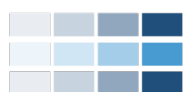


Course Corrections? The Labor Market Returns to Correctional Education Credentials

James Cowan
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Abstract

Correctional education is a prevalent form of rehabilitation programming for prisoners in the United States. There is limited evidence, however, about the labor market returns to credentials received while incarcerated. Using incarceration, educational, and labor market data in Washington State, we study the labor market returns to GEDs and short-term vocational certificates earned in prison. We identify the returns to credentials by a difference-in-differences design that compares changes in earnings and employment for incarcerated persons who earn a credential to those who enroll in a program but fail to complete a GED or certificate. We estimate that GEDs increase post-incarceration earnings by about \$450 per quarter and that vocational certificates increase earnings by about \$250 per quarter. Degree completers have higher hourly wages, are more likely to be employed, and work more hours following release. For vocational programs, earnings increases are driven by certificates in construction and manufacturing.

1. Introduction

Approximately two thirds of released prisoners are arrested within three years of leaving prison, and nearly half are convicted of a new crime (Antenangeli & Durose, 2021). The aggregate social costs of these crimes are substantial (Anderson, 1999, 2021). Reasons for the high rates of recidivism vary, but many of the formerly incarcerated struggle to find employment after release from prison (Dobbie et al., 2018; Waldfogel, 1994; Western, 2002). Education and workforce training programs are thus a popular strategy for reintegrating former prisoners into society.

Correctional education is one of the most common rehabilitation programs targeted at prison inmates. Motivated by empirical evidence that education increases earnings and reduces crime (Card, 1999; Lochner & Moretti, 2004), these programs aim to improve prospects in the formal economy and thereby disincentivize future criminal behavior. Nearly every state offers adult basic education programming and vocational training through the prison system, and these programs are mandatory for prisoners with low education in nearly half the states (Davis et al., 2014). More than half of the total incarcerated population participates in some kind of correctional education programming (Harlow, 2003).

In this study, we estimate the labor market effects of credentials earned in Washington State prisons. In partnership with the State Board of Community and Technical Colleges (SBCTC), the Washington Department of Corrections operates two major educational programs intended to culminate in either a GED or a vocational certificate. We assess these programs using an unsuccessful applicant design that compares changes in earnings between pre- and post-incarceration periods for prisoners who earn a GED or vocational certificate to those who enroll in such programs but fail to complete them.

We find that credentials earned in both programs increase earnings following release. The GED increases quarterly earnings by about \$450 and vocational certificates increase quarterly earnings by about \$250. The earnings effects of the GED persist for 4 years following release, while our most conservative estimates suggest that the effects of vocational certificates begin to fade out after 3 years. These effects operate through increased wages and labor market participation. Both the GED and vocational certificates increase hourly wages, employment, and hours worked; the GED additionally reduces future incarceration. Among vocational fields, the effects of certificates are largest in construction and manufacturing; we estimate null earnings impacts of certificates in business or information technology.

The paper makes two contributions to the emerging literature on the effects of prison education on labor market outcomes. First, we estimate labor market effects of correctional education credentials using a plausibly causal research design. In a summary of the literature, Bozick et al. (2018) identify few studies on their labor market effects using quasi-experimental research designs. This paper contributes to a small literature on the prison GED using difference-in-differences designs that has so far reached mixed conclusions about earnings (Cho & Tyler, 2010; Darolia et al., 2021; Tyler & Kling, 2007). Second, we study vocational training programs, which have received less research attention. This is an important omission, as these programs have become more popular in recent years (Davis et al., 2014) and the evidence from the general population is generally more positive than for the GED (Dadgar & Trimble, 2015; Jepsen et al., 2014; Stevens et al., 2019; Xu & Trimble, 2014). Overall, our results suggest that correctional education programs are a viable strategy for improving the labor market prospects of the formerly incarcerated.

2. Background and Literature Review

2.1 Correctional Education in Washington State

The Washington Department of Corrections (DOC) operates educational programming in conjunction with the State Board of Community and Technical Colleges (SBCTC). The programming is offered by state community colleges and falls into two major categories: adult basic skills programming, intended to lead to a GED or high school equivalent; and vocational training programs, intended to culminate in a vocational certificate or associate degree. Some prisons also offer postsecondary courses that may lead to an academic associate or bachelor's degree.

The prison system refers new inmates without a high school diploma to basic skills programming. The precise nature of the programming depends on the results of an academic proficiency test and can include coursework in reading comprehension, writing, and mathematics, as well as test preparation for the GED. In the last full year prior to the pandemic, 4,723 Washington state inmates participated in basic skills programs, 1,936 inmates took the GED, and 754 completed all of the GED testing requirements for a high school equivalency (SBCTC, 2019).

The vocational programs are similar to those offered in state community colleges and lead to certificates or applied associate degrees in various trades. The available fields differ by prison under their contracts with state colleges, but construction and business are the most popular fields. The state has favored offering short-term certificates that can be completed during a stint in prison. Historically, most certificates awarded in state prisons required fewer than 20 quarter credits to complete. This corresponds to approximately one academic quarter of full-time study. As of the very end of our sample period, the state has begun shifting toward certificates with higher credit requirements, resulting in a decline in the overall number of certificates

awarded. In 2015, the state awarded 1,918 certificates, of which 48% required at least 20 credits; by 2019, the state awarded only 1,189 total certificates, but 62% of the awards required at least 20 credits (SBCTC, 2019).

2.2 Prior Literature

In this study, we assess the labor market effects of sub-baccalaureate credentials (GED and vocational certificates) earned in prison. A key motivation for these policies is that they improve employment prospects in the formal economy and reduce the relative benefit of criminal activity (Lochner, 2004). This economic model of crime is consistent with several studies finding negative effects of educational attainment on criminal behavior (Deming, 2011; Lochner & Moretti, 2004; Machin et al., 2011). Because these benefits depend on the signaling function of credentials to potential employers, the economic return to degrees earned in prison is a key policy parameter for assessing the social value of correctional educational programming.

The empirical evidence on the effects of GED receipt for the workers in the non-incarcerated population is mixed. Cameron and Heckman (1993), for instance, find no direct effect of the GED on wages in survey data. A few studies use research designs that abstract from potential human capital effects of GED preparation and are more likely to isolate signaling effects. Jepsen et al. (2016) study the effects of qualifying for the GED using a regression discontinuity design based on assessment scores. Because those who just pass the test are not likely to differ on human capital, their results should indicate whether the certificate itself holds value for employers. They find no effect of the GED on earnings. However, in a conceptually similar design, Tyler et al. (2000) find that applicants in states with lower passing thresholds have earnings that are about 13-20% higher than unsuccessful applicants with similar scores in states with higher thresholds. Tyler (2004) finds similar increases in earnings among GED

recipients relative to unsuccessful applicants, with most of the increase coming through increased employment.

The returns to the GED may be more positive when preparation includes more substantial human capital investment, as is the case in some of the correctional education programming we study. Although the typical GED candidate spends little time studying for the GED, between 10 and 25% of candidates report studying more than 100 hours, which is about 10% of the annual class time for a typical high school student (Heckman et al., 2011). Murnane et al. (2000) find larger effects of the GED among high school dropouts with lower test scores, which they attribute in part to greater study effort among this group. These effects may better generalize to the correctional education setting: in our sample, those completing a GED spend on average more than 150 hours in basic skills programming. To the extent that this preparation improves earnings independently of the degree, our estimates relying on non-completer participants as a control group may understate the effects of basic skills programming.

Obtaining the GED might also improve access to higher education, which typically requires a high school diploma or equivalent. Consistent with this, Murnane et al. (1997) find that the GED increases college attendance by about 3-5 percentage points in any given year. Jepsen et al. (2017) obtain similar enrollment effects using a regression discontinuity design, but they also find that students induced into college by completing the GED complete few additional credits and are not more likely to complete postsecondary degrees.

Another line of studies has assessed the returns to vocational certificates earned at community and technical colleges. Jacobson et al. (2005a, 2005b) find positive effects of attending community colleges in Washington state on earnings, although their treatment includes students studying for both associate degrees and certificates. Jepsen et al. (2014) assess the

returns to specific categories of credentials and find that vocational certificates – similar to those awarded in Washington prisons – increase quarterly earnings by about \$300. Using data from other states, several other studies have reached similar conclusions (Carruthers & Stanford, 2018; Dadgar & Trimble, 2015; Stevens et al., 2019; Xu & Trimble, 2014). Notably, the returns to short-term certificates, which are common in our sample, appear to be considerably weaker than those awarded for longer programs of study (Dadgar & Trimble, 2015; Stevens et al., 2019; Xu & Trimble, 2014).

There has been less research on the effects of these credentials among the prison population, mostly focusing on recidivism (see Davis et al. (2013) for a review). Three studies rely on a similar research design as that used in this study, comparing changes in earnings for inmates who earned a GED while in prison to those who participated in basic skills programming but did not earn a credential. Tyler and Kling (2007) study the labor market returns to GEDs earned in Florida prisons. Although they find positive effects of the GED relative to prisoners who complete no basic skills programming, they find little labor market return to the credential itself. Cho and Tyler (2010) find similar results, although they do find that completing a basic skills course increases the likelihood of employment after incarceration. Darolia et al. (2021) find that the formerly incarcerated who earned a GED in Missouri prisons had earnings that were about 25% higher upon release than participants in adult basic skills programming who did not earn a credential. Other studies, typically relying on selection on observables designs, have found more positive effects of the GED (Davis et al., 2013).

3. Data and Summary Statistics

Our analysis uses a dataset that links administrative records on incarceration from the Washington DOC to educational and employment records from the state's P-20 longitudinal data system, supplied by the Washington State Education Research and Data Center (ERDC). The

DOC dataset contains records of prison admissions and exit, sentencing information, participation in correctional education programs, demographic characteristics, and measures of criminal background. We use these records to create a dataset with information on newly sentenced inmates entering the Washington state prison system between 2009 and 2020. We retain those who enter Washington prisons for the first time following a new offense and are released from prison prior to December 31, 2019.

Spells in prison are defined by the start and end date of each period of incarceration. As in other research on correctional education (e.g., Darolia et al., 2021), each observation corresponds to an uninterrupted spell in a state prison. For each spell, we also construct a number of spell-specific characteristics, including demographics, the type and severity of criminal charges, and sentence length. Inmates in this dataset are identified by name, birthdate, and social security number, which were used to match incarceration records with other state administrative databases.

The DOC data also includes information on participation in correctional education programming. Participation is recorded as attendance in particular programs, with all prisons in Washington state offering a common set of educational programs. For each spell, we construct measures of the cumulative hours spent in both basic skills and vocational programming.

We merge the spells dataset to postsecondary transcript data from ERDC. The transcript data includes a record of course enrollments and awards and includes enrollment records for students enrolled through correctional education. Using this linked data, we construct measures of the total credits and awards earned during each prison spell. In addition to the educational programming, the DOC tracks participation in prison jobs programs. We measure the total hours spent working during the prison stint in addition to participation in educational programming.

Finally, we match the prison data to quarterly employment records maintained by the Washington State Employment Security Department (ESD). The ESD collects quarterly earnings reports from employers in Washington as part of the state unemployment insurance program. The reporting excludes some classes of workers, such as federal employees, certain agricultural workers, and the self-employed. However, nationwide, UI systems cover over 96% of civilian jobs (U.S. Department of Labor, Bureau of Labor Statistics, 1997). These records also necessarily exclude individuals who leave the state, although this should be less of a concern given the restrictions on mobility after release from prison. For each quarter, we also construct measures of current incarceration and postsecondary enrollment status using the correctional and educational data, respectively.

For each spell in prison, we obtain employment outcomes for up to 12 quarters (3 years) prior to incarceration and 18 quarters (4.5 years) following incarceration. The employment data is available between 2009Q1 and 2021Q1, so not all individuals in the sample are observed for each quarter. We deflate earnings to 2017Q1\$ using the quarterly personal consumption expenditures index and winsorize earnings at the 99th percentile among the ever-incarcerated sample (approximately \$30,000 per quarter). For each spell in prison, we demarcate time relative to the incarceration period. That is, for event time $t = -12, -11, \dots, 17$, $t = -1$ denotes the quarter prior to incarceration and $t = 0$ indicates the quarter of release (we omit the quarter of incarceration and quarters spent incarcerated from the sample).

We present summary statistics for the main analytical samples in Table 1. The two samples include those who participated in a basic skills program during the focal spell in prison (Columns 1 – 3) and those who participated in a vocational skills program (Columns 4 – 6). Prisoners who earned credentials through correctional education programming tend to have more

serious criminal charges and longer prison sentences than non-completers. Among participants in basic skills programs, the most significant differences in conviction types are in property crimes (49% among completers and 43% among non-completers). Those earning GEDs had sentences of about five months longer than non-completers. Among participants in vocational programs, certificate completers are more likely to have been convicted of sex and violent crimes and serve sentences of about 15 months longer than non-completers. Vocational degree completers also have a longer pre-sentencing adjudication period: the length between crime and sentencing is nearly two months longer for those completing a certificate.

Demographically, those completing GEDs are younger, less racially diverse, and more male than those who participate in basic skills programming without completing the GED. GED completers are particularly less likely to be Black (15% among completers compared to 19% among non-completers). The vocational completer group, on the other hand, is similar demographically to the non-completer participants. Those who earned awards while incarcerated tend to have higher earnings in the pre-incarceration periods than those who enrolled in programs but failed to complete them. The earnings of GED awardees were about \$60 higher per quarter than unsuccessful enrollees (\$1,089 to \$1,026); the earnings of those receiving vocational certificates were about \$250 higher per quarter (\$1,455 to \$1,205).

In Table 2, we compare completers and non-completer participants on the intensity of their participation in various forms of correctional programming. The GED completer group spends fewer hours, on average, in basic skills programming. This may reflect the fact that DOC offers a “fast-track” basic skills program for students who test at a high school level that is more focused on preparation for the GED than on remedial literacy and numeracy skills. On the other

hand, GED completers spend considerably more time in vocational programming than non-completers.

Among vocational skills participants, completers and non-completers spend similar amounts of time in basic skills programs (about 50 hours), but completers spend about 350 more hours than non-completers in vocational courses. This likely reflects the fact the vocational certificates have credit requirements, rather than an assessment requirement as is the case with the GED. Among certificate completers, about 29% are long-term (more than 45 credit) certificates, about 45% are in construction, 25% in business or information technology (IT), 8% are in manufacturing, and 35% are in other occupational fields.

Finally, both groups of completers spend more time working in prison jobs programs than non-completers. GED completers spend about 500 more hours in prison jobs programs than non-completers and vocational certificate completers spend about 850 more hours than non-completers. It is not clear whether participation in jobs programming is a potential consequence of completing educational programming or a confound. On the one hand, completing degree programs may confer greater access to prison jobs programs. On the other, those completing degree programs may choose to participate in a broader array of correctional programming. We return to this issue in Section 5.

4. Research Design

We estimate the labor market returns to credentials earned in prison by a difference-in-differences (DID) design that compares changes in earnings for prisoners who complete correctional education programs to those who enroll but do not complete a program. Our basic model takes the form

$$Y_{it} = X_{it}\beta + \delta AWARD_i \times POST_t + \alpha_i + \lambda_t + \epsilon_{it} \quad (1)$$

where i indexes spells in prison and t indexes quarter relative to incarceration (defined above), Y_{it} is quarterly earnings, $AWARD_i$ is an indicator for whether the focal prison spell terminated in a GED or vocational certificate, $POST_t$ is an indicator for a post-release quarter, α_i is a prison spell fixed effect, and λ_t is a fixed effect for the quarter relative to the incarceration event.¹ The vector X_{it} includes indicators for calendar quarter. We estimate Eq. (1) separately for those participating in basic skills and vocational programs. The data consists of a panel of quarterly earnings omitting quarters spent incarcerated. We include up to 12 pre-incarceration and 18 post-incarceration quarters. The inclusion of up to three years of pre-incarceration earnings data helps ensure that estimated effects are not disproportionately reliant on earnings immediately preceding arrest and incarceration, which prior research has shown may tend to overstate the effects of workforce training programs (Dehejia, 2005; Sant’Anna & Zhao, 2020).

Callaway and Sant’Anna (2021) discuss the assumptions required to identify the effects of correctional degrees by difference-in-differences designs such as that described in Eq. (1). The main assumption is that prisoners who complete the GED or earn a vocational certificate would have experienced a similar post-incarceration *change* in earnings as non-completers had they failed to complete their program. The identification of a control group whose earnings trajectories would satisfy the parallel trends assumption is the primary obstacle to unbiased estimates of the effect of credentials. There are three main conceptual issues.

First, it is important to identify a group of former prisoners who demonstrate similar motivation to engage in education or other correctional programming and who might have similar tendencies to pursue formal labor market activity after leaving prison. Because these kinds of personal traits are not well measured in administrative datasets, we use observed choices

¹ The incarceration time is defined so that $t = -1$ corresponds to the quarter prior to incarceration and $t = 0$ corresponds to the quarter of release.

about educational program participation as a proxy for motivation. In our application, we limit the sample to those participating in basic skills or vocational skills programming and compare the changes in earnings for those who earn degrees to those who participate but fail to complete degrees. This research design is common in the literature on correctional and community college certificates and degrees. Tyler and Kling (2007) and Cho and Tyler (2010) use a similar design to estimate the returns to basic skills programming in Florida prisons. Darolia et al. (2021) use a related design where the comparison group consists of people taking the GED while in prison but failing to earn the credential. Jepsen et al. (2014) also implement a version of this design to estimate the effects of community college credentials in Kentucky using a comparison group of enrolled students who drop out before completing a certificate. However, it is important to emphasize that limiting the sample to participants means that we are estimating the “sheep-skin” effects of earning educational credentials, which may understate the total effects of participating in correctional education programming if participation itself improves skills.

A potential issue is that conditioning on participation in correctional education programming is insufficient to balance motivation or other unobserved factors between completers and non-completers that may contribute to differential earnings trends in the post-release period. Using non-completer participants as a control group accounts for the factors that influence whether a candidate *enrolls* in an education program and should therefore mitigate biases arising from selection into such programs based on recent labor market experiences or motivation but does not account for candidate persistence through to program completion. In some specifications, we therefore limit the control group to former prisoners who continued to participate until the final quarter of incarceration and remove dropouts who voluntarily chose to stop participating in educational programming. The latter control group consists of people whose

education was likely disrupted by their pending release from prison. Because discontinuing correctional education is outside their control, this group is less likely to differ from completers along unobserved attributes that may predict post-release earnings.

A second concern is that conviction and incarceration have effects on earnings independently of those operating through participation in correctional education programs. These effects may vary across individuals. For instance, Kling (2006) finds that longer sentences improve earnings shortly after release. And Bhuller et al. (2020) find that incarceration has positive employment effects for the previously unemployed but negative effects for the previously employed. The parallel trends assumption rests on an implicit assumption that the effects of incarceration are similar for degree completers and non-completer participants. Furthermore, visual inspection of pre-incarceration earnings trajectories is unlikely to be informative in this instance because we would only expect the earnings effects of incarceration to appear in the post-incarceration period simultaneously with the effects of degrees and certificates. The eligibility rules for correctional education programming tend to favor people with more serious convictions. Limiting the sample to participants may attenuate these differences, but as the summary statistics shown in Table 1 indicate, completers still have longer sentences on average than non-completers. They are also more likely to be employed in the pre-incarceration period. The former pattern suggests that the naïve difference-in-difference estimates may tend to overstate the effects of credentials, while the latter suggests a downward bias.

In addition, the literature on workforce development has shown that estimated effects can be sensitive to the earnings trajectories of participants in the pre-treatment period. Violations of the parallel trends assumption are a common problem in the literature on workforce development

because such programs are often targeted towards the recently unemployed whose earnings fall in the period immediately before participation (Ashenfelter, 1978). There is also a distinct concern about pre-treatment earnings trends in the correctional education setting: Arrest and pre-trial detention may prevent employment in the periods immediately before incarceration (Dobbie et al., 2018). Although there is no comprehensive source of data on pre-trial detention, available data suggests it is common. Approximately 70% of inmates in county jails in Washington state are awaiting trial (Surur & Valdez, 2019).² National surveys of county court systems indicates that the median time between arrest and incarceration for felony convictions is 266 days, with 67% of cases adjudicated within one year (Durose, 2007).³

We plot the earnings for participants in basic skills and vocational training by completion status in Figure 1. For all groups of participants, earnings tend to decline in the year prior to incarceration. For both GED and vocational participants, earnings are approximately parallel in the second and third year prior to incarceration but decline more significantly among completers in the prior year before incarceration. Combined with the descriptive evidence on the length of the pre-sentencing period in Table 1, these patterns are at least suggestive that the vocational completers are more likely to have disruptions to their employment caused by the arrest and pre-trial processes. To the extent that these disruptions do not persist after prison, this pattern may tend to artificially inflate the difference-in-differences estimates.

² County jails, which typically hold offenders for less serious crimes and shorter durations, are administered by local governments. Our data does not include records of incarceration in county jails.

³ Washington state law requires judges to release defendants unless they determine it likely the defendant will fail to appear for their court appointments, commit a violent offense, or interfere with the application of justice. Employment and education histories are among the factors considered by judges in their determination of a defendant's likelihood to appear in court (Surur & Valdez, 2019), and these are also used in the assignment of offenders to correctional education programming.

We account for differential effects of incarceration and differential pre-incarceration earnings trends using two empirical approaches. First, we estimate Eq. (1) after dropping the four quarters prior to incarceration. Darolia et al. (2021), who drop the last two quarters before incarceration, take a similar approach. We choose four quarters instead given that the Department of Justice estimates that only one third of cases are adjudicated within six months of arrest (Durose, 2007). If the parallel trends assumption is satisfied when future prisoners are not under court-ordered supervision, then removing these periods from the analysis should result in unbiased estimates of the returns to educational degrees and certificates.

Second, we implement a doubly-robust difference-in-differences (DR-DID) estimator (Callaway and Sant'Anna, 2021; Sant'Anna & Zhao, 2020). The DR-DID uses regression to construct covariate-dependent earnings trends and weights the resulting difference-in-differences estimates by a propensity score for degree completion. The advantage of the DR-DID approach is that it relaxes the parallel trends assumption to a conditional version that permits earnings trends to depend on time-invariant characteristics. If the effects of incarceration and pre-trial detention on earnings can be explained by observable characteristics of the prison spell, then this approach should provide unbiased estimates of the effects of credentials. We observe data on employment history and criminal charges, which are factors considered by judges when making pre-trial detention decisions. Other work has shown that the effects of incarceration may depend on sentence length and prior attachment to the labor force, both of which we observe (Bhuller et al., 2020; Kling, 2006).

Our baseline approach uses demographic, sentencing, and pre-incarceration employment data. The variables include race, gender, age at admission, crime type indicators (misdemeanor, property crime, violent crime, sex crime, drug crime), log of sentence length in days, date of

admission, log of days between the crime and sentencing (which we use as a proxy for the amount of time under court supervision prior to admission), average quarterly earnings in each of the three years prior to incarceration, average quarterly hours worked in the three years prior to incarceration, proportion of quarters with non-zero earnings in the three years prior to incarceration, and proportion of quarters with prison terms in the three years prior to incarceration. We estimate the propensity score by logit and construct the covariate-specific trends by OLS. We show that the weighted sample is balanced on these covariates in Appendix Table A.1; the propensity score weighted differences in characteristics between completers and non-completers are all below 0.04 standard deviations.

5. Educational Credentials and Earnings

5.1 Effects on Earnings

We report the estimated returns to credentials in Table 3. The baseline estimate of the effects of GEDs on earnings is \$477 per quarter (column 1). This is about 40% of the average pre-incarceration earnings for this group. In column 2, we let the time trends vary by incarceration cohort to avoid problems stemming from heterogeneous treatment effects and variation in treatment timing. The coefficient is quite similar to the standard two-way estimate in column 1. The results in column 3 further interact the time effects with identifiers for the prison facility. In column 4, we omit the year prior to incarceration to allow for differences in the pre-trial status of the two groups. This estimate relies on earnings in the second and third year before incarceration as the pre-treatment outcome in the difference-in-differences estimates. Results are again similar to the baseline estimates. In the fifth column, we retain only prisoners still enrolled in basic skills programming during the quarter of release as the control group to account for potential differences in motivation or job search between completers and non-completers. This restriction has little effect on the point estimate. In the remaining column, we implement the

doubly robust difference-in-differences estimators. The estimated effect of the GED is slightly smaller (\$413) in this specification but qualitatively similar to the baseline estimates.

We plot the estimated returns by quarter relative to incarceration in Figure 2. The first panel shows estimates from the baseline DID specification while the second panel shows estimates from the doubly robust estimator. The patterns suggest that the effect of the GED is positive starting in the quarter after release and remains positive for up to 4.5 years after release. Our findings are somewhat more positive than those of Darolia et al. (2021), who suggest that earnings premia begin to decline after release. Notably, we do not find evidence of differential trends in earnings prior to incarceration.

We estimate quarterly earnings premia of \$243 for the vocational certificates. This estimate is quite similar to the return to the general population certificate found by Jepsen et al. (2014). The estimate is somewhat smaller (\$215) when we allow time trends to vary by incarceration cohort (column 2). Dropping the year prior to incarceration or restricting the control group to those enrolled in the final quarter has little effect on the estimates, which is reassuring given the evidence of differential pre-trends in Figure 1. Finally, the doubly-robust estimator suggests certificates increase earnings by about \$283 per quarter, which suggests that the findings are not driven by differential pre-trial earnings trajectories.

The event study plots in Figure 3 help to explain the relative stability of the findings in Table 3. In the first panel, we show the standard event study plot based on the two-way fixed effects specification. Among vocational certificate completers, earnings tend to be stable and higher relative to the last quarter prior to incarceration for most of the pre-incarceration period. The decline in earnings is mostly concentrated in the final three quarters. Although earnings in the post-incarceration period are about \$400 higher than those in the final pre-incarceration

period, they are only about \$200 higher than in most of the remaining pre-incarceration periods, which is consistent with our point estimates. In the second panel, we show the doubly-robust DID estimates based solely on the demographic and sentencing data. These controls are sufficient to adjust for much of the pre-treatment trend and the pre-treatment indicators are no longer jointly significant. Similarly, the point estimates in the post-incarceration period tend to fall close to \$200. One notable difference between the two estimators is that the doubly-robust estimator suggests that the returns to vocational certificates mostly fade out by about four years after incarceration. This pattern is consistent with the results from Darolia et al. (2021) for the prison GED.

5.2 Effects on Wages and Hours Worked

In Table 4, we consider the effects of credentials separately for hourly wages and hours worked. The GED increases hourly wages by about 4%, employment by about 4 percentage points, and the number of quarterly hours worked by about 21 (about 0.04 FTE on an annualized basis). Given that the average hourly wage in the post-incarceration period for basic skills participants is \$17.80, most of the earnings effect comes from increases in employment and hours worked.

The effects of vocational certificates are more muted, which is consistent with the overall earnings effects in Table 3. We estimate that certificates increase hourly wages by about 2%, overall employment by about 2 percentage points, and quarterly hours worked by about 10 (about 0.02 annual FTE). Again, the increase in working hours explains most of the increase in earnings for those earning vocational certificates.

5.3 Effects by Degree Type and Subsequent Education

In Table 5, we show the effects of GEDs and certificates on earnings for different groups of completers. In column 1, we estimate the effects of the GED for people who continue on to complete a vocational certificate. Recall from Table 2 that about 14% of those who earn a GED in prison also earn a vocational certificate during the same spell. Prior work has shown that the GED increases earnings disproportionately for those who go on to complete additional postsecondary education (Murnane et al., 1997). Using the sample of basic skills participants, we estimate models that include indicators for GED receipt, vocational certificate receipt, and their interaction. The returns to both degrees are positive and significant and suggest that a prisoner who earns both a GED and a certificate increases earnings by about \$840 per quarter following release from prison. The interaction term on the GED and certificate completion outcomes (i.e., the additional benefit of certificates to GED completers) is positive, but not statistically significant.

In column 2, we show the effects of vocational certificates by occupational field. The administrative data report a Classification of Instructional Program (CIP) code for each certificate earned in state community colleges. We assign certificates to an occupational cluster based on the CIP code and the crosswalks published by the National Research for Career and Technical Education (2012). The crosswalks include 16 clusters that indicate the occupations aligned with credentials. Because there are few certificates for many of these clusters, we further combine them into Architecture and Construction (e.g., carpentry), Business and Information Technology, Manufacturing (e.g., welding), and Other. We then include indicators for certificates earned in each cluster. We find the greatest return to certificates in construction (\$358 per quarter) and manufacturing (about \$573 per quarter). Although about 25% of the

certificates earned in our sample are in business or information technology, we find little evidence that they increase earnings. The average earnings effect for certificates in the Other category is also close to zero and statistically insignificant.

5.4 Effects by Prisoner Characteristics

In Table 6, we estimate the effects of degrees separately for subgroups. In the first panel, we show results for youth (younger than 26 at the time of admission). The returns to the GED are similar to the population estimates, although the returns to vocational certificates (about \$391) are somewhat larger. We next estimate returns for Black and Hispanic prisoners. The estimates are somewhat imprecise, but the returns to vocational certificates are larger for Black participants, while the returns to the GED are larger for Hispanic participants.

6. Educational Credentials, Recidivism, and Enrollment in Postsecondary Schooling

One potential explanation for the increased employment and earnings outcomes in Section 5 is that those earning degrees are less likely to violate parole or commit new crimes and therefore face fewer restrictions on their employment. On the other hand, Cameron and Heckman (1993) suggest that the GED is mainly useful as a way of qualifying students for additional postsecondary training. Similarly, many of the short-term vocational credentials offered in Washington prisons are designed to prepare students for longer-term certificates or associate degree programs (van Noy et al., 2016). If completers are more likely to pursue additional education, they may be less likely to work in the short-run than they otherwise might have been.

To test these possibilities, we use the sample of attainers and non-completers to assess the effects of earning a certificate or degree on the likelihood that a student is incarcerated or enrolled in postsecondary education in each quarter following release. For the sake of consistency, we use an approach that mirrors the DR-DID approach in Section 5. We first estimate a propensity score for completion of a GED or vocational certificate. We then combine

the propensity score weighting with a regression-based model for the outcome (Caetano et al., 2013). We then use the sample of participants to estimate the effects in each quarter after release. For simplicity, we use the same specifications for the propensity scores and outcomes models as for the DR-DID estimator. This approach relies on more limited data for pre-treatment outcomes and the results are therefore somewhat more speculative than the difference-in-differences results in Section 5. Nonetheless, the method replicates the main earnings effects, which lends some credence to the design.

We show the results for the GED in Figure 4. Incarceration rates are lower among GED completers. The difference in the first quarter is null, but it increases to about 2 percentage points lower 2-3 years following release before declining thereafter. On average, the GED reduces incarceration by an average of approximately 1.4 percentage points lower over each of the 18 quarters following release. Using a similar doubly robust method for estimating effects on overall recidivism rates, these quarterly effects correspond to an effect of about 3 percentage points in the first three years following release. Postsecondary enrollment is also lower for those completing the GED relative to participating noncompleters, and the trend closely follows the differences in incarceration rates. This suggests that the higher postsecondary enrollment may be due to participation in correctional education during future stints in prison. This is indeed the case: postsecondary enrollment outside prison is slightly higher among completers than non-completers, and the effect is mostly concentrated in the year following release from prison.

Results for the vocational certificates are shown in Figure 5. The incarceration rate for those earning vocational certificates is lower by about 0.4 percentage points on average, but this effect is not significant. Postsecondary enrollment rates are higher for those earning certificates and increase over the first year following release. During the 5th quarter after release, those

earning certificates are about 1 percentage point more likely to be enrolled in postsecondary institutions. The overall effect is about 0.5 percentage points average over the 18 quarters following release. These effects are driven by those not incarcerated; that is, they are not driven by re-enrollment in correctional education programs.

The magnitude of the incarceration effects we find for the GED is smaller than the meta-analytic findings from Davis et al. (2014), who suggest that correctional education reduces the likelihood of recidivism by 13 percentage points. This may in part be due to our comparison of completers to a participant control group, which may attenuate bias from selection into correctional education programming. Nonetheless, our findings do suggest that reducing further incarceration is one avenue by which at least the GED increases earnings for participants.

7. Discussion

We assess the labor market returns to credentials earned in prisons using administrative data from Washington State. We find that former prisoners who earned a GED in prison have higher earnings in the four years following release. The findings are somewhat larger in magnitude than those found in Missouri by Darolia et al. (2021), and our estimates suggest the earnings effects are more durable. We also study the returns to vocational certificates, which have received less attention. We find that these certificates increase earnings by about \$250 per quarter, comparable to the return among the general population (Jepsen et al., 2014). The permanence of these earnings increases depends somewhat on the model specification, but they appear to hold for at least three years following release. The earnings effects are largely driven by certificates in construction and manufacturing. Supplementary analyses suggest that earnings effects for both types of degrees operate primarily through increased employment, with a smaller improvement due to higher wages.

As with any difference-in-differences design, the identification rests on the assumption that the change in earnings between the pre- and post-incarceration periods for the degree completers would have been similar to non-completers. The limitation of this assumption in assessing the effects of workforce training programs has been widely noted. In the correctional setting, the potential disruption to employment resulting from pre-trial detention raises an additional impediment to identification (Dobbie et al., 2018). Nonetheless, we take several steps to test the robustness of our findings. We restrict the control group to participants who enroll in programs but do not complete them, and who demonstrate similar motivation in their choice to enroll in educational programming. This design is similar to those used in several recent studies of the effects of community college degrees and the assumptions are arguably less restrictive than the selection on observables assumptions used in other prior research on correctional education. For basic skills participants, pre-incarceration earnings trends are similar between degree completers and non-completers. This is not the case for participants in vocational skills programs, but we show that allowing time trends to depend on a limited set of demographic and sentencing characteristics is sufficient to balance pre-treatment trends. Nonetheless, the results may still be sensitive to differential motivation between the two groups or to participation in other forms of correctional programming.

Our estimates suggest more positive effects of correctional education than suggested by Tyler and Kling (2007) and Cho and Tyler (2010), but they are similar to those found by Darolia et al. (2021) and more conservative than the meta-analytic analysis in Davis et al. (2014). The findings indicate that correctional education may improve the labor market outlook for the formerly incarcerated. These programs cost about \$1,300 per participant (WSIPP, 2023), and about 40% of the participants in each program in our sample completes a degree. Our findings

suggest that the annual private returns to the GED exceed the costs of the program. In addition to the private returns, we also estimate that the GED reduces recidivism by about 3 percentage points over the three years following release, and the state estimates that the marginal conviction costs about \$14,000 in prison costs alone (WSIPP, 2023). Although we do not find any effects of certificates on recidivism, we do find that they improve labor market outcomes. Overall, correctional education appears effective as a workforce development strategy and it may reduce crime among the least-educated prisoners.

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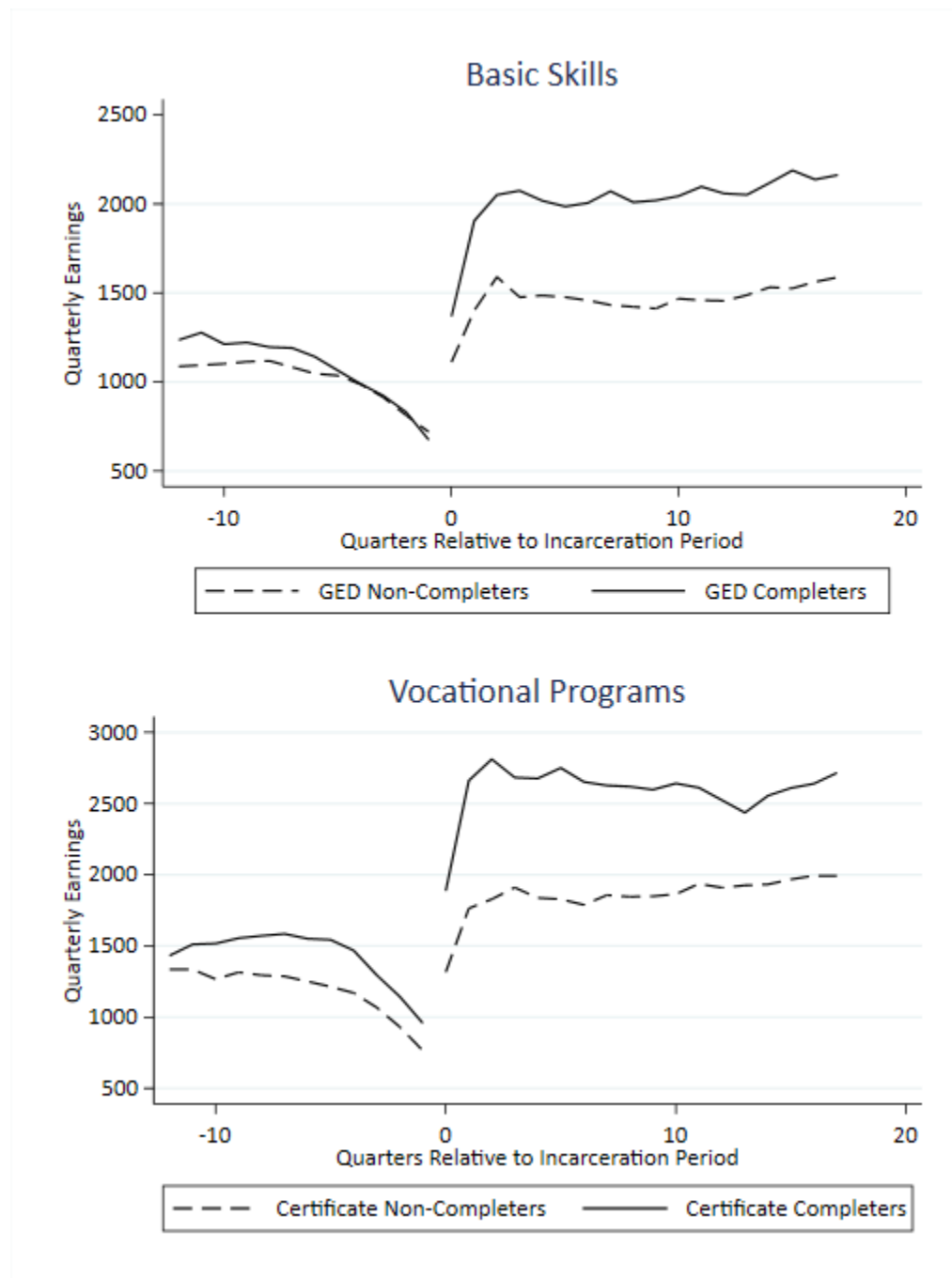
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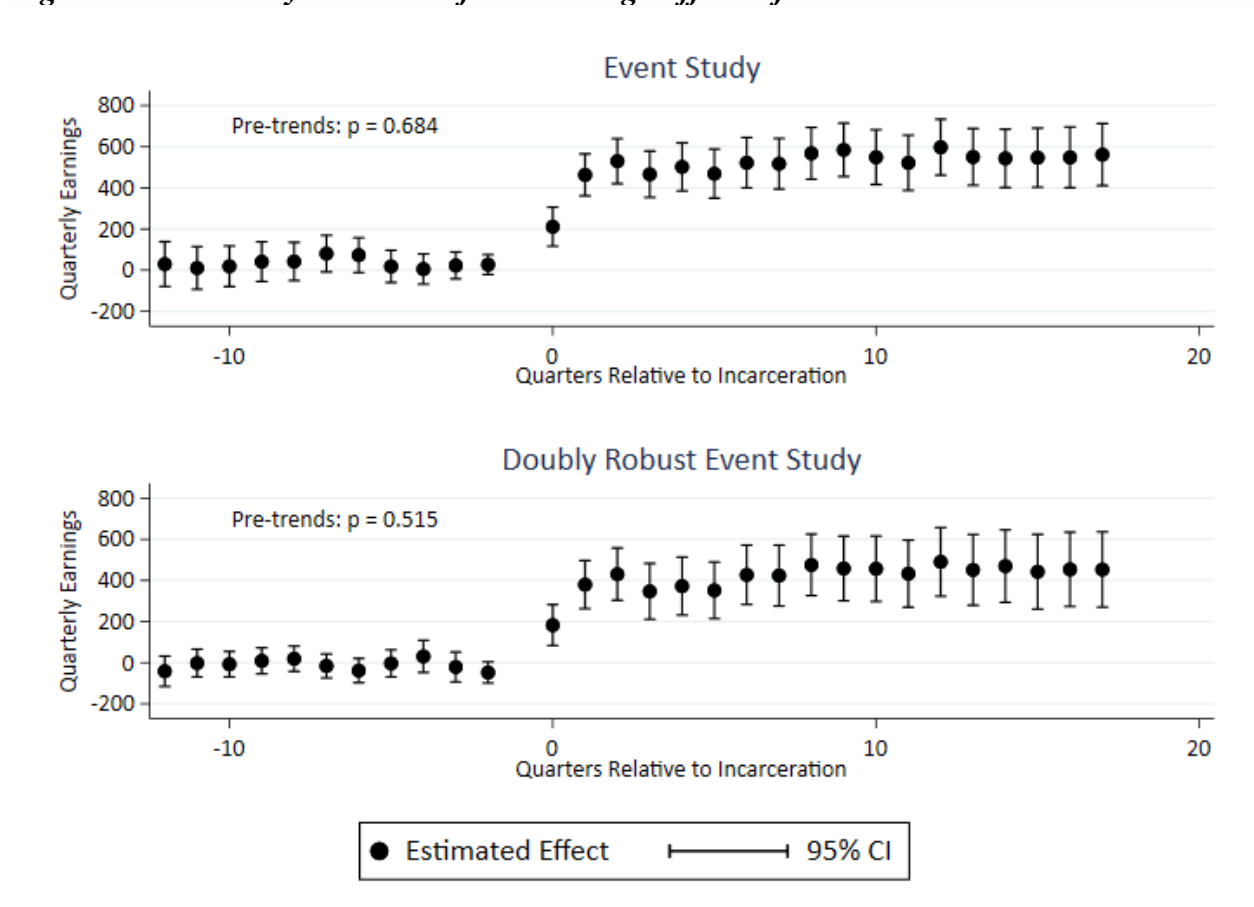
Figures and Tables

Figure 1. Earnings Trends of Correctional Education Participants



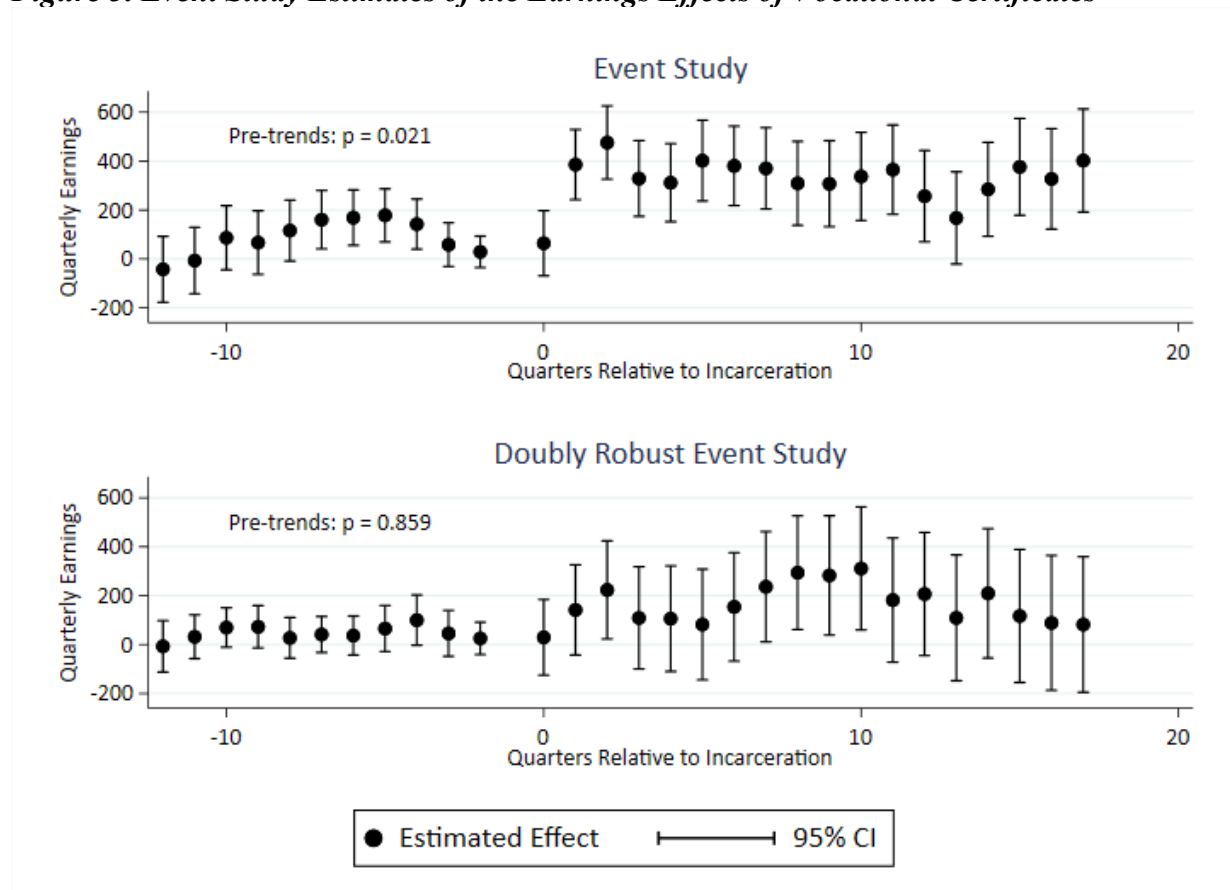
Notes: Earnings for participants in basic skills and vocational skills programs by degree completion status by quarter relative to incarceration. Quarter $t = -1$ indicates the quarter prior to incarceration; $t = 0$ indicate the quarter of release from prison.

Figure 2. Event Study Estimates of the Earnings Effects of GEDs



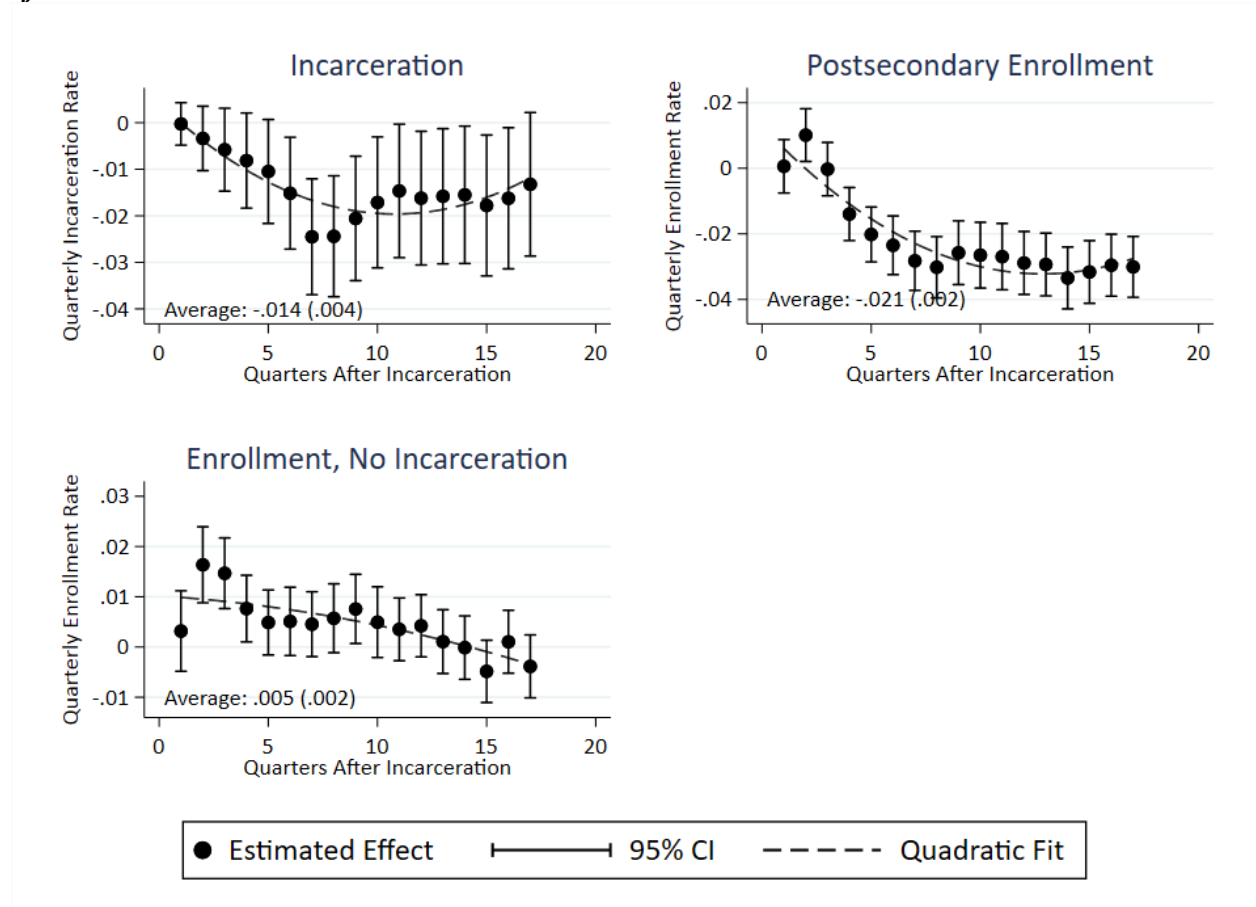
Notes: Estimated effects of receiving a GED on quarterly earnings by quarter relative to incarceration. Quarters are indexed around incarceration and release and omit periods incarcerated during the focal spell in prison ($t = 0$ indicates first quarter after release). Sample includes prison spells where offenders participated in basic skills programming. Standard event study includes prison spell fixed effects, calendar quarter fixed effects, and indicators for period relative to incarceration. The doubly robust DID estimator includes race, gender, age at admission, crime type codes, sentence length, date of admission, length between offense and sentencing, average quarterly earnings in each of the three years prior to incarceration, average quarterly hours worked in the 12 quarters prior to incarceration, the proportion of quarters with positive earnings in the 12 quarters prior to incarceration, and the proportion of quarters with prison spells in the 12 quarter before the focal spell. Standard errors clustered by individual. Pre-trends indicates p -value from joint test of the significance of the pre-incarceration indicators.

Figure 3. Event Study Estimates of the Earnings Effects of Vocational Certificates



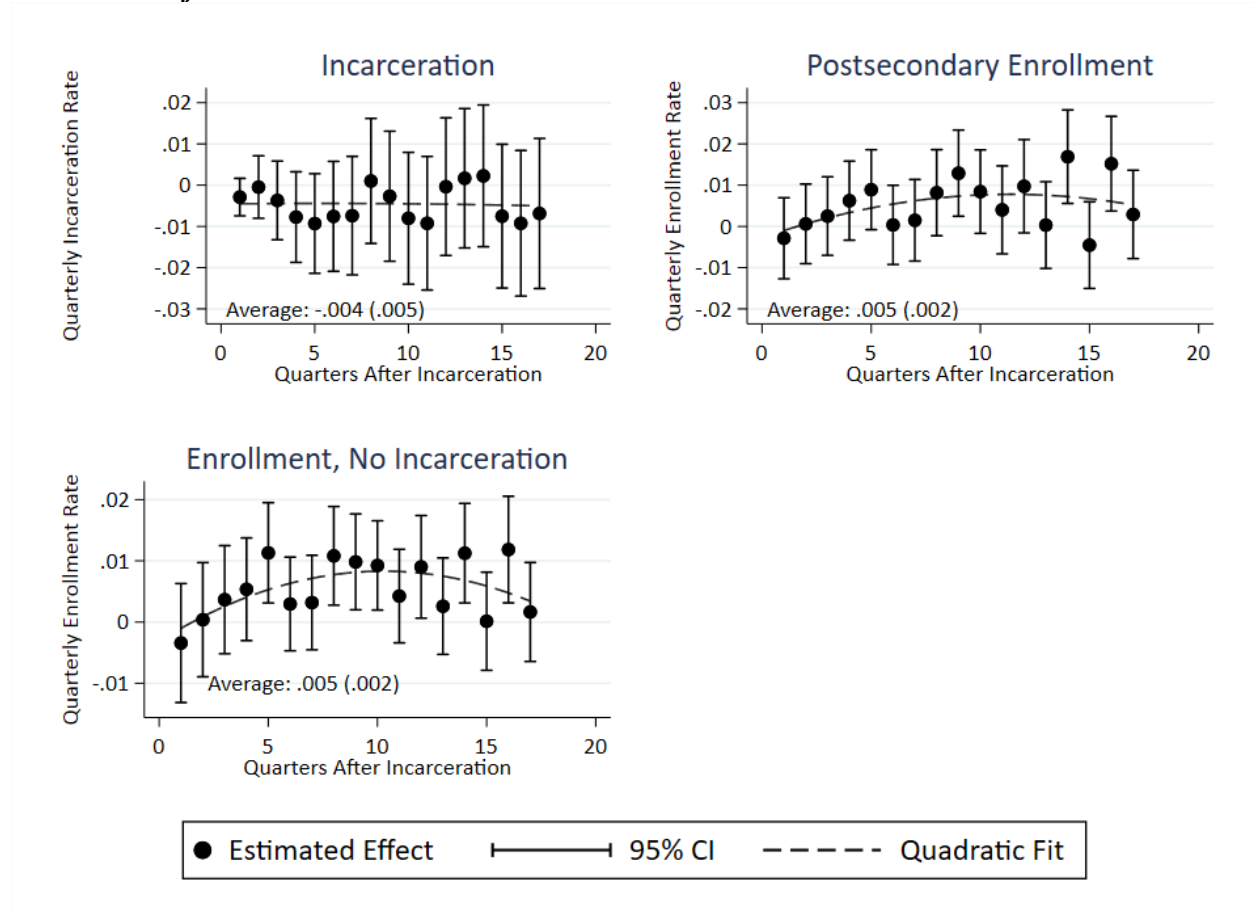
Notes: Estimated effects of receiving a vocational certificate on quarterly earnings by quarter relative to incarceration. Quarters are indexed around incarceration and release and omit periods incarcerated during the focal spell in prison ($t = 0$ indicates first quarter after release). Sample includes prison spells where offenders participated in vocational skills programming. Standard event study includes prison spell fixed effects, calendar quarter fixed effects, and indicators for period relative to incarceration. The doubly robust DID estimator includes race, gender, age at admission, crime type codes, sentence length, date of admission, length between offense and sentencing, average quarterly earnings in each of the three years prior to incarceration, average quarterly hours worked in the 12 quarters prior to incarceration, the proportion of quarters with positive earnings in the 12 quarters prior to incarceration, and the proportion of quarters with prison spells in the 12 quarter before the focal spell. Standard errors clustered by individual. Pre-trends indicates p -value from joint test of the significance of the pre-incarceration indicators.

Figure 4. GED Completion, Employment, Incarceration, and Post-Secondary Enrollment after Release



Notes: Propensity score reweighting estimates of effects of GED completion on earnings, hours worked, incarceration, and postsecondary enrollment by quarter after release. Sample includes all spells with enrollment in a basic skills program. Propensity score includes race, gender, age at admission, date of admission, sentence length, crime type indicators, length of time between offense and sentencing, average quarterly earnings in each of the three years prior to incarceration, average quarterly hours worked in the 12 quarters prior to incarceration, and proportion of quarters with positive earnings in the 12 quarters prior to incarceration.

Figure 5. Vocational Certificate Completion, Employment, Incarceration, and Post-Secondary Enrollment after Release



Notes: Propensity score reweighting estimates of effects of vocational certificate completion on earnings, hours worked, incarceration, and postsecondary enrollment by quarter after release. Sample includes all spells with enrollment in a vocational skills program. Propensity score includes race, gender, age at admission, date of admission, sentence length, crime type indicators, length of time between offense and sentencing, average quarterly earnings in each of the three years prior to incarceration, average quarterly hours worked in the 12 quarters prior to incarceration, and proportion of quarters with positive earnings in the 12 quarters prior to incarceration.

Table 1. Summary Statistics

<i>Completers?</i>	Basic Skills Programs			Vocational Programs		
	(1)	No (2)	Yes (3)	(4)	No (5)	Yes (6)
<i>Sentencing Information</i>						
Drug crime	0.264	0.275	0.249	0.249	0.262	0.230
Other crime	0.154	0.158	0.149	0.168	0.170	0.165
Property crime	0.454	0.429	0.492	0.467	0.464	0.470
Sex crime	0.081	0.079	0.084	0.096	0.085	0.112
Violent crime	0.344	0.338	0.353	0.350	0.337	0.369
Sentence length (days)	538.4	475.6	632.8	808.2	693.6	968.2
Pre-sentencing period (days)	305.7	299.2	315.5	318.4	296.2	349.5
<i>Demographics</i>						
Age at admission	30.83	32.32	28.59	32.37	32.54	32.14
American Indian	0.054	0.057	0.048	0.047	0.048	0.046
Asian/Pacific Islander	0.041	0.045	0.034	0.033	0.029	0.038
Black	0.176	0.192	0.152	0.165	0.168	0.162
Hispanic	0.168	0.191	0.132	0.100	0.105	0.094
Female	0.122	0.144	0.089	0.089	0.090	0.075
<i>Outcomes</i>						
Avg earnings (pre-inc)	1051.3	1026.0	1089.4	1309.2	1204.6	1455.2
Avg earnings (post-inc)	1769.6	1528.8	2132.2	2272.5	1927.2	2754.4
Avg hours worked (pre-inc)	61.64	59.75	64.49	74.17	67.91	82.91
Avg hours worked (post-inc)	98.05	86.13	116.0	118.6	102.4	141.3
Postsecondary enrollment (post-inc)	0.343	0.369	0.305	0.325	0.345	0.298
Prison admission (post-inc)	0.313	0.315	0.310	0.305	0.330	0.270
N	15056	9047	6009	11523	6713	4810

Notes: Summary statistics for basic and vocational skills participants by degree completion status. Observations consist of spells in prison. Basic skills completers include inmates earning a GED during the focal spell. Vocational skills completers include inmates earning a vocational certificate during the focal spell. Sentencing data includes indicators for whether the focal conviction includes crimes of the given type. Pre-sentencing period includes the number of days between the offense and sentencing. Average pre-incarceration earnings and hours worked indicate average quarterly values during the three years prior to incarceration. Average post-incarceration earnings and hours worked indicate average values over the 12 quarters following incarceration. Postsecondary enrollment and prison admission indicate any enrollment or admission over the 12 quarters following release from the focal prison spell. Postsecondary enrollment records include subsequent enrollment in correctional education programs.

Table 2. Educational Programming

<i>Completers?</i>	Basic Skills Programs		Vocational Programs	
	No	Yes	No	Yes
Basic skills (hours)	199.7	169.5	50.30	49.63
Vocational programs (hours)	41.2	101.1	177.1	517.0
Jobs programs (hours)	752.5	1239.7	1319.4	2174.4
Credits earned	12.2	17.6	13.4	46.4
Earned GED (%)	0	100	18.2	17.3
Earned certificate (%)	6.2	13.7	0	100
Earned long-term certificate (%)	1.5	3.7	0	29.3
Certificate: Architecture and Construction Cluster (%)	2.8	7.1	0	44.9
Certificate: Business & IT Cluster (%)	1.2	3.2	0	25.3
Certificate: Manufacturing Cluster (%)	0.4	1.0	0	7.8
Certificate: Other Cluster (%)	2.4	4.2	0	34.6
N	9047	6009	6713	4810

Notes: Participation in correctional programming for basic and vocational skills participants by completion status. Observations consist of spells in prison. Hours of participation in basic skills programs, vocational programs, and job programs measured from attendance data. Credits earned indicates total credits earned through state community and technical college system during incarceration spell. Earned GED/certificates indicates degrees earned during incarceration spell. Long-term certificate indicates certificate requiring at least 45 quarter hours. Certificate career clusters defined using the certificate CIP code and the National Career Clusters Framework (Kotamraju & Steuernagel, 2012).

Table 3. Effects of GED and Vocational Certificates on Quarterly Earnings

	(1)	(2)	(3)	(4)	(5)	(6)
GED	477.29** *	454.98** *	453.26** *	486.75** *	450.93** *	412.70** *
	(49.64)	(51.33)	(52.55)	(55.14)	(70.64)	(58.15)
N	416048	413155	406864	340768	209473	386227
Certificate	242.65** *	214.52** *	245.81** *	252.19** *	256.84* *	282.93** *
	(66.52)	(70.13)	(72.28)	(72.93)	(151.34)	(74.76)
N	318298	316690	309579	260683	59743	294810
Cohort Trend	No	Yes	No	No	No	No
Prison/Cohort Trend	No	No	Yes	No	No	No
Last Year	Yes	Yes	Yes	No	Yes	Yes
Dropouts	Yes	Yes	Yes	Yes	No	Yes
DR-DID	No	No	No	No	No	Yes

Notes: Estimated effects of GED and vocational certificates on quarterly earnings. Sample includes up to 12 quarters prior to incarceration and 18 quarters following incarceration for all spells where offender enrolled in a basic skills (GED) or vocational skills (certificate) program. In addition to specified controls, regressions include indicators for quarters relative to incarceration and calendar quarter fixed effects. Cohort trends indicates that the quarters relative to incarceration and calendar quarter fixed effects have been replaced by quarter-by-prison-cohort fixed effects, where prison cohort is defined based on admission/release quarters. Last year indicates that the estimation sample includes the last year prior to incarceration. DR-DID indicates the doubly robust DID estimator using race, gender, age at admission, crime type codes, sentence length, date of admission, length between offense and sentencing, average quarterly earnings in each of the three years prior to incarceration, average quarterly hours worked in the 12 quarters prior to incarceration, the proportion of quarters with positive earnings in the 12 quarters prior to incarceration, and the proportion of quarters with prison spells in the 12 quarter before the focal spell. Standard errors clustered by person in parentheses. * p < 0.10 ** p < 0.05 *** p < 0.01

Table 4. Effects of GED and Vocational Certificates on Wages and Employment

	(1) Log Wages	(2) Employed	(3) Hours Worked
GED	0.041*** (0.009)	0.042*** (0.006)	20.887*** (2.436)
N	112347	416048	416048
Certificate	0.021* (0.011)	0.017** (0.007)	9.533*** (3.053)
N	97736	318298	318298

Notes: Estimated effects of GED and vocational certificates on quarterly log wages, employment status, and hours worked. Sample includes up to 12 quarters prior to incarceration and 18 quarters following incarceration for all spells where offender enrolled in a basic skills (GED) or vocational skills (certificate) program. Regressions include fixed effects for prison spell, quarters relative to incarceration, and calendar quarter. Standard errors clustered by person in parentheses. * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$

Table 5. Earnings Effects by Degree Progression/Certificate Type

GED		Vocational Certificates	
GED	450.09*** (50.88)	Architecture and Construction Cluster	358.33*** (86.74)
Certificate	391.23** (156.57)	Business/IT Clusters	-32.05 (124.74)
GED x Certificate	77.24 (205.04)	Manufacturing Cluster	572.75*** (215.27)
		Other Clusters	-38.51 (97.20)

Notes: Estimated effects of GED and vocational certificates on quarterly earnings by degree progression or certificate occupational cluster. Estimates come from regressions using (1) GED and an interaction between GED and Certificate (the offender earned both a GED and a certificate during the focal spell) or (2) separate indicators for certificate cluster. Certificate cluster is based on the Classification of Instructional Programs (CIP) code of the field of the certificate and is matched to occupational clusters using the National Career Clusters Framework (Kotamraju & Steuernagel, 2012). Standard errors clustered by individual in parentheses. * p < 0.10 ** p < 0.05 *** p < 0.01

Table 6. Heterogeneity by Demographics and Degree

GED		Vocational Certificates	
Youth	361.14*** (59.92)	Youth	390.56*** (98.93)
Black	322.21*** (90.16)	Black	474.95*** (128.14)
Hispanic	679.09*** (131.78)	Hispanic	202.17 (201.44)

Notes: Estimated effects of GED and vocational certificates on quarterly earnings by students' characteristics. Youth offender indicates that the offender was 26 or younger at admission. Estimates come from separate regressions using only offenders of the given type. Standard errors clustered by individual in parentheses.

* $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$

Appendix A. Additional Results

Table A.1. Covariate Balance by Sample

	Basic Skills		Vocational Skills	
	Raw Difference	Weighted Difference	Raw Difference	Weighted Difference
Age	-0.405	-0.010	-0.042	0.010
American Indian	-0.041	0.014	-0.004	-0.002
Asian	-0.051	0.007	0.055	0.004
Black	-0.104	0.004	-0.026	0.003
Hispanic	-0.159	0.026	-0.029	-0.013
Race Missing	-0.024	-0.010	0.017	-0.007
Female	-0.169	0.011	-0.088	0.010
Drug Crime	-0.063	0.022	-0.077	0.010
Misdemeanor	-0.026	-0.014	-0.050	0.004
Other Crime	-0.029	-0.004	-0.018	-0.005
Property Crime	0.128	0.015	0.009	-0.008
Sex Crime	0.024	-0.019	0.094	-0.009
Violent Crime	0.029	-0.007	0.068	0.007
Admission Date	-0.359	0.031	0.205	-0.036
Sentence Length	0.350	-0.012	0.516	-0.013
Pretrial Period	0.101	-0.005	0.152	-0.009
Quarters Worked Pre-Incarceration	0.091	-0.018	0.097	0.001
Average Earnings 1-4 Qtrs Pre-Incarceration	-0.010	-0.004	0.082	0.011
Average Earnings 5-8 Qtrs Pre-Incarceration	0.024	-0.013	0.091	0.004
Average Earnings 9-12 Qtrs Pre-Incarceration	0.034	-0.024	0.058	0.011
Average Hours Worked Pre-Incarceration	0.048	-0.013	0.113	0.004
Quarters in Prison Pre-Incarceration	-0.237	0.006	0.024	-0.003

Notes: Standardized differences in covariates between completers and non-completer participants for basic skills and vocational skills programs. Propensity score and balance estimated using prison spell-level data. Propensity score estimated by logit using covariates listed in the table. Weighted difference indicates the weighted difference between completers and non-completers using propensity score weights for the treatment on the treated effect. Quarters worked pre-incarceration indicates proportion of quarters with positive earnings over the 12 quarters prior to incarceration. Average earnings pre-incarceration indicates average quarterly earnings worked in each of the three years prior to incarceration. Average hours worked pre-incarceration indicates average quarterly hours worked over the 12 quarters prior to incarceration. Sentence length is the log of the observed sentence length. Pretrial period is the log of the number of days between offense date and sentencing date. Quarters in prison pre-incarceration indicates the proportion of quarters containing prison spells over the 12 quarters prior to incarceration.