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Returns to a Prison GED

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**Abstract:** Educational and skill-building programs are commonplace in prisons. These programs are expected to increase prisoners' post-release employability, which increases the opportunity cost of future crime and facilitates re-connection to communities. One of the most popular programs prepares prisoners to pass the GED exam, which is an academic certification for those without a high-school diploma. We analyze the labor market returns to a GED earned in prison using new administrative data on all released prisoners in the state of Missouri over a 20-year period.

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## 1. Introduction

About two-thirds of released prisoners are re-arrested within just a few years after their release and nearly half return to prison (Bureau of Justice Statistics, 2014; Pew Charitable Trusts, 2011). This commonly occurring return to prison is costly and suggests that rehabilitative expenditures are inefficient. While ex-offenders face a number of challenges post-release, finding a job can be particularly difficult since a criminal record can be an impediment to gainful employment (e.g., Grogger, 1995; Holzer, Raphael, & Stoll, 2006; Pager, 2003; Waldfogel, 1994; Western, Kling, & Weiman, 2001). Therefore, one reason prison educational and skill programs are popular is because they are expected to increase prisoners' post-release employability, which increases the opportunity cost of future crime and facilitates re-connection to communities. One of the most popular programs prepares prisoners to pass the General Educational Development (GED) exam, which is an academic certification for those without high-school diplomas. Over 10% of the GED credentials issued each year are from correctional institutions and nearly 30% of the formerly incarcerated have a GED credential as their highest education attainment, which is about five times the rate in the general population (Harlow, Jenkins, & Steurer, 2010; Heckman & LaFontaine, 2010). Despite its popularity, there is limited empirical evidence to establish whether the GED affects ex-offenders' post-release labor market outcomes.

We analyze the labor market returns to a GED earned in prison using new administrative data on all released prisoners in the state of Missouri over nearly 25 years. Descriptively, those with a GED credential earned in prison experienced earnings and employment increases in the five years after being released, relative to the two years before entering prison. To identify the causal effect of the prison GED, we use a matched comparison group difference-in-differences design and individual fixed effects to compare the post-release labor market outcomes of those who

passed the GED with those who did not obtain GED certification. Relative to labor market experiences prior to entering prison, the GED leads to higher quarterly earnings of as much as 17% and employment increases of as much 9%. The largest benefits are experienced soon after release and the overall effect is stronger for white ex-offenders than for black ex-offenders.

This study contributes to the thin literature on labor market returns to the GED in prison (Tyler & Kling, 2007).<sup>1</sup> This study also situates itself in the broader literatures on returns to the GED and returns to skill-building programs in prisons more generally. Research indicates that the labor market returns to the GED credential are not promising, although the GED may yield higher benefits at a low ability margin (Heckman, Humphries, & Mader, 2010; Jepsen, Mueser, & Troske, 2016; Tyler, Murnane, & Willett, 2000). There is a general belief that prison skill-building programs more generally can generate positive returns, though causal inference from many of these studies is limited (see the review in Davis et al., 2013). Our results suggest that the GED has positive effects, particularly for white ex-offenders and for those who had low labor force participation prior to prison entry, and outweighs the negative signals that the GED conveys more generally.

These findings are important in the context of the staggering costs of incarceration and the surge in federal, state, and privately funded educational programs that attempt to enhance ex-offenders' ability to find well-paying stable jobs and, in turn, reduce recidivism.<sup>2</sup> States spend over \$50 billion a year on corrections, with an average cost per inmate of over \$31,000 per year (Pew Charitable Trusts, 2011; Henrichson & Delaney, 2012). Beyond direct monetary costs, the high

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<sup>1</sup> The *What Works in Reentry Clearinghouse* from the Council of State Governments indicates that only two papers evaluating the effects of the prison GED met their methodological standards: the aforementioned paper by Tyler and Kling (2007) examined labor market outcomes (classified as “high rigor”), and a study by Zgoba, Haugebrook, and Jenkins (2008) that finds prison GED receipt is not related to re-arrest.

<sup>2</sup> For example, the Obama administration implemented a pilot program that offers prisoners access to federal Pell Grants to pursue postsecondary education.

rate of return to prison also incurs substantial human cost; some who return to prison do so by harming victims, and returning to prison harms the ex-offender, damages communities, and contributes to an intergenerational cycle of disadvantage (Clear, 2007; Pattillo, Weiman, & Western, 2004).

## **2. Background**

Researchers consistently find that a criminal record makes it more difficult for ex-offenders to obtain employment and experience wage growth, as compared to those who did not serve time in prison (e.g., Pager, 2003; Western, 2002; Western, Kling, & Weiman, 2001). Pager (2003) found less interest from employers for applicants with prison records but similar observable measures of productivity, corresponding to research indicating that a criminal record is commonly viewed as a negative signal about ex-offenders' trustworthiness (Waldfogel, 1994). Research also finds differential experiences of ex-offenders by race; most studies find that a criminal record presents a larger barrier to employment for black ex-offenders (e.g., Holzer, Raphael, & Stoll, 2006; Pager, 2003).<sup>3</sup>

A criminal record may also hinder ex-offenders' search for employment because of real or perceived human capital erosion, reduced social networks through which job seekers commonly find jobs, and restrictions on ex-offenders to obtain certain types of jobs such as those in the public-sector (e.g., Bushway & Sweeten, 2007; Grogger, 1995; Hagan, 1993; Waldfogel, 1994). However, comparisons of prisoners' pre- and post-labor market prospects do not yield consistent conclusions. Using administrative data from California, Grogger (1995) found that arrests moderately reduced employment and earnings in the short term. On the other hand, a number of

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<sup>3</sup> This negative stigma spills over to law-abiding black job applicants (Pager, 2003). An explanation for this effect is statistical discrimination, which explains why policies to "ban the box" and remove criminal records from job applications end up harming black job applicants (e.g., Doleac & Hansen, 2016).

studies observe higher earnings for prisoners post-release as compared to before prison entry. Kling (2006) found that longer prison sentences correspond to better short term labor market outcomes and negligible medium term effects using administrative data from California and Florida. Tyler and Kling (2007) also observed increases in post-prison earnings relative to earnings prior to incarceration, in their analysis of released prisoners in Florida. Nagin and Waldfogel (1995) found higher levels of youths' earnings after convictions as compared to prior to entry but found a negative relationship for older ex-offenders.

There are a number of possible mechanisms for these positive post-prison outcomes, including positive effects of skill-building programs in prison and the role that incarceration may play distancing prisoners from prior damaging criminal networks. Observed short-term increases in employment and earnings may also not result in persistent labor market gains. Nagin and Waldfogel (1995) argue that a criminal record hinders ex-offenders' ability to obtain stable jobs that have low initial wages but rising wage profiles, and, as a result, they are likely to work in spot market jobs that are relatively higher paying but unstable and temporary. Alternatively, higher employment may reflect employment requirements that some ex-offenders must meet as conditions of their post-release supervision or be a product of support services ex-offenders can access only while they are on probation or parole.

The challenges ex-offenders face when seeking employment are important because researchers often consider criminal behavior to be a part of a decision-making process where an individual weighs the expected benefits of the crime against the probability of being apprehended and the expected penalty (e.g., Becker, 1968; Ehrlich, 1973; Lochner, 2004). Therefore, when the opportunity cost of crime increases – for example because the individual has a well-paying job – the incentive to commit crime should decline. Employment can also stem crime because jobs can

provide structure and enhance community bonds (Wilson, 1996). There is considerable evidence that economic hardship contributes to crime and that economically motivated crime decreases when individuals have better economic prospects (Grogger, 1998; Gould, Weinberg, & Mustard, 2002; Krivo & Peterson, 1996; Raphael & Winter-Ebmer, 2001).<sup>4</sup>

Therefore, one reason educational programs are commonplace in prisons is because they can make ex-offenders more employable after prison, thereby increasing the opportunity cost of crime. Over 90% of state prisons and all federal prisons have some sort of educational program for prisoners, and roughly half of all state prisoners will participate in an educational program (Harlow, 2003). One of the most popular programs prepares prisoners to pass the GED exam, and over 10% of the GED test-takers in the US were in correctional centers; this proportion jumps to 22% for black males (American Council on Education, 2011; Heckman & LaFontaine, 2010). The GED program can improve post-release outcomes by increasing the human capital of those who study for the exam or by serving as a positive signal to employers; as described later, our research focuses primarily on this second mechanism.

Whether the GED leads to better labor market outcomes depends on how employers value the credential. Though commonly presented as equivalent to a high school degree, completion of a GED does not provide the same benefits in the labor market as a high school diploma (Cameron & Heckman, 1993). In fact, research indicates that the GED has little to no effect on average labor market outcomes among the general population (see Heckman, Humphries, & Mader, 2010 for a

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<sup>4</sup> Moreover, at a community level, research indicates incarceration in a community begets not only more incarceration, but also weakened communities, and a repeating cycle of economic and social hardship (Clear, 2007; Pattillo, Weiman, & Western, 2004; Western, 2006). A large literature studies neighborhood effects by looking at the relationships between community disadvantage and criminal activity (e.g. Glaeser, Sacerdote, & Scheinkman, 1996; Sampson, Raudenbush, & Earls, 1997).

review).<sup>5</sup> However, research also indicates that the GED may have differential returns across groups. The GED is likely to have greater benefit for those with lower initial academic endowments, which may be particularly relevant for the incarcerated population (e.g., Murnane, Willett, & Tyler, 2000; Tyler, Murnane, & Willett, 2000; Tyler, Murnane, & Willett; 2003). Tyler, Murnane, & Willett (2000) provide evidence of higher returns to the GED among white recipients as compared to minority recipients at the lower academic endowment margins. There is limited evidence, however, that returns to the GED differ by gender or nativity (Clark & Jaeger, 2006; Heckman & LaFontaine, 2006; Tyler, Murnane, & Willett; 2003). Though college-going rates are generally low for GED recipients, Jepsen, Mueser, and Troske (2017) found that GED certification increases postsecondary participation.

Extant research on the labor market returns to a GED among ex-offenders is limited.<sup>6</sup> Using administrative UI data from Florida, Tyler and Kling (2007) found that minority ex-offenders who participated in a GED program in prison had higher short-term earnings and employment than those who had similar levels of education pre-prison but did not study for the GED exam; they found no corollary positive labor market effects for white ex-offenders or when comparing GED recipients to those who participated in the program but did not pass the exam. The authors note appropriate caution to assigning causality to their results. We improve upon prior estimates by using detailed exact matching and individual fixed effects facilitated by our access to a much larger sample of labor market and prison records of GED test takers and ex-offenders more generally.

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<sup>5</sup> Heckman, Humphries, and Mader (2010) also describe ways that the GED can actually harm recipients because it can induce students to drop out of high school, but this concern is unlikely to be relevant to the adult prisoner population who takes the GED.

<sup>6</sup> Research generally finds a positive relationship between education programs more broadly defined and employment, and a negative relationship with recidivism, although causal inference is appropriate in only limited cases (see Davis et al., 2013). Cho and Tyler (2010) find that adult education targeted to those reading below a ninth-grade level is associated with higher earnings and employment following release.

### 3. Data and Context

We examine the labor market returns to the GED for prisoners released after serving in Missouri. In Missouri, state prisons cost over \$650 million per year, with a per prisoner cost of about \$20,870 annually (Missouri Department of Corrections, 2012). About half of released prisoners return to prison within five years in Missouri (Missouri DOC, 2012; Pew Charitable Trusts, 2011). We use administrative micro data provided by two state agencies. We begin with a census of all individuals released from a Missouri prison from 1990 to 2013 based on records from the Missouri Department of Corrections (DOC).<sup>7</sup> The DOC data are structured at the prisoner-stint level, where “stint” is defined as a time in prison with a recorded entry and exit date; 59% of the ex-offenders in our data sample served multiple prison stints.

We merge the prisoner-stint data with administrative quarterly earnings data from the first quarter of 1990 to the second quarter of 2014 based on administrative records maintained as part of the state’s Unemployment Insurance system by Missouri’s Department of Labor and Industrial Relations. If a prisoner had positive earnings in at least one of the quarters for which we have earnings data, then we considered earnings in other quarters where no earnings were reported to be a quarter of nonemployment with earnings equal to zero.<sup>8</sup> Our administrative earnings data are from covered jobs as reported by employers in Missouri to the state’s Unemployment Insurance program. Therefore, ex-prisoners who do not work, who move out of state, or who work in jobs not subject to UI reporting requirements in every quarter during the analysis period are not included in our sample. Of the 171,312 prisoners released from prison from 1990-2014 in the state,

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<sup>7</sup> Because our sample includes only released prisoners we cannot analyze how educational programs undertaken in prison relate to release or time served.

<sup>8</sup> For each released prisoner, our analysis uses up to 8 quarters of earnings pre-incarceration and up to 20 quarters after release. We consider earnings greater than \$50,000 in any quarter to be an error. Less than 0.01% of quarterly earnings exceed this threshold.



we have earnings data for 133,058 individuals.<sup>9</sup> We provide further detail on the sample construction in Appendix A.

Education is one of the prominent rehabilitative services offered by the DOC. Prisoners' educational backgrounds are assessed upon entry and the DOC requires that offenders who enter prison without a high school diploma pursue a GED while incarcerated.<sup>10</sup> Of our total sample, 29,742 prisoners took the GED exam while in prison, of whom almost 92% ultimately passed. This high passage rate reflects the internal practice whereby only those likely to pass the exam were encouraged to take it. Prisoners could retake the GED exam if they failed.<sup>11</sup> Approximately 45% of ex-offenders in our sample who failed the exam the first time took it again and nearly 90% of those who re-took the exam ultimately passed it.

Since only those who were expected to pass the GED exam were encouraged to take it, these prisoners are relatively positively selected as they have relatively low rates of physical and mental health impairments at time of entry. As might be expected, those who did not take the GED are likely to have spent less time in prison. They are also more likely to be black, whereas other differences are smaller. Table B1 in the Appendix provides more detailed information.

Figure 1 displays earnings and employment trends for ex-offenders who earned the GED while in prison and for all other ex-offenders. In Panels A and B, we see generally declining earnings leading up to prison, with the rate of decline increasing about two quarters prior to prison entry. This is mirrored in the employment trends in Panel C. This dip is consistent with the theory

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<sup>9</sup> Our analytic sample excludes 163 individuals who were under the age of 18 or over the age of 65 for our entire observation period (8 quarters prior to entry and 20 quarters after exit).

<sup>10</sup> Offenders aged 65 and older, who are sentenced to life in prison without parole, or sentenced to capital punishment are exempt from this requirement. This requirement was put into place in 1996, which is after the start of our sample period. As a sensitivity check, we analyze a subsample of offenders released in 1997 or later and find qualitatively similar results.

<sup>11</sup> Records indicate that even prisoners who took the GED exam multiple times did so during just one stint in our sample.

that economic hardship leads to increased crime. More generally, since informal or illegal employment are not captured by the state earnings data, it may not be surprising that lower formal earnings may indicate or facilitate greater involvement in criminal activities. Finally, for some individuals, there may be a time gap between apprehension for a crime and the beginning of the prison sentence, where factors such as employer responses to arrests, timing related to posting bail, and legal hearings lead to decreased employment (Grogger, 1995). Because these two quarters can reflect labor market experiences that are related to incarceration itself, we estimate our main results while dropping the two quarters prior to prison entry.<sup>12</sup> After prison, earnings are generally higher across groups and the trends are mildly downward sloping. We see that earnings for those employed are increasing over time after being incarcerated, whereas employment is substantially higher than prior to prison entry immediately after release but then declines over time to at or below pre-prison levels within a few years.

We estimate descriptive regressions of labor market outcomes (earnings, log earnings, and employment),<sup>13</sup>  $Y_{it}$ , in year-quarter  $t$  for each ex-offender  $i$  who obtained the GED while in prison as:

$$Y_{it} = \alpha + \gamma Post_{it} + d_i + d_a + d_t + \varepsilon_{it}. \quad (1)$$

$Post$  is equal to zero in the time periods prior to entering prison; this variable switches to one in all time periods once the prisoner is released. The individual-stint fixed effect is  $d_i$ . We include quarter/year fixed effects,  $d_t$ , to account for macroeconomic variation and other variation over time that is common across all individuals in the sample. Age fixed effects in each time period,  $d_a$ ,

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<sup>12</sup> Estimates including the two pre-prison quarters lead to similar inference as our base models, though with generally larger magnitudes (available upon request).

<sup>13</sup> Earnings include quarters with no earnings coded as zero. Log Earnings omit quarters with no earnings. Employment is coded one in any quarter in which earnings are positive, zero otherwise. As noted above, any individual with no recorded earnings during our analysis window is omitted.

accounts for common labor market differences across the life cycle.<sup>14</sup> From this equation,  $\gamma$  is the average difference between post- and pre-release earnings for each person who obtained a GED in prison, conditional on covariates.<sup>15</sup>

The coefficient,  $\gamma$  includes any effect of obtaining the GED, but it is likely biased by other factors associated with time in prison that also have a net effect on outcomes. Insofar as employers use prison record in their hiring, or if skill degradation (declining social or other skills) occurs in prison, the coefficient will be downwardly biased. If, on the other hand, other kinds of services, such as mental health counseling or other rehabilitative services, aid prisoners, the effect may be upwardly biased. In addition, if parole or probation requirements push individuals into the labor market after release, this would also cause an upward bias.

We present results from these estimates in Table 1 to provide descriptive magnitudes to the average earnings of released prisoners increase post-prison. Overall quarterly earnings are on average \$403 higher post-release (a 38% increase over average pre-prison earnings), while log earnings (conditional on employment) are 18 percent higher and employment rates are 10 percentage points higher (about a 27% increase over average pre-prison employment). These positive post-prison trends are consistent with prior research (Looney & Turner, 2018; Kling, 2006; Nagin & Waldfogel, 1995 [for younger ex-offenders], Tyler & Kling, 2007). If we undertake separate analyses for black and white ex-offenders, we find that both experience post-release increases, but the magnitude of these increases, relative to pre-prison averages, are larger for black ex-offenders than for white ex-offenders.

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<sup>14</sup> Because of fewer observations among older workers, we aggregate age fixed effects for those aged 50-55 and 56-65.

<sup>15</sup> We use ordinary least squares for all outcomes, including the binary employment outcome. Estimates using logistic models for employment produce similar results (available upon request).

#### 4. Empirical Approach

To address the potential bias due to non-GED related changes experienced in prison, we estimate the following model for each GED taker (including those who passed and those who did not pass)  $i$  in year-quarter  $t$ :

$$Y_{it\tau} = \alpha + \delta(Post_{it} \times GED_i) + d_i + d_a + d_t + d_\tau + \varepsilon_{it\tau} \quad (2)$$

As in equation (1),  $Post$  is equal to zero in the time periods prior to entering prison; this variable switches to one in all time periods once the prisoner is released.  $GED$  is equal to one if the individual passed the GED while in prison and zero if they did not. Therefore, the coefficient on the interaction between  $Post$  and  $GED$ ,  $\delta$ , measures the effect of GED passage on within-person post-release outcomes relative to pre-prison outcomes, as compared to the post-pre within-person outcome differences of those who did not pass. We include an individual-stint fixed effect  $d_i$ , a quarter/year fixed effect  $d_t$ , an age fixed effect  $d_a$ , and quarter relative to incarceration  $d_\tau$ . The main effect for GED is absorbed in the individual-stint fixed effect and the main effect for the post-period is absorbed in the quarter relative to incarceration fixed effect. Following prior research that finds differential experiences of ex-offenders by race (e.g., Holzer, Raphael, & Stoll, 2006; Pager, 2003; Tyler & Kling, 2007) and differential returns to the GED by race (Tyler, Murnane, & Willett, 2000), we test for potential heterogeneity across black and white ex-offenders.<sup>16</sup> We examine labor market outcomes 20 quarters (5 years) after release.

We begin with a control group that draws from prisoners who took, but did not pass the GED exam. As described earlier, about 92% of individuals who took the GED ultimately passed. This high passage rate is by design, as prisoners are not encouraged to take the exam unless deemed

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<sup>16</sup> These are the only two races with large numbers in our sample – other races make up about 1% of the released population in our context. Another 1% of ex-offenders identify as a Hispanic or Latino ethnicity. Approximately 90% of the prisoners in the sample are males; we find similar results when examining a sample of just male prisoners.

ready by DOC officials. This aids in the comparability of the two groups and also makes our results based on this comparison group more likely to be a reflection of signaling effects of the GED rather than about human capital accumulation acquired through preparation programs.

While these groups' pre-prison labor market trends appear generally parallel (see Appendix Figure B1), we further use an exact match to enhance the comparability of the control group. We exactly match on race, gender, marital status, type of offense, treatment type, and coarsened categories of sentence length, age at exit, and average earnings and employment rate 3-4, 5-6, and 7-8 quarters prior to prison entry. We describe the matching procedure in detail in Appendix C. We excluded any person-stints that did not have at least one treatment and control observation within their group and weight observations by the probability of treatment within the group ( $p$ ), with treatment observations having a weight of  $1/p$  and control observations having a weight of  $1/(1 - p)$ .<sup>17</sup> Finally, we follow the same procedure to match those who earned the GED in prison to the full sample of ex-offenders.

We display descriptive statistics in Table 2. Compared to the sample of ex-offenders who did not pass the GED exam (column 2), those who earned a GED (column 1) are more likely to be white and less likely to have a prior incarceration; other differences are generally minor. When comparing GED earners to the full sample in column (3), more substantial differences are evident. When comparing the matched samples in columns 4-5 and columns 6-7, the groups are nearly identical based on pre-entry observable characteristics. The match comes at a cost to sample size, as we match about a third of GED passers when matching to the GED failer group, and about 60 percent of GED passers when matching to the full ex-offender sample. We also note that, relative to the unmatched samples, both matched samples are less likely to be married and more likely to

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<sup>17</sup> We further remove observations from cells where the probability of treatment is less than the first percentile and greater than the 99th percentile.

be serving a regular sentence, as opposed to a short-term shock treatment, institutional treatment, or long-term drug offense.

While the similarity of observable pre-entry characteristics provides some confidence in the comparability of treatment and control groups, the identifying assumption of this difference-in-differences approach is that any differences between GED earners and comparison ex-offenders in terms of expected trends (in the absence of GED certification) are captured in the pre-release labor market returns. It assumes, for example, that post-prison trends of GED passers would be similar to trends of matched ex-offenders, but for the GED.

We examine pre-prison trends graphically in Figure 2 for the two matched groups.<sup>18</sup> Compared to the full sample, pre-incarceration employment and earnings levels are relatively low in the matched samples. Therefore, results from our analysis are most directly relevant to ex-offenders who had relatively poor labor market experiences prior to prison entry. For both comparison groups, pre-incarceration earnings and employment trends are visually indistinguishable. In sum, graphical observation provides support for the use of the matched comparison group difference-in-differences research design to yield estimates of the causal effect of the GED on post-prison labor market outcomes.

In order to provide a formal test of the common trends assumption, we estimate event-study models where we replace the *Post* variable from equation (2) with a set of indicators for quarters before and after incarceration:

$$Y_{it\tau} = \alpha + \sum_{j=-8}^{20} \delta^j (GED_i \times \mathbf{1}[\tau = j]) + d_i + d_a + d_t + d_\tau + \varepsilon_{it\tau} \quad (3)$$

where  $\mathbf{1}[\tau = j]$  indicates the period  $j$  quarters before or after incarceration (as with earlier estimates, we omit the two quarters immediately preceding prison entry). From these estimates we

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<sup>18</sup> Parallel trend graphs for the full sample of (unmatched) GED test takers are available in Appendix B.

can explicitly test whether earnings and employment trends are different for treatment and control groups. These estimates also allow us to examine time-varying effects of the GED on earnings and employment. As with our primary estimates, we estimate equation (3) for all ex-offenders and for black and white ex-offenders separately. We present event study results in section 5.2.

## 5. Results

### 5.1. Estimates of Labor Market Outcomes

We present the main results from our difference-in-differences estimates, corresponding to the specification provided in equation (2), in Table 3.<sup>19</sup> Here we do not see a positive earnings effect of obtaining the GED when accounting for the trends of a matched group of GED test failers, as point estimates for earnings and log earnings are not significantly different than zero (panel A of columns 1 and 2). From Figure 2, we see that both GED exam passers and failers experience post-release increases in earnings, but the increase among GED exam passers is not different than the increase among GED exam failers. We see that employment for GED recipients is two percentage points higher relative to the comparison group (an effect magnitude of about 8% off a post-prison average of 26.5% for the comparison group).

In panel B we display results for the matched sample of all ex-offenders. Here we see stronger evidence of an effect of the GED on post-release labor market outcomes. Quarterly earnings are \$130 higher for GED earners (an effect of about 17% of the comparison group post-release mean), which is a function of both higher earnings for those employed (6.5%) and greater employment (2.1 percentage points, which equates to an effect size of about 9%).

We split the sample between black and white ex-offenders in Table 4. Consistent with our main results, we do not see a precisely estimated difference in earnings when using the sample of

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<sup>19</sup> We display results for the matched samples; results for the full GED test-taking group are available in Appendix Table B2.

matched GED test takers. However, we see that the pooled employment effect is largely driven by white ex-offenders, with a point estimate of 2.9 percentage points (11% of the comparison group post-release mean), while the employment point estimate for black ex-offenders is close to zero and statistically insignificant. Results from the broader matched group in panel B indicate positive effects of the GED earned in prison for both white and black ex-offenders. Earnings, log earnings, and employment effects are \$153 (an effect size of 17%), 8.2%, and 2.2 percentage points (effect size of 9%), respectively for white ex-offenders and \$63 (effect size of 13%), 1.8% (not statistically significant), and 2.3 percentage points (effect size of 12%) for black ex-offenders. Taken together, our results indicate a positive effect of the GED on labor market outcomes, though with generally stronger results for white ex-offenders.

## 5.2. Event studies

In Figure 3 we present event study results. We plot coefficients ( $\delta^\tau$  from equation (3)) using circle markers, with the coefficient for three quarters prior to incarceration set to zero, and the dotted lines denote the 95% confidence level for each point estimate. Pre-entry coefficients are close to zero in magnitude and statistically indistinguishable from zero. Therefore, these results provide further support that our matched groups satisfy parallel trend assumptions. In all panels, there is a positive effect of the GED for at least the first two quarters after release, after which point estimates decline. In the matched GED test taker group, these point estimates are not statistically significant for the following 18 quarters. However, for the more broadly matched group, the point estimates, while declining, are positive for nearly the full five years for earnings (panel C) and for about two years for employment. Taken together, positive effects of the GED appear strongest soon after release, but fade over time. One explanation for this declining trend corresponds to research which indicates that the labor market learns about worker productivity



over time, so signals of educational credentials are the most valuable soon after receipt (Altonji & Pierret, 2001; Lange, 2007).

We display corollary event study results for white and black ex-offenders in Figures 4 and 5. Results are largely consistent with the pooled results. Pre-incarceration trends are similarly small in magnitude and statistically insignificant, indicating that pre-prison labor market trends are unlikely to be biasing our results. Moreover, for ex-offenders of both groups, we generally see the most beneficial effects of the GED soon after release, after which effects decline over time.

The post-release trends for black ex-offenders differ somewhat from those of the white ex-offenders. Reflective of the overall lack of an effect for black ex-offenders using the matched GED test taker sample, the post-release coefficients in panels A and B of Figure 5 are all statistically insignificant. When compared to matches from the all ex-offenders in panels C and D, the effect of the GED on earnings fades out quicker for black ex-offenders than for white ex-offenders, as point estimates reported in Figure 5 are not statistically different than zero by the end of the second year and onward.

## **6. Discussion**

Our analysis indicates that the prison GED can have positive benefits to ex-offenders in the labor market in both earnings and employment. This positive effect is in contrast to the broader literature that finds generally no or modest effects of the GED on labor market outcomes, but is consistent with evidence that the GED has more promise for those with lower academic endowments, as is true for some of the prison population (e.g., Heckman, Humphries, & Mader, 2010; Murnane, Willett, & Tyler, 2000; Tyler, Murnane, & Willett, 2000). In the prison case, it may be that the GED presents a positive signal of accomplishment and rehabilitation, as opposed to a negative signal of high school drop out in the broader population.

Positive effects are most acute soon after prison release and appear to fade out over time. This likely reflects the value of educational credentials being highest before employers are able to learn about the productivity of workers. The benefits are also greater for white ex-offenders than for black ex-offenders. One explanation for this negative black ex-offender effect corresponds to research that shows widespread statistical discrimination against black job applicants in the labor market (e.g., Doleac & Hansen, 2016). 22% of all black males' GED credentials are earned in prison, as compared to just 5% of white males' with GED credentials (Heckman, Humphries, & Mader, 2010). Therefore, our results are consistent with an explanation that employers statistically discriminate against black ex-offenders with a GED because employers view it as a signal of a criminal record rather than as an educational credential. This explanation could only apply if substantial numbers of employers had no access to information about criminal records from job applications.

There may be other benefits to a GED program that are not captured in labor market outcomes, for example, if it stems recidivism, regulates behavior in prison, or enhances cognitive development. More research is needed, however, to investigate these outcomes.

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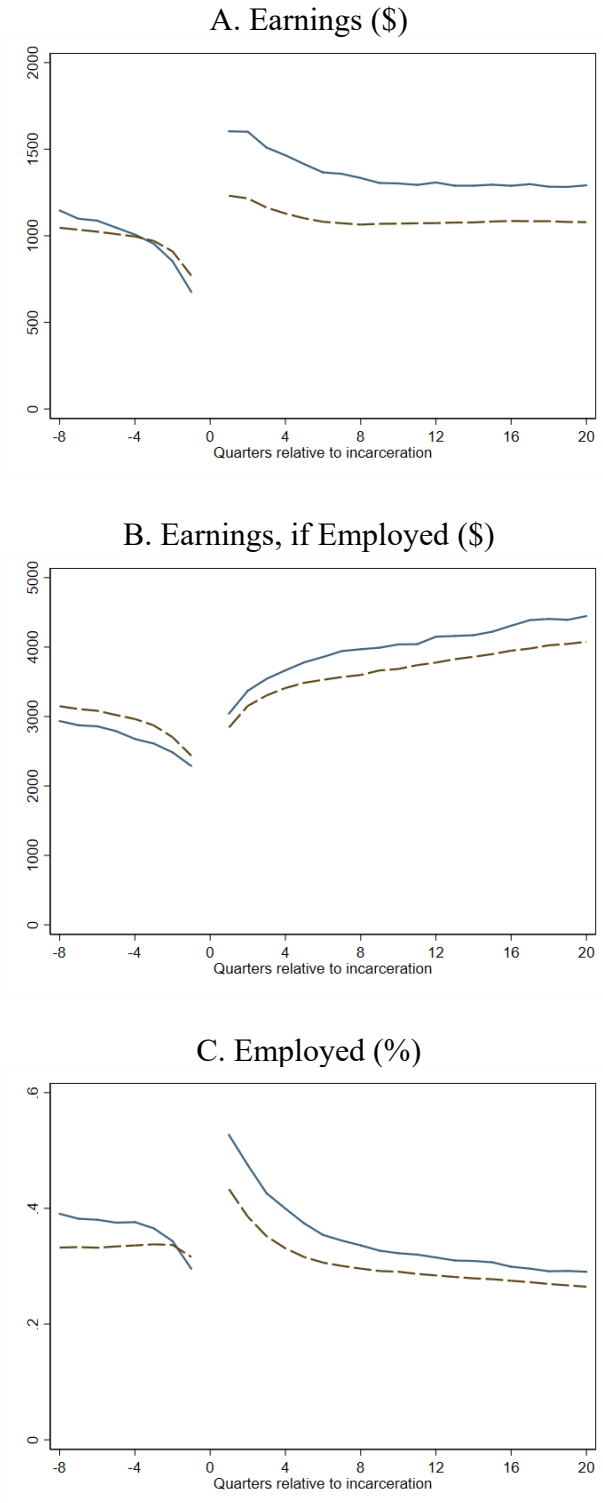
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Figure 1: Quarterly Earnings and Employment Trends

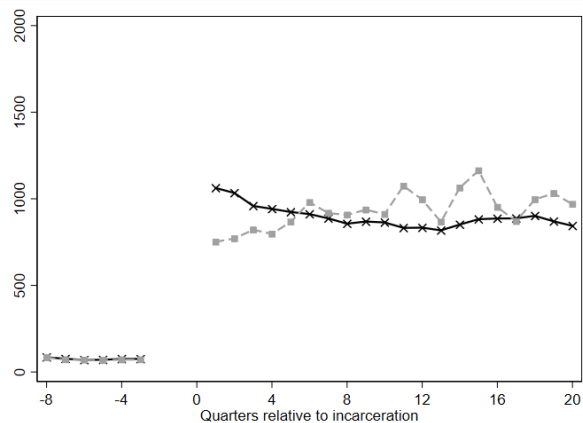


Source: Administrative data from Missouri. Notes: Solid line is the trend of those who earned a GED in prison and dashed line is the trend of those who did not earn a GED in prison. All earnings in constant 2014 dollars.

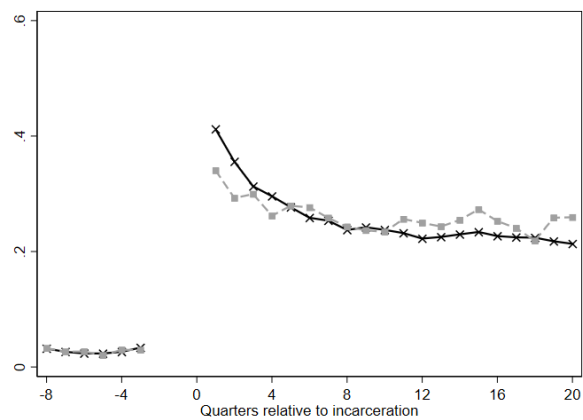
Figure 2: Quarterly Earnings and Employment Trends, GED recipients and comparison groups

**Matched to GED failers**

**A. Earnings (\$)**

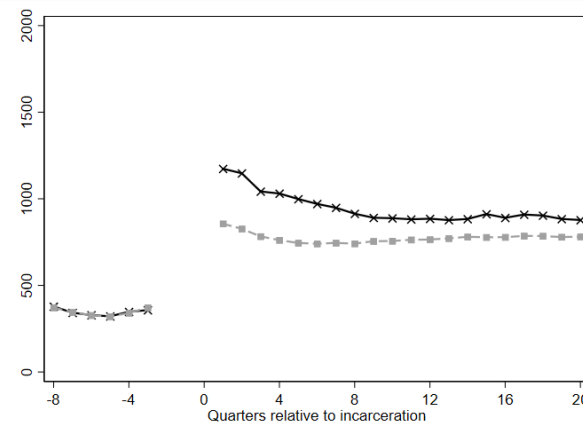


**B. Employed (%)**

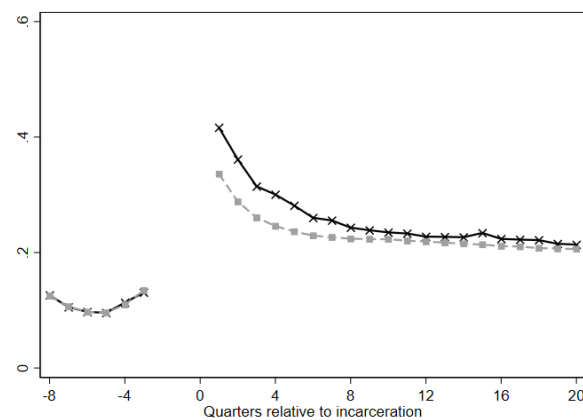


**Matched to all ex-offenders**

**C. Earnings (\$)**



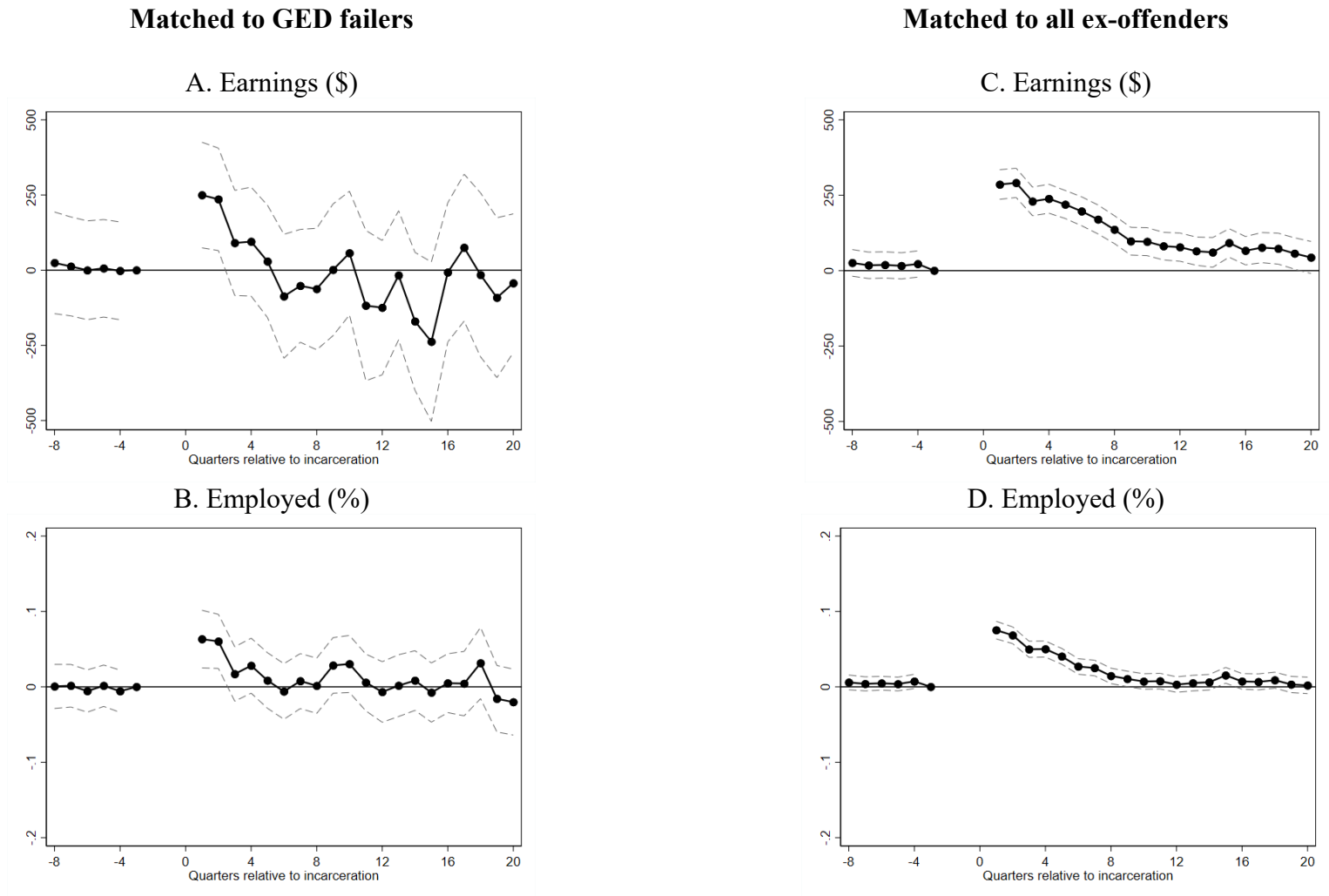
**D. Employed (%)**



Source: Administrative data from Missouri. Notes: Solid line with X markers is the trend of individuals who earned the GED in prison, while the dashed line with circle markers is the trend of matched persons who took the GED exam while in prison but did not pass (panels A and B) or the trend of matched persons from the full sample of the formerly incarcerated. Weights used. All earnings in constant 2014 dollars.

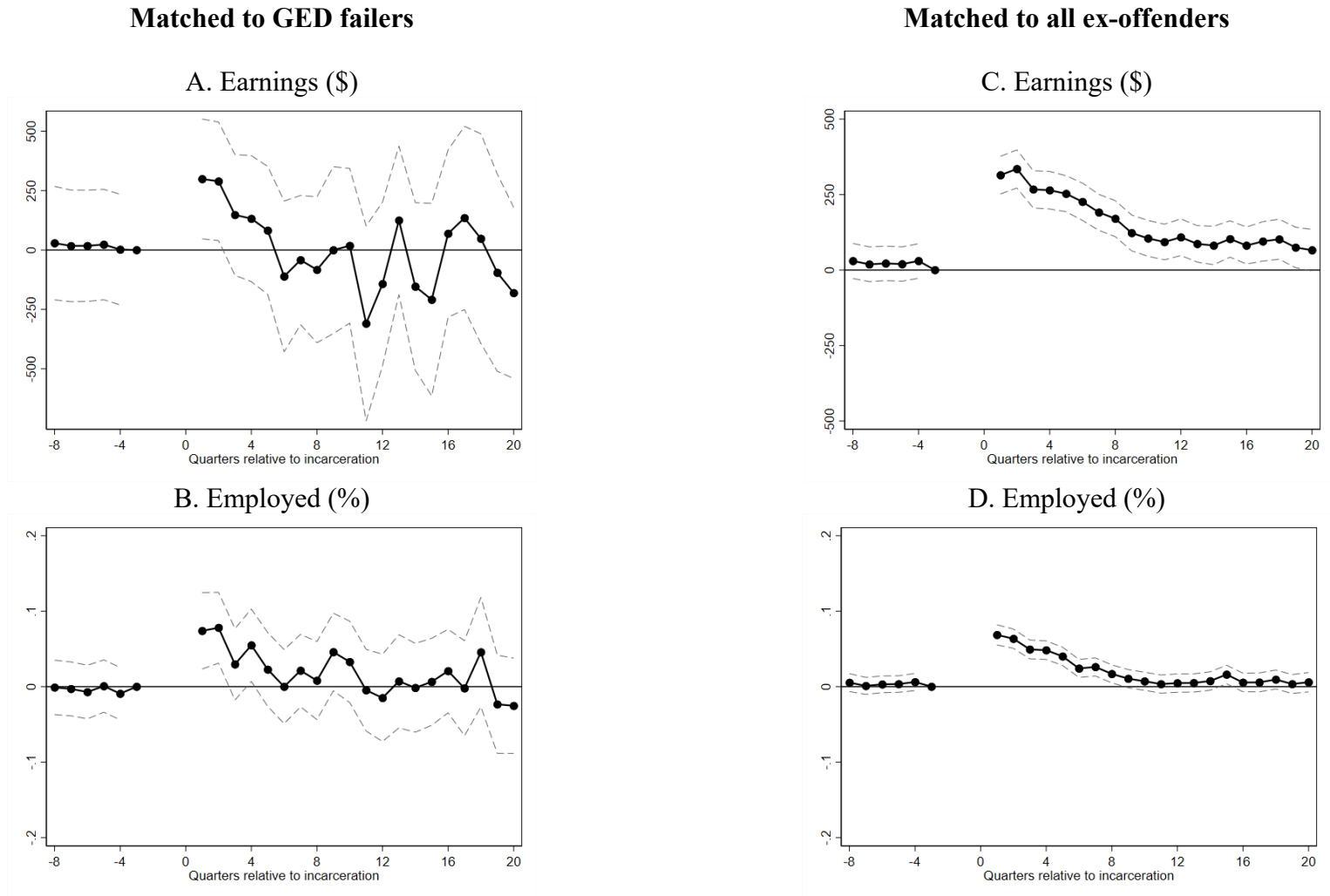


Figure 3: Effect of GED on Quarterly Earnings and Employment



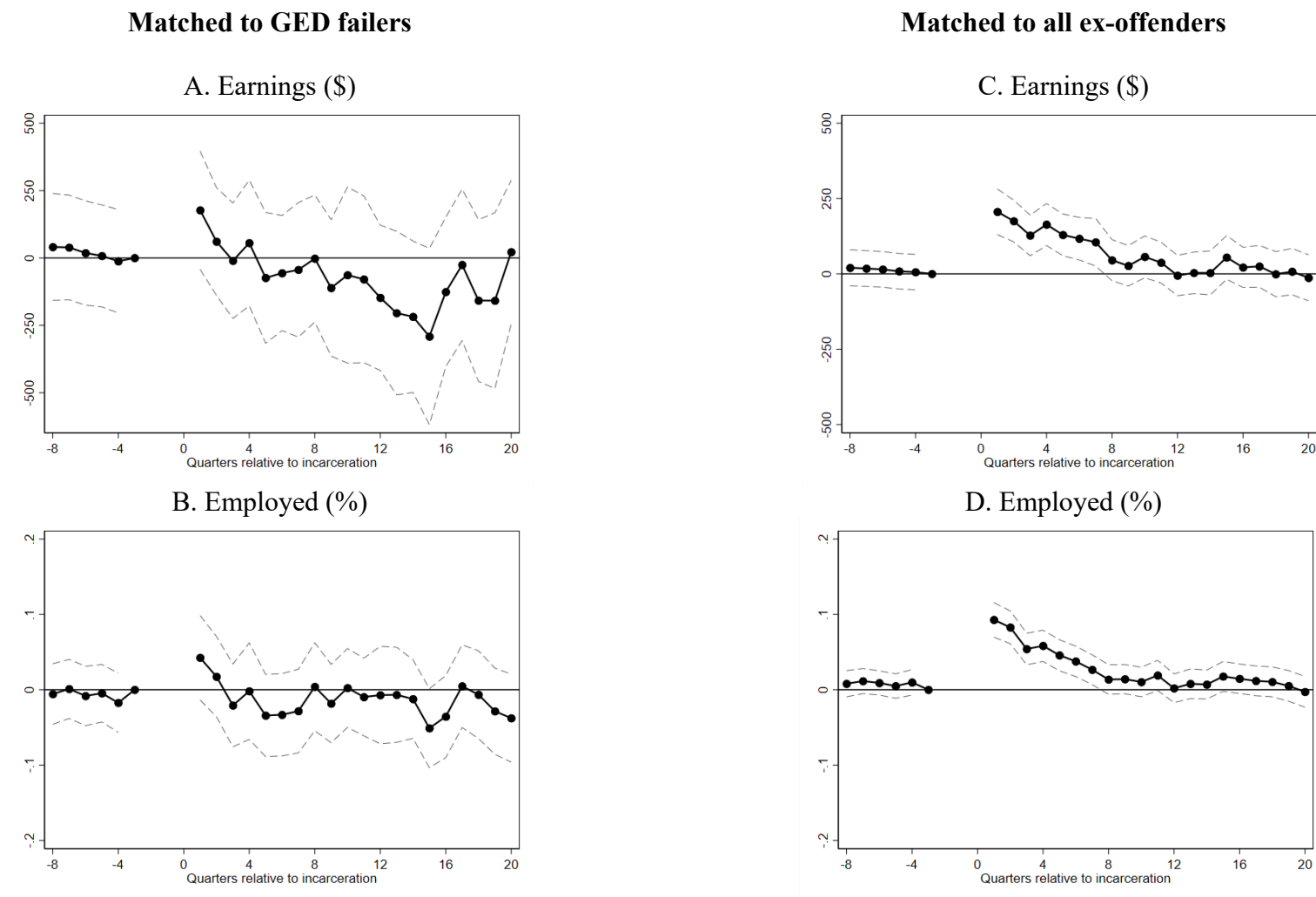
Source: Administrative data from Missouri. Notes: Marker is the point estimate for each quarter, grey dashed lines are the 95% confidence interval. Weights used.

Figure 4: Effect of GED on Quarterly Earnings and Employment, White Ex-Offenders



Source: Administrative data from Missouri. Notes: Marker is the point estimate for each quarter, grey dashed lines are the 95% confidence interval. Weights used.

Figure 5: Effect of GED on Quarterly Earnings and Employment, Black Ex-Offenders



Source: Administrative data from Missouri. Notes: Marker is the point estimate for each quarter, grey dashed lines are the 95% confidence interval. Weights used.

Table 1: Estimates of Post-Release Changes in Quarterly Earnings and Employment, GED recipients

	Earnings	Log Earnings	Employed
	(1)	(2)	(3)
<b>A. All Ex-offenders</b>			
Post-release	403**	0.181**	0.103**
	(12)	(0.011)	(0.002)
Pre-release mean	1054	na	0.378
Observations	629319	224339	629319
<b>B. White Ex-offenders</b>			
Post-release	449**	0.183**	0.113**
	(15)	(0.013)	(0.003)
Pre-release mean	1205	na	0.400
Observations	449396	166119	449396
<b>C. Black Ex-offenders</b>			
Post-release	340**	0.206**	0.121**
	(18)	(0.025)	(0.005)
Pre-release mean	637	na	0.317
Observations	176012	56848	176012

Source: Administrative data from Missouri. Notes: Each coefficient is from a separate regression. Standard errors are in parentheses. All earnings in constant 2014 dollars. All models control for year and quarter, age, and individual fixed effects. These estimates exclude earnings, log earnings, and employment rates for the two periods immediately prior to entering prison.

\*\* p < 0.01, \* p < 0.05

Table 2: Sample Summary Statistics

	Full Sample			GED passers matched to GED failers		GED Passers matched to all ex-offenders	
	Passed GED	Did not pass GED	Did not take GED	Passed GED	Did not pass GED	Passed GED	Did not take GED
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Age at exit	30.8 (8.6)	32.7 (9.1)	33.6 (9.4)	30.8 (9.1)	30.9 (9.4)	32.8 (9.3)	33.1 (9.6)
Race: White	0.71	0.48	0.65	0.62	0.62	0.69	0.69
Race: Black	0.28	0.51	0.35	0.38	0.38	0.31	0.31
Gender: Male	0.90	0.88	0.86	0.94	0.94	0.91	0.91
Married at entry	0.19	0.19	0.19	0.12	0.12	0.14	0.14
Prior incarceration	0.46	0.56	0.60	0.53	0.53	0.67	0.67
Offense type: Drug	0.24	0.26	0.28	0.24	0.24	0.26	0.26
Offense type: DWI	0.04	0.03	0.06	0.03	0.03	0.04	0.04
Offense type: Non-Violent	0.42	0.42	0.48	0.46	0.46	0.54	0.54
Offense type: Sex	0.06	0.05	0.04	0.02	0.02	0.03	0.03
Offense type: Violent	0.24	0.23	0.14	0.24	0.24	0.13	0.13
Sentence length in years (std. dev.)	6.2 (4.1)	10.0 (18.1)	6.1 (8.3)	6.0 (3.6)	5.8 (3.6)	5.3 (3.0)	5.6 (6.3)
Incar. type: Short-term shock	0.05	0.05	0.08	0.01	0.01	0.04	0.04
Incar. type: Institutional	0.07	0.08	0.12	0.02	0.02	0.06	0.06
Incar. type: Long-term drug offense	0.04	0.03	0.02	0.01	0.01	0.02	0.02
Incar. type: Regular sentence	0.84	0.84	0.78	0.95	0.95	0.89	0.89
Person-stints (unweighted)	27348	2394	290431	6386	938	16393	121916

Source: Administrative data from Missouri. Notes: Means are weighted. Observations are unweighted prisoner-stint.

Table 3: Estimates of Effects on Quarterly Earnings and Employment

	Earnings	Ln Earnings	Employed
	(1)	(2)	(3)
<b>A. Matched to GED failers</b>			
GED*Post-Release	16	-0.148	0.020**
	(37)	(0.140)	(0.006)
Comparison group post-release mean	916	na	0.265
Observations	160,416	33,443	160,416
<b>B. Matched to all ex-offenders</b>			
GED*Post-Release	130**	0.065**	0.021**
	(9)	(0.017)	(0.002)
Comparison group post-release mean	774	na	0.233
Observations	3,189,475	658,318	3,189,475

Source: Administrative data from Missouri. Notes: Standard errors are in parentheses. All earnings in constant 2014 dollars. All models control for calendar year/quarter, period relative to incarceration, age, and individual-stint fixed effects. Weights used. These estimates exclude earnings, log earnings, and employment rates for the two periods immediately prior to entering prison.

\*\* p < 0.01, \* p < 0.05

Table 4: Estimates of Effects on Quarterly Earnings and Employment

	White			Black		
	Earnings	Ln Earnings	Employed	Earnings	Ln Earnings	Employed
	(1)	(2)	(3)	(1)	(2)	(3)
<b>A. Matched to GED failers</b>						
GED*Post-Release	22	-0.092	0.029**	-71	0.042	-0.005
	(55)	(0.170)	(0.008)	(42)	(0.231)	(0.010)
Comparison group post-release mean	1041	na	0.267	745	na	0.263
Observations	100,273	20,900	100,273	60,143	12,543	60,143
<b>B. Matched to all ex-offenders</b>						
GED*Post-Release	153**	0.082**	0.022**	63**	0.018	0.023**
	(11)	(0.018)	(0.002)	(13)	(0.049)	(0.004)
Comparison group post-release mean	906	na	0.250	492	na	0.197
Observations	2,177,468	488,898	2,177,468	1,006,204	168,700	1,006,204

Source: Administrative data from Missouri. Notes: Standard errors are in parentheses. All earnings in constant 2014 dollars. All models control for calendar year/quarter, period relative to incarceration, age, and individual-stint fixed effects. Weights used. These estimates exclude earnings, log earnings, and employment rates for the two periods immediately prior to entering prison.

\*\* p < 0.01, \* p < 0.05

## Appendix A: Sample Construction

A total of 171,312 individuals were released from Missouri prisons from 1990-2013. Individuals could have served in prison multiple times, with each “stint” defined as a time in prison with a recorded entry and exit date. Of this population, 24,240 individuals did not have a unique identifier that allowed us to link the Missouri Department of Corrections data to earnings records from the Missouri Department of Labor and Industrial Relations. We further dropped 13,851 individuals who did not have a single earnings record from 1990-2014 and 163 individuals who were under the age of 18 or over the age of 65 for our entire observation period (8 quarters prior to entry and 20 quarters after exit). The resultant analytical sample includes 133,058 individuals and 320,173 individual-stints. Of this sample, 29,742 individuals took the GED. Although we observe individuals taking the GED multiple times within the same stint, individuals in our data only take the GED during one stint; thus, the number of stints and individuals in our analytic data set both equal 29,742.

Table A1: Sample Construction

	Individuals	Individual-Stints
	(1)	(2)
All prisoners released from 1990-2014 in MO	171,312	370,195
Records with SSN	147,072	344,375
Records that link to wage data	133,221	320,501
Records that meet age requirements	133,058	320,173
Took GED	29,742	29,742



## Appendix B: Supplementary Figures and Tables

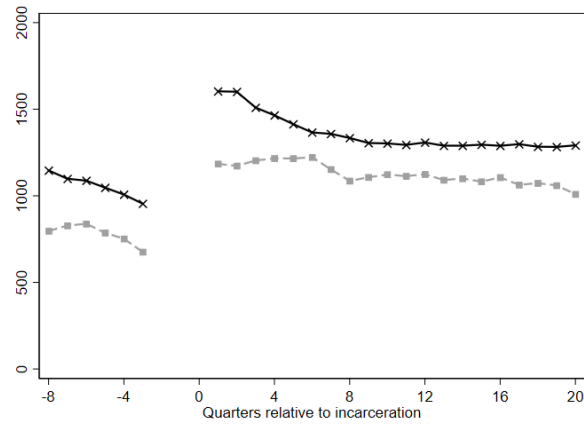
Appendix Table B1: GED test-takers compared to the overall ex-incarcerated population

	<u>Took the GED</u>		<u>Did not take GED, &lt; HS</u>		<u>Did not take GED, ≥ HS</u>	
	<u>Mean</u>	<u>SD</u>	<u>Mean</u>	<u>SD</u>	<u>Mean</u>	<u>SD</u>
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Characteristics</b>						
Age at exit	30.93	8.70	32.56	9.49	35.60	9.23
Race: White	0.69	0.46	0.59	0.49	0.73	0.45
Race: Black	0.30	0.46	0.40	0.49	0.27	0.44
Ethnicity: Hispanic	0.01	0.12	0.01	0.12	0.01	0.10
Gender: Male	0.90	0.30	0.85	0.36	0.83	0.37
Married	0.19	0.39	0.20	0.40	0.19	0.39
<b>Evaluations at entry</b>						
Mental Health Issue, if evaluated	0.13	0.34	0.15	0.36	0.17	0.38
Mental Health Not Evaluated	0.07	0.25	0.00	0.00	0.00	0.00
Physical Health Issue, if evaluated	0.03	0.18	0.06	0.23	0.06	0.24
Physical Health not Evaluated	0.07	0.25	0.00	0.00	0.00	0.00
<b>Incarceration</b>						
120 Day Shock Treatment	0.05	0.23	0.09	0.29	0.05	0.22
Institutional Treatment	0.07	0.25	0.05	0.23	0.06	0.24
Long term Drug Offense	0.04	0.20	0.02	0.15	0.05	0.21
Regular Sentence	0.84	0.37	0.83	0.37	0.84	0.36
Length of Prison Stay (years)	2.87	3.31	1.50	2.16	1.57	2.08
<b>Reason for Incarceration</b>						
New Offense	0.34	0.48	0.33	0.47	0.23	0.42
Parole Violation	0.25	0.43	0.28	0.45	0.47	0.50
Probation revoked	0.41	0.49	0.39	0.49	0.30	0.46
<b>Offense Type</b>						
Drug Offense	0.24	0.43	0.26	0.44	0.29	0.45
DWI Offense	0.04	0.21	0.05	0.21	0.06	0.25
Non-Violent Offense	0.42	0.49	0.50	0.50	0.45	0.50
Sex Offense	0.06	0.24	0.05	0.22	0.04	0.21
Violent Offense	0.24	0.43	0.14	0.35	0.15	0.36
<b>Release</b>						
Discharged	0.08	0.26	0.11	0.31	0.15	0.36
Parole	0.79	0.41	0.70	0.46	0.71	0.46
Probation	0.09	0.29	0.15	0.35	0.11	0.32
Other	0.04	0.20	0.04	0.20	0.03	0.17
N	29,742		117,402		98,169	

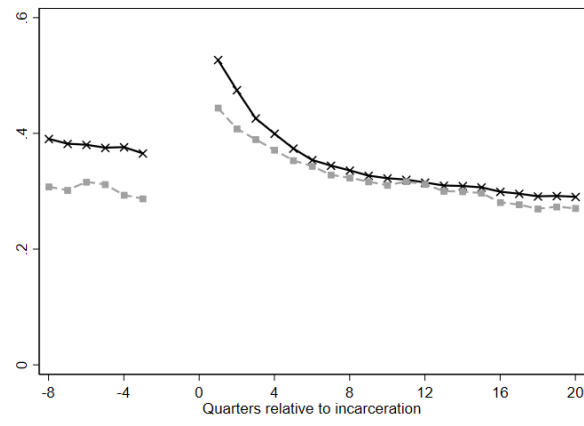
Source: Administrative data from Missouri.

# Appendix Figure B1: Earnings and Employment Trends – GED Test Takers

## A. Quarterly Earnings (\$)



## B. Employed (%)



Source: Administrative data from Missouri. Notes: Solid line with X markers is the trend of individuals who earned the GED while in prison, while the dashed line with square markers is the trend of those who took the GED exam while in prison but did not pass. All earnings in constant 2014 dollars.

Appendix Table B2: Estimates of Earnings and Employment, All GED test takers

	Earnings	Ln Earnings	Employed
	(1)	(2)	(3)
GED*Post-Release	-5	0.014	-0.030**
	(22)	(0.024)	(0.004)
Comparison group post-release mean	1133	na	0.331
Observations	679,851	240,717	679,851

Source: Administrative data from Missouri. Notes: Standard errors are in parentheses. All earnings in constant 2014 dollars. All models control for calendar year/quarter, period relative to incarceration, age, and individual-stint fixed effects. These estimates exclude earnings, log earnings, and employment rates for the two periods immediately prior to entering prison.

\*\* p < 0.01, \* p < 0.05

## Appendix C: Matching and Weighting Procedure

### 1. Matching

We perform exact matches on the following categories, with all factors measured at the time of prison entry. In other words, each ex-offender who obtained a GED is matched to ex-offenders who were in the same cell based on all of the variables listed below.

#### Categorical variables

- Race; White, Black, Other/Unknown
- Gender: Male, Female
- Marital status: Married, Not Married
- Had a prior stint in prison: Yes, No
- Offense type: Drug, Violent, Sex, DWI, Non-violent
- Incarceration type: Short-term shock treatment, Institutional treatment, Long-term drug offense, Regular sentence

#### Continuous variables

We create mutually exclusive categories for each of the following.

- Age at exit: 18-20, 21-24, 25-39, 30-34, 35-39,  $\geq 40$
- Sentence length years (SL):  $SL < 1$ ,  $1 < SL \leq 5$ ,  $5 < SL \leq 10$ ,  $SL > 10$ , SL missing

#### Pre-incarceration labor market experiences

We average the following variables in two quarter blocks (7-8 quarters prior to incarceration, 5-6 quarters prior, 3-4 quarters prior), and create mutually exclusive categories for each block.

- Employment rate (ER):  $ER = 0.0$ ,  $0.0 < ER \leq 0.5$ ,  $0.5 < ER \leq 1.0$ , ER missing
- Earnings \$ (W):  $\$ = 0$ ,  $0 < W \leq 250$ ,  $250 < W \leq 500$ ,  $500 < W \leq 1000$ ,  $1000 < W \leq 2000$ ,  $2000 < W \leq 3000$ ,  $3000 < W \leq 5000$ ,  $5000 < W \leq 10000$ ,  $W \geq 10000$ , W missing

## 2. Groups

Within each group  $j$ , we calculate the proportion, of ex-offenders who earned a GED in prison,  $p$ , as the number of ex-offenders who earned the GED divided by the total number of ex-offenders

in the group:  $p_j = \frac{\#GED_j}{N_j}$

## 3. Exclusions

We exclude ex-offenders in the following groups:

- All members passed the GED
- No members passed the GED
- $p_j < 1$ st percentile or  $p_j > 99$ <sup>th</sup> percentile of the non-0, non-1 distribution of  $p_j$

## 4. Weights

We assign the following weights:

- Treatment group (GED earners):  $1/p_j$
- Control group (did not earn a GED):  $1/(1 - p_j)$

## Appendix D: Regression Discontinuity

Conceptually, we can use the scores on the GED exam as a forcing variable in a regression discontinuity (RD) framework. The identifying assumption is that those just over and just under the GED passage threshold are as good as randomly distributed, thereby allowing inference about local treatment effects akin to a randomized experiment. We could estimate such a function using a sharp RD estimating equation:

$$Y_{it} = \delta \mathbf{1}[\tilde{S}_i > 0] + f(\tilde{S}_i \times \mathbf{1}[\tilde{S}_i > 0], \lambda_1) + g(\tilde{S}_i, \lambda_2) + X_i\beta + d_t + e_{it}. \quad (1)$$

The indicator function  $\mathbf{1}[\tilde{S}_i > 0]$  identifies prisoners who obtained passing scores on the GED, where  $\tilde{S}_i = \text{GED score} - 2250$ , i.e.,  $\tilde{S}_i$  is the GED score centered at the passing threshold. We allow for flexible polynomial functions of  $\tilde{S}_i$  on either side of the passing score cutoff with estimated parameter vectors  $\lambda_1$  and  $\lambda_2$ , with the functions chosen so that  $f(0, \lambda_1) = g(0, \lambda_2)$ . The  $X$ -vector contains covariates and  $d_t$  is a quarter/year fixed effect.

There is an important consideration in using a RD framework with GED test scores in this setting. Most test takers who fail the exam take it again. In our data, nearly half of those who failed the exam retake it, and this proportion rises as scores approach the threshold (see Table E1). Therefore, while test takers' "final" scores (i.e., the score that incorporates the most recent GED exam taken) clearly identifies those who pass the GED exam, the use of final score leads to a discontinuity in test scores density, implying manipulation of the final test score and possible violation of the assumptions of the RD design (see Figures D1 and D2). To address this issue, we follow Jepsen, Mueser, and Troske (2016, 2017) and instead use the score for the first GED test of each test taker. Figure D3 shows that using this initial test score results in a generally smooth distribution of scores around the passing cutoff.

Since those with scores below the cutoff on the first test may ultimately obtain GED certification, a fuzzy RD structure is more appropriate than the sharp RD in this context. Another consideration is that although an aggregate score of 2250 is necessary to pass the exam, test takers need to also pass each of five subtests with a minimum score of at least 410.<sup>20</sup> Thus, there are some test takers with scores greater than 2250 who do not pass the GED exam because they did not pass all subtests. In our sample, this happens relatively infrequently, accounting for about 5% of exam scores.

To account for this imperfect correlation between an exam score over the threshold and passage of the GED, we could estimate the following equation:

$$GED_{it} = \Gamma \mathbf{1}[\tilde{S}_i > 0] + f(\tilde{S}_i \times \mathbf{1}[\tilde{S}_i > 0], \eta_1) + g(\tilde{S}_i, \eta_2) + X_i\beta + d_t + \epsilon_{it}. \quad (2)$$

Using the results from equations (1) and (2) would allow us to calculate the fuzzy RD estimate of the effect of GED certification as  $\hat{\tau} = \hat{\delta} / \hat{\Gamma}$ .<sup>21</sup>

An impediment arises, however, with the use of the first test score. About 60-80% of test takers with GED scores just under the passing threshold ultimately pass the GED exam with subsequent retakes (see Figure D4). As a result,  $\hat{\Gamma}$  is less than 0.4, and contains appreciable estimation error. Estimates for  $\hat{\tau}$  are therefore unreasonably large and unstable, and ultimately uninformative.

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<sup>20</sup> One way to handle this would be to use a multiple-discontinuity design, as in Jepsen, Mueser, and Troske (2017) or Papay, Murnane, and Willett (2009). This threshold was 400 prior to 2002.

<sup>21</sup> For a discussion of methods for estimating a fuzzy RD, see Imbens and Lemieux (2008).

Appendix Figure D1: Passage by Last Test Score

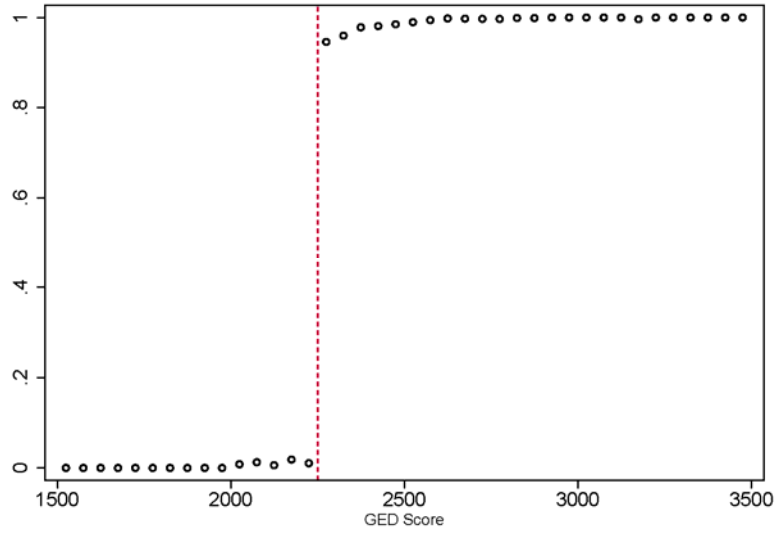
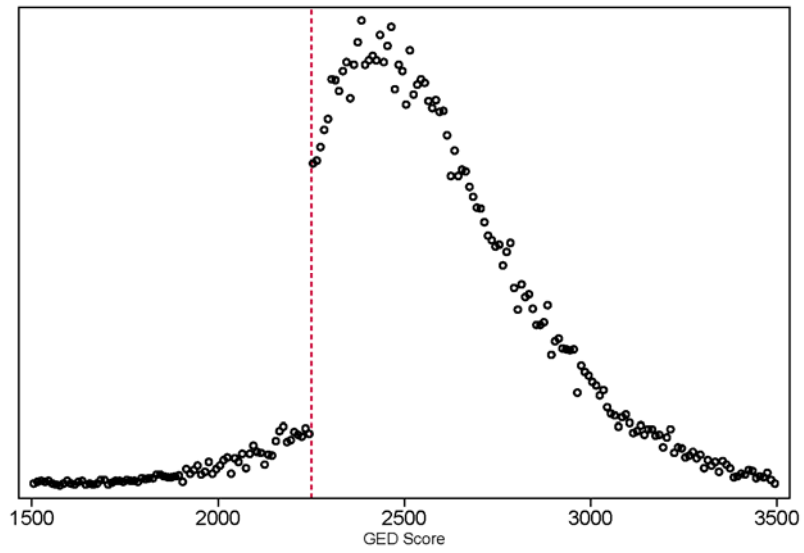
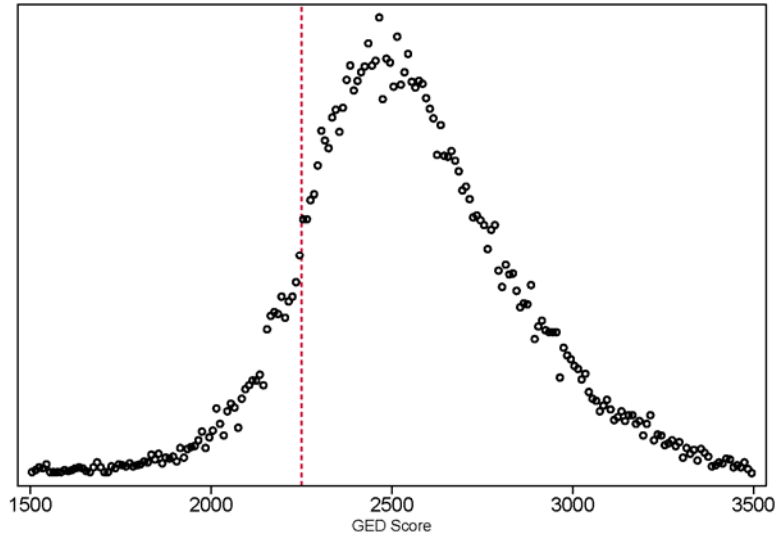


Figure D2: Distribution of Last Test Scores

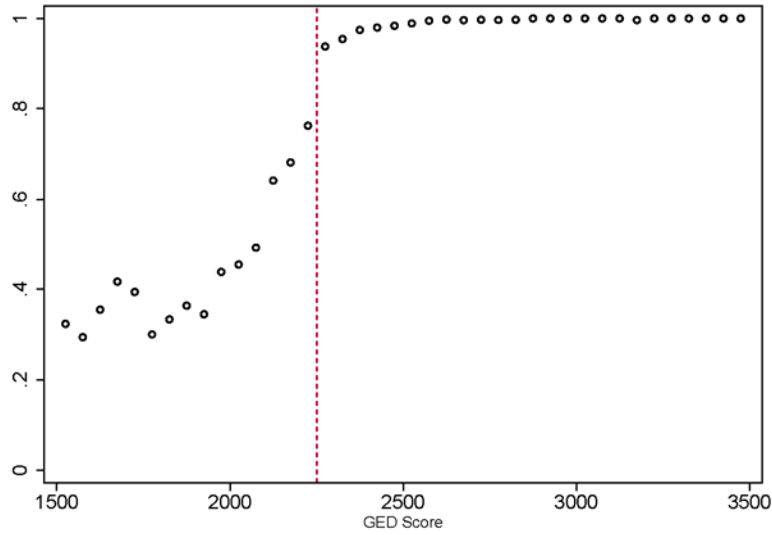




Appendix Figure D3: Distribution of First Test Scores



Appendix Figure D4: Passage by First Test Score



Appendix Table E1: Distribution of Test Scores

First Score Range	Count	Retake	Ever Passed Rate
1500-1649	82	49%	33%
1650-1799	119	52%	36%
1800-1949	279	44%	35%
1950-2099	814	60%	47%
2100-2249	2279	77%	71%
2250-2399	5206	14%	96%
2400-2549	6412	4%	98%
2550-2699	5409	1%	100%
2700-2849	3633	1%	100%
2850-2999	2252	0%	100%
>3000	2270	0%	100%