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THE GED

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ABSTRACT

The General Educational Development (GED) credential is issued on the basis of an eight hour subject-based test. The test claims to establish equivalence between dropouts and traditional high school graduates, opening the door to college and positions in the labor market. In 2008 alone, almost 500,000 dropouts passed the test, amounting to 12% of all high school credentials issued in that year. This chapter reviews the academic literature on the GED, which finds minimal value of the certificate in terms of labor market outcomes and that only a few individuals successfully use it as a path to obtain post-secondary credentials. Although the GED establishes cognitive equivalence on one measure of scholastic aptitude, recipients still face limited opportunity due to deficits in noncognitive skills such as persistence, motivation and reliability. The literature finds that the GED testing program distorts social statistics on high school completion rates, minority graduation gaps, and sources of wage growth. Recent work demonstrates that, through its availability and low cost, the GED also induces some students to drop out of school. The GED program is unique to the United States and Canada, but provides policy insight relevant to any nation's educational context.

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1 Introduction

The General Educational Development (GED) program has become a major factor in American education.[1] Dropouts from high school can take a seven hour battery of tests to obtain a GED credential. GEDs are widely held to be equivalent to individuals who receive a traditional high school diploma by taking courses and acquiring credit hours. Indeed, capturing this sentiment, many erroneously term the GED certificate as a "General Equivalency Degree". The GED program is quantitatively significant. Figure 1 shows that currently 12% of all high school credentials issued are GEDs,[2] and that there has been substantial growth overtime in the number of GED certificates issued.

This chapter reviews a body of literature, starting with Cameron and Heckman [1993], that shows that GEDs are *not* equivalent to ordinary high school graduates. GEDs have higher achievement test scores than dropouts in part because they complete more years of high school. Controlling for their greater scholastic ability, GEDs are equivalent to uncredentialed dropouts in terms of their labor market outcomes and their general performance in society. On average, obtaining a GED does not increase the wages of dropouts. While GEDs go to college at higher rates than dropouts, few finish more than one semester. The same traits that lead them to drop out of school also lead them to leave from jobs early, to divorce more frequently, and to fail in the military.[3]

Given the preponderance of evidence against beneficial effects of GED certification for the average GED recipient, it is surprising that the GED program has grown so dramatically in the past 50 years. We examine explanations for its growth. A primary cause is the growth of government programs that promote the GED as a quick fix for addressing the high school dropout problem. Adult Education programs and programs designed to promote convict rehabilitation are major contributors, the latter being especially important for African-American males. We present evidence that high schools are increasingly promoting the use of the GED.

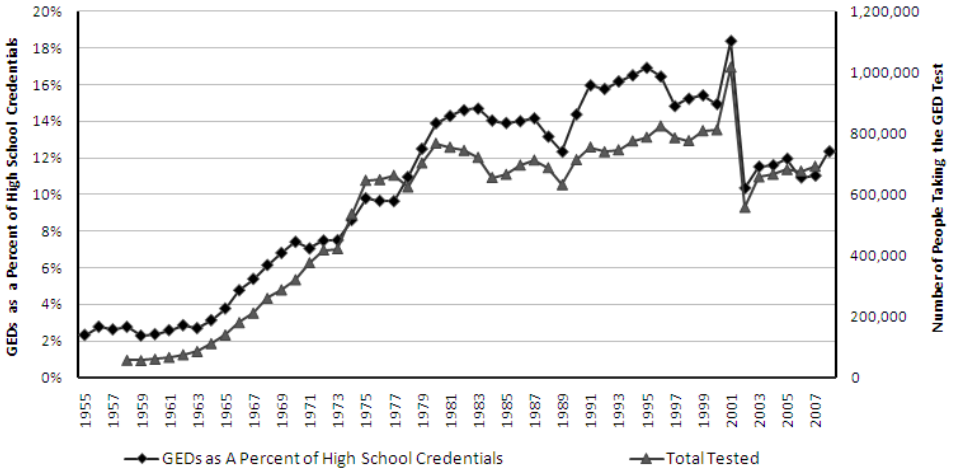
None of this would matter if the GED were harmless, like wearing a broken watch and knowing that it is broken. But the GED is not harmless. Treating it as equivalent to a high school degree distorts social statistics and gives false signals that America is making progress when it is not. A substantial part of the measured convergence of black and white high school attainment is fueled by prison-issued GEDs. Counting GEDs as dropouts, the African-American

[1] The GED program is unique to the United States and Canada, but analysis of this program provides general insights into the limitations of using achievement exams to certify preparedness for schools and the workplace.

[2] Henceforth, "GED" refers either to the certificate itself or to an individual who has received a GED certificate, depending on the context. "GEDs" refer to individuals who choose to certify by the GED, "GED program" is used to refer to the entire program, and "GED test" refers to the test itself.

[3] See Heckman and Rubinstein [2001] and Laurence [forthcoming].

Figure 1: Growth in the GED - Percent of High School Credentials and Number of Takers



Sources: National Center for Education Statistics [Various Years], and GED Testing Service [1958-2008]. Notes: The spike and fall in 2001-2002 is from a change in test series combined with an increase in passing standards. The "percent of high school credentials" statistic is calculated by dividing the number of GEDs issued divided by the sum of diplomas and GEDs issued that year.

male high school graduation rate in 2000 is at the same level as it was in 1960. Improperly counting GEDs as high school graduates also overestimates the returns to college. We document how American social statistics are distorted by assuming that GEDs are equivalent to ordinary high school graduates. We also show how the GED *creates* problems. It induces students to drop out of school and lose the benefits of a high school degree.

There are larger lessons from a study of the GED program. GEDs are as smart as ordinary high school graduates, as measured by a scholastic achievement test. Yet, as a group, GEDs fail to perform at the level of high school graduates. We show that noncognitive deficits – such as lack of persistence, low self-esteem, low self-efficacy, and high propensity for risky behavior – explain the lack of success for many GEDs. Deficits of what are sometimes called "soft" skills are often not taken into account in public policy discussions involving economic opportunity. A study of the GED shows the influence of personality traits on success in life and the need for public policies that address both cognitive and personality deficits.

This paper is organized as follows: Section 2 provides a short introduction to the GED, its structure, and a brief history. Section 3 looks at differences among dropouts, GEDs, and high school graduates, and discusses the evidence on labor market performance and educational attainment of GEDs. Section 4 presents evidence on the sources of growth of the GED program, and the changes over time in demographic groups it serves. Section 5 reviews the

adverse consequences of the GED. Section 6 concludes.

2 Institutional Background and Functions of the GED

There are substantial consequences of being a high school dropout. Wage premia for education have increased over the last three decades. Using Census PUMs data, Goldin and Katz [2008] report that the wage differential between high school graduates and dropouts grew from 16.7% in 1970, to 21% in 1990, to 25.5% in 2000. Figure 2, reproduced from Autor, Katz, and Kearney [2008], shows that real wages by educational level have diverged across time for both males and females. At the same time that real wages for those with college are steadily increasing, real wages for male dropouts are currently below their 1963 levels, and real wages for female dropouts are effectively unchanged since 1970.

Figure 3 shows that across cohorts, college attendance and college completion have both increased.[4] The rate of college attendance conditional on finishing high school, and the rate of college graduation conditional on attendance have both trended upward. The outlier is the high school graduation rate, which has trended *downward* starting with the 1950 birth cohort. The growth in people seeking alternative certification through the GED is a major contributor to this trend. Figure 4 shows that dropout rates since 1970 have decreased if GEDs are counted as high school graduates, but have increased if they are counted as dropouts.

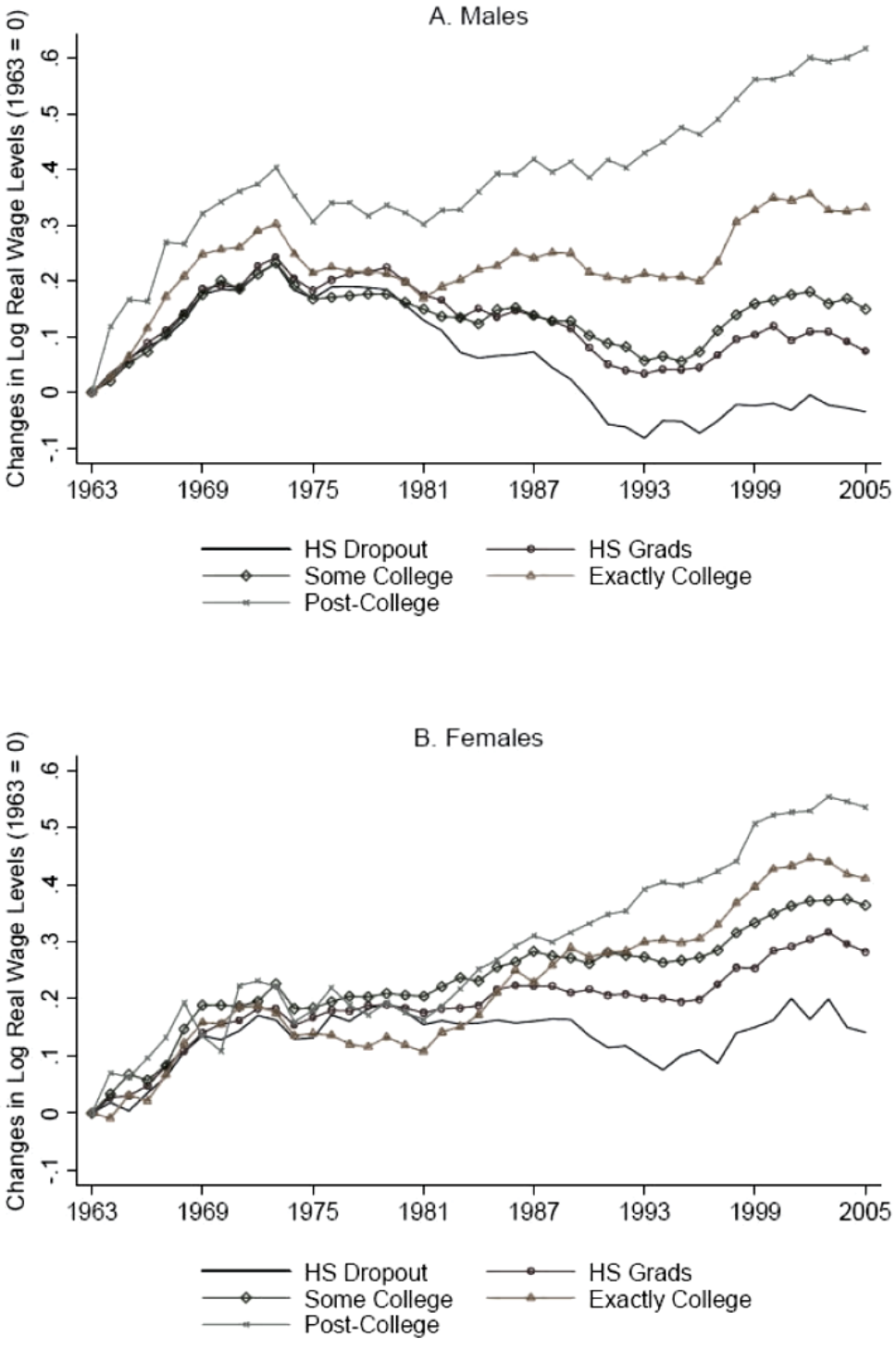
2.1 The GED Test

The GED was introduced by the American Council on Education (ACE) in 1942 as a credential for returning World War II veterans who entered the armed services before completing high school.[5] The test was originally used as a tool for placing returning veterans in college and high school. It was quickly expanded as a method for earning high school diplomas or equivalency credentials.

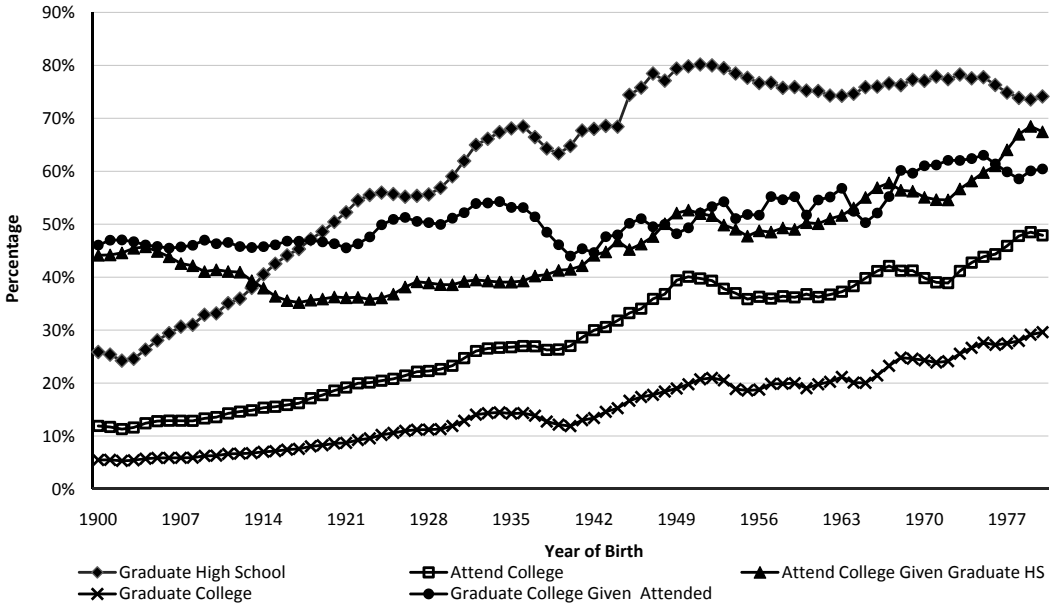
States began to offer the test to civilians in the late 1940s and, by 1959, civilian GED test takers outnumbered veteran GED recipients [GED Testing Service 1958-2008, Quinn 2002]. Relative to its very targeted beginning, the GED program has expanded to serve dropouts across a wide population. The GED currently targets a large and diverse population, including many who are unqualified to join the military [Laurence, forthcoming].[6]

[4] Figure 3 does not count GEDs as high school graduates.
[5] See Quinn [2002] for a detailed exposition of the GED's history.
[6] Section 3 demonstrates that the value of the GED depends on characteristics of the test taker, and Section 4 demonstrates that

Figure 2: Log Wage Levels By Education

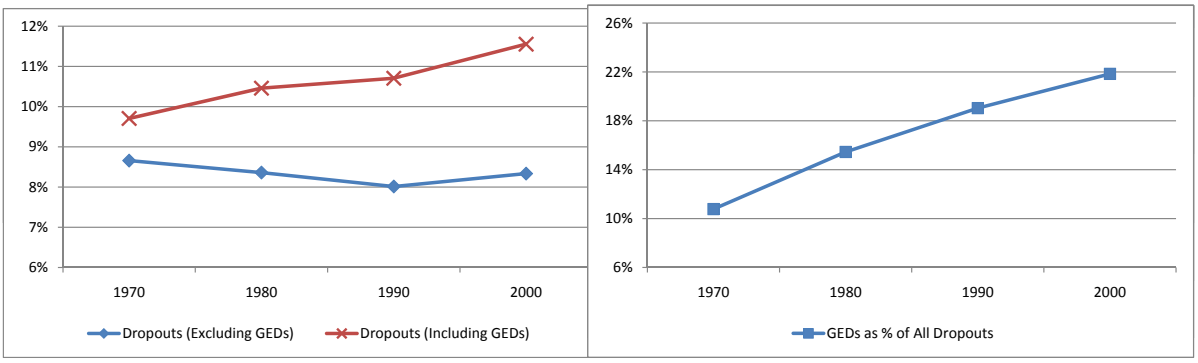


Source: Reproduced from Autor, Katz, and Kearney [2008], Figure 5.



Source: Reproduced from Heckman and LaFontaine [2010], Figure XIII. Notes: 3-year moving averages based on Current Population Survey (CPS) October, Census, CPS March and National Center for Education Statistics (NCES) data. HS graduates are those who obtained a regular public HS diploma (excluding GEDs) from the NCES. "Graduate HS" is the fraction of 8th grade enrollments for a given cohort who report a regular HS diploma. "Attend Given HS" is the fraction of recent HS graduates who report being enrolled the fall of the year following graduation. "Attend College" is college enrollments of recent HS graduates as a fraction of 18 year old cohort size. College graduates are those who report a BA or higher by age 25. "Graduate Given Attend" is those who obtained a four year degree as a fraction of the college enrollment total for that cohort. Two-year degrees are not included. "Graduate College" is the number of college graduates as a fraction of the 18 year old cohort size. Population estimates are from the Census P-20 reports. HS diplomas issued by sex are estimated from CPS October data after 1982.

Figure 4: The effect of including/excluding GEDs in the calculation of the dropout rate



Sources: GED Testing Service (1958-2008), and U.S. Decennial Census 1970-2000. In the left-hand panel, all percentages are status dropout rates for 20-to-24-year-olds, except for 1970 which reflects status dropout rates for 20-to-23-year-olds. In the right-hand panel, the data series shows GEDs as a percentage of all credentialed and uncredentialed dropouts.

Figure 5: GED Sample Questions

Mathematics

Easy Sample Question	If 8x + 16 = 32, what is x? A) 8 B) 2 C) 4 D) 3 E) 7
Difficult Sample Question	Alex has a job working for Adam's Apple Orchard. Two hundred new apple trees just arrived, which Mr. Adams would like Alex to plant. Alex can plant an average of 15 trees per workday. At this rate, approximately how many workdays will it take Alex to plant the 200 trees? A) between 7 and 9 B) between 9 and 11 C) between 11 and 13 D) between 13 and 15 E) between 15 and 17

Source: Reproduced from Bobrow [2002]. Notes: The source is a preparation guide for the most recent 2002 series of the GED test.

The GED Test: The GED exam has been a battery of five tests since its introduction. Its content has been updated three times with the introduction of new "series" designed to keep the test relevant to job skills and educational requirements [GED Testing Service, 2009]. The current version of the GED test takes just over seven hours to complete and focuses on interpretation and analysis of information rather than on factual recall. The reading section has changed from being a general reading comprehension test to a test of reading "real life" work materials or newspaper articles. The math content demands more analysis and synthesis than factual recall. Examples of an easy and hard math problem are shown in Figure 5. The GED test introduced a short essay or writing sample starting in 1988, and the use of a calculator for part of the math subsection was introduced on the 2002 test series [GED Testing Service, 1958-2008].

It was initially decided that the pass score should be set so that 80% of graduation-bound high school seniors could pass [Boesel et al. 1998, Quinn 2002]. An analysis of the 1943 norming study suggests that the 80% pass rate overstates the actual difficulty of the original test [Quinn, 2002]. Quinn [2002] also highlights that the original test included a high probability of passing due to chance.

After three increases in the difficulty of the test, only 60% of current graduation-bound high school seniors are now estimated to be able to pass the entire test on their first try [GED Testing Service, 2009].

Key changes to the GED test are displayed in Table 1, which also documents the expansion of the test. In 1947, New York was the first state to offer the test to civilian dropouts [Quinn, 2002]. In 1974, California was the last state to offer a recognized GED certificate for passing the GED test. The table covers the three changes in test series as well as the three changes in test difficulty. For more details on the GED's history, content, standards, norming, and scoring procedures see Section A of the Web Appendix (http://jenni.uchicago.edu/GEDHandbookChapter/).

GED Preparation and Means of Benefit: The data on preparation times suggest that study for the GED is likely to lead to little or no human capital formation. In 1980, the median test-taker had studied for 20 hours and, in 1989, had invested 30 hours of preparation [Quinn 2002, GED Testing Service 1958-2008].[7] However, a sizable number of individuals study more than 100 hours, growing from 11.8% to 24.2% of takers in that same period. This indicates that certain populations may benefit somewhat from their preparation for the GED. To put this statistic into perspective, an average high school student spends approximately 1,080 hours in class a year [Carroll, 1990].

changes in the demographic groups served by the GED have led to differences in composition away from the motivated, disciplined group of individuals to whom it was initially targeted.

[7] This amount applies only to test takers not qualifying as exceptions to the minimum age requirement.

Table 1: Key Changes to the GED

Year	Changes to the GED Testing Program
1942	GED test introduced for veterans. 80% of graduation bound high school seniors said to be able to pass all five batteries
1947	New York offers GED test to civilian high school dropouts
1959	More civilians taking the GED test than veterans
1974	California becomes last state to introduce GED test for dropouts
1978	Second series of the GED test introduced. Test time of 6 hours.
1981	Time limit extended to 6.75 hours. National Minimum age for testing abolished
1982	Standards made more difficult, 75% of graduate bound high school seniors said to be able to pass the entire test
1988	Third series of GED test introduced. First series to include a writing sample. Time extended to 7.5 hours for taking the test
1992	National minimum age for GED test taking of 16 implemented
1997	Passing standards made more difficult, 67% of graduate bound high school seniors said to be able to pass the entire test
2002	Fourth series of the GED test introduced. Calculator allowed for first time on parts of the math test. Passing standards made more difficult, 60% of graduate bound high school seniors said to be able to pass the entire test. Test time of approximately 7 hours.

Sources: GED Testing Service [2009], Quinn [2002], and GED Testing Service [1958-2008].

More recently, Zhang et al. [2009] find that, in 2006, the median study time for those who reported studying for the GED was 25 hours.

At the same time, the availability of the GED may induce a decrease in the effort spent on schooling. The academic literature often compares outcomes for GEDs to those for dropouts. However, for many individuals, the relevant counterfactual comparison is between the GED and high school graduation. As passing the GED requires substantially less effort than completing high school, its availability induces many students who would otherwise complete school to leave [Heckman et al. 2008, Humphries 2010]. This evidence is corroborated by a 2002 survey by the National Center for Education Statistics [2006] which found that 40.5% of surveyed high school dropouts listed "would be easier to get the GED" as among their reasons for leaving school. Behind "Missed too many school days", this was the second most frequently cited reason for leaving.

With the possible exception of individuals in the right-hand tail of the preparation time distribution, it seems unlikely that GED test takers are producing valuable human capital that will directly increase their wages. However, as a widely-recognized credential that tests for certain types of ability, it may serve as a signal to employers, the military, and post-secondary institutions that the individual is more capable than the average uncredentialed dropout.[8] A key caveat to the signaling argument is that the signaling value of a GED will reflect all associations due to sorting, such as through disproportionate receipt by the incarcerated or unmotivated takers who are able to complete high school but choose not to. The quality of the signal has changed over time due to shifts in the attributes of the GED-certified population.

GED Acceptance: The extent to which employers and colleges treat the GED as equivalent to a high school diploma is uncertain. A poll reported by the Society for Human Resource Management [2002] finds that 96% of U.S. employers and training programs respond affirmatively to the question "Does your company accept applications with a GED credential for jobs requiring a high school degree?" [GED Testing Service, 2009]. A positive response suggests that a GED is an acceptable prerequisite for consideration, but does not indicate what relative weight employers give to the GED.

The GED's wide acceptance as a valid prerequisite for admission to post-secondary institutions suggests that the GED might facilitate human capital development. A poll by the The College Board [2007] finds that 98% of colleges respond positively to the prompt that "High school diploma is required and GED is accepted". Again, it is unclear

[8] Spence [1973] is the classic reference on signaling.

if GEDs get equal consideration for admission relative to high school graduates.

3 The Effects of GED Certification

Section 3.1 reviews the literature on the value of the GED credential in labor markets. Section 3.2 focuses on the question of whether, and for whom, the GED leads to enrollment and completion of post-secondary education.

3.1 The Direct Benefit of GED Certification

This section demonstrates that pre-existing differences in traits causally unrelated to the effect of the GED are responsible for the different labor market outcomes experienced by dropouts and GEDs. The early literature on the topic found that GED certification has little or no effect on labor market outcomes for the average test taker. Subsequent work has attempted to identify different populations and margins for which it might hold more value.

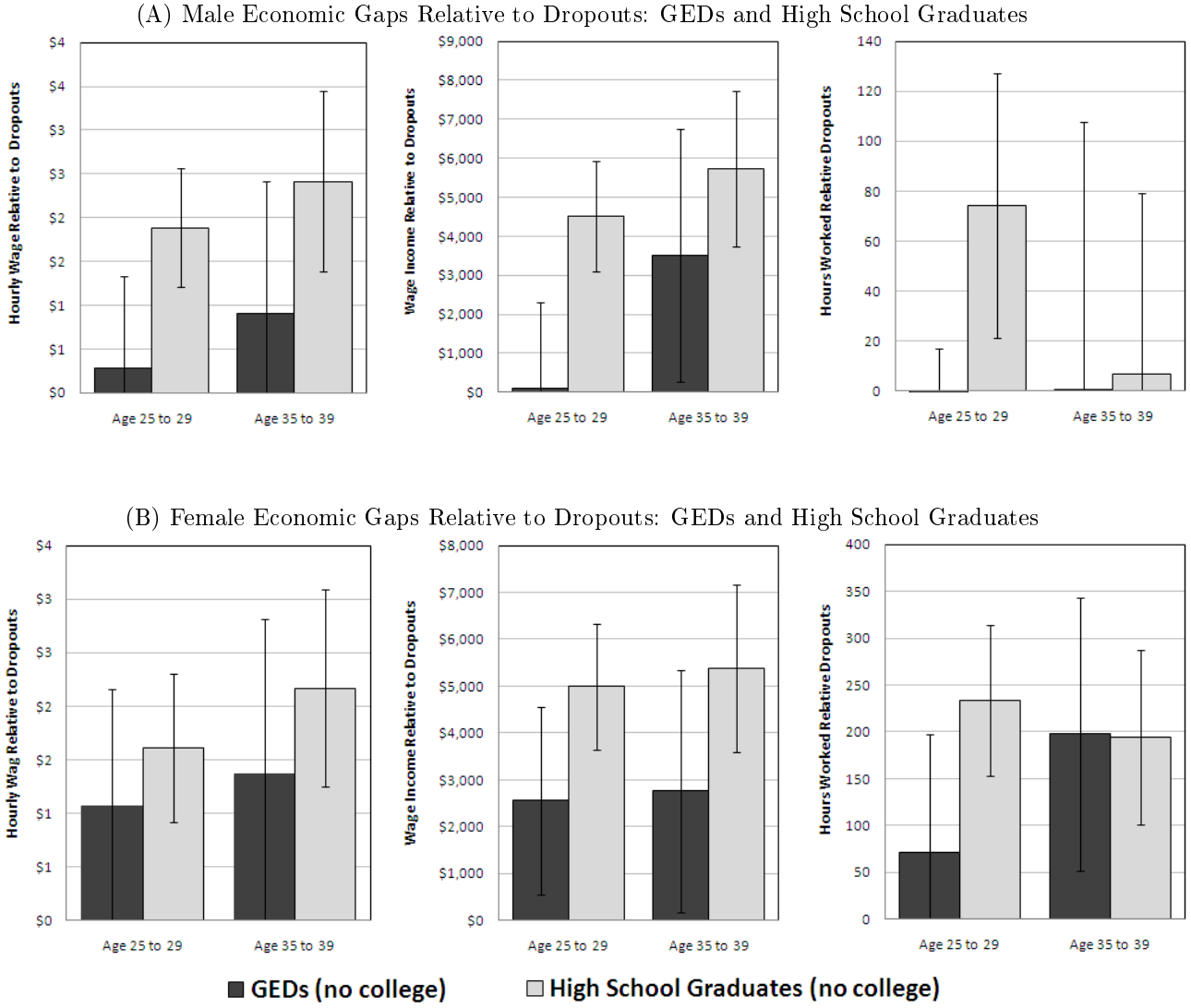
3.1.1 Average Labor Market Outcomes

Raw comparisons of earnings, wages, and hours worked based on the National Longitudinal Study of Youth 1979 (NLSY79) data are displayed in Figure 6.[9] This figure shows the gap in wage income, hourly wages, and hours worked for terminal GEDs and terminal high school graduates over uncredentialed dropouts. There is a clear ordering among dropouts, GEDs, and traditional high school graduates in each measure. These differences persist across the life cycle, with the wage and hours premia for higher credentials increasing from their late 20s to their late 30s.

Background Differences Among Dropouts, GEDs, and High School Graduates: The differences in labor market outcomes among these three groups can be largely explained by pre-existing characteristics that may generate economic returns, creating a non-causal association among education levels and wages. Tables 2 and 3 show comparisons of early life characteristics by final level of education for white males in the NLSY79 and in the

[9]The NLSY79 is a survey starting in 1979 following a nationally representative cohort of individuals age 14 to 21 with follow up interviews at least every two years on a wide range of social, educational, and economic variables. For more details on the NLSY79, see Section B.1 of the Web Appendix (http://jenni.uchicago.edu/GEDHandbookChapter/).

Figure 6: Economic gaps relative to dropouts: GEDs and high school graduates for males (A) and females (B)



Source: National Longitudinal Survey of Youth 1979 (NLSY79). Notes: Regressions control for age, mother's highest grade completed, and dummies for urban residence at age 14, Southern residence at age 14, and race. The regressions use the cross-sectional subsample and minority oversamples of the NLSY79 data. The estimation sample is restricted to individuals who never attend college and who have not yet been incarcerated. Regressions for hourly wage and hours worked are restricted to those reporting more than \$1/hour and less than \$100/hour, and individuals working less than 4,000 hours in a given year. Wage income regressions are restricted to individuals reporting wage incomes between \$1,000/year and \$100,000/year. All monetary values are in 2005 dollars. Standard errors are clustered by individual. 95% confidence bands are displayed for each bar chart.

Table 2: Comparison of Key Characteristics by Educational Level - White Males - NLSY79

	Drop Out	GED No College	High School No College	Some College	Associate Degree	Bachelor Degree or More
Highest Grade Comp. 2006	**9.44**	**10.70**	**11.90**	**13.50**	**14.10**	**17.00**
	(1.34)	(1.24)	(0.82)	(0.75)	(0.91)	(1.51)
South Age 14	**0.39**	**0.36**	**0.23**	**0.26**	**0.26**	**0.25**
	(0.49)	(0.48)	(0.42)	(0.44)	(0.44)	(0.43)
Urban Age 14	**1.38**	**1.31**	**1.37**	**1.26**	**1.31**	**1.21**
	(0.62)	(0.59)	(0.62)	(0.55)	(0.55)	(0.50)
Mother Worked Age 14	**0.49**	**0.52**	**0.49**	**0.50**	**0.50**	**0.52**
	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)
Father Worked Age 14	**0.89**	**0.93**	**0.95**	**0.97**	**0.97**	**0.98**
	(0.32)	(0.26)	(0.21)	(0.18)	(0.16)	(0.14)
Magazines Age 14	**0.42**	**0.61**	**0.68**	**0.75**	**0.79**	**0.88**
	(0.49)	(0.49)	(0.47)	(0.43)	(0.41)	(0.33)
Newspaper Age 14	**0.71**	**0.85**	**0.89**	**0.91**	**0.91**	**0.94**
	(0.46)	(0.36)	(0.31)	(0.29)	(0.28)	(0.24)
Library Card Age 14	**0.55**	**0.72**	**0.70**	**0.83**	**0.80**	**0.87**
	(0.50)	(0.45)	(0.46)	(0.38)	(0.40)	(0.34)
Mother's Highest Grade Comp.	**10.30**	**10.70**	**11.50**	**12.20**	**12.10**	**13.30**
	(2.45)	(2.31)	(2.11)	(2.20)	(1.92)	(2.39)
Father's Highest Grade Comp.	**9.57**	**10.50**	**11.50**	**12.80**	**12.60**	**14.30**
	(3.41)	(2.92)	(2.76)	(3.15)	(2.94)	(3.27)
Net Family Income 1979	**15,001**	**19,162**	**23,060**	**23,072**	**25,781**	**28,598**
	(12,215)	(14,879)	(14,454)	(16,196)	(14,605)	(18,515)
Family Poverty Status 1979	**0.24**	**0.15**	**0.06**	**0.08**	**0.06**	**0.07**
	(0.43)	(0.35)	(0.24)	(0.28)	(0.24)	(0.25)
Family Size	**4.25**	**4.05**	**4.19**	**3.88**	**4.27**	**4.15**
	(1.90)	(1.89)	(1.81)	(1.84)	(1.75)	(1.76)

Source: National Longitudinal Survey of Youth 1979 (NLSY79). Notes: All results are from 1979 using nationally representative weights. Notes: Family size includes both parents and children. Net family income in 1979 dollars. Standard errors in parenthesis.

National Longitudinal Survey of Youth 1997 (NLSY97) data sets.[10,11]

These tables show a clear ordering across final levels of education–notably highest grade completed, magazine subscriptions and home environment indices, family income, and poverty rates. Terminal GEDs (i.e. those that do not continue to college) generally fall between dropouts and terminal high school graduates. There are some exceptions. In the NLSY97, the parents of GED recipients are more educated than parents of high school graduates, and GEDs are as likely or more likely to come from a broken household than are dropouts.[12] The differences in these measures demonstrate the potential importance of controlling for pre-existing heterogeneity among educational groups.

[10]The NLSY97 is a survey starting in 1997 following a nationally representative cohort of individuals age 12 to 16 with follow up interviews every year on a wide range of social, educational, and economic variables. For more details on the NLSY97, see Section B.2 of the Web Appendix (http://jenni.uchicago.edu/GEDHandbookChapter/).

[11]These statistics are reported for other races and gender groups in Section C.1 of the Web Appendix (http://jenni.uchicago.edu/GEDHandbookChapter/). A similar pattern characterizes the other groups.

[12]In Section C.1 of the Web Appendix (http://jenni.uchicago.edu/GEDHandbookChapter/) we show that minority GEDs have higher delinquency rates and higher home risk indices than dropouts.

Table 3: Comparison of Key Characteristics by Educational Level - White Males - NLSY97

	Drop Out	GED No College	High School No College	Some College	Associate Degree	Bachelor Degree or More
Highest Grade Comp. Age 22	**9.60**	**9.94**	**12.00**	**13.00**	**14.60**	**16.00**
	(1.21)	(1.00)	(0.00)	(0.00)	(0.49)	(0.21)
South Age 12	**0.30**	**0.36**	**0.27**	**0.27**	**0.24**	**0.24**
	(0.46)	(0.48)	(0.44)	(0.45)	(0.43)	(0.42)
Urban Age 12	**0.77**	**0.79**	**0.72**	**0.86**	**0.85**	**0.88**
	(0.42)	(0.41)	(0.45)	(0.35)	(0.36)	(0.32)
Inner City Age 12	**0.21**	**0.19**	**0.17**	**0.19**	**0.20**	**0.14**
	(0.41)	(0.39)	(0.38)	(0.39)	(0.40)	(0.35)
Household Size Age 12	**4.31**	**4.41**	**4.43**	**4.32**	**4.39**	**4.37**
	(1.41)	(1.45)	(1.32)	(1.20)	(1.21)	(1.07)
Broken Household Age 12	**0.60**	**0.60**	**0.35**	**0.32**	**0.26**	**0.16**
	(0.49)	(0.49)	(0.48)	(0.47)	(0.44)	(0.36)
Mother's Highest Grade Comp.	**11.70**	**13.10**	**12.70**	**13.60**	**14.30**	**14.60**
	(2.02)	(7.24)	(2.13)	(2.40)	(2.43)	(2.55)
Father's Highest Grade Comp.	**11.50**	**12.70**	**12.70**	**13.50**	**14.60**	**15.30**
	(2.38)	(7.82)	(4.22)	(2.59)	(2.88)	(2.82)
Family Routine Index 1997	**-0.19**	**-0.20**	**-0.09**	**0.07**	**0.13**	**0.06**
	(0.96)	(0.84)	(0.95)	(0.86)	(0.84)	(0.79)
Home Risk Index 1997	**0.49**	**0.30**	**-0.05**	**-0.29**	**-0.59**	**-0.68**
	(1.08)	(1.11)	(0.95)	(0.87)	(0.66)	(0.54)
Physical Environment Index 1997	**0.35**	**0.10**	**-0.11**	**-0.27**	**-0.47**	**-0.70**
	(0.97)	(0.91)	(0.82)	(0.78)	(0.75)	(0.45)
Enriching Environment Index 1997	**-0.38**	**-0.20**	**-0.03**	**0.31**	**0.49**	**0.69**
	(0.93)	(0.93)	(0.88)	(0.88)	(0.87)	(0.83)
Deliquency Index 1997	**0.91**	**0.86**	**0.34**	**0.31**	**-0.09**	**-0.21**
	(1.38)	(1.31)	(1.14)	(1.16)	(0.83)	(0.67)

Source: National Longitudinal Survey of Youth 1997 (NLSY97). Notes: All results are from 1997 using nationally representative weights. All index scores are standardized mean zero, standard deviation one. See Section B.2.2 of the Web Appendix (http://jenni.uchicago.edu/GEDHandbookChapter/) for detail on the construction of the family routine, home risk, physical environment, enriching environment, and delinquency indices. Standard errors in parenthesis.

Dropouts, terminal GEDs, and terminal high school graduates also differ in their performance on academic tests, which are predictive of earnings. The Armed Forces Qualification Test (AFQT) was administered in the NLSY79 and in the NLSY97, and is a commonly used measure of academic, or cognitive, ability.[13,14] When the AFQT was administered, the surveyed individuals were of different ages and had acquired different levels of schooling. These differences affect their measured performance. In order to make comparisons of academic ability, we adjust individual scores to account for the level of schooling at the time of the test. This adjustment controls for final educational attainment using a structural model as laid out in Hansen et al. [2004] and implemented in Heckman, Urzua, and Veramendi [2010]. This allows comparisons of latent cognitive ability between dropouts, GED recipients, and high school graduates prior to schooling decisions.

The comparisons in Figure 7 show that, before entry into high school, individuals who eventually GED certify have higher cognitive ability than dropouts, and are very similar to terminal high school graduates. The cognitive ability distribution for GEDs is nearly identical to that of high school graduates and is strongly right shifted from uncredentialed dropouts for both males and females.

Accounting for Cognitive Ability: Cameron and Heckman [1993] find that the GED provides on average no benefit to male test takers after controlling for either years of completed schooling or AFQT scores. While their study follows the NLSY79 sample through age 28, subsequent analysis replicates this finding through later ages. Heckman and LaFontaine [2006] use later waves of the NLSY79 and find that the GED has no benefit on average log hourly wages after controlling for AFQT. They find that high school graduation is still associated with a positive wage premium. Once Heckman and LaFontaine correct for selection and control for AFQT scores, male GEDs earn on average 1% less per hour than dropouts while terminal high school graduates make 3.6% more per hour on average than dropouts. Similarly they find that female GEDs earn 1.7% more per hour than dropouts while high school graduates with no college earn 10.6% more per hour. They also show that the GED has little or no benefit after controlling for reported test scores using the National Adult Literacy Survey (NALS) data.

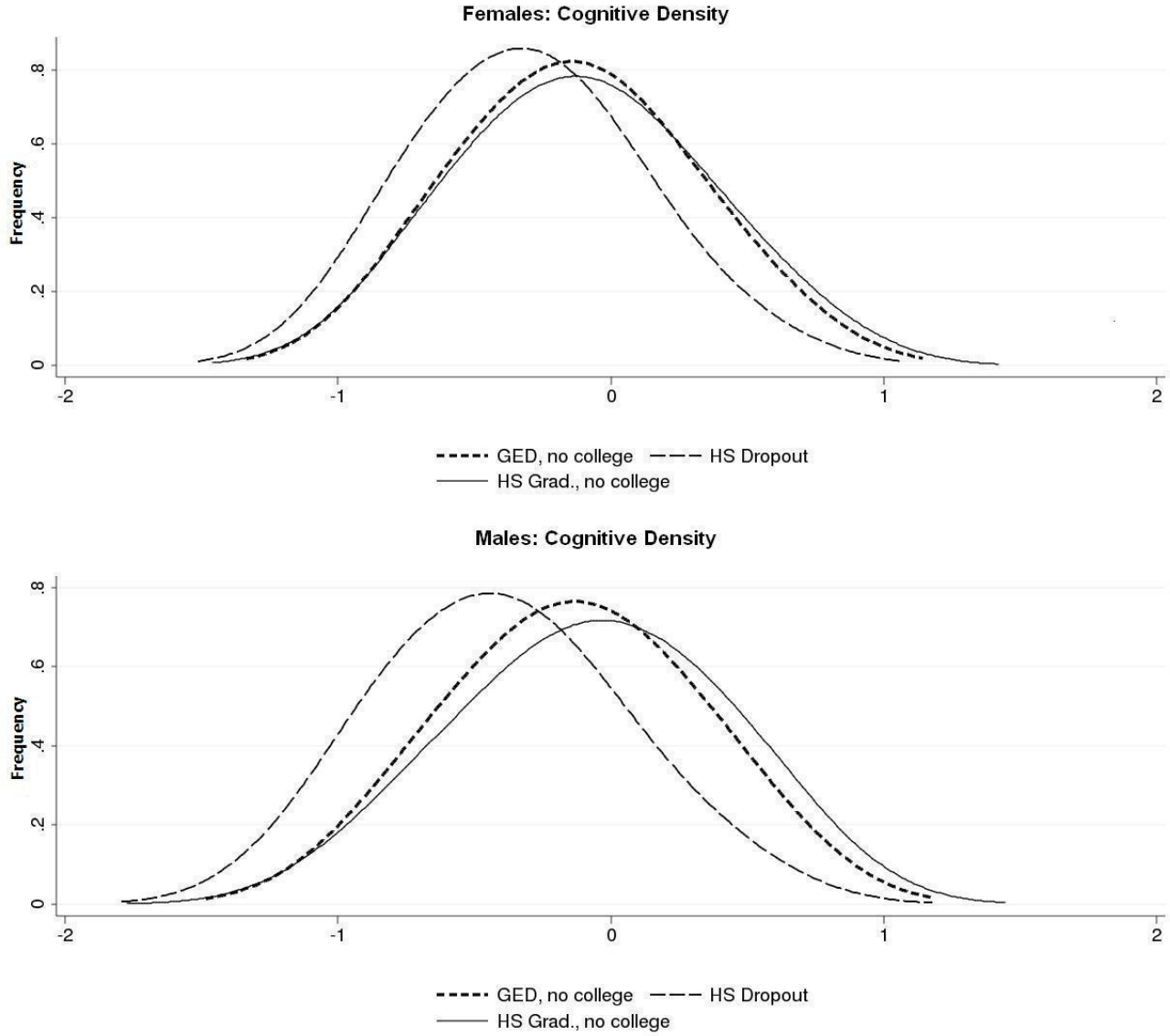
Figure 8 shows that, relative to the differences shown in Figure 6, the economic benefits associated with the GED are greatly reduced and become statistically insignificant once pre-existing cognitive ability is controlled for.[15] When

[13] The Armed Forces Qualification Test is an achievement test measuring numerical operations, arithmetic reasoning, paragraph completion, and word knowledge. The AFQT was administered to individuals in the NLSY79 in 1979 when they were aged 14 to 22, and to individuals in the NLSY97 in 1999 when they were age 14 to 18. The AFQT tests administered to each sample represented the same content, but differed in format and scoring procedure. See Section B.1.1 of the Web Appendix (http://jenni.uchicago.edu/GEDHandbookChapter/) for more details.

[14] Borghans, Golsteyn, Heckman, and Humphries [2010] show that the AFQT is predicted by both cognitive and noncognitive traits.

[15] To obtain the baseline standardized mean test score adjusted to the seventh grade level, we remove the estimated mean impact of

Figure 7: Cognitive ability by educational status (no college sample, all ethnic groups)



Source: Reproduced from Heckman, Urzua, and Veramendi [2010]. National Longitudinal Study of Youth 1979. Notes: The distributions above represent cognitive ability factors estimated using a subset of the Armed Services Vocational Aptitude Battery and educational attainment as laid out in Hansen, Heckman, and Mullen (2004). Sample restricted to the cross-sectional subsample for both males and females. Distributions show only those with no post-secondary educational attainment. The cognitive ability factors are separately normalized to be mean zero standard deviation one.

including estimated post-high school AFQT scores, the benefit of the GED is further reduced for all three economic outcomes. For terminal high school graduates, however, economic benefits persist after controlling for pre-existing cognitive ability. This suggests a causal effect of high school graduation. That high school still has value after controlling for pre-existing cognitive ability suggests high school graduates possess a valued trait not captured by an achievement test. Section 3.1.3 extends this discussion to encompass both cognitive and noncognitive ability. The next section follows the development of the literature in trying to identify specific populations that benefit from the GED.

3.1.2 Heterogeneous Labor Market Returns

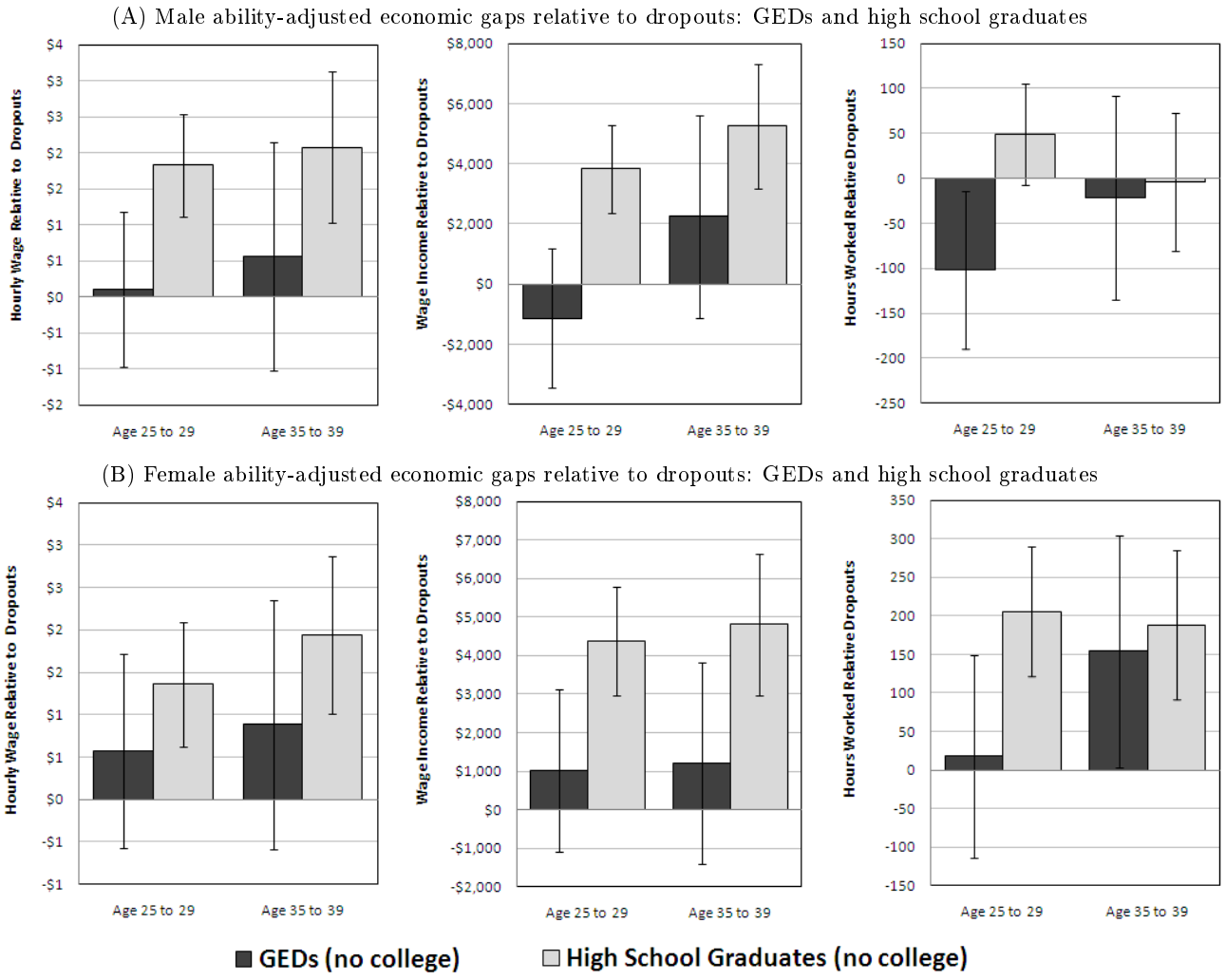
Recent work on the GED has sought to identify groups of test takers for which individual traits or circumstances contribute to a stronger signal or increased human capital development. This section focuses on several different potential margins of benefit, discusses hypotheses and reviews the related literature.

Wage Growth for GEDs with Experience: It is argued that, similar to the pattern of returns to college, the benefits to a GED would increase with time in the labor market. Clark and Jaeger [2006] present evidence from the Current Population Survey (CPS) that is apparently consistent with the hypothesis that the wage premium to GED certification for males is increasing with age. Given the cross-sectional nature of the CPS data, this finding may be attributed to either experience effects or cohort effects. Using white males and females in the NLSY79 sample, Heckman and LaFontaine [2006] show that this higher premium to older cohorts is explained by their greater ability. When not controlling for ability, the NLSY79 sample shows a wage premium for GED recipients that is comparable to that found in samples of individuals from the CPS data for the same birth cohorts. Once one controls for AFQT scores for the NLSY79 sample, there is no statistically significant effect of certification on wages.

Using longitudinal data on earnings in the NLSY79, Murnane et al. [1995] argue that the value of the GED increases with experience as recipients use the degree's signal for promotion, better job placement in the future, and on-the-

schooling attained over the seventh grade level using the procedure of Hansen et al. (2004) as implemented in Carneiro, Heckman, and Masterov [2005]. Let S_t be the random variable denoting schooling attained at year t (the date of the survey) and let s_t be its realized value. Let S_F be the random variable denoting the final level of schooling attained and s_F its realized value. Let $T(s_t, s_F)$ be the test score at time t for a person whose schooling at the time of the test is $S_t = s_t$ and whose final schooling level is $S_F = s_F$. The assumption of the procedure is that the unobservables generating $T(s_t, s_F)$ are mean independent of S_t given $S_F = s_F$. For each $S_F = s_F$, we can identify the causal effect of a year of schooling on the test score for each level of completed final schooling. Then we can adjust the mean test score to baseline levels $S_t = s_b$ by subtracting the term $E\left(T(s_t, s_F) \mid S_t = s_t, S_F = s_F\right) - E\left(T(s_b, s_F) \mid S_t = s_b, S_F = s_F\right)$. Both terms are identified, assuming in addition that at the time of the test for each level of $S_F = s_F$, there are some persons at schooling level $S_t = s_b$. Post schooling mean test scores are obtained in a similar fashion, but now adjusting to years of final schooling. See Section D of the Web Appendix for a detailed discussion of this procedure. See Hansen et al. (2004) for a more general procedure.

Figure 8: Ability-adjusted economic gaps relative to dropouts: GEDs and high school graduates for males (A) and females (B)



Source: National Longitudinal Survey of Youth 1979 (NLSY79). Notes: Regressions control for baseline AFQT scores, age, mother's highest grade completed, and dummies for urban residence at age 14, Southern residence at age 14, and race. Baseline test scores are estimated using the procedure of Hansen et al. 2004 as implemented in Carneiro, Heckman, and Masterov [2005]. The regressions use the cross-sectional subsample and minority oversamples of the NLSY79 data. The estimation sample is restricted to individuals who never attend college and who have not yet been incarcerated. Regressions for hourly wage and hours worked are restricted to those reporting more than \$1/hour and less than \$100/hour, and individuals working less than 4,000 hours in a given year. Wage income regressions are restricted to individuals reporting wage incomes between \$1,000/year and \$100,000/year. All monetary values are in 2005 dollars. Standard errors are clustered by individual. 95% confidence bands are displayed for each bar chart.

job training. Consistent with Cameron and Heckman [1993], they find no treatment effect of the GED on mean wage levels at age 28, but they report a statistically significant 2.4% wage increase for every year of experience after receiving a GED. Murnane, Willett, and Boudett [1999] control for cognitive ability or individual fixed effects in different models specifications. They find that the complementarity of GED and years of experience is statistically significant only for individuals with low ability.

Murnane, Willett and Boudett pool person-year observations in their regressions. They infer increasing returns to the GED from variables interacting GED receipt with years of experience. In contrast to this approach, Heckman and LaFontaine [2006] estimate separate regressions for earnings at different ages, allowing separate estimates of returns to ability and experience by age. They find that there is no statistically significant effect to GED certification at any age for both white males and white females.

Males vs. Females: Males and females might derive different value from the GED through having different motivations for dropping out of school. Using data from the NLSY79 Market Experience survey, Rumberger [1983] presents differences in self-reported reasons for dropping out for males and females.[16] Males were 65% more likely than females to report school related issues, indicating dislike of school, being expelled, and poor performance as their primary reason for leaving school. Among other explanations, males were more likely to leave school due to economic reasons while a third of all women left due to pregnancy or marriage. If there are gender differences in later-life motivations to work and seek higher education, there could be differential value of the GED for men and women.

Cao, Stromsdorfer, and Weeks [1996] test for the GED's direct effect on economic outcomes for women using data from the NLSY79 and from Washington State. Given their focus on women who may have custody of children and be eligible for public transfer programs, they attempt to eliminate selection bias related to both the decision to participate in the labor force and to not enroll in welfare. They find no statistically significant differences between the labor supplies of women of different education levels. The positive association of GED certification with hourly wage is eliminated by controlling for the number of years of schooling completed at the time people drop out.

Table 4 presents a comparison of qualitative findings for males and females from selected papers in the literature and information on which data sets and cohorts are studied. In addition, both Murnane et al. [2000] and Tyler et al. [2003] use the High School and Beyond (HSB) data set and find, respectively, positive effects of GED certification

[16] This table is reproduced in Section C.2 of the Web Appendix (http://jenni.uchicago.edu/GEDHandbookChapter/).

Table 4: Literature Summary - Labor Market Effects - Males vs. Females

Study	Data	Population	Method/Identification	GED Effect	Findings
Cameron and Heckman (1993)	NLSY79 (1979-1987)	White males	Control for cognitive ability, correction for self-selection into working status	1/0 GED[1]	Income: no effect Wage: no effect
Murnane, Willett and Boudett (1995)	NLSY79 (1979-1991)	Males	1/0 if ever got GED	(1/0 GED) x (work experience)	Income: no effect Wage: (+,**)
Cao, Stromsdorfer and Weeks (1996)	NLSY79 (1979-1991), Washington State Family Income Study	Females	Correction for self-selection into working status	1/0 GED	Hours worked: no effect Wage: no Effect
Heckman and LaFontaine (2006)	NLSY79 (1979-2001)	Males and females	Control for cognitive ability, correction for self-selection into working status	1/0 GED	Wage: no effect

Notes: [1] "1/0" refers to a binary indicator of the associated variable. For example, under GED Effect "1/0 GED" refers to 1 = receives GED, 0 = does not, indicating a simple binary treatment effect.
The study samples are statistically representative of the US unless otherwise indicated in the "Population" field. The "Findings" field codes no statistically signficant effect as "No effect", and otherwise shows (<indicator of a positive or negative finding>, <level of significance>) where * = p < .10, ** = p < .05, and *** = p < .01.
See the Web Appendix (http://jenni.uchicago.edu/GEDHandbookChapter/) for tables with more detail on each paper's outcomes examined, lists of regressors, and point estimates for each regression specification.

on the earnings of low-ability males and on the hours worked by low-ability females.[17] Because neither study can identify the sources of selection of each gender into drop out status–or selection into educational status and work in general–it is difficult to interpret these findings.

Using evidence from the NLSY79, CPS, and NALS, Heckman and LaFontaine [2006] establish that both male and female GEDs have higher wages than dropouts and that, for both genders, the explanation is sorting by ability and not a causal effect of the GED. They consistently find a small but statistically significant benefit for females of 1-2% on hourly wage which is not present or slightly negative for males. This finding is consistent with the hypothesis that females are more likely to drop out of high school for reasons unrelated to intrinsic labor market motivation, for example, due to pregnancy. Similarly, they find much larger benefits from high school graduation for females than for males.

Native vs. Foreign Born: While much has been written about the education and labor market performance of immigrants,[18] little attention has been paid to the value they receive from earning a GED. Clark and Jaeger [2006] argue that the GED might provide a signal of ability that is more familiar to employers than educational credentials earned outside the country, or may signal language ability and cultural assimilation. Clark and Jaeger use earnings data in the CPS and find that only foreign-born GEDs with no domestic credentials have a statistically significantly higher wage than native-born dropouts.

Heckman and LaFontaine [2006] examine the Clark and Jaeger [2006] analysis and find that their results are produced by data artifacts and limitations. One source of bias in the Clark and Jaeger [2006] analysis is that

[17] See Section B.5 of the Web Appendix (http://jenni.uchicago.edu/GEDHandbookChapter/) for more details on the High School and Beyond data set.
[18] See the edited volume Borjas [2000] and Betts and Lofstrom [2000] in particular.

Table 5: Literature Summary - Labor Market Effects - Native vs. Foreign Born

Study	Data	Population	Method/Identification	GED Effect	Findings
Clark and Jaeger (2006)	CPS	Foreign born, males and females	OLS	(1/0 GED[1]) x (foreign born)	Wage: (+, ***)
Heckman and LaFontaine (2006)	CPS, excluding wage imputation	Males and females	Individual fixed effects	1/0 GED	Wage: no effect
	NALS (1992)	Foreign born, males and females	Control for cognitive ability, correction for self-selection into working status	(1/0 GED) x (foreign born)	Wage: no effect

Notes: [1] "1/0" refers to a binary indicator of the associated variable. For example, under GED Effect "1/0 GED" refers to 1 = receives GED, 0 = does not, indicating a simple binary treatment effect.
The study samples are statistically representative of the US unless otherwise indicated in the "Population" field. The "Findings" field codes no statistically signficant effect as "No effect", and otherwise shows (<indicator of a positive or negative finding>, <level of significance>) where * = p < .10, ** = p < .05, and *** = p < .01.
See the Web Appendix (http://jenni.uchicago.edu/GEDHandbookChapter/) for tables with more detail on each paper's outcomes examined, lists of regressors, and point estimates for each regression specification.

the CPS imputes values of missing wages for GEDs by sampling earnings of high school graduates, a process that contaminates comparisons of the outcome differences between those two groups and dropouts. A second source of bias is the reliance on cross-sectional variation of wages. By making longitudinal comparisons with the CPS data, Heckman and LaFontaine [2006] find that receipt of a GED has no effect on earnings and explain Clark and Jaeger's findings as due to sorting along characteristics unmeasured in the CPS. Heckman and LaFontaine also analyze the NALS which also identifies the foreign born. They demonstrate no earnings premium to GED receipt for any group once selection and cognitive ability are controlled for. Table 5 shows a comparison of qualitative findings for native- and foreign-born individuals from selected papers in the literature and information on which data sets and cohorts are studied.

Signaling: Tyler et al. [2000] use a difference-in-differences approach to examine the returns to the GED for individuals at the cusp of passing the test. Using variation in test score thresholds across states, they contend that focusing on individuals who would pass the GED under one regime but not under the other will identify the signaling effect of the GED for people at that margin. Using data from the GED Testing Service and Social Security Administration, they separate individuals into groups by performance on the GED exam and state of residence. Variation in the passing standards enforced by different states arguably creates a natural experiment where individuals with the same score do or do not pass the GED based on their state of residence. To understand their paper we use the notation in Table 6. Let "-" over a variable denote its mean.

The difference-in-differences estimator (DID) used by Tyler et al. [2000] is:

$$DID = \left(\bar{Y}_{LS,LP} - \bar{Y}_{LS,HP}\right) - \left(\bar{Y}_{HS,LP} - \bar{Y}_{HS,HP}\right). \quad (1)$$

In the notation of Table 6, $\bar{Y}_{A,B}$ represents the mean wage of individuals with score A in a state with passing

Table 6: Treatment Classifications of Individuals in Tyler et al. [2000]

	Low GED Score ("LS")	High GED Score ("HS")
State of Residence has Low Passing Standard ("LP")	$Y_{LS,LP}$ (GED)	$Y_{HS,LP}$ (GED)
State of Residence has High Passing Standard ("HP")	$Y_{LS,HP}$ (no GED)	$Y_{HS,HP}$ (GED)

standard B, where A is either low score (LS) or high score (HS), and B is either low passing standard (LP) or high passing standard (HP). Because their analysis only includes individuals measured in the neighborhood of GED passing standards, none of the individuals studied are high scoring in an absolute sense.

The first term in equation (1) takes the difference in average earnings between individuals who have the same ability but different credential status. The second term is used to adjust for the possibility that wages in the two states in the first difference are unequal. The second difference is an estimate of the baseline wage difference across those states for individuals with the GED credential at the same low ability margin (in absolute terms).[19]

Tyler et al. [2000] report a 10-19% earnings benefit to GED certification at the margin for whites.[20] They argue that these estimates are consistent with earlier studies whose findings of no effect of certification only apply to the average test taker. They claim that for the particular margin they investigate–that of low-skilled takers–there are high signaling benefits to certification that are absent for the general population of test takers.

To defend the assumption of exogeneity of state passing standards with respect to individual earnings, they perform robustness checks considering selective mobility, differential access to post-secondary training, differences in state labor markets, selective taking of the GED, and selective effort in studying across states. Rubinstein [2003] discusses their paper, claiming that the endogeneity of studying effort would lead to upwardly-biased estimates. His model predicts that, at the margin, low-ability individuals will exert more effort than high-ability individuals when passing thresholds are higher. If these efforts have little or no effect on long-term productivity,[21] both $\bar{Y}_{LS,HP}$ and $\bar{Y}_{HS,HP}$ will include individuals whose true productivity is overstated, but abilities in $\bar{Y}_{LS,HP}$ will be overstated to a greater degree relative to $\bar{Y}_{LS,LP}$ than for $\bar{Y}_{HS,HP}$ relative to $\bar{Y}_{HS,LP}$. Greater downward bias in $\bar{Y}_{LS,HP}$ than in $\bar{Y}_{HS,HP}$

[19] Tyler et al. [2000] implement this estimation in a linear regression to pool all states together and control for mean gender differences in earnings. See their paper for details.

[20] They suggest that their lack of a significant finding for non-whites may be due to an institutional effect where both disproportionate representation of minorities in prison and the growth of GED programs for the incarcerated lead to negative associations with the test, thus decreasing its signaling value. See Section 4 below for evidence of these demographic trends in prison-based GED receipt. The separate estimation of the GED effect by race is rare in the literature, which typically includes regression controls for race but does not treat it as a separate conditioning variable. See Section E.1 of the Web Appendix (http://jenni.uchicago.edu/GEDHandbookChapter/) for a full account of study samples, treatment of race, and separate estimates by race.

[21] Rubinstein assumes that these studying efforts represent "cramming", and do not represent durable investments in human capital.

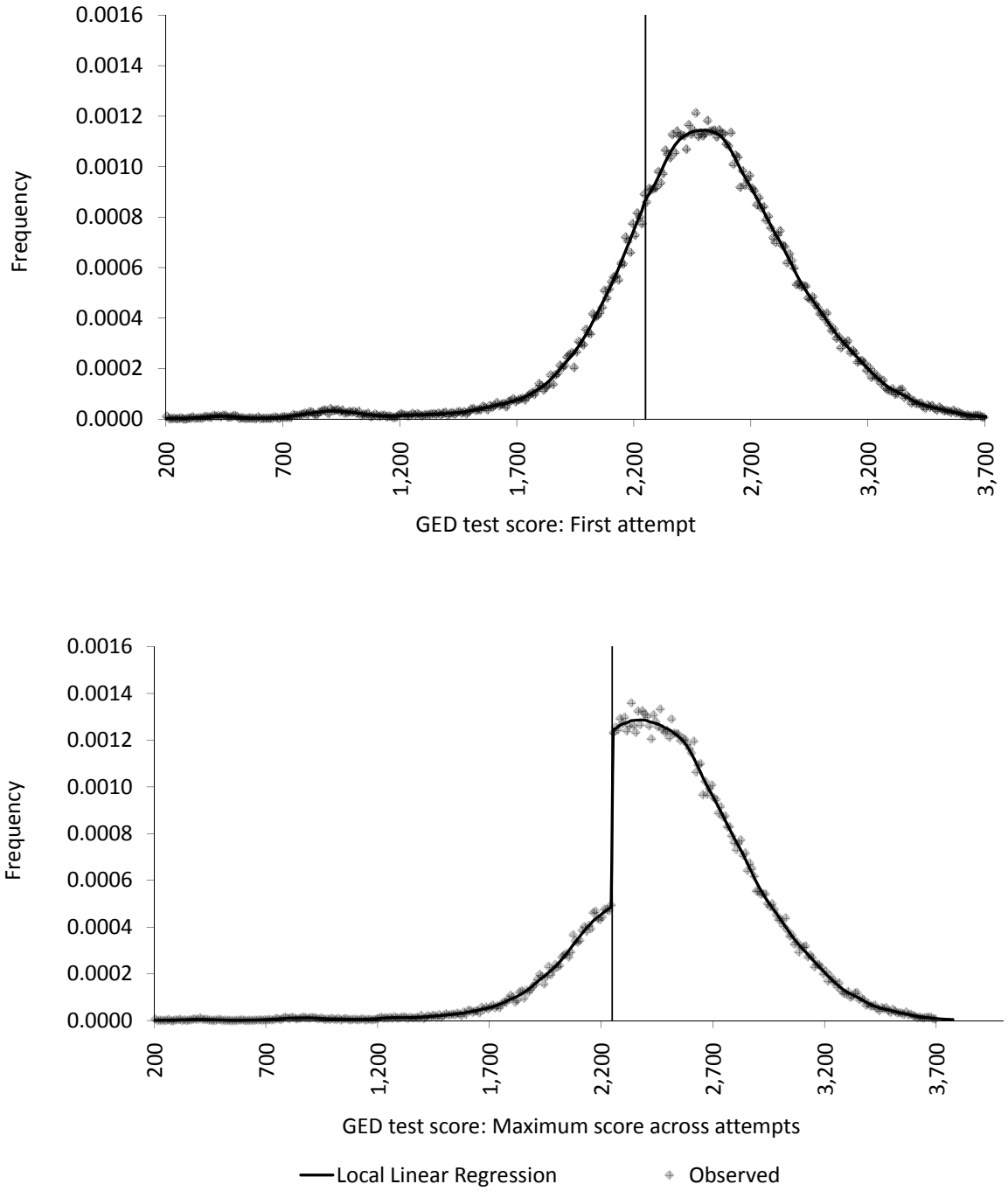
leads to upward bias in the DID estimate. He presents no direct empirical evidence on this bias. It is also possible that the higher passing standard discourages low ability persons from taking the test so that his conclusion is reversed.

Jepsen et al. [2010] show evidence of endogeneity of test taking effort in a single state with one passing standard. GED policy in Missouri permits individuals to pass the GED if their maximum scores on individual tests across retakes of the GED exam meet the passing standard.[22] Figure 9 shows the distribution of scores from the first administration of the test in its first panel, and the distribution of maximum scores across all administrations of the GED exam that each individual opted to take in its second panel, where a clear discontinuity arises at the passing standard of 2,250. This behavior introduces several possible sources of bias in the comparisons between GED certifiers and dropouts. Selective retaking will lead to low ability individuals being improperly counted in higher score groups. If changes in scores across retakes are due to unproductive cramming (as conjectured by Rubinstein, 2003) coupled with luck, this misclassification will lead to over-representation of low ability persons among GEDs producing a downward bias in comparisons of successful GED test takers with those who fail. On the other hand, if the choice to retake the test is associated with a trait of persistence that is productive in the workplace, these persons who become GEDs have high noncognitive skills that will moderate the downward bias due to their low ability. Jepsen et al. [2010] use Missouri administrative data on first test scores and final GED outcomes to implement a Fuzzy Regression Discontinuity (FRD) estimation of the effects of the GED.[23] They find no effects of GED receipt on earnings or employment for individuals at the margin of passing on their first attempt, but find a statistically significant increase in post-secondary schooling attendance of 10%.

[22] Thus top scores on the various subtests across retakes of the test are aggregated.

[23] See Imbens and Lemieux [2008] for discussion of the FRD method. See Hahn, Todd, and Van der Klaauw [2001] for the original paper.

Figure 9: Distribution of First Test Scores and Final Test Scores After Retakes Missouri



Source: Reproduced from Jepsen et al. [2010] using Missouri administrative records from 1995-2006. Notes: The first figure is the distribution of individual GED scores on the first test. The second figure represents the distribution of GED test score outcomes reflecting the maximum scores across all attempts of the GED that each individual elected to take. Passing the GED in Missouri requires a minimum score requirement on each subtest and a total score of 2,250.

Table 7: Literature Summary - Labor Market Effects by Ability

Study	Data	Population	Method/Identification	GED Effect	Findings
Murnane, Willett and Boudett (1999)	NLSY79 (1979-1991)	Males, includes low-income sample	Individual fixed effects	(Post-GED work experience) x (1/0 low cognitive ability)[1]	Income: no effect Wage: (+, ***) if low cognitive ability
Murnane, Willett and Tyler (2000)	HSB (1980-1991)	Males	Control for cognitive ability quartile, OLS	(1/0 GED) x (1/0 low cognitive ability)	Income: (+,**)
Tyler, Murnane and Willett (2003)	HSB (1980-1991)	Females	Control for highest grade completed, OLS and logit	(1/0 GED) x (1/0 low cognitive ability)	Income: no effect Probability of working: (+,**) Work experience: (+,***)
Heckman, Urzua and Veramendi (2010)	NLSY79 (1979-2006)	White males	Dynamic discrete choice framework, latent factor analysis	(1/0 GED) x (cognitive ability, noncognitive ability)	Wage: $(+)^2$ if high cognitive and noncognitive ability

Notes: [1] "1/0" refers to a binary indicator of the associated variable. For example, under GED Mechanism "1/0 GED" refers to 1 = receives GED, 0 = does not, indicating a simple binary treatment effect.
[2] Heckman, Urzua and Veramendi (2010) is a working paper that uses simulations to identify heterogeneous treatment effects. The most recent draft has distributions of treatments but has not yet bootstrapped the relevant standard errors.
The study samples are statistically representative of the US unless otherwise indicated in the "Population" field. The "Findings" field codes no statistically signficant effect as "No Effect", and otherwise shows (<indicator of a positive or negative finding>, <level of significance>) where * = p < .10, ** = p < .05, and *** = p < .01.
See the Web Appendix (http://jenni.uchicago.edu/GEDHandbookChapter/) for tables with more detail on each paper's outcomes examined, lists of regressors, and point estimates for each regression specification.

Dropouts with Low Initial Endowments: Tyler et al. [2000] focus on a low ability margin, and argue that low ability GEDs command higher wages relative to dropouts of comparable ability than high ability GEDs command relative to their non-GED counterparts. Murnane et al. [1999], Murnane et al. [2000], and Tyler et al. [2003] suggest a human capital explanation for large effects at a low ability margin where, in order to meet a uniform passing bar, GED recipients with the lowest academic ability when leaving school must have made the largest human capital investments in order to pass. That is, individuals with low initial ability may disproportionately comprise the sizable right tail in the distribution of preparation hours discussed in Section 2.1, and may thus generate a nontrivial amount of human capital. While no data sets combine information on GED preparation times, schooling at the time of dropping out, cognitive ability, and wages, the findings of these three papers are consistent with the hypothesis that low ability GEDs study more. As previously noted, the low ability GEDs who try repeatedly to pass and do so may have higher noncognitive traits than their low ability non-GED counterparts and this might explain their findings. The samples and qualitative findings of each paper are summarized in Table 7.

All of these papers find positive returns to the GED associated with low levels of academic ability. Murnane et al. [1999] control for individual heterogeneity using a long panel of earnings data from the NLSY79 sample to control for individual fixed effects. The wage returns are limited, with Murnane et al. [1999]'s analysis suggesting a statistically significant 6% hourly wage premium five years after GED certification. It would be instructive to compare the noncognitive skills of the low ability GEDs with those of dropouts who do not certify. To the best of our knowledge, this has not been done.

Murnane et al. [2000] use the High School and Beyond (HSB) data to examine growth in scores on subject tests

that are administered with the initial wave when participants are in 10th grade, and tests that are administered in the next wave that is sampled two years later. Controlling for completion of 10th and 11th grade and baseline test scores, GEDs make larger test score gains than do dropouts. They note that while this finding may be due to differential returns to education or other unobserved heterogeneity, this pattern is consistent with the hypothesis that studying for the GED examination did increase the math skills of dropouts.

3.1.3 Cognitive and Noncognitive Ability

Just as cognitive ability is commonly a confounding factor in explaining the labor market returns to education, Heckman and Rubinstein [2001] demonstrate that dropping out is associated with negative social traits such as criminal behavior, divorce, risky social behaviors, and job turnover that are not controlled for in statistical studies. As a test of cognitive ability, the GED does not directly measure these negative social traits or induce sorting along the lines of positive traits. Heckman and Rubinstein introduce the idea that this association of the GED with negative social traits makes it a "mixed signal".

While Section 3.1.1 demonstrates that GEDs lie between dropouts and high school graduates in academic outcomes and home background, Figures 10 and 11 show that GEDs are similar to, or worse than, dropouts in terms of social outcomes.[24] This suggests that underlying behavioral characteristics can explain in part why GED recipients do not receive the benefit that high school graduates do from their credentials.

Heckman, Stixrud, and Urzua [2006] test for the influence of cognitive and noncognitive skills on choices of schooling and the wage returns to schooling. They use the Rosenberg Self-Esteem Scale and Rotter Locus of Control[25], both administered early in the NLSY79 panel to measure noncognitive skill.[26] Heckman, Urzua, and Veramendi [2010] similarly account for both cognitive and noncognitive ability, but anchor noncognitive ability in crime and risky behavior choices early in life. Figure 12 plots the noncognitive ability distributions from Heckman, Urzua, and Veramendi [2010] for males and females. Terminal GEDs and uncredentialed dropouts have nearly identical distributions of noncognitive ability while high school graduates are substantially right shifted.

Table 8, reproduced from Heckman, Stixrud, and Urzua [2006], shows that both cognitive and noncognitive[27] skills

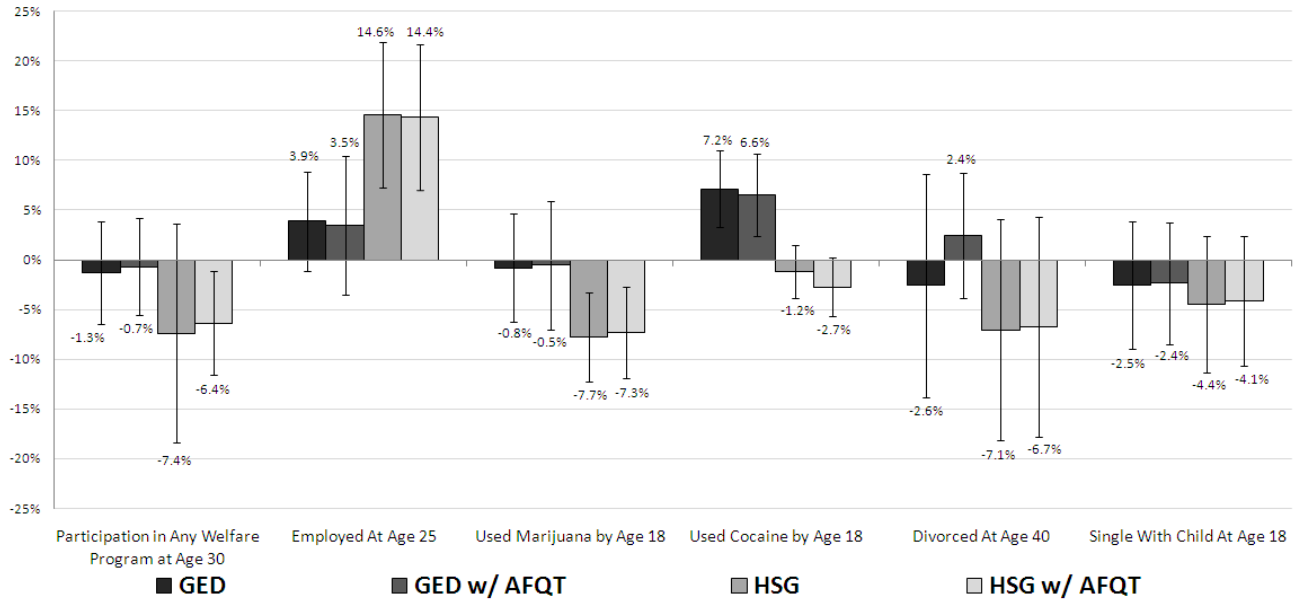
[24] These figures display different social outcomes due to the fact that the same measures are not surveyed in the NLSY79 and NLSY97.

[25] The Rosenberg Self-Esteem Scale is a series of 10 yes or no questions to evaluate self-esteem. The Rotter Locus of Control is a set of four paired statements used to measure self-efficacy. The taker must indicate which she believes to be more true, then indicates if they believe this to be "somewhat true" or "very true".

[26] See Section B of the Web Appendix (http://jenni.uchicago.edu/GEDHandbookChapter/) for detailed descriptions of each measure.

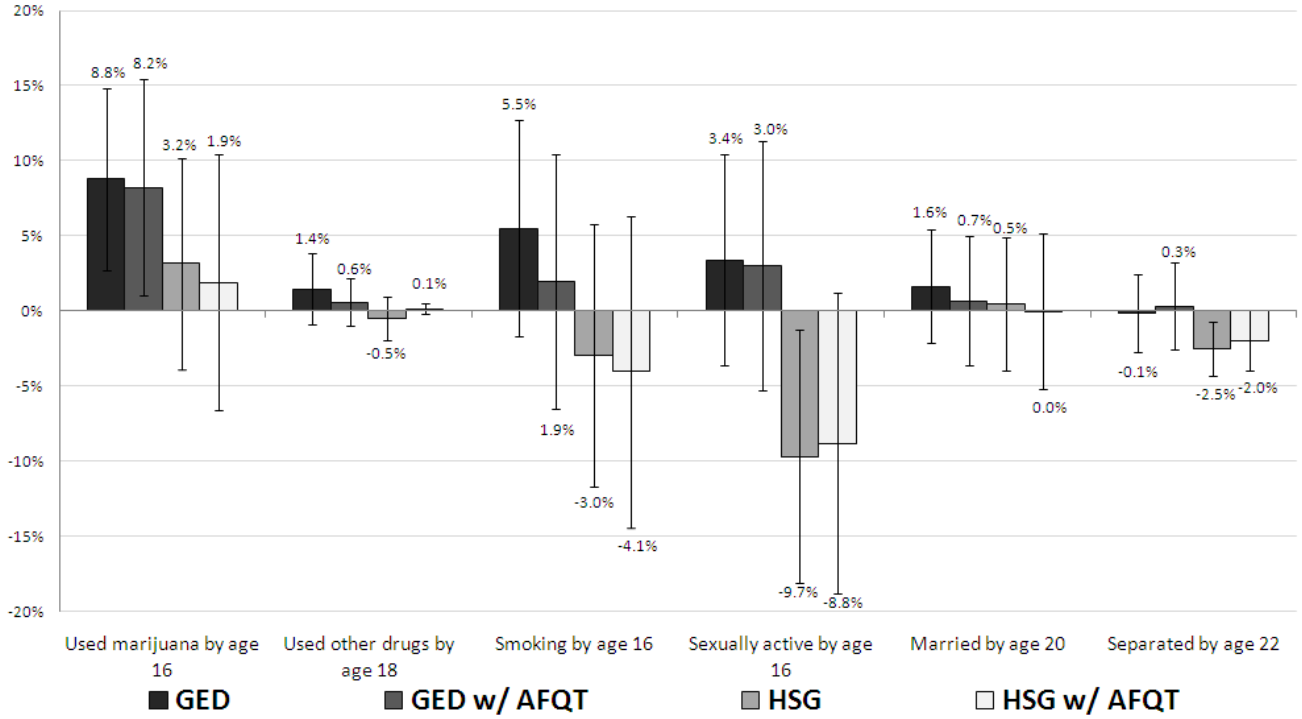
[27] Cognitive skill is measured by the Armed Services Vocational Aptitude Battery (ASVAB) which is used to construct the AFQT. Noncognitive skill is measured by the Rosenberg and Rotter scales.

Figure 10: Gaps in the Probability of Various Social Outcomes Compared to High School Dropouts with and without controlling for scholastic ability (NLSY79). All demographic groups pooled unless otherwise noted.



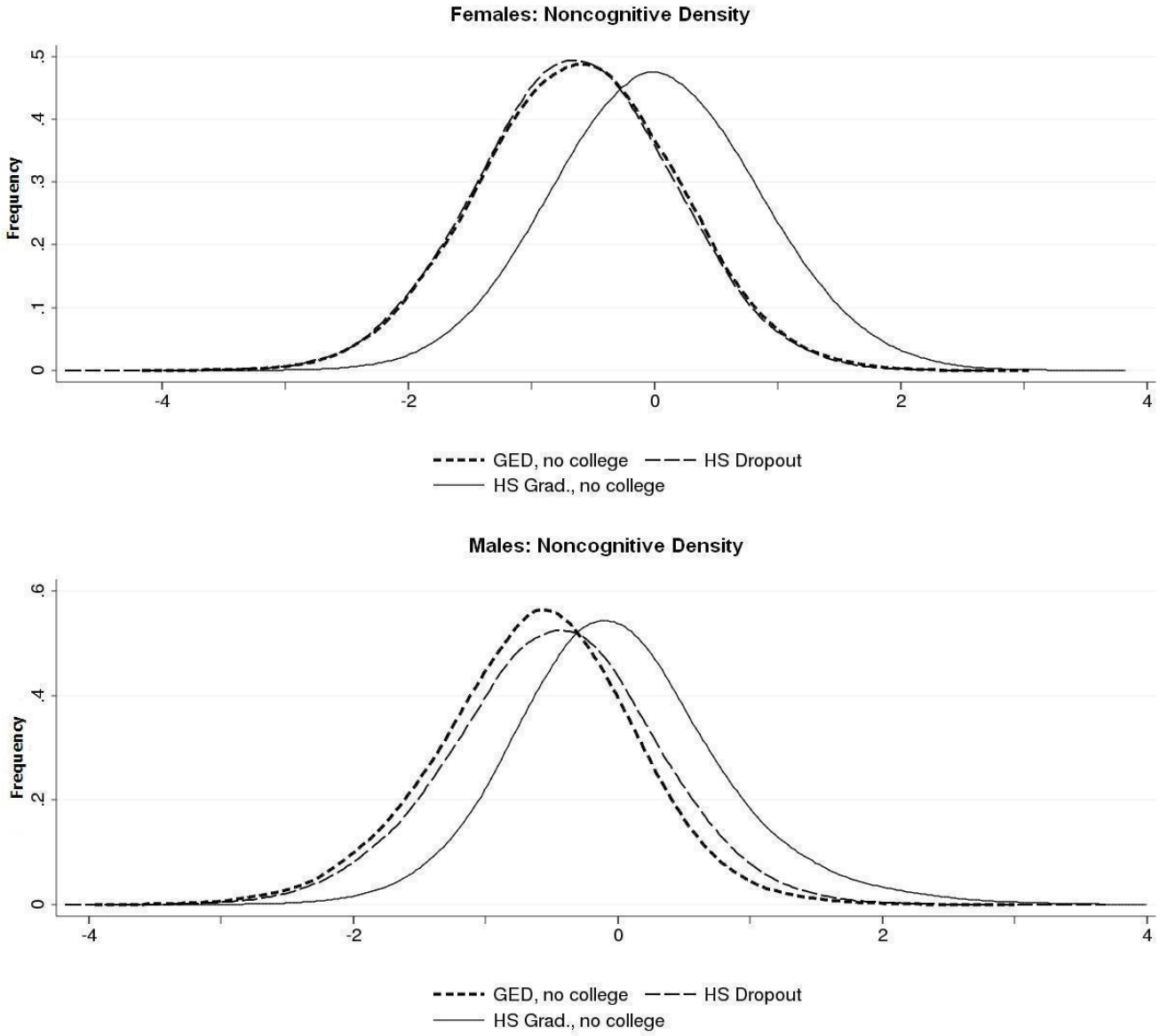
Source: National Longitudinal Survey of Youth 1979 (NLSY79). Notes: This analysis is restricted to the cross-sectional sample of NLSY79 reporting no completed years of college, having never been incarcerated, and having valid AFQT scores. "Single With Child at Age 18" includes only females. All regressions control for race, gender, Southern residence at age 14, and urban status at age 14. Regressions with controls for ability use "pre-8th grade" estimates of AFQT scores. Marginal effects reported. 95% confidence intervals are displayed.

Figure 11: Gaps in the Probability of Various Social Outcomes Compared to High School Dropouts with and without controlling for scholastic ability (NLSY97). All demographic groups pooled unless otherwise noted.



Source: National Longitudinal Survey of Youth 1997. Notes: This analysis is restricted to the cross-sectional sample of NLSY97 reporting no completed years of college at age 22, having valid AFQT scores. "Separated by 22" indicates that the individual is divorced or separated from one's spouse by age 22. All regressions include highest grade completed at 22, urban and rural status at age 12, and race and gender dummies. Regressions with controls for ability use "pre-8th grade" estimates of AFQT scores. Marginal effects reported. 95% confidence intervals are displayed.

Figure 12: Noncognitive ability by educational status (no college sample, all ethnic groups)



Source: Reproduced from Heckman, Urzua, and Veramendi [2010]. National Longitudinal Study of Youth 1979. Notes: The distributions above represent noncognitive ability factors estimated using measures of early violent crime, minor crime, marijuana use, regular smoking, drinking, early sexual intercourse, and educational attainment as laid out in Hansen, Heckman, and Mullen [2004]. Sample restricted to the cross-sectional subsample for both males and females. Distributions show only those with no post-secondary educational attainment. The noncognitive ability factors are separately normalized to be mean zero standard deviation one.

Table 8: Coefficients from Log Wage Regression on Cognitive and Noncognitive Measures

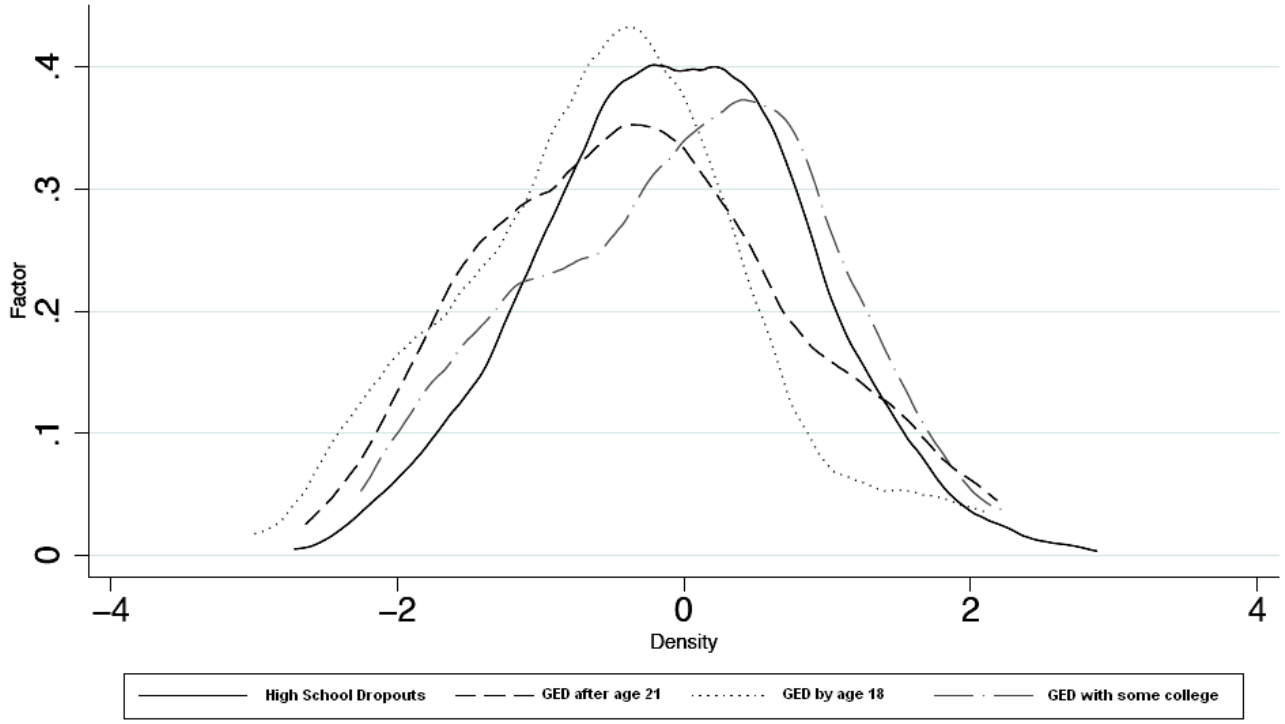
	Males		Females	
Schooling Level	Cognitive	Noncognitive	Cognitive	Noncognitive
High school dropout	.113	.424	.322	.208
	(.076)	(.092)	(.125)	(.103)
GED	.175	.357	.020	.242
	(.107)	(.117)	(.137)	(.153)
High school graduate	.259	.360	.341	.564
	(.041)	(.059)	(.049)	(.056)
Some college, no degree	.069	.401	.093	.569
	(.086)	(.110)	(.084)	(.116)
2-year-college degree	.039	.368	.206	.279
	(.138)	(.209)	(.096)	(.145)
4-year-college degree	.296	−.060	.290	.379
	(.075)	(.175)	(.066)	(.103)

Source: Reproduced from Heckman, Stixrud, and Urzua [2006], Table 4. National Longitudinal Survey of Youth 1979 (NLSY79). Notes: Sample from NLSY79 males and females at age 30. Individuals are pooled across race/ethnic groups. The analysis uses the cross-sectional subsample of NLSY79, restricted to those not currently enrolled in college. The cognitive measure represents the standardized average over the raw ASVAB scores (arithmetic reasoning, word knowledge, paragraph comprehension, math knowledge, and coding speed). The noncognitive measure is computed as a (standardized) average of the Rosenberg Self-Esteem Scale and Rotter Internal-External Locus of Control Scale. The model also includes a set of cohort dummies, local labor market conditions (unemployment rate), region of residence, and dummies for race/ethnicity dummies. Standard errors are in parentheses.

are valued in the labor market for individuals of all educational levels. The table reports the coefficients for the cognitive and noncognitive measures (which are standardized to mean zero, standard deviation 1) on log hourly wages by educational attainment. While the value of cognitive and noncognitive ability varies by education status and sex, noncognitive skills are of equal or greater importance at many educational levels as measured in effects on outcomes of unit changes in standard deviations.

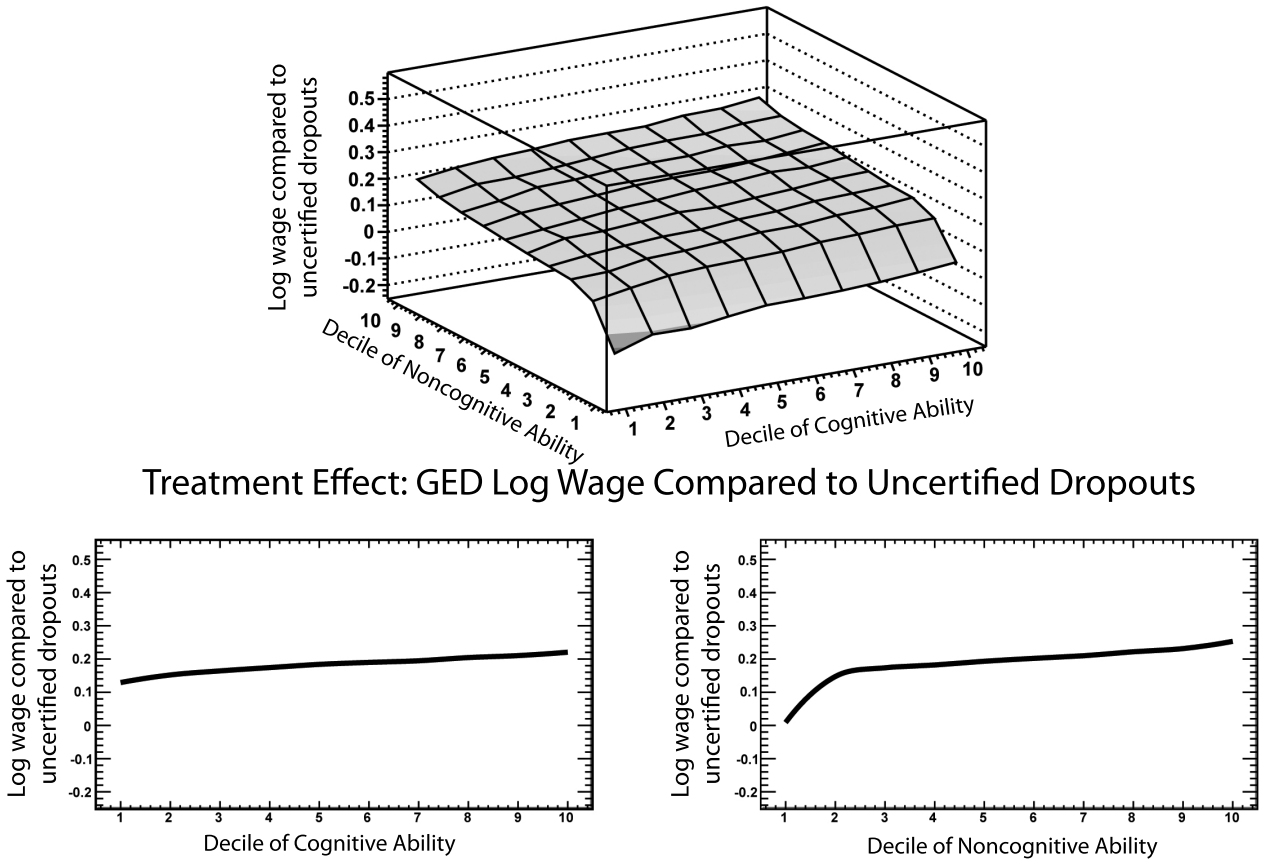
Heckman, Stixrud, and Urzua [2006] and Heckman, Urzua, and Veramendi [2010] study the effect of education and noncognitive skills on earnings and other outcomes. Both papers use factor models to generate estimates of cognitive and noncognitive ability from multiple measures of those traits, and both choices of education levels and earnings outcomes as functions of those skills. Both papers use a generalized Roy model to control for selection into schooling and to estimate labor market returns to educational attainment that vary by levels of cognitive and noncognitive skill. While both papers measure cognitive ability from AFQT scores, Heckman et al. [2006] measure noncognitive factors using Rosenberg and Rotter scales in conjunction with educational choices. Heckman et al. [2010] construct noncognitive factors from measures of teenage behavior, specifically participation in minor and major illegal activity, smoking, drinking, drug use, involvement in after-school clubs, and sexual intercourse by the age of 15.

Figure 13: Distribution of noncognitive factor for GEDs and dropouts (white males)



Source: Reproduced from Heckman and Urzua [2010]. Notes: "GED after age 21" are those that GED certify at age 22 or later. "GED by age 18" are those that GED certify before the age of 19.

Figure 14: Log wage effects of GED recipient as a function of cognitive and noncognitive skills (white males)

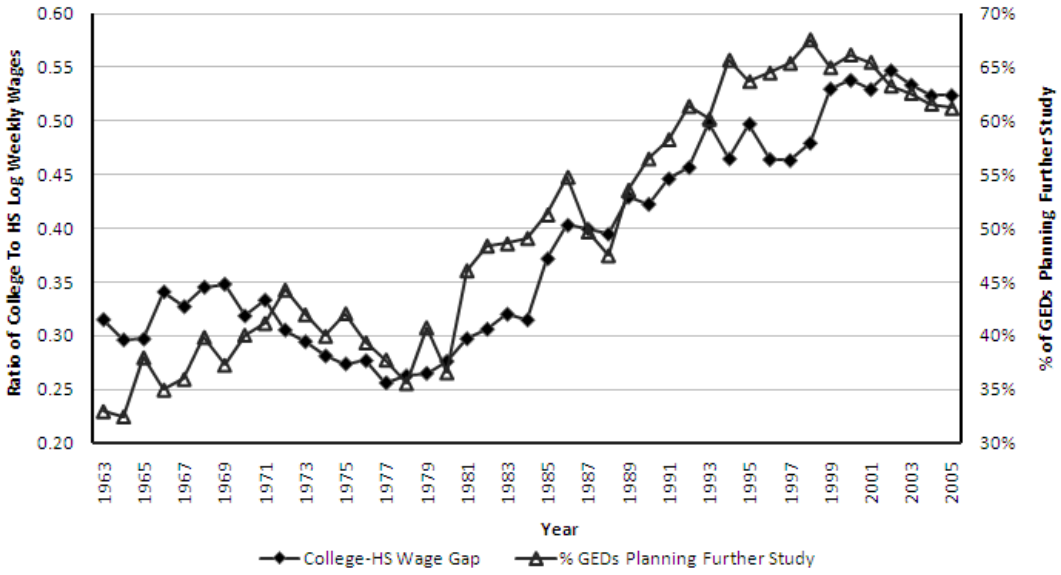


Source: Reproduced from Heckman et al. (2010). Notes: The top panel represents the log wage effect of GED receipt by joint distribution of cognitive and noncognitive ability. The lower panels show the log wage effect of GED receipt by marginal distributions of cognitive and noncognitive ability.

Figure 13 shows the estimated distributions of noncognitive ability for dropouts and different types of GED recipients from Heckman and Urzua [2010]. Consistent with differences displayed in Figures 10 and 11, it shows that all GEDs, except those with some college, are *below* uncredentialed dropouts in noncognitive ability. Figure 14, reproduced from Heckman et al. [2010], shows how the effect of GED certification on wages varies by levels of individual skill type. It shows that the marginal benefit of increasing a decile of noncognitive ability for GEDs, especially in the bottom two deciles, is greater than the marginal benefit of increasing a decile of cognitive ability. This analysis confirms the findings of Heckman et al. [2006] that there are positive returns to both noncognitive and cognitive ability in low skill labor markets.

A key observation is that GEDs are typically far down in the distribution of noncognitive ability. As discussed in

Figure 15: Returns to College and GED Test Takers Seeking Further Education



Source: GED Testing Service [1958-2008] and Current Population Survey Data.

the next section, noncognitive ability is also a key characteristic for predicting which individuals will successfully use the GED to obtain post-secondary training.

3.2 Educational Attainment

Patterns of Post-Secondary Enrollment and Persistence: As noted above, the GED is widely accepted as a prerequisite for admission to post-secondary education. Thus it serves as an intermediate step to obtaining more valuable credentials. In 2008, 60% of GED test takers self-reported further education as a reason for taking the test. Of this 60%, 20% planned on enrolling in four year college, 28% in two year college, and 22% in a technical or trade program [GED Testing Service, 1958-2008]. Figure 15 presents time trends in the motivation to use the GED for post-secondary education, showing an awareness of the increasing returns to college. As the college-high school wage gap has grown, so has the percentage of GED recipients planning further education.

Few GEDs follow through with these plans. A recent study by the GED Testing Service [Patterson et al., 2009] followed 1,000 randomly selected individuals who passed the GED test after the increase in test difficulty in 2002. It found that 31% ever enrolled in a post-secondary institution of any kind, and that 77% of those who ever enrolled did so for only a single semester.

Table 9: Literature Summary - Outcomes Pertaining to Post-Secondary Education through the GED

Study	Data	Population	Method/Identification	GED Effect	Findings
Cameron and Heckman (1993)	NLSY79 (1979-1987)	White males	Correction for self-selection into working status	1/0 GED[1] x college	Wage: no effect
Murnane, Willett and Boudett (1997)	NLSY79 (1979-1991)	Males and females	Probit	1/0 GED, (1/0 GED) x (post-GED work experience)	Probability of acquiring training: (+,***) if female Probability of acquiring training: no effect if male Probability of attending college: (+,***) for females and males
Heckman and Urzua (2010)	NLSY79 (1979-2006)	White males	Dynamic discrete choice framework, latent factor analysis	(1/0 GED) x (cognitive ability, noncognitive ability)	Educational option value: increasing in cognitive and noncognitive ability

Notes: [1] "1/0" refers to a binary indicator of the associated variable. For example, under GED Effect "1/0 GED" refers to 1 = receives GED, 0 = does not, indicating a simple binary treatment effect.
The study samples are statistically representative of the US unless otherwise indicated in the "Population" field. The "Findings" field codes no statistically signficant effect as "No effect", and otherwise shows (<indicator of a positive or negative finding>, <level of significance>) where * = p < .10, ** = p < .05, and *** = p < .01.
See the Web Appendix (http://jenni.uchicago.edu/GEDHandbookChapter/) for tables with more detail on each paper's outcomes examined, lists of regressors, and point estimates for each regression specification.

Figure 16 shows rates of enrollment and completion of various types of post-secondary education, comparing GEDs with high school graduates among the NLSY79 with NLSY97 cohorts at age 22.[28,29] As documented in the Patterson et al. [2009] report, many GEDs enrolled in college by age 22 but very few went on to ever earn degrees or complete a meaningful amount of post-secondary education. In contrast to the trend of self-reported plans in Figure 15, fewer GED recipients had enrolled by age 22 in NLSY97 than in NLSY79.[30] Figure 17 demonstrates that by 2006, when the NLSY79 sample is in their 40s, very few GEDs managed to earn four year credentials although more earn associates degrees. As we discuss below, this trend may also be due to changes in the composition of GED test takers which is increasingly younger and more likely to attempt the GED through institutional requirements.

Causal analysis of outcomes pertaining to post-secondary education through the GED: GED recipients receive tangible improvements in their labor market outcomes when they complete post-secondary education. A summary of the qualitative findings and approaches of selected papers in this literature is presented in table 9.

Cameron and Heckman [1993] calculate the option value or expected benefit of GED receipt through a wide array of types of post-secondary training–on- and off-the-job training, military service, and two and four year college–as the benefit to each type of training times the expected amount of training obtained.[31] They find that the wage benefit

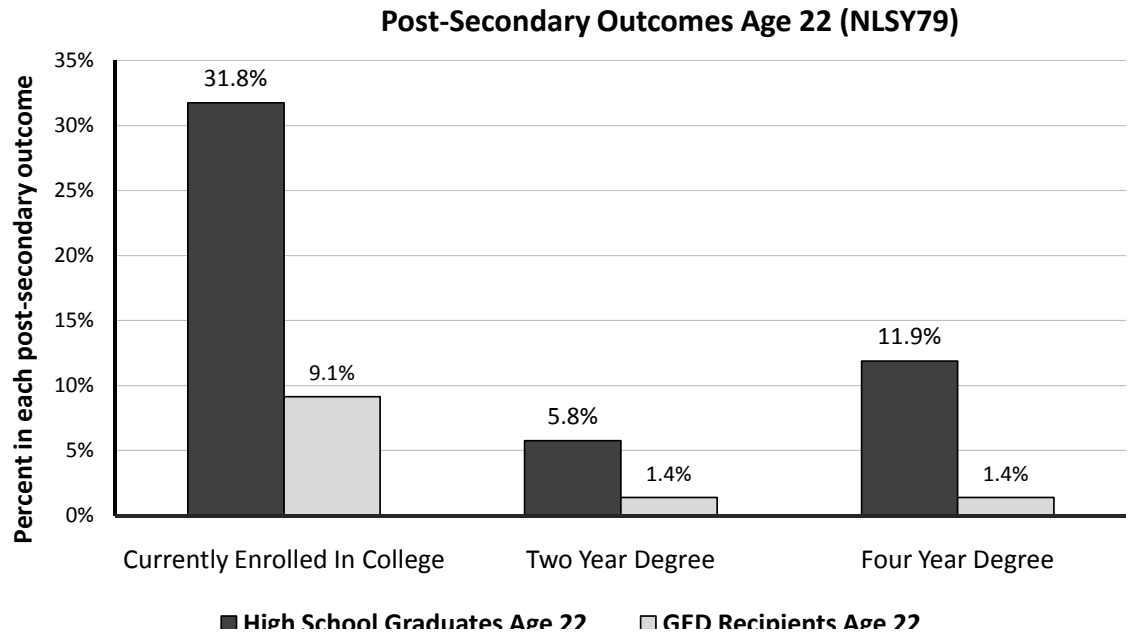
[28] We compare NLSY79 and NLSY97 at age 22 as it is the oldest age reached by the entire NLSY97 sample. The low rates of earned bachelor's/four year college degrees is explained by the fact that many students in this young sample are still working towards their degrees, given their relatively young age and the number of individuals reporting current enrollment in four year college in the NLSY97 survey.

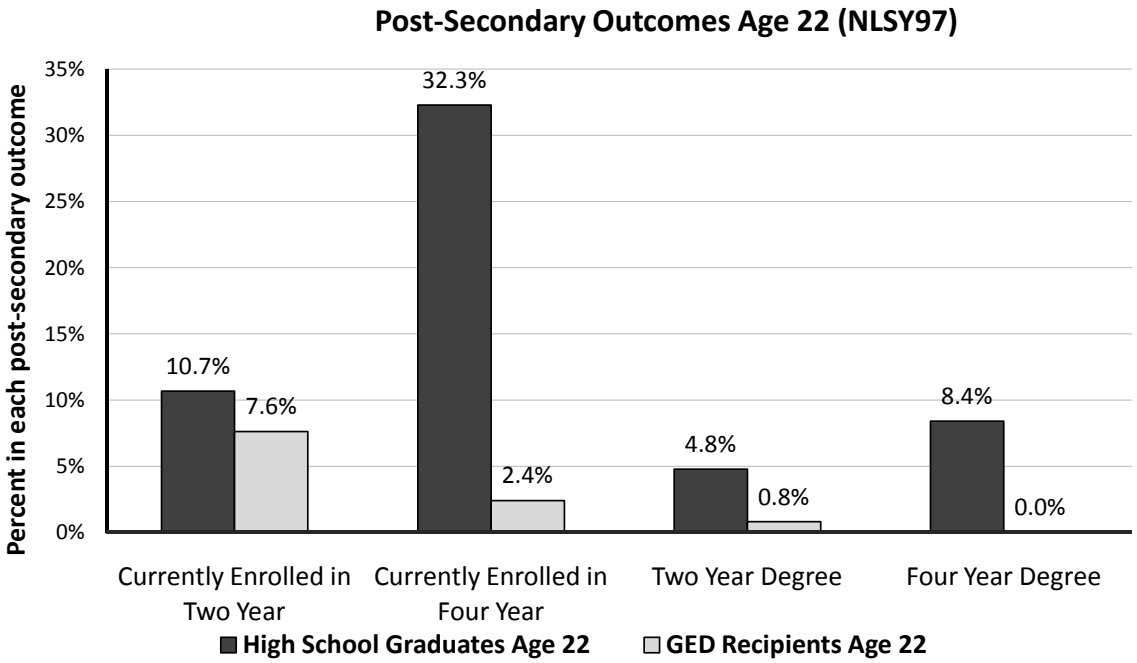
[29] Murnane et al. [1997] contains a table that displays participation rates by degrees of participation in post-secondary activities including on-the-job training, off-the-job training, college and military. These figures are divided by level of final educational attainment and by gender. Their table is reproduced in Section C.3 of the Web Appendix (http://jenni.uchicago.edu/GEDHandbookChapter/).

[30] Sampling variation may explain this trend across NLSY79 and NLSY97 samples given that relatively few GEDs attempt post-secondary training. Another possible factor, discussed below, is that the composition of GED test takers has changed for the worse.

[31] Grubb [2002] surveys work that compares the wage and earnings returns to study in two year and four year colleges in terms of both completed degrees and individual credits earned at each type of institution. Whereas the value of a completed four year (bachelor)

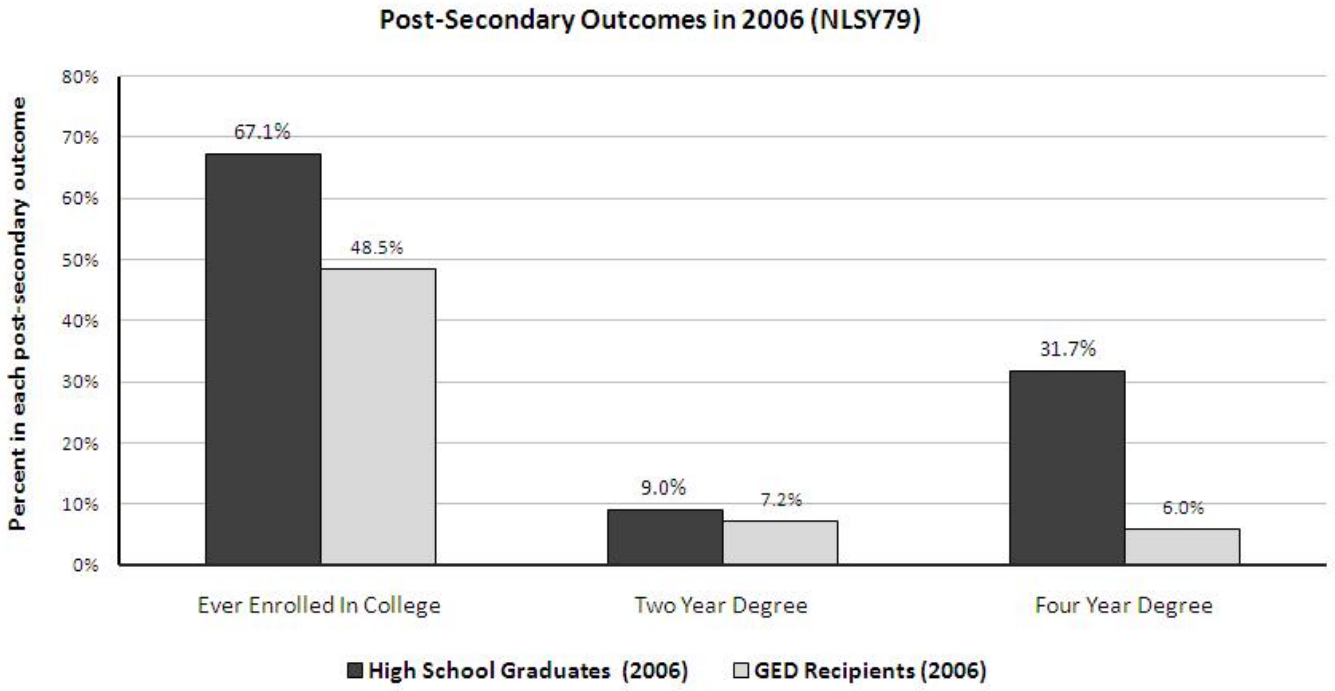
Figure 16: Post-secondary educational attainment at age 22 by high school certification type (all demographic groups)





Source: National Longitudinal Survey of Youth 1979 (NSLY79) and the National Longitudinal Survey of Youth 1997 (NLSY97). Notes: Calculations are based on the cross-sectional subsample of each survey which are drawn to be representative of the full population. "Currently Enrolled in" variables are those who reported no two or four year degrees but reported being enrolled in college at age 22. "Four Year Degree" and "Two Year Degree" represent individuals who have earned such a degree by age 22.

Figure 17: Post-secondary educational attainment in 2006 for the NLSY79 sample by high school certification type



Source: National Longitudinal Survey of Youth 1979 (NSLY79). Notes: Calculations are based on the cross-sectional subsample of the NLSY79. "Ever Enrolled in College" is defined for the case that individuals ever report enrolling in college and is not conditional on completing any college.

Figure 1: Post-secondary educational attainment in 2006 for the NLSY79 sample by high school certification type. Source: National Longitudinal Survey of Youth 1979 (NSLY79). Notes: Calculations are based on the cross-sectional subsample of the NLSY79. "Ever Enrolled in College" is defined for the case that individuals ever report enrolling in college and is not conditional on completing any college.

associated with further education is much larger than the direct effect of GED receipt. Murnane et al. [1999] find strongly significant hourly wage and income premiums conditional on receiving these types of training, but note that few GEDs receive them. Murnane et al. [1997] use the same NLSY79 data as both of these studies and confirm that, net of controls, GEDs pursue more of these types of post-secondary education than dropouts, but that the predicted rates of completion are very low.

Heckman, Stixrud, and Urzua [2006], Heckman, Urzua, and Veramendi [2010], and Heckman and Urzua [2010] study the probability of selecting higher levels of educational attainment as a function of cognitive and noncognitive skills.[32] They find that both cognitive and noncognitive skills predict which individuals will drop out and use the GED for higher levels of education. Each approach studies the net present value (NPV) of income for individuals of a given skill set and choice of education level. Heckman and Urzua [2010] use a dynamic discrete choice framework where individuals make a sequence of decisions based on their expected income returns and psychological costs and payoffs (i.e. non-pecuniary factors that influence individual decisions beyond just income returns). Heckman and Urzua [2010] estimate "option values", which are the benefits conferred by completing one stage of education in terms of access to the returns of later stages of education. The option value associated with an educational choice at a given level of education is defined as the NPV of future educational decisions that choice opens up, net of the NPV of staying at the same level of education. For an individual with a given set of cognitive and noncognitive skills, the option value of the GED equals the returns that individual would receive from post-secondary education multiplied by the probability that they would choose and successfully complete that education.

Figure 18 shows for white males the respective probabilities of being a terminal dropout and of obtaining a GED based on population deciles of cognitive and noncognitive ability. "1" represents the lowest decile and "10" represents the highest. The first panel (A) shows that the probability of being a terminal dropout is primarily associated with low cognitive ability. The second panel (B) shows that, relative to the probability of dropping out, the probability of obtaining a GED is higher for higher levels of cognitive ability, and is higher for *lower* levels of noncognitive ability.

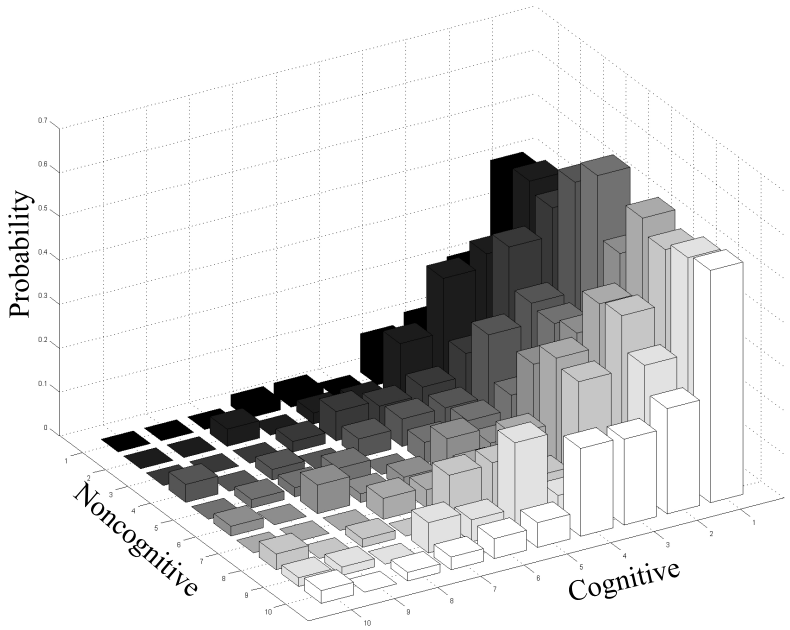
Figure 19 shows the estimated option values of the GED as a function of cognitive and noncognitive ability. The option value increases sharply in both cognitive and noncognitive ability. The axes of this graph represent population deciles. Very few dropouts are in the upper deciles of cognitive or noncognitive ability. As is evident from Figure

degree is decisively higher than that for a complete two year (associate) degree, there is no consensus on which type of college is associated with higher returns to earned credits that are not associated with degree completion.

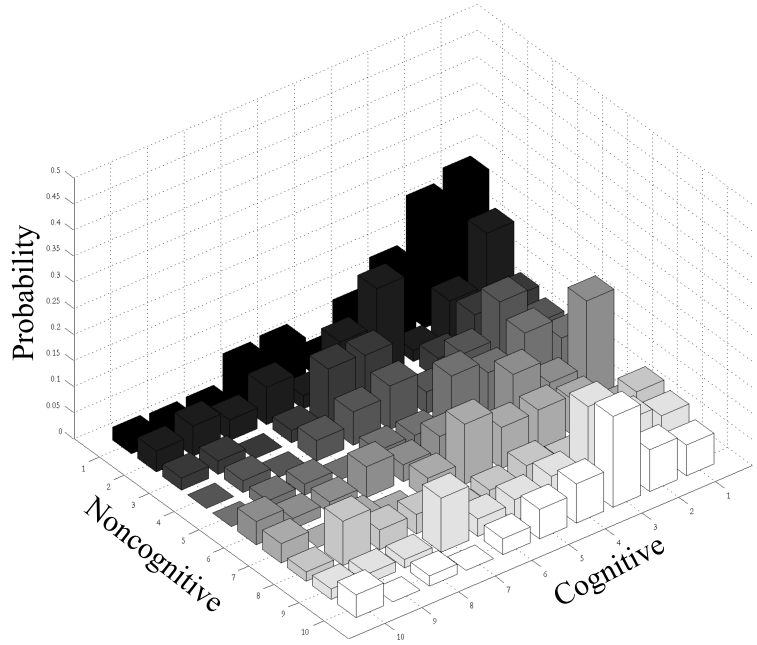
[32] Like Heckman et al. [2006], Heckman and Urzua [2010] use the Rosenberg and Rotter scores to measure noncognitive ability.

Figure 18: Distribution of Probability of Dropping Out (A) and GED Receipt (B) by Cognitive and Noncognitive Ability (white males)

(A)

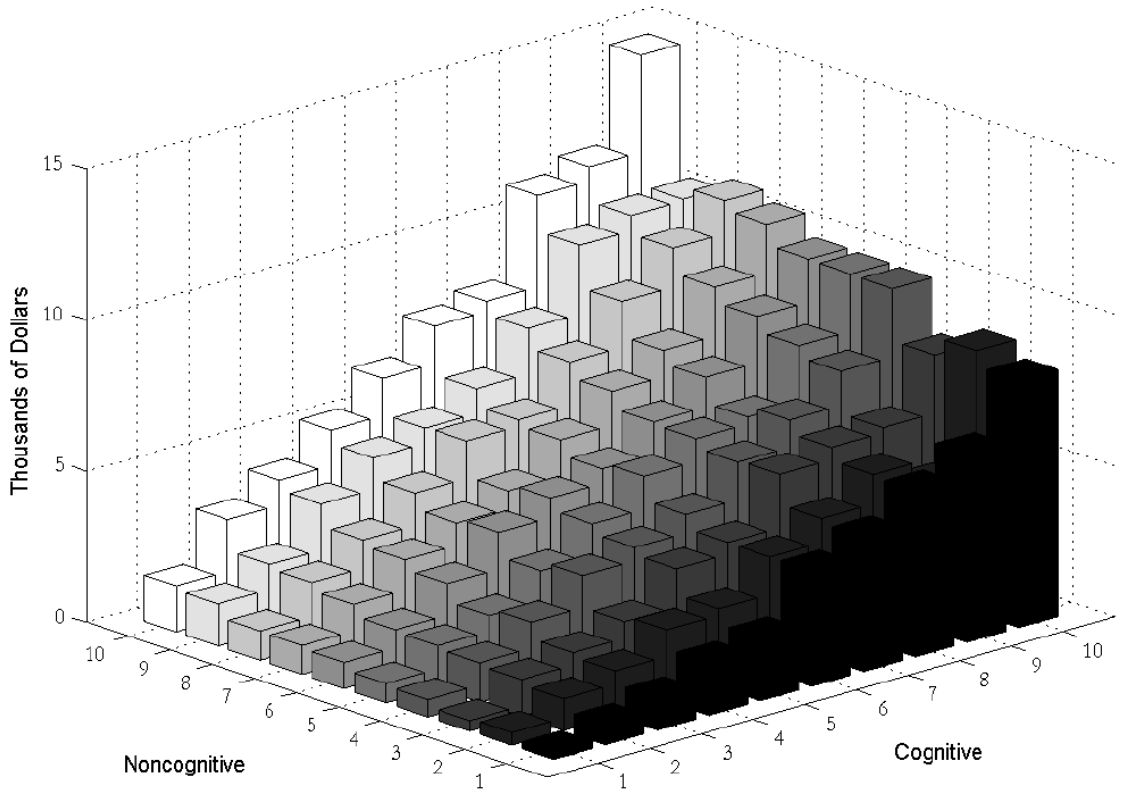


(B)



Source: Reproduced from Heckman and Urzua [2010]. Notes: x and y axes represent deciles of cognitive and noncognitive factors as defined in this section. "1" represents the lowest decile and "10" represents the highest decile.

Figure 19: Distribution of GED Option Values by Cognitive and Noncognitive Ability Deciles for white males



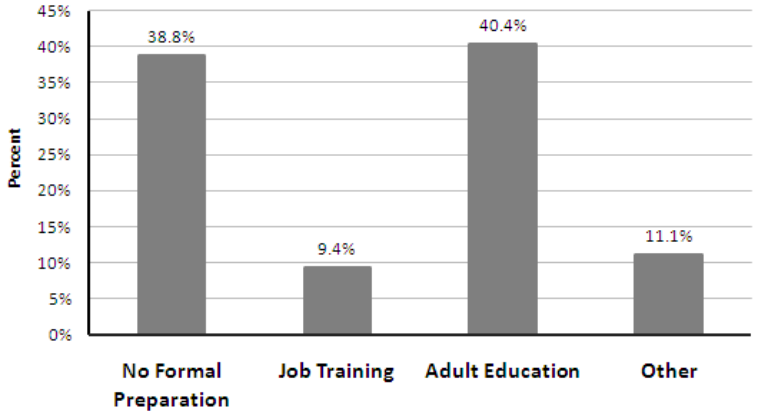
Source: Reproduced from Heckman and Urzua [2010]. Notes: Option value of GED certification for 17-year-old high school dropouts. x and y axes represent deciles of cognitive and noncognitive factors as defined in this section. "1" represents the lowest decile and "10" represents the highest decile.

18(B), few individuals have the skills that produce a high option value for GED certification.

4 Changes and Growth in the GED Test Taking Population

Given the low returns to GED certification for the majority of GED test takers, the question remains why GED certification has reached such a large scale and continues to grow. As shown in Figure 1, the GED program grew from 50,000 takers in 1960 to over one million in 2001. A recent increase in the test's difficulty paired with the introduction of a new test series led to a decrease in takers in 2002, but growth resumed afterward with 700,000 people taking the test in 2008. In this section we review several explanations for the growth of the GED testing

Figure 20: Route to GED Certification Taken by NLSY97 GED Recipients



Source: National Longitudinal Survey of Youth 1997 (NLSY97). Notes: Statistics include all individuals who earn a GED by 2007.

program over time. We show the significant role of government programs which both directly and indirectly subsidize the cost of GED certification. Much of the recent growth has occurred in populations such as younger teenagers and the incarcerated, populations that the literature shows have low expected benefit to GED certification.

4.1 Government Education and Training Programs

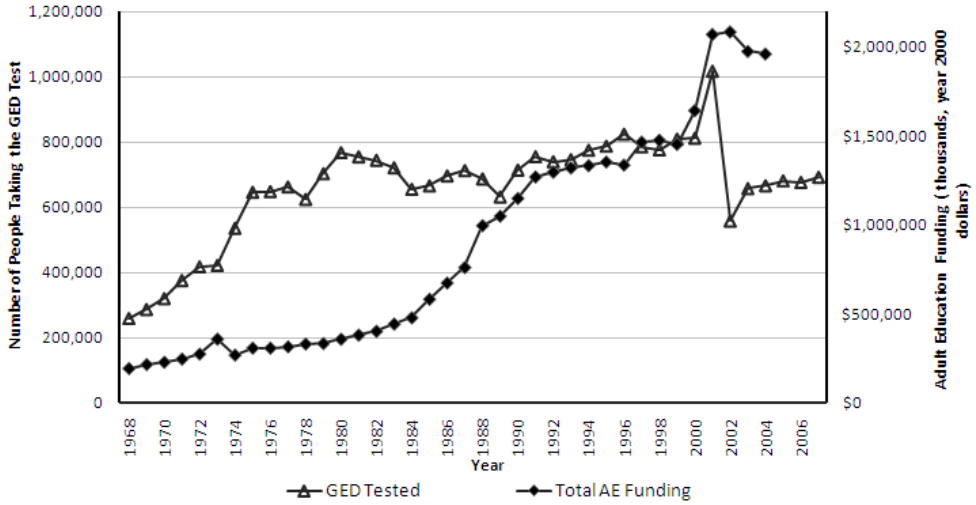
Many government educational and job training programs have adopted the GED as a second chance program. These include government programs such as Job Corps, state anti-poverty programs,[33] and Adult Education programs. The GED test is used as a standardized, external measure of success for programs providing education. Figure 20 shows that 50% of individuals in the NLSY97 report obtaining the GED through either Adult Education programs or another job training program, demonstrating the role these government programs play in promoting the GED.

Adult Education is the largest government program promoting and subsidizing GED preparation and certification. The Adult Basic Education Act was signed into law in 1964. It was intended to provide funding for educating people aged 18 and older who lacked basic skills such as reading and basic arithmetic [National Advisory Council on Adult Education, 1980]. The program expanded in 1970 to include Adult Secondary Education (ASE), which focused on high school-level learning [Rose, 1991].[34] The GED was quickly adopted by ASE programs as both a goal and a

[33] One example, documented in Quinn [2002], is of welfare reform initiatives in Ohio which paid mothers for sending their teenagers to attend GED classes.

[34] With the introduction of ASE, the age requirement was decreased to 16. Adult Education was extended to incarcerated populations

Figure 21: Adult Education Funding and GED Test Taking



Source: GED Testing Service [1958-2008], U.S. Department of Education [Various Years], and National Advisory Council on Adult Education [Various Years].

metric of program success. Adult Education programs are not homogeneous. They range from stand-alone GED classes to programs bundling job and vocational training with GED preparation.

Adult Education is a significant producer of GED certificates. In 1975, 26% of GED credentials were issued through Adult Education, increasing to 40% by 1980 and 50% in 1990 [U.S. Department of Education, Various Years]. In 1995, six times as many people achieved a GED rather than a traditional high school diploma through Adult Education [National Advisory Council on Adult Education, Various Years]. McLaughlin et al. [2009] examine the preparation methods for 90,000 GED test takers, and find that 46% of the sample took the GED through an Adult Education program.[35] Figure 21 shows Adult Education funding (both state and Federal, in year 2000 dollars) graphed against the number of GED test takers. Expansion of Adult Basic Education promoted the growth of the GED. Figure 22 shows the proportions of individuals taking different routes of preparation for the GED test.

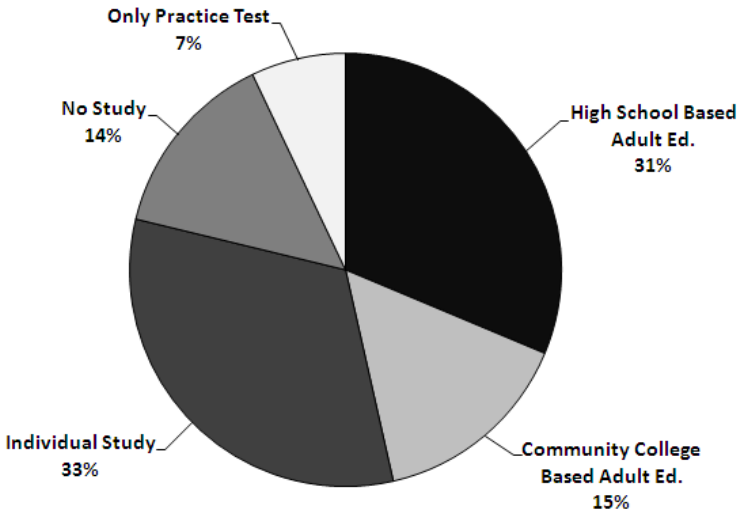
4.2 Changes in the Costs and Benefits to Education

The costs and benefits of being a dropout, of GED certification, and of college completion have changed over time. These shifts play key roles in determining who selects into GED certification. As discussed in Section 2, the wage

in 1981, though total expenditures on incarcerated education programs was capped at 20% of total Adult Education funding.

[35] These 90,000 were chosen from a larger sample, removing individuals facing institutional influences on testing such as those in states requiring a practice test or being in prison.

Figure 22: GED Test Takers by Study Type



Source: Constructed from McLaughlin et al. [2009]. Notes: Of 90,000 test takers fitting into these categories without other restrictions on test taking such as being required to take a pre-test in one's state of residence or being incarcerated.

premium associated with getting any level of education above that of dropping out has been stable or increasing for both males and females in the last 25 years.

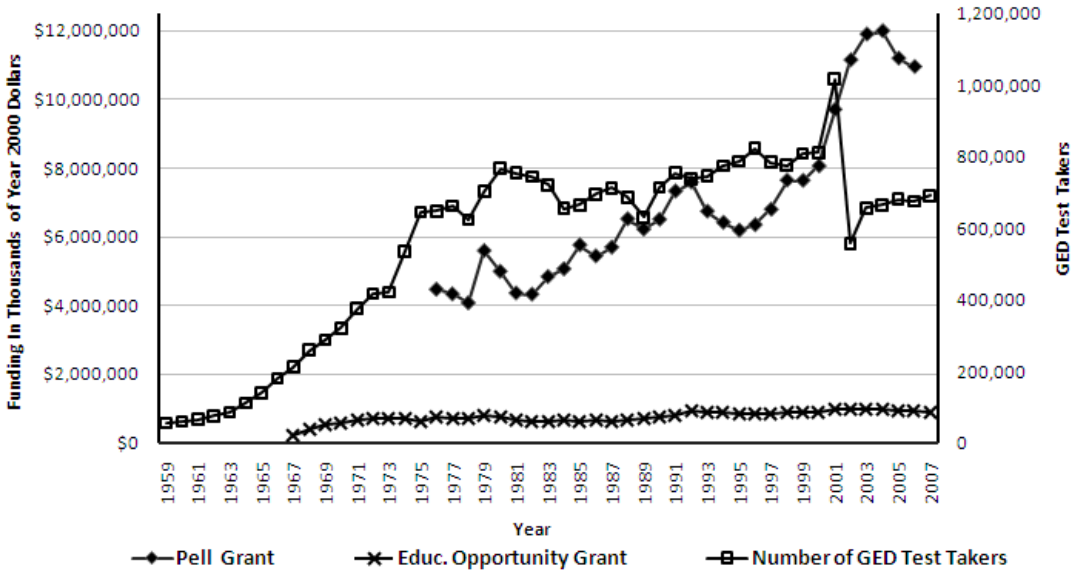
At the same time, both the financial and effort costs to education have changed. The difficulty of high school completion has increased in terms of class hours needed to graduate (measured in Carnegie Units[36]) and through implementation of "exit exams" that must be passed in order to graduate. The late 1980s saw growth in the number of Carnegie Units required for graduation increasing from an average of 13.5 in 1985 to 17.4 in 1990. Only one state required an exit exam to earn a high school diploma in 1980, increasing to twenty-two states by 2008. Warren et al. [2006] show that completion rates decrease, and 16-to-19-year-old GED testing rates increase when high school exit exams are introduced. The increasing difficulty of high school may induce more students to dropout or to GED certify thinking that they can then go straight to college.

The monetary costs of college have also grown in the last three decades. From 1985 to 2005 the real cost of public and private four year colleges grew, respectively, by 95% and 83% [National Center for Education Statistics, Various Years]. On the other hand, Federal assistance may have lowered the cost for some individuals.[37] The establishment of Pell grants in 1972 decreased the costs of post-secondary education for individuals with high

[36] Carnegie Units are standard measures of class hours. One Carnegie Unit is equivalent to one year long high school class.

[37] See Section C of the Web Appendix (http://jenni.uchicago.edu/GEDHandbookChapter/) for the full trends of Carnegie Units, high school exit exams, and tuition costs of college.

Figure 23: Federal Aid For Post-Secondary Education and GED Test Takers



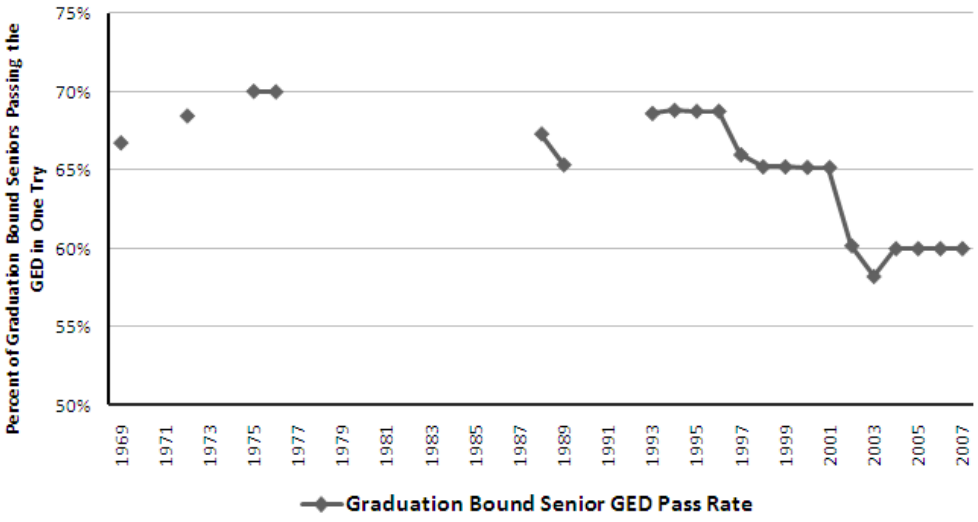
Source: "2000 Status Report on the Pell Grant Program", Federal Campus-Based Programs Data Book [1998, 1999, 2000, 2001], U.S. Census Bureau, and GED Testing Service [1958-2008].

school-level credentials, including the GED. Figure 23 displays Pell grant funding and GED test-taking rates across time. The spike in the average age of GED test takers in 1972, shown in Figure 26, is due to a number of older dropouts seeking the GED to become eligible for Pell grants when they first became available. This demonstrates the responsiveness of GED test taking to incentives to participate in complementary programs.

Monetary costs of GED certification have always been nominal. Testing fees for taking the GED range from $0 to $100, and enrollment in programs such as Adult Education often leads to reduced-fee or free testing [GED Testing Service, 1958-2008]. On the other hand, the difficulty of passing the GED test has increased over time. National minimum difficulty has increased three times, but many states have consistently required higher passing standards. Figure 24 displays the population-weighted average GED difficulty, measured by the percentage of graduation-bound high school seniors estimated to be able to pass the GED in a single try. The effect of an increase in the difficulty of the test is seen in the dramatic decline in 2001 shown in Figure 23.

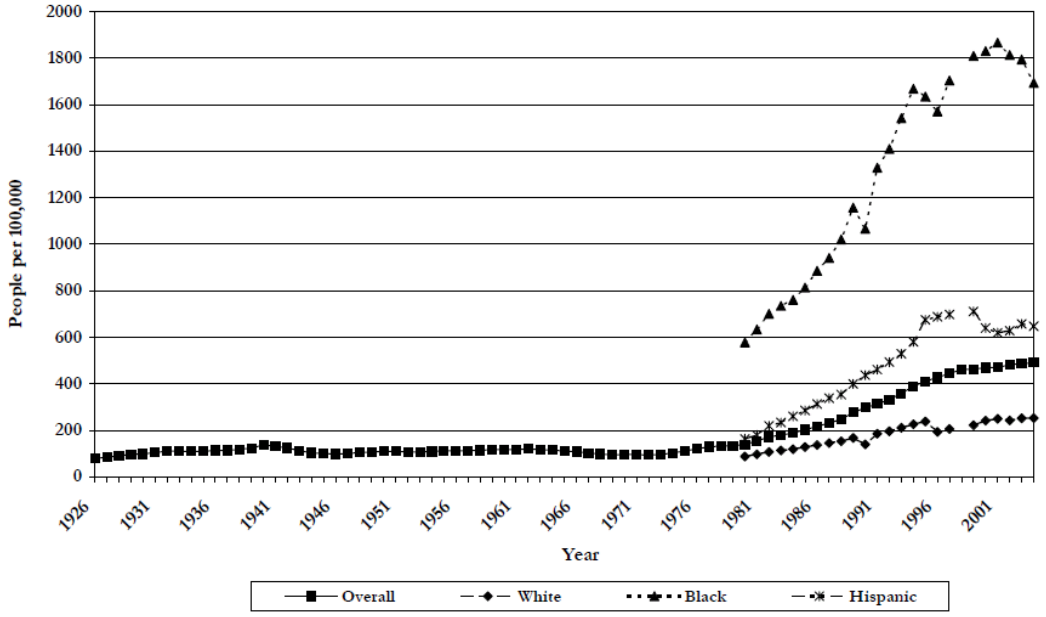
Incarceration and Prison Education The number of incarcerated individuals in the United States has grown rapidly since the mid 1970s. Figure 25 plots the total incarceration rate from 1926 to 2005, adding racial breakdowns starting in 1981. Growth occurs across all race groups, with a disproportionate amount coming from blacks. Faced

Figure 24: Estimated Percent of Graduation Bound High School Seniors Able to Pass the GED In First Try



Source: GED Testing Service [2009], GED Testing Service [1958-2008], and GED Testing Service [Various Years]. Notes: Numbers are population weighted averages of State Requirements. Only years with 40 or more states reporting the passing requirement are displayed. Gaps are due to missing data.

Figure 25: Growth in Incarcerated Populations by Race



Reproduced from Heckman and LaFontaine [2010]. Source: Bureau of Justice Statistics and the U.S. Census Bureau. Based on the U.S. Census Bureau estimated resident population, as of December 31 of each given year. Includes all persons under jurisdiction of federal and state authorities rather than those in the custody of such authorities. Represents inmates sentenced to minimum term of more than a year.

Table 10: Percentage of GEDs Obtained in Prison, Average Time

Table S.2 GED Credentials Issued in Correctional Institutions as a Percentage of Total Issued

Year	Coverage	State Prisons	Federal Prisons	Total
1994	57.1%	6.7%	1.4%	8.1%
1995	71.9%	8.6%	1.2%	9.8%
1996	72.5%	9.2%	1.2%	10.4%
1997	73.1%	9.4%	1.4%	10.8%
1998	76.2%	9.6%	1.4%	11.0%
1999	75.4%	9.8%	1.5%	11.3%
2000	79.5%	9.8%	1.6%	11.4%
2001	55.9%	7.9%	1.6%	9.5%
2002	58.0%	11.3%	1.7%	13.0%
2003	58.4%	10.2%	1.6%	11.8%
2004	67.3%	11.0%	1.8%	12.8%
2005	60.5%	11.8%	1.8%	13.6%

Sources: Various state Department of Corrections and GED offices. Data for federal prisoners from GED Testing Service "Who took the GED?" various years.
See Appendix for details of states included in the estimation.
Notes: State coverage represents the total number of GED credentials issued in those states with information available as a percentage of total GED credentials issued in the US. Total percentage of GED credentials issued in state prisons represent credentials issued in correctional institutions of those states that have prison information for a given year as a percentage of total GED credentials issued in those states. The percentage of GED credentials issued in federal prisons is calculated on total credentials issued in the US in a given year as a percentage of total GED credentials issued in the US. The percentage of GED credentials issued in federal prisons is calculated on total credentials issued in the US (including federal prisons). Credentials issued in insular areas, freely associated states, Canada, overseas locations and military bases are excluded.

Reproduced from Heckman and LaFontaine [2010]. Sources: Various state Departments of Corrections and GED offices. Data for federal prisoners from GED Testing Service "Who took the GED?" [1958-2008]. Notes: State coverage represents the total number of GED credentials issued in those states with information available as a percentage of total GED credentials issued in the US. Total percentage of GED credentials issued in state prisons represent credentials issued in correctional institutions of those states that have prison information for a given year as a percentage of total GED credentials issued in those states. The percentage of GED credentials issued in federal prisons is calculated on total credentials issued in the US in a given year as a percentage of total GED credentials issued in the US. The percentage of GED credentials issued in federal prisons is calculated on total credentials issued in the US (including federal prisons). Credentials issued in insular areas, freely associated states, Canada, overseas locations and military bases are excluded.

with a growing population of the incarcerated, prison educational programs have been promoted on the basis of the belief that education will decrease recidivism. The GED has quickly become a key ingredient in prison education programs [United States Sentencing Commission, 2009]. In Federal prisons, inmates without a secondary degree are required to complete 240 hours of class work, or to GED certify [United States Sentencing Commission, 2009]. Incarcerated individuals can qualify for monetary compensation for earning a GED as well as earning credits towards early release [Ekstrand 2001, U.S. Department of Justice 2008]. Furthermore, in 1995, the incarcerated made up 9% of all Adult Education participants [National Advisory Council on Adult Education, Various Years]. A Bureau of Justice Statistics (BJS) special report states that in 1997, 26% of all prison inmates earned a GED in prison [Harlow, 2003].[38] Figure 10 shows the percent of GEDs produced in prison which has grown consistently from 1994 to 2005. Overall, the GED has become a near-mandatory component of the prison education system. The growth of prison GEDs weakens its overall signaling value by its association with criminality.

Tyler and Kling [2007] study the post-release earnings of individuals who studied for the GED in prison. They use longitudinal data from the Florida Department of Corrections and other Florida state agencies to compare pre- and post-incarceration earnings for those who study for and receive GEDs. They find that GED preparation and receipt are associated with an increase in earnings for the first three years after release, but fade thereafter. The

[38] The BJS brief does not explain their methodology and there may be survey bias (people in prison longer are more likely to get GED and surveyed) or other statistical concerns.

positive initial impact might be explained by non-random institutional sorting of individuals and by self-selection. To net out self-selection, the authors also compare earnings of those obtaining a GED with those that take GED preparation classes but do not earn a credential. They find no effect. Because both of these populations undertook some amount of study, this finding rules out a signaling effect of the GED.

There is a substantial literature that studies the impact of prison-based educational systems with a focus on recidivism, but this work faces significant challenges in addressing the endogeneity of educational attainment and the lack of baseline data on prior to imprisonment. Gaes [2009] surveys this literature and highlights the effect of GED receipt, as well as vocational training and Adult Basic Education training, on post-release wages and recidivism. Results from studies that he identifies as "methodologically sound" are generally mixed with effects that are either very modest or statistically insignificant.

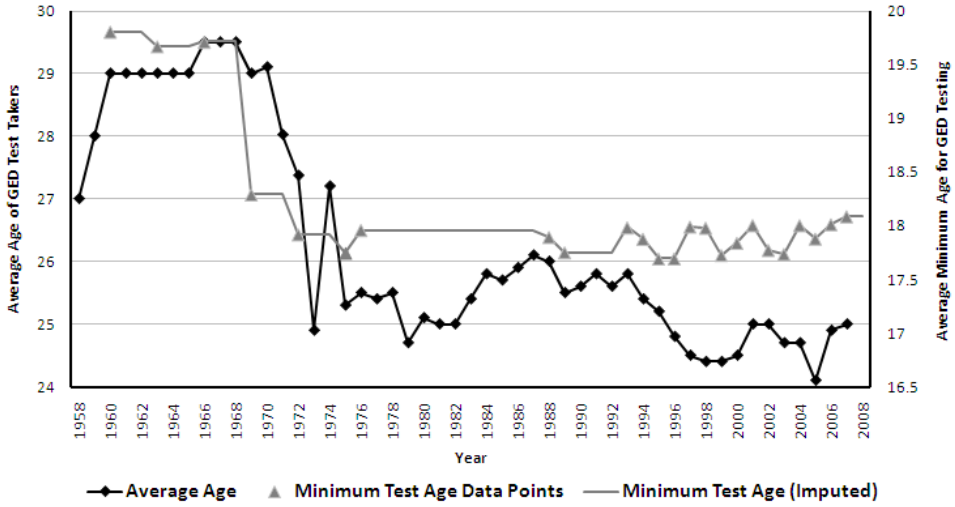
4.3 Growth in High School-Age Test Takers

In 1955, as more states began offering the GED to civilians, the American Council of Education implemented a minimum age of 20 for taking the GED test to prevent teen-aged students from seeking the GED as a replacement for high school [Quinn, 2002]. In 1970, the national age requirement was lowered to 18. Following a period between 1981 and 1992 where there was no national age requirement, the national minimum has been set at 16. Many states set age requirements above the national minimum. Figure 26 shows the population-weighted average national age requirement for taking the GED and the average age of GED test takers over time. The sharp fall in both age requirement and average age in the early 1970s represents the expansion of the population eligible to take the GED.

Originally, states granted exceptions to age requirements in specific cases, such as teenage pregnancy. The number of exceptions to age restrictions has greatly increased over time, leading to growth in the number of 16-to-17-year-olds attempting the GED. The two relevant age restrictions for taking the GED are the statutory age requirement and, indirectly, the minimum age that students can drop out of high school. Figure 27 plots the percentage of GED test takers qualifying as age exceptions to the minimum testing age, and the percentage of GED test takers qualifying as both an exception to the minimum testing age and the minimum age for compulsory high school attendance. Both series are increasing with GED age exceptions growing from 6% in 1980 to nearly 14% in 2007, and dual exceptions growing from 1% in 1990 to over 6% in 2007 Humphries [2010].

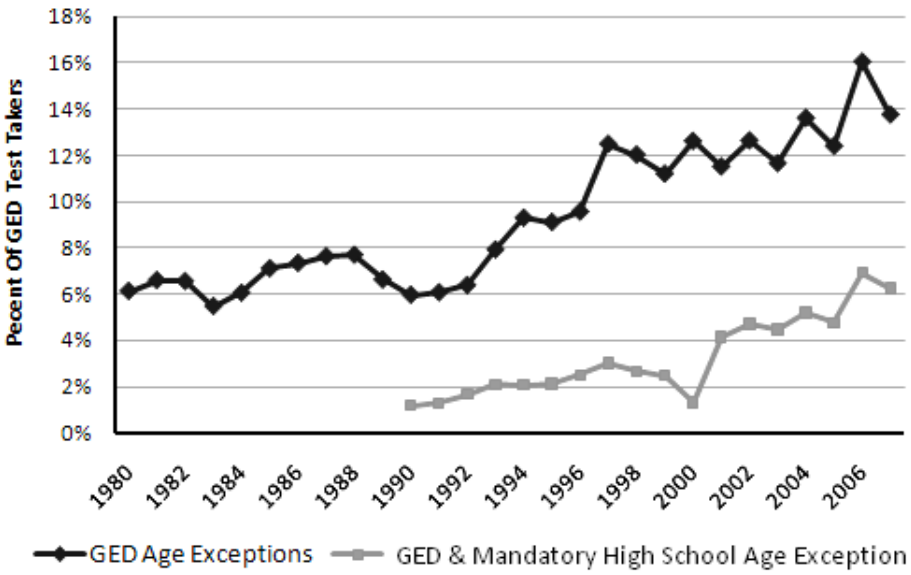
Trends in the age composition of GED takers reflect these changes in eligibility and institutional allowances. Figure 28 shows the number of test takers by age. The first panel shows that growth since the early 1980s is almost

Figure 26: Minimum Age Requirement and Average GED Testing Age



Source: GED Testing Service [1958-2008]. Notes: The population-weighted average minimum age is calculated by weighting the states' age requirements by the state's total population. The national age requirement is assigned to states with requirements below the national age requirement.

Figure 27: GED Test Takers Qualifying as Exceptions to Age Requirements



Reproduced from Humphries [2010]. Source: GED Testing Service [1958-2008]. Notes: National Center for Educational Statistics Data. "GED Age Exceptions" are individuals taking the GED at ages below the minimum GED testing age. "GED & Mand. High School Age Exceptions" are individuals from GED Age Exceptions that are also below the compulsory schooling age in their state, making them double exceptions.

completely attributable to growth in 16-to-19-year-old takers. Test taking rates were distinguished between 16-to-17-year-old and 18-to-19-year-old takers in 1980. The second panel shows that 16-to-17-year-olds are responsible for virtually all growth in GED test taking within the 16-to-19 age group. Because these individuals are still of high school age, their growth as a group raises the question of whether the GED is serving as a true second chance opportunity or as a substitute for a more valuable high school degree. Of particular concern is the possibility that teenagers with the lowest levels of noncognitive skills are the most likely to opt out of high school in order to receive the GED and least likely to benefit from doing so.

The decision-making process of teens may lead them to make choices that restrict their educational paths and earnings in a way that they later regret.[39] Given questionable teen decision-making, several institutional practices may increase the rate of ill-advised dropping out. Many state-issued GED certificates have names such as "Kansas State High School Diploma" or "Maryland High School Diploma" which mislead students into false expectations of equivalence with traditional high school [GED Testing Service, 1958-2008].

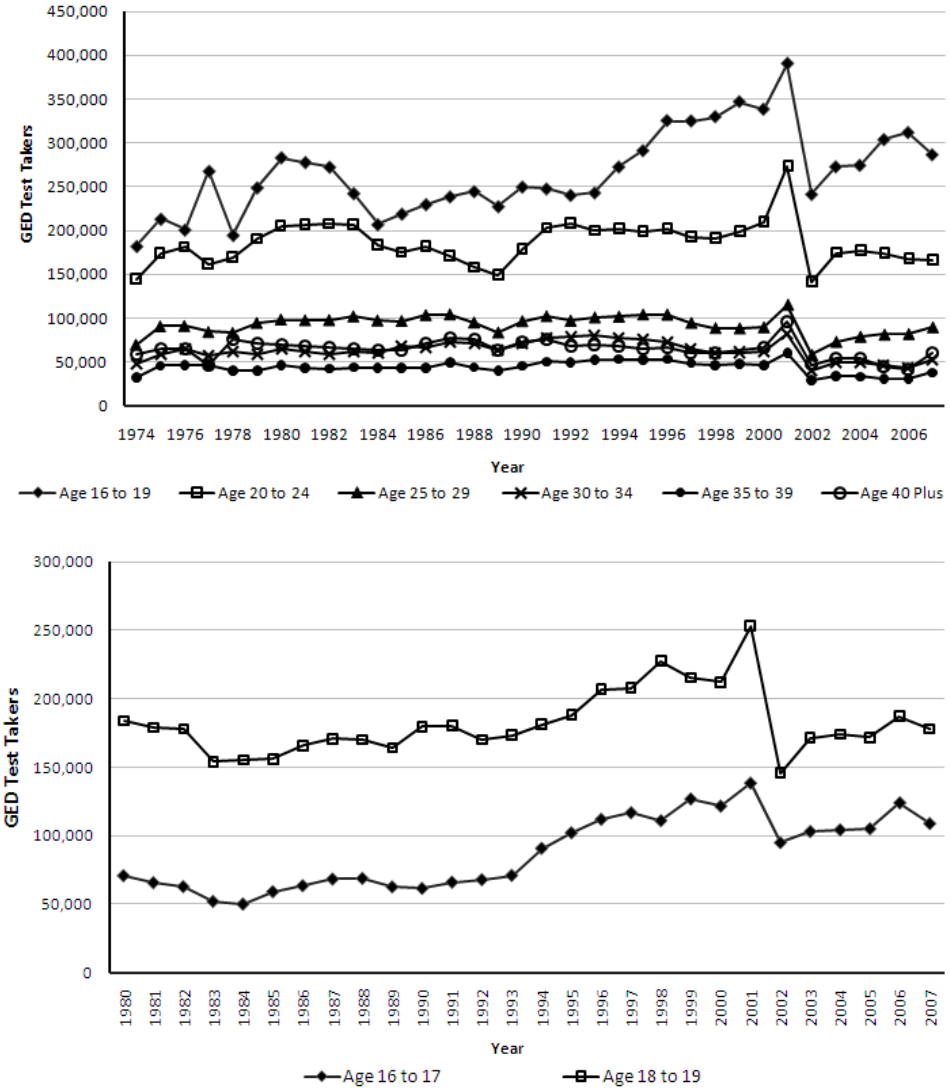
The GED Option Programs represent another institutional path to GED certification for high school students. In some states, the American Council on Education has approved programs which directly target at-risk students in high school and guide them toward GED certification. While states set their own determination of "at-risk", this commonly means students at risk of not graduating with their class.[40] Each state has its own set of requirements on what structure the GED Option Program takes and who is eligible. This introduces a range in the rigor of preparation across the 11 participating states. States vary in the hours of preparation required per week, requirements of complementary career-based training, practice-test policies, and in the study hours elicited from participants.[41] These programs have not been evaluated for their effect on labor market outcomes, but represent an institutional shift toward younger populations.

[39] The literature in psychology formally recognizes this as time-inconsistent preferences, where teens may discount future outcomes at a higher rate than they would at full maturity. Recent work in neuroscience gives concrete support to the common notion that teens in late adolescence–the period when the decision to drop out is made–make decisions that are inconsistent with their adult preferences. See Steinberg [2007] and Steinberg [2008].

[40] See the GED Option Statistical Report [GED Testing Service, 2008] for more detail on these programs.

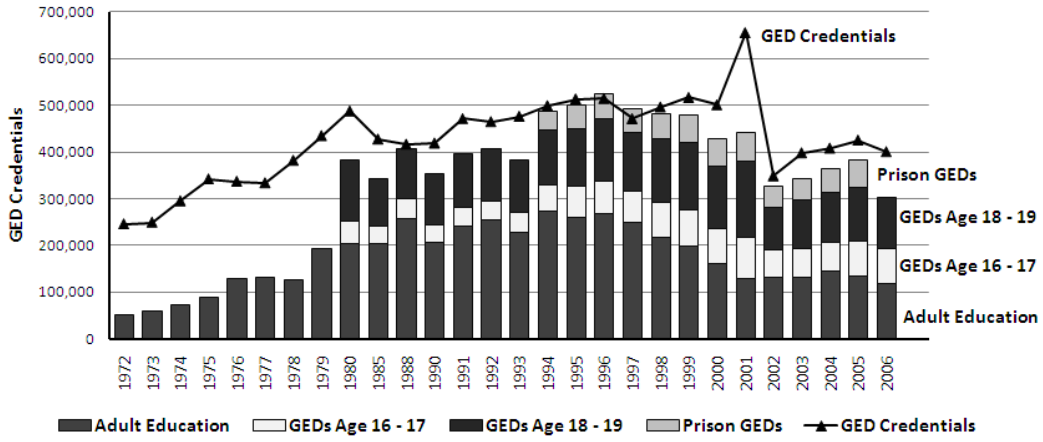
[41] Virginia for example has a demanding Option Program requiring 15 hours of academic preparation per week, work- or career-based training for 10 hours a week, and scores of 450 on each subsection of the official practice test (higher than the 410 minimum 450 average state passing requirement for the GED) before GED certification is allowed. On the other hand, Oregon allows the requirements to be set to a much higher degree by the institution allowing much more flexibility including self-study, and technology-assisted study as a means of GED preparation. Similarly, the hours of studying and days enrolled in the option program also vary greatly. For example, Oregon's GED Option participants reported studying for a median of 20 hours with few explicit requirements. Louisiana, on the other hand, reported a mean of 150 hours and require 15 hours of academic preparation per week and 10 hours a week of job training.

Figure 28: Test Taking Populations By Age



Source: GED Testing Service [1958-2008]. 1974 is the year that test taking rates by age were first reported. Starting in 1980 the 16-to-19 age category is divided into 16-to-17 and 18-to-19-year-olds.

Figure 29: Decomposing Growth in GED Credentials.

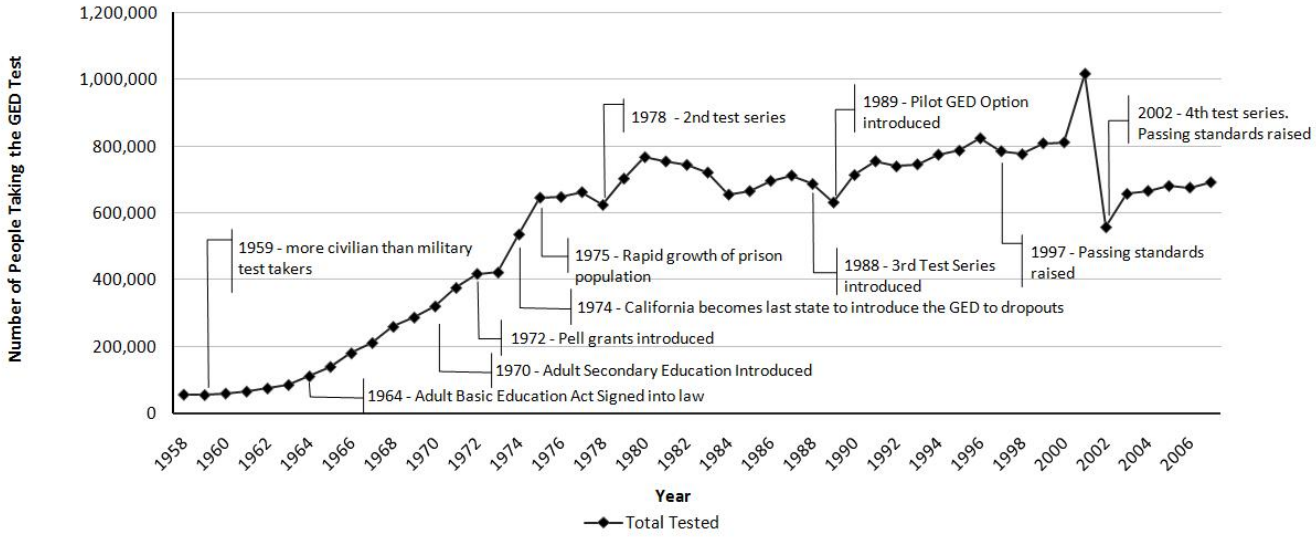


Sources: GED Testing Service [1958-2008], National Advisory Council on Adult Education [Various Years], National Center for Education Statistics [Various Years], U.S. Department of Education [Various Years], and Heckman and LaFontaine [2010]. Notes: The categories of GED credentials are not mutually exclusive; an individual may be counted in multiple categories. Years missing specific categories are due to missing data. Specific years have been excluded from the graph due to highly incomplete data. Prior to 1990, the age categories are imputed from the percent of GED test *takers* in the specific age category times the number of *credentials*. Adult Education statistics did not separate between GEDs and high school diplomas after 1996. From 1997 to 2006 the numbers are imputed by multiplying the total number of GEDs and high school diplomas issued by the average ratio of GEDs to GEDs plus high school diplomas from 1991 to 1996.

4.4 Summing up the Sources of Growth of GEDs

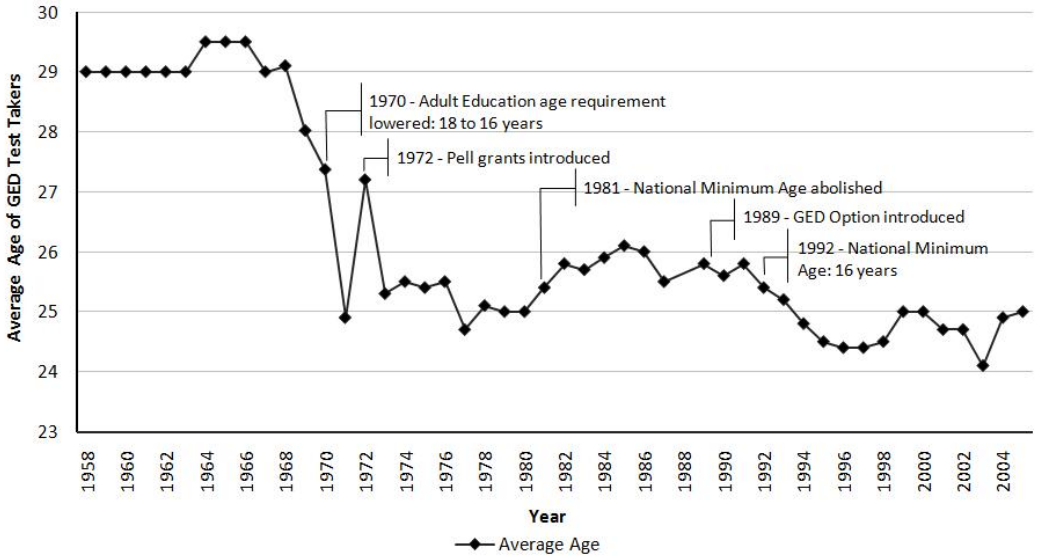
Since its introduction, the GED has grown rapidly. This rapid growth occurs despite the GED's low economic returns. The growth of the GED can be credited to the adoption of the GED by government and non-profit entities, as well as the expansion of the GED into new populations. Figure 29 shows the number of total credentials issued each year, as well as the number of credentials contributed by Adult Education, prison populations, 16-to-17-year-old GED test takers and 18-to-19-year-old GED test takers. These four categories each account for a large percentage of the credentials issued. Unfortunately, the promotion of the GED has pushed it further from subpopulations that might potentially benefit from it. The test has expanded to younger populations which provides adverse incentives to high school-age individuals discussed in more detail below. Figure 30 and 31 provide a time line of key events in the growth of the GED.

Figure 30: Key Dates and the Number of GED Test Takers



Sources: GED Testing Service [1958-2008], Quinn [2002], Rose [1991], GED Testing Service [2008], Heckman and LaFontaine [2010], and Boesel et al. [1998]

Figure 31: The Average Age of GED Test Takers and Key Changes in Age Policies



Sources: GED Testing Service [1958-2008], Quinn [2002], Rose [1991], GED Testing Service [2008], Heckman and LaFontaine [2010], and Boesel et al. [1998]

5 Adverse Consequences of the GED

The GED's low returns may be unfortunate, but one might argue that its low costs and low returns balance and may not do much harm. In this section we show that its availability and scale does cause harm. One concern is that the availability of the GED as an easier-to-obtain secondary credential induces many individuals to drop out of high school. The alternative to GED receipt for these individuals is high school completion and not dropping out. An additional harm arises from counting GEDs in graduation statistics. This practice hides declines in traditional high school graduation rates and thus has disguised educational problems. Finally, the practice of improperly counting the GED as a high school diploma generates biased estimates of the returns to education.

5.1 The GED Induces Would-Be High School Graduates to Drop Out

The availability of the test induces some students to drop out and seek a GED rather than persist in high school. Several papers in the literature demonstrate that changes in the relative costs of the GED certification and high school completion induce substitutions of one degree for the other at different margins. Lillard and DeCicca [2001] demonstrates that the number of students who drop out of high school (including GEDs) increases when the number of credits needed to graduate increases. They estimate that a standard deviation increase in the course graduation requirements in the US would cause 26,000 to 65,000 individuals to drop out of high school. Chaplin [1999] provides descriptive evidence that high school-aged students are dropping out to take the GED and that requiring parental consent helps curb this practice. Humphries [2010] demonstrate that 16-to-17-year-old GED test taking rates respond to high school credit requirements, minimum high school dropout age, and the difficulty of the GED test. He estimates that a minimum dropout age of 18 policy would decrease state-wide GED test taking by 0.22% of the entire population of 16-to-17-year-olds. He also finds that an increase the difficulty of the GED so that 10% fewer graduation-bound high school seniors could pass the test would decrease state-wide GED test taking by 0.14% of the entire 16-to-17-year-old population.[42] Warren et al. [2006] demonstrate that 16-to-19-year-old GED test-taking rates respond to the presence of high school exit exams and other state high school policies. They report that a high school exit exam leads to a state-wide increase in GED test taking of 0.12% of the entire 16-to-19-year-old population.

Heckman et al. [2008] analyze two large natural experiments to study the effect of introducing the GED on inducing dropouts. The national minimum difficulty for passing the GED increased in 1997 which forced only a subset of

[42] Median 16-to-17-year-old state population was 112,000 in year 2000.

states to increase their passing standards to be compliant. The increase raised the difficulty of the test so that only 60% rather than 66% of graduation bound high school seniors would be able to pass the test on a single try. The study also looks at the effect of California's introduction of a GED credential in 1974. Difference-in-differences estimates show that these two policy changes resulted in a 1.3% decrease in dropout rates for states where the passing standard increased, and 3.1% fall in high school graduation rates when the GED became available.[43]

Humphries [2010] examines the effect of introducing GED Option Programs at the school district level using data from Oregon.[44] Using school district-level panel data from Oregon with year and district fixed effects, Humphries finds that introduction of these programs at the district level or in traditional high schools led to a fall of approximately 5% in four year high school completion rates. Interestingly, in districts where the Option Program was only introduced in alternative institutions, such as community colleges or charter schools, the effect was a decrease of only 1.8%.[45]

Heckman et al. [2008] and Humphries [2010] demonstrate that the GED induces some would-be high school graduates into dropping out, but we do not know which individuals drop out or how successful they would have been if they had stayed in high school. The dynamic model of Heckman and Urzua [2010] can be used to simulate counterfactuals. Table 11 contrasts the actual patterns of educational attainment of white males in the NLSY79 sample with predicted values if the GED were abolished. Not all GEDs persist as dropouts. Of the 3.7% of the sample that obtains a terminal GED or some college through the GED, only 2.3% remain as dropouts in the counterfactual state, whereas the rest either finish high school or complete higher levels of post-secondary education. While this line of structural research is still being refined, it has the promise of generating the likely effects on educational attainment arising from enforced age limits or increased test difficulty. The magnitudes in Table 11 are broadly consistent with the estimates reported from natural experiments in Heckman et al. [2008].

5.2 The GED Inflates High School Graduation Statistics

The high school graduation rate is a barometer of the health of American society and the skill level of its future workforce. Historically, the U.S. graduation rate continued to climb as schooling became increasingly important. This trend, however, counts GEDs as high school graduates. When GEDs are counted separately, the traditional high school graduation rate was falling until 2000.

[43] See Section E of the Web Appendix (http://jenni.uchicago.edu/GEDHandbookChapter/) for more in depth description of these results.

[44] A full list of states implementing GED Option Programs can be found in GED Testing Service [2008].

[45] For further results see Section E of the Web Appendix (http://jenni.uchicago.edu/GEDHandbookChapter/).

Simulation Exercise: The Effects of Eliminating the GED[a]
Option Value Model

Table 11: Simulated Response of Educational Attainment to Elimination of the GED

Schooling Level	Simulated with GED (1)	No GED (2)	Change in Rate (2)-(1)	% Change ((2)/(1)-1)%
Four Year College	25.5%	26.0%	0.5%	2.1%
Some Four Year College	7.0%	7.1%	0.1%	1.3%
Two Year College	7.2%	7.8%	0.6%	8.0%
Some Two Year College	10.2%	10.7%	0.6%	5.5%
Some College GED	2.5%	-		
High School Graduates	31.9%	34.0%	2.1%	6.5%
GEDs	3.7%	-		
High School Dropouts	12.0%	14.3%	2.4%	19.6%

Note: The numbers in columns (1) and (2) are computed as fractions of the overall population

Source: Reproduced from Heckman and Urzua [2010].

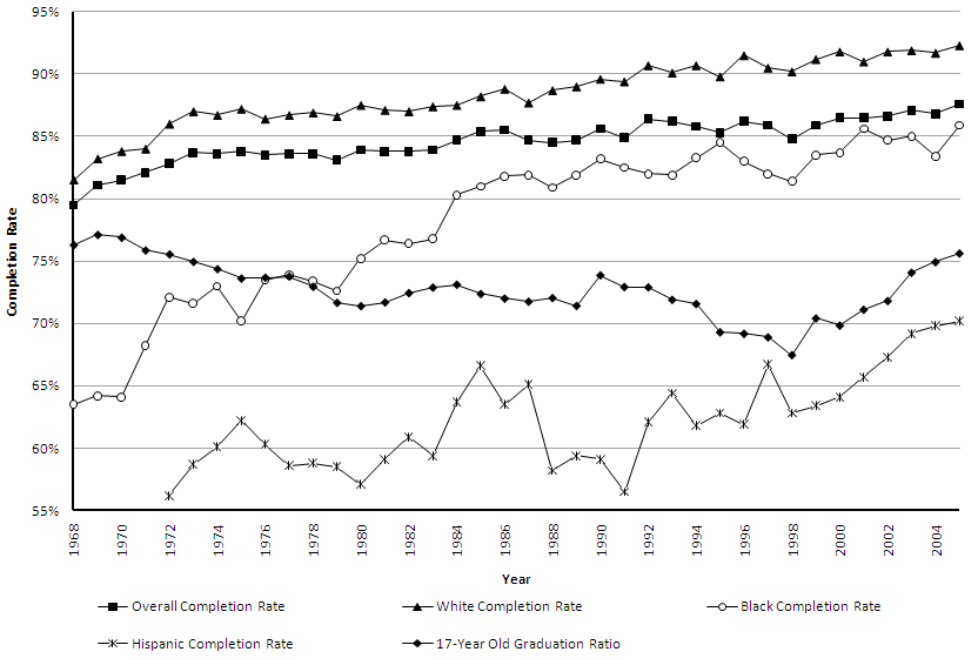
Two commonly-used measures of the high school graduation rate are reported by the National Center of Education Statistics (NCES). The first is the "high school status completion rate" which counts the number of 18-to-24-year-olds possessing a high school credential and divides it by the population aged 18 to 24. The second is the "17-year-old graduation ratio", which is the number of diplomas issued in any given state divided by their 17-year-old population in a given year. The former includes the GED as a high school credential; the latter does not.

Figure 32 shows the time path of both measures, including the completion rate by race. The overall completion rate and 17 year-old graduation ratio were relatively similar in 1968 but diverged afterward. High school graduation was falling from the 1970s through about year 2000, The US graduation rate has only recently returned to where it was forty years ago.

The differences between status completion rates and the graduation ratio has previously been noted. Most of the gap comes from "alternative certifications" which are predominantly GEDs [Finn, 1987]. Once the nonequivalence of GEDs to high school graduates is demonstrated, the growing gap in the status completion rate and graduation ratio becomes a great concern. Rather than an 88% graduation rate in the recent decade, estimates were reported as low as 66% as several researchers made efforts to construct correct high school graduation rates not counting GEDs as high school graduates (Greene [2001], Swanson [2004], Miao and Haney [2004], Warren [2005]). These corrected estimates varied depending on the data set and methodology used, leading to further confusion over which number was the "real" graduation rate.

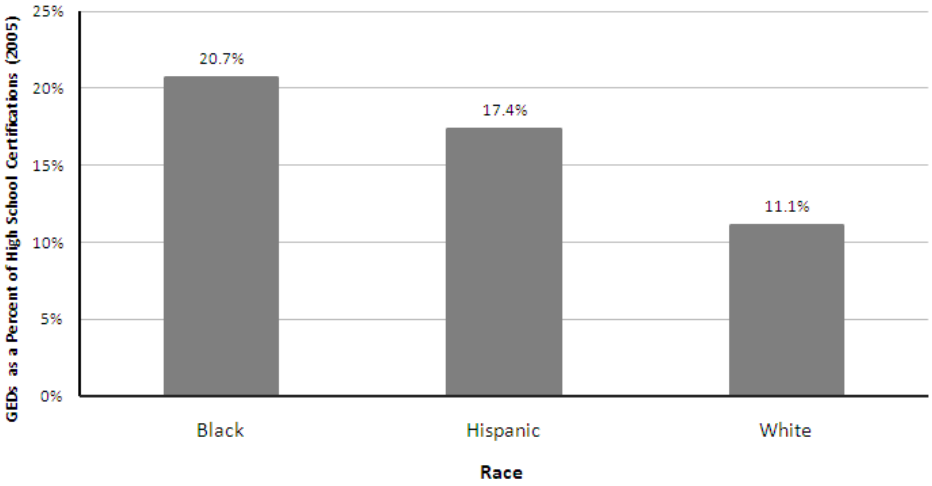
Heckman and LaFontaine [2010] systematically examine each data set used in this debate and consider sources of

Figure 32: Trends in Commonly-Reported Measures of High School Graduation Rates



Reproduced from Heckman and LaFontaine [2010]. Source: Reproduced in part from the National Center for Educational Statistics (NCES) publication "Dropout Rates in the United States: 2005" (Laird et al. [2007]). Notes: Rates prior to 1972 are based on author's calculations using Current Population Survey (CPS) data. The status completion rate is the percentage of 18-to24-year-olds not enrolled in secondary school who have a high school credential. High school credentials include regular diplomas and alternative credentials such as GED certificates. Hispanic ethnicity is not available before 1972. The 17-year-old graduation ratio is from the Digest of Education Statistics. HS graduates for the graduation ratio include both public and private school diplomas and exclude GED recipients and other certificates. October 17-year-old population estimates are obtained from Census Bureau P-20 reports.

Figure 33: GEDs as a Percent of HS Credentials by Race, 2005



Source: GED Testing Service [1958-2008].

bias in each data set in order to construct measures that are consistent across data sets.[46] They find that using year 2000 Census data, removing GEDs lowers overall graduation rates by 7.4%. Because of differential rates of alternative credentialing, graduation rates fall by different amounts for different groups: 8.1% for males, 6.6% for females, 10.3% for black males, and 8.7% for black females.

While the completion rates by race shown in Figure 32 shows a decreasing white-black and white-Hispanic high school certification rate over time, those trends are fully explained by increasing rates of alternative certification. Figure 33 shows GED credentials as a percent of high school credentials issued broken down by race in 2005. GEDs account for 20% of black high school credentials, but only 11% of white credentials.[47] Over the last 40 years the minority education gap has been constant.

5.3 The GED Obscures the Actual Returns to Education

The misclassification of GEDs also affects estimates of the returns to education. While the dropout-to-high school and high school-to-college wage gaps have indeed been increasing, the GED misclassification is responsible for a

[46] For bias extending beyond the GED across the Census, the Current Population Survey (CPS), and Common Core Data (CCD) see Heckman and LaFontaine [2010] directly.

[47] See Section E of the Web Appendix (http://jenni.uchicago.edu/GEDHandbookChapter/) for tables demonstrating the effect on the differential effect on graduation rates for different races and genders of removing prisoners, immigrants, and military servicemen from calculations of the graduation rate.

sizable amount of this gap. Using the traditional CPS method of treating GED recipients and high school graduates as equivalent, Cameron and Heckman [1993] estimate a 21% return to four year college completion. When classifying GEDs and high school graduates separately, the high school-to-college gap falls to 19.6%.

Heckman and LaFontaine [2006] show that the imputation method used by the CPS generates biased wages across educational levels. The CPS imputes missing wages by matching on socioeconomic data using other observations in the same educational categories: 1) high school dropouts; 2) high school graduates with up to, but not including, a bachelor's degree; and 3) bachelor's degree or above. This procedure allocates missing GED wages with data drawn from high school graduates (including individuals with some college), and fills in missing high school graduate wages with data drawn from GEDs. Heckman and LaFontaine find that estimated returns to GED certification were overstated by 35% when CPS allocated wages are included for native-born males, and 25% for native-born females. Similarly, they find that excluding allocated earners lowers the returns to high school graduation for the full sample of males by 5% and the returns to college by 12%. The fact that the CPS increasingly reports missing values, coupled with the misallocation error of GED and high school wages, has lead to increasingly biased estimates of the returns to education over time.

Table 12 displays evidence from three birth cohorts within the NLSY79 sample to compare how high school-to-college and dropout-to-high school wage differentials vary depending on how GED recipients are classified. Because the number of GED recipients grows from 9% of high school credentials to 20% across these birth cohorts, the bias the GED generates in returns to educational categories also increases over time. For the 1957-1958 birth cohort, GED misclassification accounts for 6.1% of the college-high school wage gap in log annual earnings. By the 1962-1964 birth cohort, GED misclassification grew to 9.5% of the college-high school wage gap in log annual earnings and 5.6% of the dropout-college wage gap.

6 Conclusion

This chapter reviews the scholarly literature on the General Educational Development certificate. The consensus in the literature is that the GED testing program does little good for the substantial majority of its takers in generating economic opportunity directly and in opening the door to post-secondary education. This finding is especially troubling given the size and rate of growth of the GED. Growth in the GED appears to be largely fueled by various government policies. Until recently, misclassification of the GED as a high school equivalent credential has

Table 12: The Role of the GED in Explaining Rising Educational Wage Gaps

A. Prevalence of GED as a	1957-1958 Birth Cohort	1959-1961 Birth Cohort	1962-1964 Birth
% of GED+HS Category	9.16%	13.82%	20.34%
% of GED+Dropout Category	38.29%	46.08%	60.14%
B. College-HS Wage Gap*			
Log Annual Earnings	.338	.411	.469
Log Weekly Wage	.297	.358	.418
Log Hourly Wage	.270	.311	.376
C. Bias in College-HS Gap from Counting GEDs as HS Graduates**			
Log Annual Earnings	.021	.030	.045
Log Weekly Wage	.010	.016	.025
Log Hourly Wage	.007	.010	.022
D. % of Current College-HS Gap Explained by GED			
Log Annual Earnings	6.1%	7.4%	9.5%
Log Weekly Wage	3.3%	4.5%	6.0%
Log Hourly Wage	2.6%	3.3%	5.9%
E. College-Dropout Wage Gap			
Log Annual Earnings	.635	.724	.747
Log Weekly Wage	.512	.593	.610
Log Hourly Wage	.474	.521	.555
F. Bias in College-Dropout Gap from Counting GEDs as HS Graduates†			
Log Annual Earnings	.029	.039	.056
Log Weekly Wage	.041	.051	.054
Log Hourly Wage	.044	.056	.049
G. % of Current College-Dropout Gap Explained by GED			
Log Annual Earnings	2.9%	3.9%	5.6%
Log Weekly Wage	4.1%	5.1%	5.4%
Log Hourly Wage	4.4%	5.6%	4.9%

Percentage of Overall Change Explained by GED Misclassification from 1957 to 1964	Annual Earnings	Weekly Wage	Hourly Wage
Growth in College-HS Gap	18.4%	12.8%	14.4%
Growth in College-Dropout Gap	23.7%	13.6%	5.5%

Source: Reproduced from Heckman and LaFontaine [2010] who use NLSY79 data on males and females aged 25-29. Notes: The college category includes those with a four year degree or higher. Those with some college and no two or four year degree are included in the GED and HS categories, respectively, depending on their credential. Two year degree holders are estimated separately. All education dummies are mutually exclusive. Estimated wage gaps are based on the following 3 OLS specifications; Model 1: GEDs are included as HS graduates; Model 2: GEDs treated separately; and Model 3: GEDs treated as dropouts. Persons enrolled in school at each age are deleted as are those who are not working or self-employed. Those making less than $2 or more than $100 per hour are deleted as are those making less than $100 or more than $4,000 weekly. In addition, those making less than $2,000 or more than $200,000 are dropped. Region dummies are included in all regressions but are not shown. Percentages of GEDs are calculated using sampling weights. Weekly wage estimates are weighted by weeks worked last year. Hourly wage estimates are weighted by hours worked last year. Huber-white robust standard errors clustered by individual are reported.

*Based on Model 1: Counting GEDs as HS graduates

**Computed as the difference in the college-HS log wage gap in Model 1 vs. Model 2

†Computed as the difference in the college-dropout wage premium in Model 1vs. Model 3

hidden decreases in the high school graduation rate and has disguised the failure of minority graduation convergence. The study of the GED sheds considerable light on the value of noncognitive skills and the danger of relying solely on tests of scholastic aptitude to monitor the success of American educational policy.

References

David H. Autor, Lawrence F. Katz, and Melissa S. Kearney. Trends in U.S. wage inequality: Revising the revisionists. *Review of Economics and Statistics*, 90(2):300–323, 2008.

Julian R. Betts and Magnus Lofstrom. The educational attainment of immigrants: Trends and implications. In George J. Borjas, editor, *Issues in the Economics of Immigration*, Chapter 2, pp. 51–116. University of Chicago Press, 2000.

Jerry Bobrow. *GED (General Educational Development)*. Cliffs Notes, Indianapolis, IN, 1st edition, 2002.

David Boesel, Nabeel Alsalam, and Thomas M. Smith. *Educational and Labor Market Performance of GED Recipients*. U.S. Dept. of Education, Office of Educational Research and Improvement, National Library of Education, Washington D.C., 1998.

Lex Borghans, Bart H. H. Golsteyn, James J. Heckman, and John Eric Humphries. IQ, achievement, and personality. Unpublished manuscript, University of Maastricht and University of Chicago (revised from the 2009 version), 2010.

George J. Borjas, editor. *Issues in the economics of immigration*. University of Chicago Press, Chicago, IL, 2000.

Stephen V. Cameron and James J. Heckman. The nonequivalence of high school equivalents. *Journal of Labor Economics*, 11(1, Part 1):1–47, January 1993.

Jian Cao, Ernst W. Stromsdorfer, and Gregory Weeks. The human capital effect of general education development certificates on low income women. *Journal of Human Resources*, 31(1):206–228, Winter 1996.

Pedro Carneiro, James J. Heckman, and Dimitriy V. Masterov. Labor market discrimination and racial differences in pre-market factors. *Journal of Law and Economics*, 48(1):1–39, April 2005.

Joseph M. Carroll. The Copernican Plan: Restructuring the American high school. *Phi Delta Kappan*, 71(5): 358–365, 1990.

Duncan Chaplin. GEDs for teenagers: Are there unintended consequences? Technical report, The Urban Institute, November 1999.

Melissa A. Clark and David A. Jaeger. Natives, the foreign-born, and high school equivalents: New evidence on the returns to the GED. *Journal of Population Economics*, 19(4):769–793, October 2006. doi: 10.1007/s00148-005-0037-8.

Laurie E. Ekstrand. Reintegration of offenders into communities. Technical Report GAO-01-966T, United States General Accounting Office, Washington, DC, 2001. Testimony Before the Subcommittee on the District of Columbia, Committee on Government Reform, House of Representatives.

Chester E. Finn, Jr. The high school dropout puzzle. *Public Interest*, 87(2):3–22, 1987.

Gerald G. Gaes. The impact of prison education programs on post-release outcomes. Presented at the Reentry Roundtable on Education, March 31 and April 1, 2008. John Jay College of Criminal Justice, New York City., November 2009.

GED Testing Service. *The GED Option Program Statistical Report.* GED Testing Service, Washington, DC, 2008.

GED Testing Service. *Technical Manual: 2002 Series GED Tests.* GED Testing Service, Washington, DC, March 2009.

GED Testing Service. *Examiner's Manual Tests of General Educational Development.* GED Testing Service, Washington, DC, Various Years.

GED Testing Service. *Who Took the GED?: GED Statistical Report.* American Council on Higher Education, Washington, DC, 1958-2008.

Claudia Goldin and Lawrence F. Katz. *The race between education and technology.* Belknap Press of Harvard University Press, Cambridge, MA, 2008.

Jay P. Greene. High school graduation rates in the United States. Civic Report 31, Center for Civic Innovation at the Manhattan Institute with Black Alliance for Educational Options, 2001.

W. Norton Grubb. Learning and earning in the middle, part I: National studies of pre-baccalaureate education. *Economics of Education Review*, 21(4):299–321, 2002.

Jinyong Hahn, Petra E. Todd, and Wilbert Van der Klaauw. Identification and estimation of treatment effects with a regression-discontinuity design. *Econometrica*, 69(1):201–209, January 2001.

Karsten T. Hansen, James J. Heckman, and Kathleen J. Mullen. The effect of schooling and ability on achievement test scores. *Journal of Econometrics*, 121(1-2):39–98, July–August 2004.

Caroline Wolf Harlow. Education and correctional populations. Bureau of Justice Statstics Special Report NCJ 195670, Bureau of Justice Statistics, Washington, DC, 2003.

James J. Heckman and Paul A. LaFontaine. Bias corrected estimates of GED returns. *Journal of Labor Economics*, 24(3):661–700, July 2006.

James J. Heckman and Paul A. LaFontaine. The American high school graduation rate: Trends and levels. *Review of Economics and Statistics*, 92(2):244-262, 2010.

James J. Heckman and Yona Rubinstein. The importance of noncognitive skills: Lessons from the GED testing program. *American Economic Review*, 91(2):145–149, May 2001.

James J. Heckman and Sergio Urzua. The option value and rate of return to educational choices. Unpublished Manuscript, Northwestern University, 2010.

James J. Heckman, John Eric Humphries, and Nicholas Mader. Studies of the GED testing program. Under preparation, University of Chicago Press, Chicago, IL, 2010a.

James J. Heckman, John Eric Humphries, and Nicholas Mader. Hard evidence on soft skills: The GED and the problem of soft skills in America. Under preparation, University of Chicago Press, Chicago, IL, 2010b.

James J. Heckman, Paul A. LaFontaine, and Pedro L. Rodríguez. Taking the easy way out: How the GED testing program induces students to drop out. Under review, *Journal of Labor Economics*, 2008.

James J. Heckman, Jora Stixrud, and Sergio Urzua. The effects of cognitive and noncognitive abilities on labor market outcomes and social behavior. *Journal of Labor Economics*, 24(3):411–482, July 2006.

James J. Heckman, Sergio Urzua, and Gregory Veramendi. The effects of schooling on labor market and health outcomes. Unpublished Manuscript, Northwestern University, 2010.

John Eric Humphries. Young GEDs: The growth and change in GED test takers. Unpublished Manuscript. University of Chicago, 2010.

Guido Imbens and Thomas Lemieux. Regression discontinuity designs: A guide to practice. *Journal of Econometrics*, 142(2):615–635, 2008.

Christopher Jepsen, Peter Mueser, and Kenneth Troske. Labor market returns to the GED using regression discontinuity analysis. Presented at the EALE - SOLE 2010 Third World Conference . June 17-19, 2010 at University College London., April 2010.

Jennifer Laird, Gregory Keinzl, Matthew DeBell, and Chris Chapman. Dropout rates in the United States: 2005. Compendium Report NCES 2007-059, National Center for Education Statistics, June 2007.

Janice H. Laurence. The military performance of dropouts and GED holders. In: Heckman, J. J., Humphries. J. E., Mader, N. S. (Eds.), Studies of the GED Testing Program. University of Chicago Press, Chicago, IL.

Dean R. Lillard and Philip DeCicca. Higher standards, more dropouts? Evidence within and across time. *Economics of Education Review*, 20(5):459–473, 2001.

Joseph W. McLaughlin, Gary Skaggs, and Margaret Becker Patterson. Preparation for and performance on the GED test. Research Studies 2009-2, American Council on Education: GED Testing Service, Washington, DC, August 2009.

Jing Miao and Walt Haney. High school graduation rates: Alternative methods and implications. *Education Policy Analysis Archives*, 12:1–68, 2004.

Richard J. Murnane, John B. Willett, and Kathryn Parker Boudett. Do high school dropouts benefit from obtaining a GED? *Educational Evaluation and Policy Analysis*, 17(2):133–147, Summer 1995.

Richard J. Murnane, John B. Willett, and Kathryn P. Boudett. Does acquisition of a GED lead to more training, post-secondary education, and military service for school dropouts? *Industrial Relations Review*, 51:100–116, 1997.

Richard J. Murnane, John B. Willett, and Kathryn Parker Boudett. Do male dropouts benefit from obtaining a GED, postsecondary education, and training? *Evaluation Review*, 22(5):475–502, October 1999.

Richard J. Murnane, John B. Willett, and John H. Tyler. Who benefits from obtaining a GED? Evidence from High School and Beyond. *Review of Economics and Statistics*, 82(1):23–37, February 2000.

National Advisory Council on Adult Education. *A History of the Adult Education Act.* National Advisory Council on Adult Education, Washington, DC, 1980.

National Advisory Council on Adult Education. *Annual Report to the President of the United States.* National Advisory Council on Adult Education, Washington, DC, Various Years.

National Center for Education Statistics. *Education Longitudinal Study of 2002 (ELS:2004/04), First Follow-up, Student Survey.* National Center for Education Statistics, Washington, DC, 2006.

National Center for Education Statistics. *Digest of Education Statistics.* National Center for Education Statistics, Washington, DC, Various.

National Center for Education Statistics. *Digest of Educational Statistics.* National Center for Education Statistics, Washington, DC, Various Years.

Margaret Becker Patterson, Wei Song, and Jizhi Zhang. GED candidates and their postsecondary educational outcomes: A pilot study. Research Studies 2009-5, GED Testing Service, Washington, DC, December 2009.

Lois M. Quinn. An institutional history of the GED. WI: University of Wisconsin-Milwaukee Employment and Training Institute, 2002.

Amy D. Rose. Ends or Means: An overview of the history of the Adult Education Act. Information Series 346, ERIC Clearinghouse on Adult, Career, and Vocational Education, Center on Education and Training for Employment, Ohio State University, Columbus, OH, 1991.

Yona Rubinstein. The use of inter-states variation in GED passing standards for estimating the effect of a GED degree on labor market outcomes of high school dropouts - a critique. Unpublished Manuscript, Brown University, Department of Economics, August 2003.

Russell W. Rumberger. Dropping out of high school: The influence of race, sex, and family background. *American Educational Research Journal*, 20(2):199–220, 1983.

Society for Human Resource Management. Does your company accept applicants with a GED credential for jobs requiring a high school degree? Online Poll, Retrieved January 25, 2008 from www.shrm.org/poll/results.asp?question=67., 2002.

A. Michael Spence. Job Market Signaling. *Quarterly Journal of Economics*, 87(3):355–374, August 1973.

Laurence Steinberg. Risk taking in adolesence - New perspectives from brain and behavioral science. *Current Directions in Psychological Science*, 16(2):55–59, 2007.

Laurence Steinberg. A social neuroscience perspective on adolescent risk-taking. *Developmental Review*, 28(1): 78–106, 2008.

Christopher B. Swanson. Who graduates? Who doesn't? A statistical portrait of public high school graduation, class of 2001. Technical report, The Urban Institute Education Policy Center, 2004. http://www.urban.org/url.cfm?ID=410934, Last accessed April 26, 2010.

The College Board. *Annual Survey of Colleges*. The College Board, New York, NY, 2007. Data file.

John H. Tyler and Jeffrey R. Kling. Prison-based education and re-entry into the mainstream labor market. In Shawn Bushway, Michael Stoll, and David Weiman, editors, *Barriers to Reentry? The Labor Market for Released Prisoners in Post-Industrial America*. Russell Sage Foundation Press, New York, NY, 2007.

John H. Tyler, Richard J. Murnane, and John B. Willett. Estimating the labor market signaling value of the GED. *Quarterly Journal of Economics*, 115(2):431–468, May 2000.

John H. Tyler, Richard J. Murnane, and John B. Willett. Who benefits from a GED? Evidence for females from High School and Beyond. *Economics of Education Review*, 22(3):237–247, June 2003.

Austin Texas United States Sentencing Commission, Western District of Texas. Regional hearing on the state of federal sentencing. Testimony of Harley G. Lappin, March 18 2009.

U.S. Department of Education. *Division of Adult Education and Literacy*. Washington, DC, Various Years. Unpublished Data. Office of Vocational and Adult Education.

U.S. Department of Justice. Inmate work and performance pay. Technical report, U.S. Department of Justice, Federal Bureau of Prisons, Washington, DC, 2008.

John Robert Warren. State-level high school completion rates: Concepts, measures, and trends. *Education Policy Analysis Archives*, 13:1–34, 2005.

John Robert Warren, Krista N. Jenkins, and Rachael B. Kulick. High school exit examinations and state-level completion and GED rates: 1975 through 2002. *Educational Evaluation and Policy Analysis*, 28(2):131–152, Summer 2006.

Jizhi Zhang, Mee Young Han, and Margaret Becker Patterson. Young GED examinees and their performance on the GED tests. Research Studies 2009-1, GED Testing Service, 2009.