we note separately. In the “Earnings Gains for Certificates (Effects on Log Earnings)” column, we convert the changes in earnings from log points to percentage points for the purpose of comparison across studies. To be specific, the percent change in earnings is equal to: $e^{\text{change in log earnings}} - 1$. When a study employs various identification strategies or estimation models and yields multiple results, we exclusively present the outcomes that the author(s) consider as the most preferred. The categories of “Short-Term Certificates” and “Long-Term Certificates” follow the definitions used by the authors.

Table 2: Descriptive Estimates of Post-Program Changes in Quarterly Earnings and Employment (Short-Term Certificate Earners Only)

	Quarterly Earnings (1)	Prob of Employment (2)
Panel A: Full Sample		
Post-Certificate	-174 (123)	0.038*** (0.014)
Pre-Enrollment Mean	3587	0.663
Observations	40,248	40,248
Panel B: Certificates with 1-6 Credits		
Post-Certificate	364** (157)	0.087*** (0.021)
Pre-Enrollment Mean	3091	0.644
Observations	14,456	14,456
Panel C: Certificates with 7-15 Credits		
Post-Certificate	133 (212)	0.047* (0.027)
Pre-Enrollment Mean	3789	0.663
Observations	9,542	9,542
Panel D: Certificates with 16-36 Credits		
Post-Certificate	-984*** (227)	-0.025 (0.023)
Pre-Enrollment Mean	3909	0.679
Observations	16,250	16,250

Notes: Observations are student-quarters. Sample is limited to short-term certificate earners only. Each coefficient is from a separate regression. Robust standard errors clustered at the student level are in parentheses below each coefficient. All earnings are adjusted to 2019 dollars. All models include fixed effects for ages, individuals, and calendar year-quarters. Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3: Matched Sample Summary Statistics

	Full Sample		Certificates with 1-6 Credits		Certificates with 7-15 Credits		Certificates with 16-36 Credits	
	Certificate Earners	Non-Completers	Certificate Earners	Non-Completers	Certificate Earners	Non-Completers	Certificate Earners	Non-Completers
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
# of Total Observed Credits Earned During the Program	9.245 (7.557)	8.471 (9.273)	3.637 (1.282)	2.814 (1.397)	7.988 (3.918)	7.168 (5.557)	15.821 (8.022)	16.156 (9.906)
Major Fields								
Business and Communication	0.021	0.021	< 0.010 [§]	< 0.010	0.026	0.026	0.034	0.034
Health	0.789	0.789	0.887	0.887	0.692	0.692	0.751	0.751
STEM	0.024	0.024	0	0	0.021	0.021	0.051	0.051
Skilled Trades	0.131	0.131	0.084	0.084	0.209	0.209	0.129	0.129
Other Fields	0.035	0.035	≈ 0.024 [§]	≈ 0.024	0.053	0.053	0.035	0.035
Demographic Characteristics								
Age at First Enrollment	31.556 (10.009)	31.282 (9.562)	32.672 (10.994)	32.175 (10.207)	30.136 (9.507)	30.126 (9.172)	31.317 (9.096)	31.106 (9.015)
Female	0.773	0.773	0.831	0.831	0.705	0.705	0.757	0.757
White	0.877	0.877	0.844	0.844	0.894	0.894	0.899	0.899
Black	0.099	0.099	0.128	0.128	0.077	0.077	0.084	0.084
Hispanic	0.027	0.027	0.037	0.037	0.029	0.029	0.016	0.016
Pre-Enrollment Labor Market Outcomes								
Average Quarterly Earnings (\$)	3450 (3890)	3555 (4441)	2939 (3283)	2998 (3429)	3604 (4442)	3722 (5395)	3877 (4030)	4022 (4620)
Probability of Employment	0.656	0.656	0.640	0.640	0.648	0.648	0.678	0.678
Observations	2595	15100	1000	8359	623	7720	972	7161

Notes: Summary statistics in this table are created based on coarsened exact matching weights. Observations are students. Standard deviations for continuous variables are in parentheses. Standard deviations for dummy variables can be calculated using the formula: $\sqrt{mean \times (1 - mean)}$. Major fields are categorized into five groups following definitions from the Kentucky Center for Statistics (KYSTATS): business and communication, health, STEM, skilled trades, and other fields. Information on major fields is obtained from degree records (for certificate earners) or enrollment records (for non-completers). Labor market performance prior to students' first observed enrollment is measured based on earnings and employment information in the five quarters prior to the initial enrollment. All earnings are adjusted to 2019 dollars. §: Following KYSTATS's redaction and suppression guidelines, we cannot present exact values for groups with less than 10 students in order to maintain the privacy of individual students.

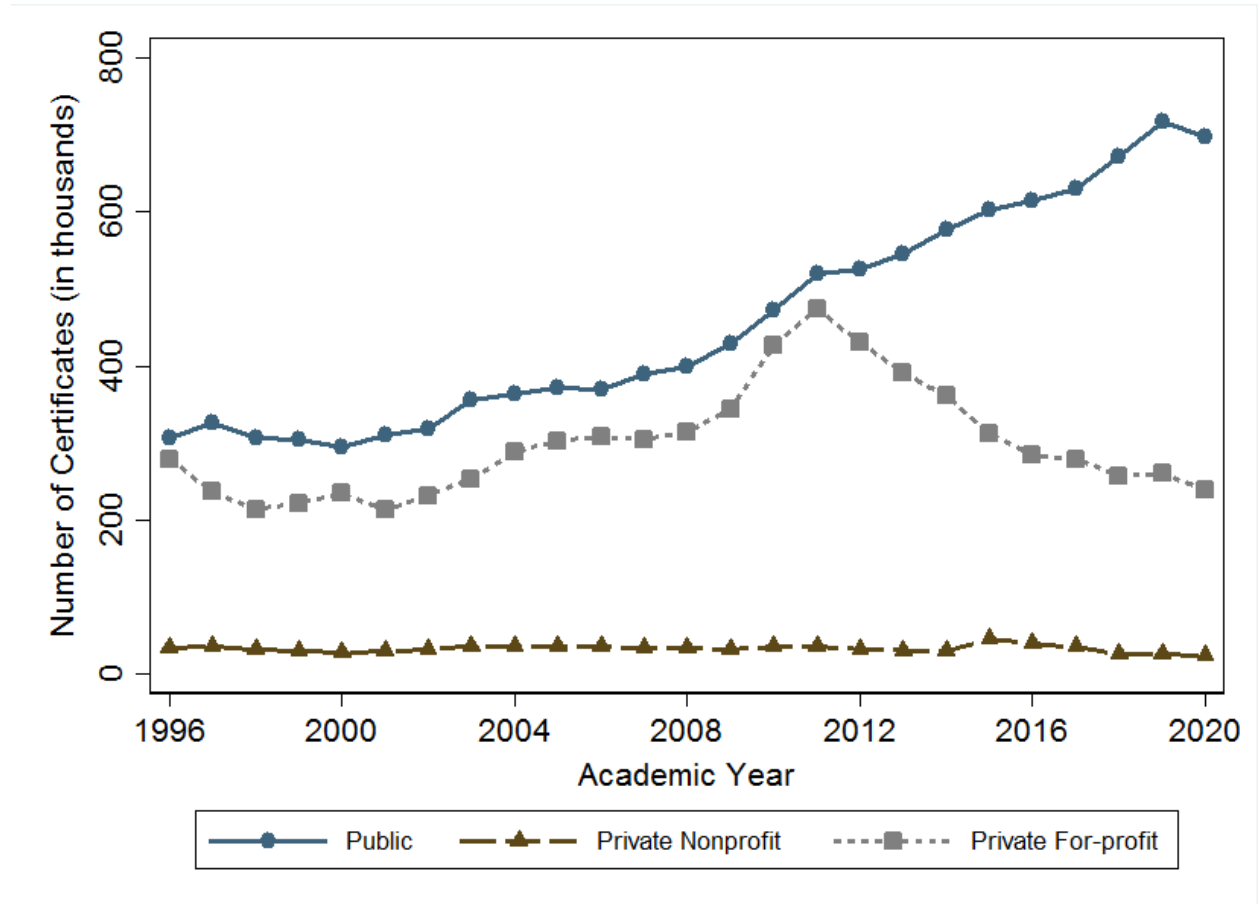
Table 4: Estimated Effects of Short-Term Certificates on Quarterly Earnings and Employment

	Quarterly Earnings (1)	Prob of Employment (2)
Panel A: Full Sample		
Certificate × Post	320*** (94)	0.062*** (0.011)
Pre-Enrollment Mean (Matched Treatment Group)	3450	0.656
Observations	230,035	230,035
Panel B: Certificates with 1-6 Credits		
Certificate × Post	261* (134)	0.056*** (0.017)
Pre-Enrollment Mean (Matched Treatment Group)	2939	0.640
Observations	121,667	121,667
Panel C: Certificates with 7-15 Credits		
Certificate × Post	259 (188)	0.064*** (0.020)
Pre-Enrollment Mean (Matched Treatment Group)	3604	0.648
Observations	108,459	108,459
Panel D: Certificates with 16-36 Credits		
Certificate × Post	273 (172)	0.046** (0.019)
Pre-Enrollment Mean (Matched Treatment Group)	3877	0.678
Observations	105,729	105,729

Notes: Observations are student-quarters. Each coefficient is from a separate regression. Robust standard errors clustered at the student level are in parentheses below each coefficient. All earnings are adjusted to 2019 dollars. All models include cumulative number of observed course credits completed, an indicator for contemporaneous enrollment, and fixed effects for quarters before first observed enrollment or since credential attainment/final observed enrollment, ages, individuals, and calendar year-quarters. Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

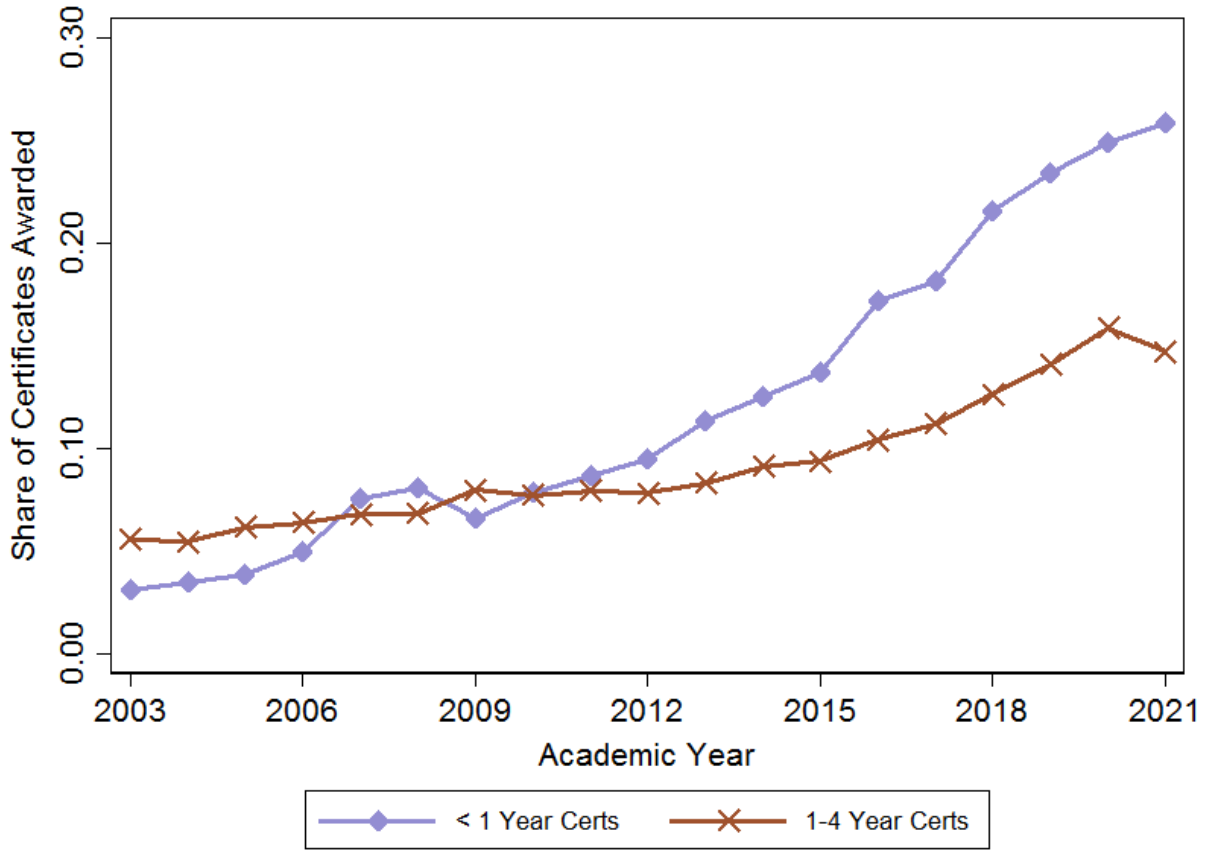
Appendix A: Supplementary Figures and Tables

Figure A1: Number of Certificates Awarded by Sector, 1995-1996 to 2019-2020 Academic Years



Source: Digest of Education Statistics 2021, Table 318.40. Notes: This figure only includes certificates awarded from postsecondary institutions participating in Title IV federal financial aid programs. Certificate counts include both degree- and non-degree-granting institutions. The x-axis represents the year corresponding to the spring semester of each academic year. For instance, the academic year 2020 refers to the 2019-2020 academic year.

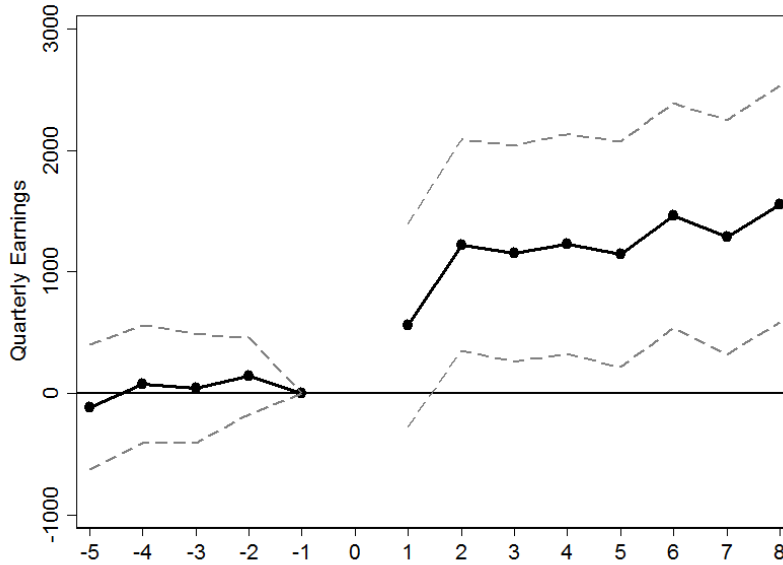
Figure A2: Share of Certificates Awarded by 4-Year Institutions, 2002-2003 to 2020-2021 Academic Years



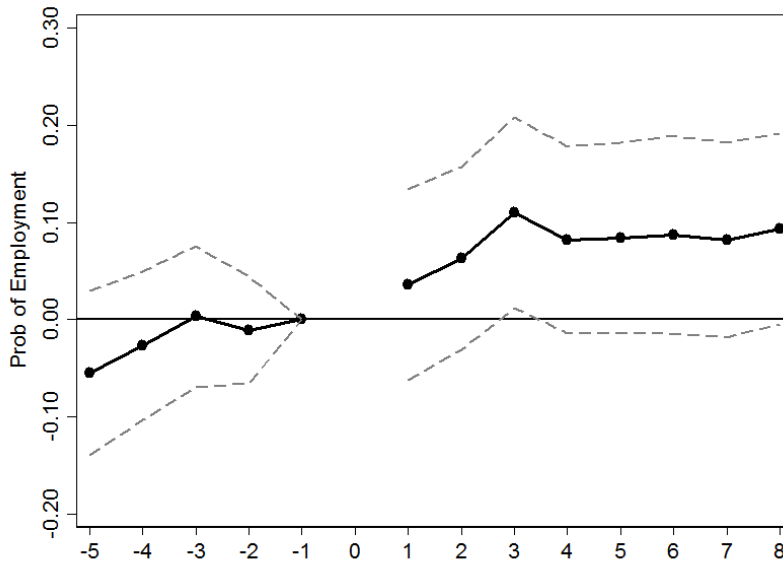
Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Completions component final data (2002-2003 to 2019-2020) and provisional data (2020-2021). Notes: This figure only includes certificates awarded from postsecondary institutions participating in Title IV federal financial aid programs. To determine the share of certificates awarded by 4-year institutions for each certificate type, we divide the number of certificates awarded by 4-year institutions by the total number of certificates awarded by institutions across all sectors. The x-axis represents the year corresponding to the spring semester of each academic year. For instance, the academic year 2021 refers to the 2020-2021 academic year.

Figure A3: Effects of 1-2 Year Certificates on Quarterly Earnings and Employment

(A) Quarterly Earnings



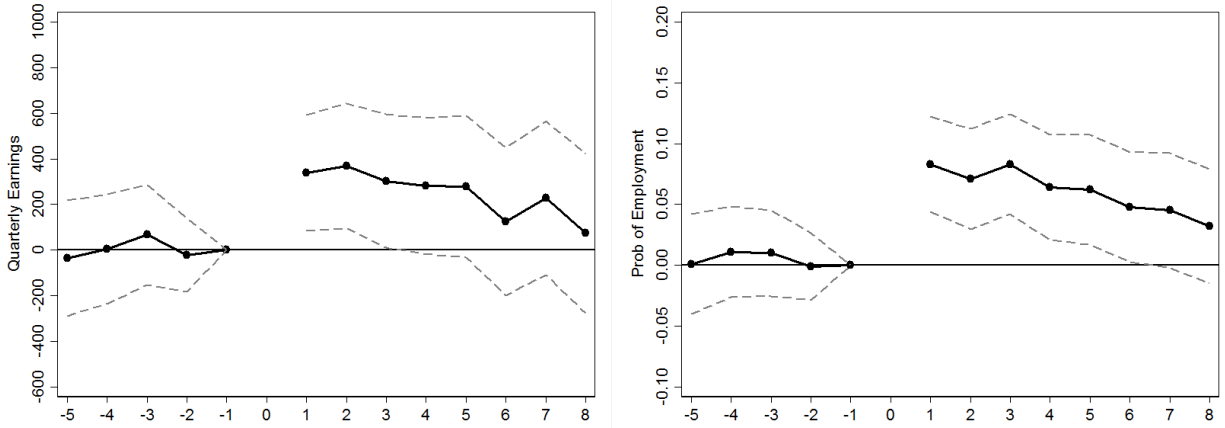
(B) Employment



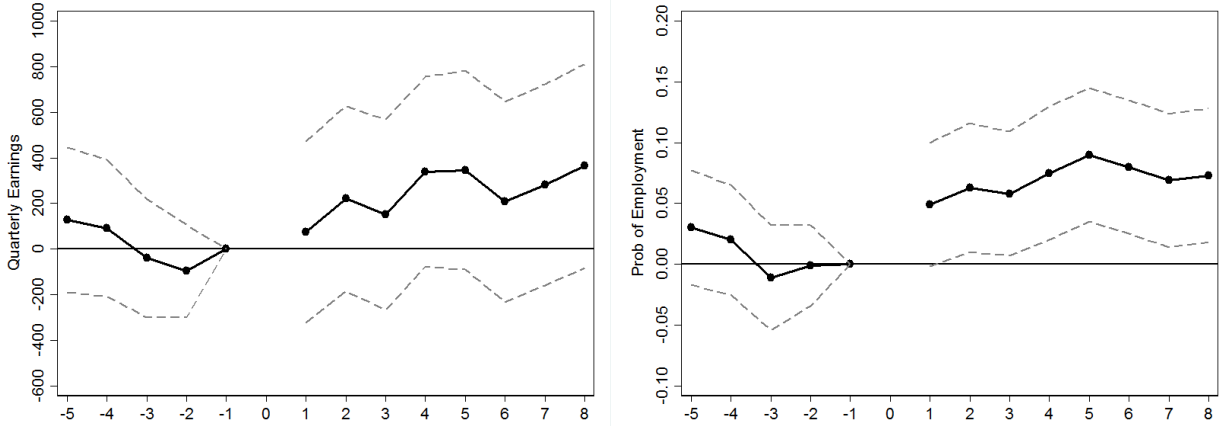
Notes: Treatment sample is restricted to certificate earners who earned one 1–2-year certificate with 30-76 credits. The horizontal axis represents quarters prior to the initial enrollment (if negative) or since earning the credential or the last observed enrollment (if positive). Marker reports the point estimate for the treatment effect for each quarter, and grey dashed lines are the 95% confidence interval.

Figure A4: Effects of Short-Term Certificates on Quarterly Earnings and Employment (By Certificate Length, Adding Time Trends Interacted with Individual Characteristics)

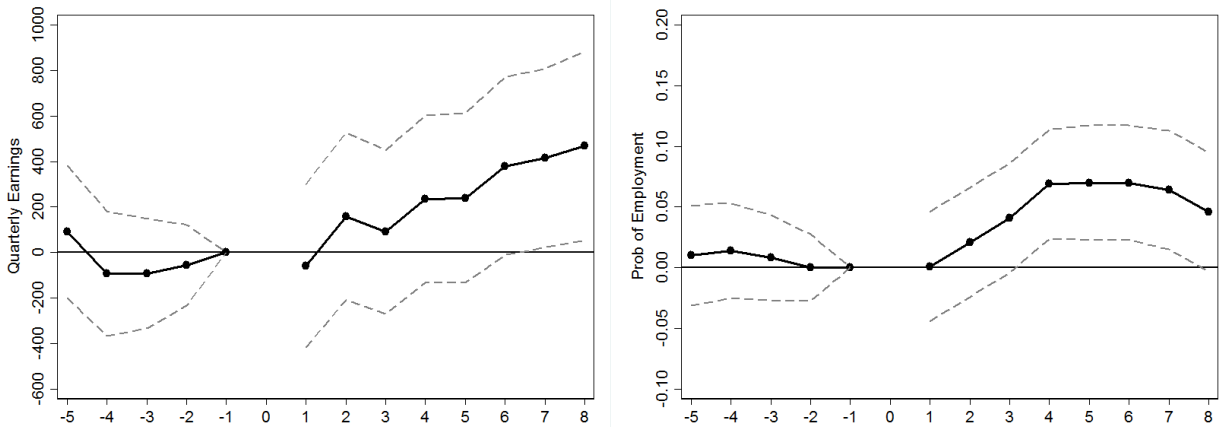
(A) Certificates with 1-6 Credits



(B) Certificates with 7-15 Credits



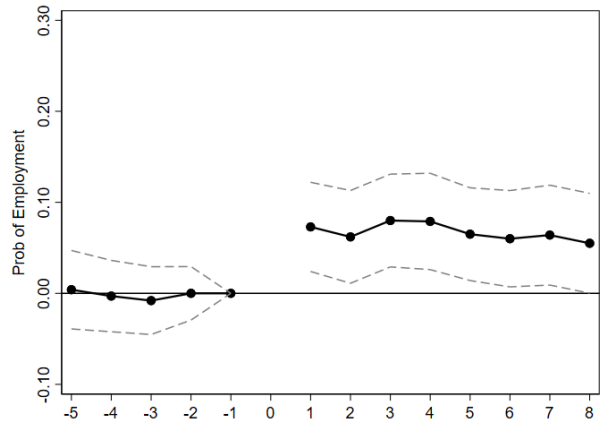
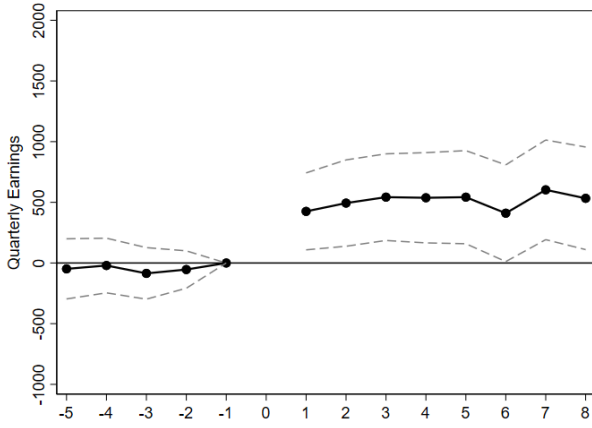
(C) Certificates with 16-36 Credits



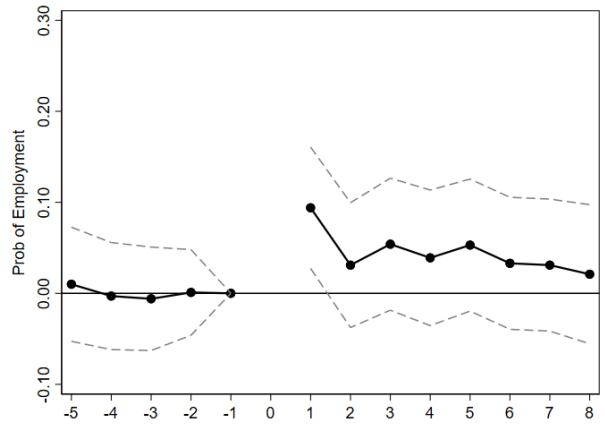
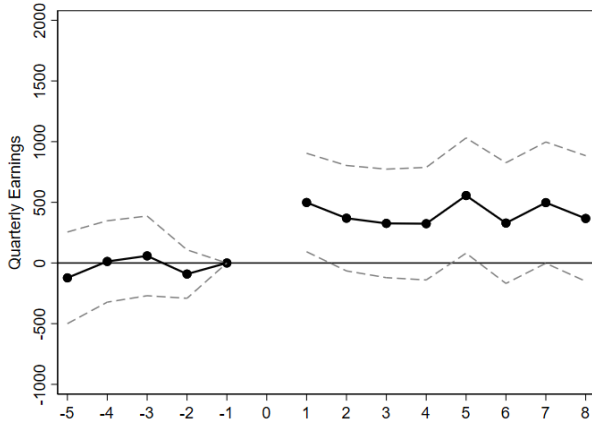
Notes: The horizontal axis represents quarters prior to the initial enrollment (if negative) or since earning the credential or the last observed enrollment (if positive). Marker reports the point estimate for the treatment effect for each quarter, and grey dashed lines are the 95% confidence interval.

Figure A5: Effects of Short-Term Certificates on Quarterly Earnings and Employment (First-Time Students Only)

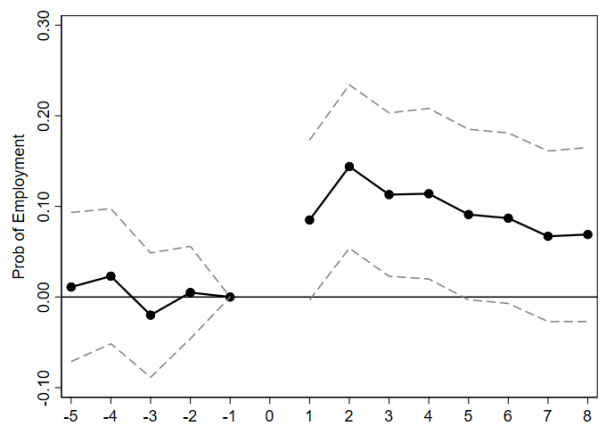
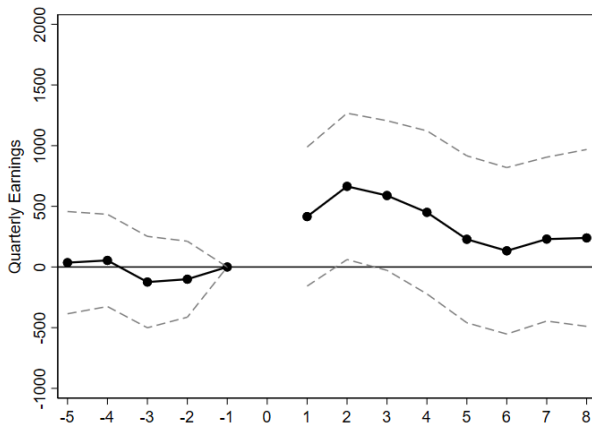
(A) Full Sample



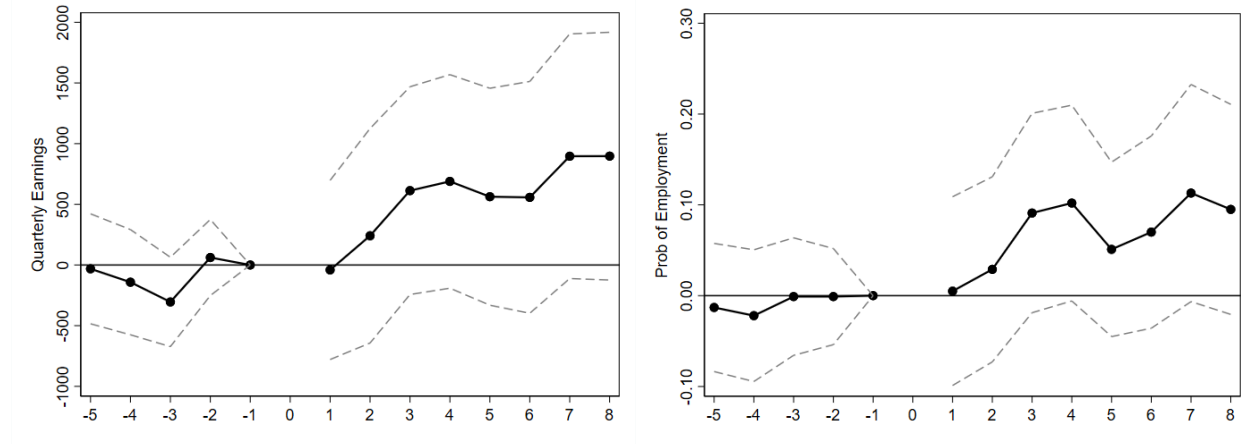
(B) Certificates with 1-6 Credits



(C) Certificates with 7-15 Credits



(D) Certificates with 16-36 Credits



Notes: Treatment sample is restricted to first-time certificate earners who earned one short-term certificate. The horizontal axis represents quarters prior to the initial enrollment (if negative) or since earning the credential or the last observed enrollment (if positive). Marker reports the point estimate for the treatment effect for each quarter, and grey dashed lines are the 95% confidence interval.

Appendix B: Data

To conduct this study, we use administrative Kentucky Postsecondary Education Data System (KPEDS) provided by the Kentucky Council on Postsecondary Education to the Kentucky Center for Statistics (KYSTATS). KPEDS is part of the broader Kentucky Longitudinal Data System (KLDS). The KLDS data contain individual-level records from the state agencies that oversee K-12 education, postsecondary education, and the Unemployment Insurance (UI) system. The primary data we use in the paper are KPEDS data that include information on postsecondary institutions attended, enrollment and course-taking records, credits attempted and earned, credential attainment, and student-level demographics for eight public four-year institutions and 16 community colleges with more than 70 locations.

Using the KPEDS data files, we construct a student-level data set that consists of all individuals who earned short-term certificates through public postsecondary education programs in the Kentucky Community and Technical College System between the 2008-2009 and 2019-2020 academic years. We then merge the postsecondary education data with quarterly earnings and employment records from the state UI program that is available from the third quarter of calendar year 2008 to the second quarter of calendar year 2019. Administrative UI records are from covered jobs as reported by employers in Kentucky to the state's UI system. This includes most workers, but those who do not work, who work only out of state, or who work in jobs not subject to UI reporting requirements (for example, federal employment and self-employment) in every quarter during the analysis period will not be included in our analytical sample.

Appendix C: Descriptive Statistics for the Full Sample

In this appendix, we present and discuss descriptive statistics for the full sample. In Table C1, we see that short-term certificate earners completed the program with the average length of 14 credential-specific credits (see Columns 1 and 2). The observed time to credential is about 4.4 quarters for certificate earners, which are slightly shorter than 5 quarters of observed enrollment for non-completers (see Columns 3 and 4). However, certificate recipients earned more credits (9.7 credits) than non-completers (7.6 credits) based on what we can observe in the data. Among the four main major fields, certificate earners are more likely to enroll in health-related programs (about 77%) than programs in other fields.²² Across the various demographic groups, there are slight differences in the distributions of age at first observed enrollment, race, and ethnicity. The largest difference is that the proportion of female students is much lower among non-completers (about 50%) than among certificate earners (about 74%).

Regarding labor market performance, certificate earners' average pre-first observed enrollment quarterly earnings and employment are around \$3,600 and 66%, respectively, which are lower than those of non-completers (\$6,300, 71%). We also present descriptive statistics by grouping certificate earners into three categories based on certificate length: certificates with 1-6 credential-specific credits, 7-15 credits, and 16-36 credits (see Columns 5 to 10). We observe that students earning a certificate with 1-6 credits on average have comparatively worse labor market performance prior to the first observed enrollment than those earning longer certificates.

²² We follow the Kentucky Center for Statistics and use their classification of major fields. To be specific, we group major fields into four general categories: business and communication, health professions, STEM, and skilled trades, with the remainder of fields falling into the "others" category. See Table C2 for the classification scheme. We collect the two-digit Classification of Instructional Programs (or CIP) code information from degree records to determine major fields for certificate earners. We use the CIP code in which students earned the largest number of observed credits from enrollment records to determine major fields for non-completers.

Females are much more likely to earn a certificate with 1-6 credits (about 81%), and health-related fields account for a larger proportion among these very short certificates (about 88%) than longer certificates (about 70% on average).

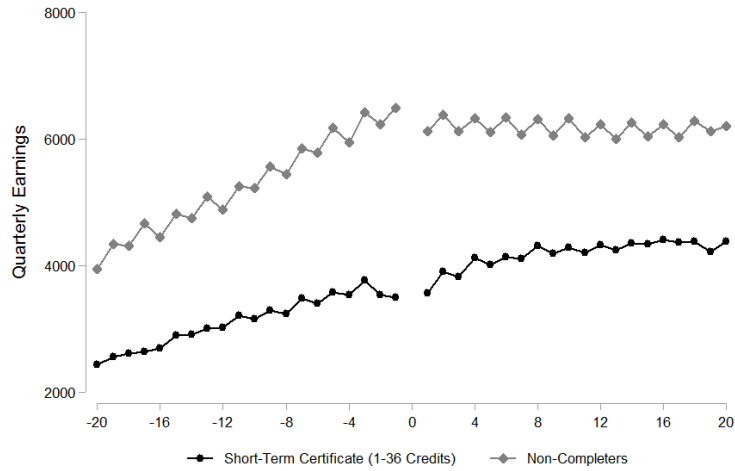
In Figure C1, we further present descriptive trends of quarterly earnings (Panels A and B) and employment (Panels C and D) for the full sample from twenty quarters prior to a student's first observed entrance into a program to twenty quarters after attaining the credential (for short-term certificate earners) or after leaving college (for non-completers). Overall, average quarterly earnings are higher among non-completers than certificate earners over quarters as we observe in Panel A. In Panel C, the probability of employment is slightly higher for non-completers before the first observed enrollment, but it starts to decrease over time after they drop out of college and falls below the trend for certificate earners.

Regarding the trajectories by certificate length, we see that during post-certificate periods, quarterly earnings steadily increase for students who earned 7-15 credit and 16-36 credit certificates, while remaining relatively stable over time for students with 1-6 credit certificates (Panel B). The employment rate for students holding longer certificates increases slightly in the first four quarters following program completion before gradually declining. In contrast, the rate begins to decline immediately after program completion among students completing very short certificates (Panel D). More importantly, we see clearly that certificate earners exhibit a decline in earnings and employment two quarters prior to the first observed enrollment, even though their labor market performance improves over time before the decline. This suggests that weakened labor market conditions may be contributing to these students' decisions to return to school to pursue a short-term certificate (referred to as the "Ashenfelter dip"). The dip is less evident among those who did not earn a credential. This could indicate that there are distinct

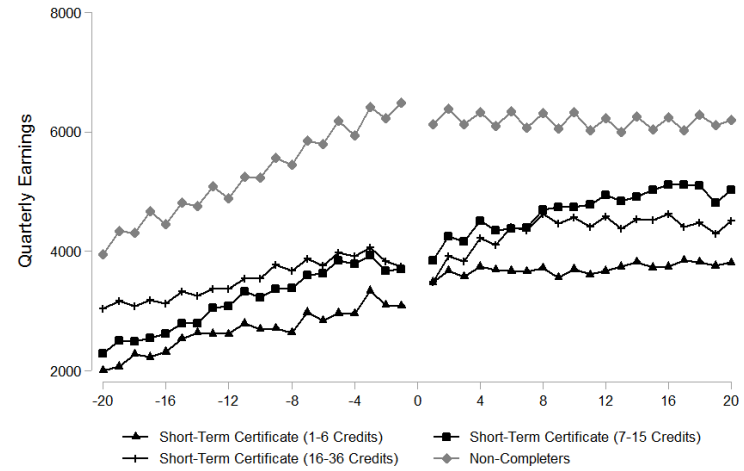
motivations behind pursuing different types of programs, and that those who complete and those who do not possess distinct skills or goals.

Figure C1: Quarterly Earnings and Employment Trajectories, Full Sample

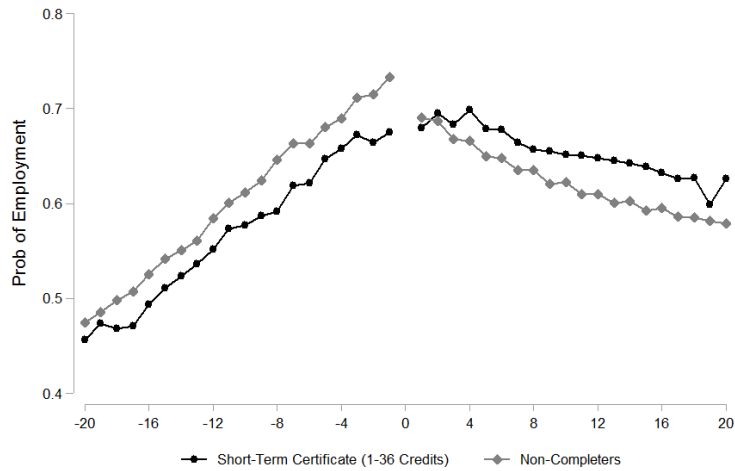
(A) Quarterly Earnings, Full Sample



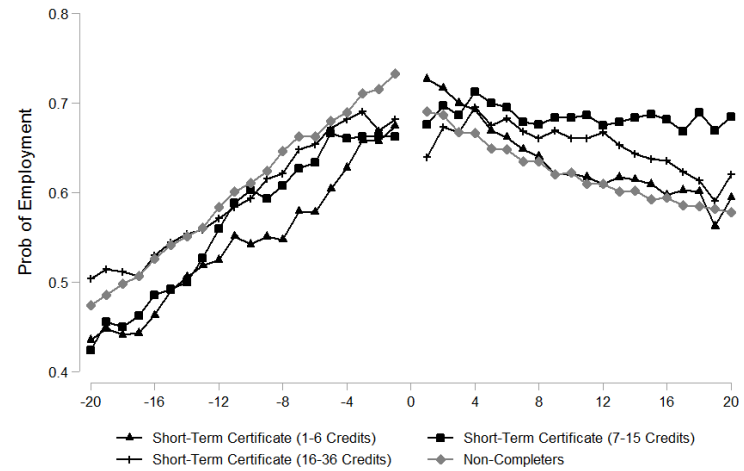
(B) Quarterly Earnings, By Certificate Length



(C) Employment, Full Sample



(D) Employment, By Certificate Length



Notes: The horizontal axis represents quarters prior to the initial enrollment (if negative) or since earning the credential or the last observed enrollment (if positive).

Table C1: Full Sample Summary Statistics

	Certificate Earners		Non-Completers		Certificates with 1-6 Credits		Certificates with 7-15 Credits		Certificates with 16-36 Credits	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Certificate Length	14.332	10.354	NA	NA	3.844	1.276	11.337	2.501	25.421	5.856
Time to Credential/Last Enrollment (# of Observed Quarters)	4.445	3.943	5.019	4.616	2.948	2.509	4.292	3.983	5.868	4.424
# of Total Observed Credits Earned During the Program	9.718	7.818	7.588	13.027	3.709	1.705	8.023	3.925	16.059	8.108
Major Fields										
Business and Communication	0.026	0.161	0.084	0.277	0.005	0.073	0.027	0.163	0.045	0.207
Health	0.770	0.421	0.138	0.344	0.879	0.327	0.684	0.465	0.725	0.447
STEM	0.033	0.178	0.059	0.235	0.003	0.052	0.025	0.155	0.064	0.245
Skilled Trades	0.138	0.345	0.091	0.287	0.092	0.289	0.214	0.410	0.135	0.342
Other Fields	0.032	0.177	0.271	0.445	0.022	0.145	0.050	0.219	0.031	0.174
Missing/Unknown	0.000	0.000	0.358	0.480	0.000	0.000	0.000	0.000	0.000	0.000
Demographic Characteristics										
Age at First Enrollment	31.876	9.965	33.827	10.616	32.979	11.020	30.590	9.554	31.650	9.075
Female	0.740	0.439	0.497	0.500	0.806	0.396	0.680	0.467	0.717	0.451
White	0.825	0.380	0.815	0.388	0.805	0.396	0.845	0.362	0.831	0.375
Black	0.124	0.330	0.130	0.337	0.143	0.350	0.105	0.307	0.118	0.323
Hispanic	0.062	0.242	0.052	0.222	0.064	0.245	0.057	0.232	0.064	0.245
Pre-Enrollment Labor Market Outcomes										
Average Quarterly Earnings (\$)	3587	3892	6251	7551	3091	3358	3789	4423	3909	3959
Probability of Employment	0.663	0.376	0.706	0.365	0.644	0.378	0.663	0.378	0.679	0.371
Number of Students	3,096		104,414		1,112		734		1,250	

Notes: Columns 1 and 2 present summary statistics for students who have earned a short-term certificate with 1-36 credits. Columns 3 and 4 present summary statistics for students who pursued credentials but never completed during the analytical time frame. Columns 5 to 10 present summary statistics for students who have earned a short-term certificate by different certificate length. Observations are students. Certificate length measures credential-specific credits. Time to credential/last enrollment measures the number of observed quarters from the first observed enrollment to the quarter when the certificate was earned (for certificate earners) or to the last observed enrollment (for non-completers). Major fields are categorized into five groups following definitions from the Kentucky Center for Statistics (KYSTATS): business and communication, health, STEM, skilled trades, and other fields. Information on major fields is obtained from degree records (for certificate earners) or enrollment records (for non-completers). Labor market performance prior to students' first observed enrollment is measured based on earnings and employment information in the five quarters prior to the initial enrollment. All earnings are adjusted to 2019 dollars.

Table C2: Classification of Major Fields

Category	2-Digit CIP Code	Fields
Business and Communication	09	Communication, Journalism, & Related Programs
	10	Communications Technologies/Technicians & Support Services
	52	Business, Management, Marketing, & Related Support Services
Health	51	Health Professions & Related Programs
STEM	01	Agriculture, Agriculture Operations, & Related Sciences
	03	Natural Resources & Conservation
	04	Architecture & Related Services
	11	Computer & Information Sciences & Support Services
	14	Engineering
	15	Engineering Technologies & Engineering-Related Fields
	26	Biological & Biomedical Sciences
	27	Mathematics & Statistics
	28	Military Science, Leadership & Operational Art
	40	Physical Sciences
Skilled Trades	41	Science Technologies/Technicians
	12	Personal & Culinary Services
	33	Citizenship Activities
	43	Homeland Security, Law Enforcement, Firefighting & Related Protective Services
	46	Construction Trades
	47	Mechanic & Repair Technologies/Technicians
Others	48	Precision Production
	49	Transportation & Materials Moving
	05	Area, Ethnic, Cultural, Gender, & Group Studies
	13	Education
	16	Foreign Languages, Literatures, & Linguistics
	19	Family & Consumer Sciences/Human Sciences
	22	Legal Professions & Studies
	23	English Language & Literature/Letters
	24	Liberal Arts & Sciences, General Studies & Humanities
	25	Library Science
	30	Multi/Interdisciplinary Studies
	31	Parks, Recreation, Leisure, & Fitness Studies
	38	Philosophy & Religious Studies
	39	Theology & Religious Vocations
42	Psychology	
44	Public Administration & Social Service Professions	
45	Social Sciences	
50	Visual & Performing Arts	
54	History	

Notes: We follow the Kentucky Center for Statistics and use their classification of major fields. See Page 14 of *Postsecondary Feedback Report Technical Notes* (Available at https://kystats.ky.gov/Content/Reports/2020_PostsecondaryFeedbackReportTechnicalNotes.pdf)

Appendix D: Coarsened Exact Matching Procedure

In our study, the treatment group is certificate earners who earned one short-term certificate, and the control group is non-completers who attempted but did not complete a credential. To balance covariates and pre-first observed enrollment labor market performance across the treatment and control group, we use coarsened exact matching (CEM). Theoretically, the matching algorithm splits the sample into strata based on coarsened observed variables, exact matches the treatment and control group within each stratum, and then only retain the original uncoarsened values of the matched sample. Observations in any strata that do not contain at least one treated and one control unit are dropped.

The CEM algorithm assigns the following weights to matched individual i in stratum s :

$$w_i^s = \begin{cases} 1, & \text{if } i \text{ in the treatment group} \\ \frac{n_T^s N_C}{n_C^s N_T}, & \text{if } i \text{ in the control group} \end{cases}$$

where n_T^s and n_C^s are the number of matched individuals in the treatment and control group in stratum s , respectively. N_T and N_C are the number of matched individuals in the whole sample for the treatment and control group, respectively. Unmatched individuals receive a weight of 0. With a CEM matched sample, we are able to estimate the average treatment effect on the treated (or ATT).

In this paper, we perform exact matches by matching each certificate earner to non-completers who are in the same stratum based on the following categories.

1. Categorical variables:

- Gender: male, female
- Race: white, black, other/unknown
- Ethnicity: Hispanic, non-Hispanic

- Major fields: business and communication, health, STEM, skilled trades, and others

2. Continuous variables:

We create mutually exclusive categories for each of the following variables:

- Age at first observed enrollment: 20-24, 25-29, 30-34, 35-39, 40-60
- Total observed credits earned during the program: 0-6, 7-15, 16-36, 37 and above

3. Pre-first observed enrollment labor market experiences:

We average the following variables in quarter blocks (3-5 quarters prior to the first observed enrollment, 2 quarters prior, and 1 quarter prior), and create mutually exclusive categories for each block.

- Average employment rate (ER): $ER = 0$, $0 < ER \leq 0.34$, $0.34 < ER \leq 0.67$, $0.67 < ER \leq 1$
- Average quarterly earnings (QE): $QE = 0$, $0 < QE \leq 1^{\text{st}} \text{ quartile}$, $1^{\text{st}} \text{ quartile} < QE \leq \text{median}$, $\text{median} < QE \leq 3^{\text{rd}} \text{ quartile}$, $QE > 3^{\text{rd}} \text{ quartile}$